Draft
Environmental Impact Report

2016 Campus Master Plan

California State University, San Bernardino

CALIFORNIA STATE UNIVERSITY
SAN BERNARDINO

March 2017

WSP | PARSONS BRINCKERHOFF

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Summary

This Program Environmental Impact Report (EIR) has been prepared in accordance with the California Environmental Quality Act (CEQA) of 1970 (Public Resources Code, Section 21000 et seq.) and the CEQA Guidelines (California Code of Regulations, Section 15000 et seq.) to analyze the potential significant impacts associated with the 2016 Campus Master Plan project at the California State University, San Bernardino (CSU San Bernardino or University).

The Project

The project is the adoption and implementation of the California State University San Bernardino main campus (CSU San Bernardino) 2016 Campus Master Plan. The current Master Plan provided for campus facilities accommodating up to 20,000 full-time equivalent (FTE) students. The 2016 Campus Master Plan provides a framework for implementation of the University's goals and programs, by identifying needed facilities and improvements to accommodate a gradual growth in student enrollment projected to reach 25,000 FTEs by 2035. The University conducted over a year-long, wide-ranging planning process to develop the Campus Master Plan. The aim of that process was to develop a comprehensive plan for campus development that will maintain and enrich the campus as an attractive, accessible, safe and functional environment for learning, living, recreation, and culture for the University's faculty, staff and visitors, and for the surrounding communities. To do so, the Campus Master Plan also incorporates Design Guidelines, Landscape Palette Guidelines, and Sustainability Guidelines.

Campus Master Plan Objectives

The principal objective of the Campus Master Plan is to support and advance the University's educational mission by providing a guide to the development of the physical campus and its facilities. In support of this objective, the Campus Master Plan provides guidelines and framework for creating a campus environment that:
The main objective of the Master Plan is to guide the development of the campus over the next 20 years to accommodate gradual student enrollment growth, through infill development within the existing developed campus area, while enhancing the quality of campus life. To do so, the Master Plan creates a physical campus environment that facilitates the CSU San Bernardino's ability to achieve the following objectives:

- Support students, faculty and staff with appropriate teaching, research and administrative facilities
- Serve as a regional center for intellectual, cultural, and life-long learning
- Reinforce the University's active learning focus by providing opportunities for interactions and collaborations among students, faculty, staff and the greater community

- Support the creation and maintenance of residential and non-residential learning communities on the campus, including the accommodation of smaller learning communities within a variety of campus spaces such as the Pfau Library, classroom/laboratory buildings, the Santos Manuel Student Union, and the Commons
- Support the creation of a range of student learning/research/incubator type spaces through public-private and public-public partnerships
- Where appropriate, offer student learning and community-oriented/outreach programs in University-controlled centers off the main CSU San Bernardino campus
- Reinforce positive intrinsic features of the CSU San Bernardino campus including views to the San Bernardino Mountains, the signature campus gateway/quad lawn, and physical connections with surrounding neighborhoods and facilities
- Make efficient use of developable campus land and preserve a balance between built-up areas and open space
- Create a series of campus outdoor spaces framed by buildings and protected from extremes of sun and wind that facilitate student interaction, student learning and passive recreation
- Provide appropriate facilities for informal and organized recreation and intercollegiate athletics
- Serve as an accessible, safe and attractive campus for students, staff, faculty and the community
- Provide for a range of ways for students and the community to access the campus and its facilities including public transportation and distance learning
- Through a comprehensive approach to sustainability, maintain CSU San Bernardino's stewardship of campus landscape and natural resources
- Conserve natural resources while creating and fostering an environmentally, socially, and economically sustainable physical and operational campus
- Create and foster campus facilities that efficiently utilize university human, natural, and financial resources
- Provide for correctly sized and oriented Teaching Resource Center (TRC) to accommodate the range of faculty needs

Project Location

The CSU San Bernardino 441-acre campus is located at the base of the San Bernardino Mountains, and is separated from the existing surrounding residential development to the south, west, and east by Northpark Boulevard. Northpark Boulevard also provides access to the campus from I-215 freeway.

Campus Master Plan Characteristics

The Campus Master Plan provides a new strategic infill approach to the long-term campus development which utilizes the existing developed campus land to provide all needed facilities while preserving campus open space and views toward the mountains. To do so, the Master Plan integrates the campus into a framework of eight functional and geographic precincts. The precincts are based on functional and geographical adjacencies and effectively concentrate specific land uses within each precinct to space for a broad range of programs, to achieve the following objectives:

- Making efficient use of University-owned land currently occupied by facilities that have reached the end of their useful life cycles
- Increasing campus density and reducing walking distances by infilling new facilities to create new smaller, more human-scaled spaces, which avoids using important open spaces for new facilities
- Reinforcing the pedestrian pathway system (Coyote Walk) by orienting buildings entrances to campus walkways
- Linking the precincts by an enhanced pedestrian pathway systems that focuses on Coyote Walk and Sycamore Walk and incorporates major open space and landscape elements
- Create new student housing facilities to encourage a more 24/7 "Live-Work-Teach-Learn-Play" campus environment that serves students, faculty, and staff
- Configure the campus environment and link all residential villages by Sycamore Walk
- Reinforcing the campus open space context by improving open space along two major and two minor corridors to establish clearer routes across campus
- Increase student housing opportunities to provide a desirable, healthy, and safe campus lifestyle and create a defined sense of place and community identity
- Advance campus athletic fields and student recreation to allow for greater focus on academic, health, nutrition, and play development. The fields will also create new opportunities to attract top level student athletes.

To accommodate the projected future campus student enrollment within the new framework, the Master Plan provides for campus development with approximately 2.9 million gross square feet of needed new facilities and improvements over the next 20 years. The future development focuses on the facilities needed by the University's academic programs; campus life programs, including student housing, recreation, and facilities maintenance; and campus infrastructure, including parking. These facilities include:

Academic Facilities: Approximately 1.2 million square feet of new classrooms, laboratories, library, collaborative, and other instructional space for the University's academic programs.
Student Life and Support Facilities: Student housing providing approximately 3,320 beds on campus, in new dormitory-style residential halls, residential suites, and student apartments. The new student housing will be supported with dining halls, student support spaces, and other amenities.
Administrative and Support Facilities: Approximately 200,000 square feet of administrative facilities and campus support facilities. The Master Plan also provides for modifications and augmentations of the campus utilities systems to serve the new facilities, including an expansion of the campus' physical plant.
Physical Education and Athletic Facilities: The Master Plan provides for new baseball, basketball, softball, and soccer fields; a multi-use stadium for track and field, soccer, and football with 6,000 seats, and expanded tennis courts. A new, approximately 63,000 square-foot physical education facility will be provided adjacent to the existing gymnasium.
Entrepreneurial Facilities: Approximately 200,000 square feet of research, technology, and other space, including a conference center with an 80-room hotel. These facilities will be developed in partnership with public and private organizations through enterprises that support the University's educational mission and generate potential revenue for the University's programs and functions.
Parking: Approximately 3,600 new parking spaces within new parking structures strategically located at the perimeter of the campus, predominantly in the areas currently developed with surface parking lots.

Many of the existing academic, student housing, and other facilities have reached the end of their functional life and are in need of remodel or replacement. Therefore, the replacement and provision of remodeled facilities is a large component of the Master Plan.

The Master Plan also provides for major open space, landscape, and design enhancements that will elevate the University's presence in the global higher education arena and the academic and living environment of the campus. These include:

- Reinforcing intrinsic features of the campus including views to the San Bernardino Mountains, the signature campus gateway/quad lawn, and physical connections with surrounding neighborhoods and facilities
- Preserving a balance between built-up areas and open space, including preservation of the heritage landscapes and creation of a habitat conservation areas
- Augmenting and expanding an integrated network of plazas and promenades, with tree-lined major pedestrian Coyote Walk and Sycamore Walk as major campus promenades
- Developing quads, courtyards, and other outdoor spaces as part of facilities design to encourage social interactions for students, faculty, and staff
- Enhancing the identity of the University and its campus through landscape and identification at campus entries
- Using design guidelines in the development of new facilities and integrating their form and materials with existing outdoor environment.

To create the campus that is both sustainable and resilient, the Master Plan builds upon the University's sustainability policies and initiatives by providing the framework, specific recommendations, and future goals for the campus' stormwater runoff and waste management, energy and water conservation, reduction of greenhouse gases emissions, and aligning the University's new buildings with LEED Gold-equivalent criteria.

Environmental Impacts

CSU San Bernardino prepared this EIR to analyze the potential environmental impacts associated with the Campus Master Plan project. In addition, the EIR identifies mitigation measures capable of avoiding or substantially reducing significant impacts. A summary of environmental impacts, mitigation measures, and a level of impact remaining after mitigation is presented in Table S-1 at the end of this Summary.

The analysis contained in this EIR uses words "significant" and "less than significant" in the discussion of impact. These words specifically define the degree of impact and parallel language used in CEQA Guidelines. As required by CEQA, mitigation measures have been identified in this EIR to avoid or substantially reduce the level of potentially significant adverse impacts to the greatest extent possible. Certain significant impacts, even with the inclusion of mitigation measures, cannot be reduced to a level below significance. Such impacts are identified as "unavoidable significant impacts."

Beneficial Impacts

This EIR identifies the following effects of the Campus Master Plan that are beneficial:

- Creating a more sustainable and resilient campus
- Enhancing aesthetics and visual character of the campus
- Reducing per-person vehicle miles travelled (VMTs)
- Improving campus' pedestrian and bicycle connections and circulation

Impacts Considered and Found to be Less Than Significant

The analysis contained in the EIR indicates that the project will not result in a significant impact with respect to the following:

- Police and fire protection services
- Utilities and service systems
- Cumulative effects, other than short-term cumulative peak construction emissions and lighting
- Growth-inducing and significant irreversible effects

Pursuant to CEQA and the CEQA Guidelines, an Initial Study was prepared for this project (refer to Appendix A). The Initial Study concluded that implementation of the Campus Master Plan will result in either no impact or a less than significant impact with regards to:

- Agricultural and forest resources
- Geology and soils
- Hazards and hazardous materials
- Hydrology
- Land use and planning
- Mineral resources
- Population and housing
- Recreation

Potentially Significant Impacts that Can Be Mitigated

The EIR analysis identified the following potentially significant impact associated with the Master Plan that can be mitigated to less than significant levels.

- Impact on biological resources related to future development nearby campus' habitat preservation areas
- Impact on historic resources related to John M. Pfau Library improvements
- Impact on archaeological resources, including potentially inadvertently discovered resources
- Impact on potentially inadvertently discovered tribal resources
- Short-term and intermittent construction-related traffic and solid waste impacts

Unavoidable Significant Impacts

The CEQA Guidelines define a significant impact on the environment as "a substantial, or potentially substantial, adverse change in any of the physical conditions within an area affected by the project, including land, air, water, flora, fauna, ambient noise, and objects of historic or aesthetic significance" (Section 15382). In order to approve a project with unavoidable significant impacts, the lead agency must adopt a Statement of Overriding Considerations. In adopting such a statement, the lead agency finds that it has reviewed the EIR, has balanced the benefits of the project against its unavoidable significant effects, and has concluded that the benefits of the project outweigh the unavoidable adverse environmental effects, and thus, the adverse environmental effects may be considered "acceptable" (CEQA Guidelines, Section 15093[a]).

The EIR identifies the following unavoidable significant impacts associated with implementation of the Campus Master Plan:

- Project-specific and cumulative traffic impact on I-215 freeway
- Project-specific and cumulative air quality impact

- Cumulative traffic noise impact along University Parkway, from I-215 to Kendall Boulevard
- Short-term and intermittent construction-related project-specific and cumulative air quality impact and project-specific noise impact
- Cumulative impact related to lighting associated with the campus' new and improved facilities

Alternatives to the Project

The alternatives to the Campus Master Plan considered include the following:

Alternative 1: "No Project" – Continuation of Current Master Plan alternative, required by CEQA
Alternative 2: Smaller Facility Development
Alternative 3: More Student Housing on Campus

Among the alternatives considered, the More Student Housing on Campus Alternative could be considered environmentally superior to the project because it would substantially reduce the magnitude of significant unavoidable traffic and air quality impact impacts, avoid a significant unavoidable traffic noise impact, reduce vehicular trips and vehicles travelled (VMTs)per person. However, since funding for tripling the amount of student housing on campus over the life of the Master Plan is not in place, this alternative may not be fiscally viable at this time.

Issues Identified During the NOP Process

No areas of controversy were identified during the Notice of Preparation (NOP) process. In response to the NOP, the following issues were raised and these issues are addressed in the EIR as follows:

- Tribal resources (addressed in Section 3.3)
- Water supply (addressed in Section 3.8)

Mitigation Monitoring Program

In accordance with CEQA Section 21081.6, a mitigation monitoring program will be adopted by the Board of Trustees of the California State University if the Campus Master Plan is approved. The mitigation monitoring program will be prepared as a separate document and will be designed to ensure compliance with the adopted mitigation measures contained in the Final EIR. The program will be available for public review prior to the Board of Trustees actions on the Campus Master Plan.

Summary of Impacts

Table S-1 summarizes the environmental effects associated with implementation of the Campus Master Plan, the mitigation measures required to avoid or minimize adverse impact, and the level of impact remaining after full implementation of identified mitigation measures.

Table S-1
Summary of Environmental Impacts and Mitigation Measures

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
Beneficial Impacts			
Sustainability and Resilience	The Master Plan builds upon the University's sustainability policies and initiatives by providing the framework, specific recommendations, and future goals for the campus' stormwater runoff and waste management, energy and water conservation, reduction of greenhouse gases emissions, and aligning the University's new buildings with LEED Gold-equivalent criteria. Full implementation of the comprehensive sustainability guidelines over the life of the Master Plan could result in a 46% reduction in energy use, 42% reduction in water use, and 77% of campus' energy derived from renewable solar power.	Impact will be beneficial, no mitigation is required.	Impact will be beneficial, no mitigation is required.
Aesthetics	The Campus Master Plan will result in substantially enhancing the visual and aesthetic campus character and quality. With the Master Plan's Design Guidelines, Landscape Guidelines, and Sustainability Guidelines, the new and renewed buildings and other facilities, landscaping, open space, signage, and other elements will create visual appearance of the campus that is both distinct and cohesive.	Impact will be beneficial, no mitigation is required.	Impact will be beneficial, no mitigation is required.
Vehicles Miles Traveled (VMT) per person	By providing additional on-campus housing for students, faculty, and staff, the Campus Master Plan will	Impact will be beneficial, no mitigation is required.	Impact will be beneficial, no

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
	result in reducing overall VMT per FTE student rate from the existing 50.9 to 47.9 VMTs.		mitigation is required.
Impacts Considered But Found To Be Less Than Significant (CEQA Guidelines Section 15128)			
Noise (project-specific)	The project-related traffic noise is not projected to be significant at any the 11 study roadway segments.	Impact will be less than significant, and no mitigation is required.	Less than significant
Fire and Police Protection Services (project-specific and cumulative)	The gradual growth in student enrollment with the implementation of the Campus Master Plan will result in incremental increase in demand for fire and police protection services. However, it does not result in the need for new fire or police protection facilities. Enhanced operating procedures, incorporation of required fire suppression and safety features, continued emergency response training, and appropriate staffing of the University Police Department will work to minimize increased demand for service. Cumulative future growth will incrementally increase the demand for fire and police protection services. Give that the surrounding area is largely developed, the University's contribution to cumulative demand will be relatively minor. The University, City of San Bernardino, County of San Bernardino, and other local jurisdictions will continue to review fire and police protection issues to ensure adequate levels of service.	Impact will be less than significant, and no mitigation is required.	Impact will be less than significant, and no mitigation is required.
Utilities and Service Systems (project-specific and cumulative)	Based on current pattern of water use, the future campus water use can be accommodated within the SBMWD's projected 2035 surplus water supplies during both normal and dry years. Furthermore, the campus water use is anticipated to decrease with the implementation of the Master Plan. The Master Plan's Sustainability Guidelines include a	The existing utilities infrastructure on campus will be expanded and improved as necessary to serve the new facilities and improvements developed pursuant to the Master Plan. Implementation of the Master Plan's sustainability guidelines in future campus development will result in reduced water use, reduced wastewater generation, reduced stormwater generation and improved stormwater	Less than significant

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
	wide range of water conservation programs and measures in design and operation of new facilities, improvements, and campus landscape with a target of 42% reduction in the campus' total water use. The reduction in water use will result in a subsequent proportional reduction in generation of waste water. The Master Plan includes sustainability features and measures that reduce stormwater generation, including bioswales, and additional quads and other permeable spaces, use of permeable materials, and other features to capture runoff. The University's commitment to a campus-wide consolidated waste management program has resulted in diverting up to 57% of waste from landfills through recycling and other waste diversion measures. This waste reduction and diversion is anticipated to continue to grow consistent with the State law of diverting at least 75%, and the California State University's goal of diverting 80% of waste by 2020.	quality, and reduced generation of non-recyclable waste. With these Master Plan features, compliance with existing requirements, and payment of all legally required capital facilities fees pursuant to and in compliance with the California Government Code Section 54999, impact on the regional public utilities systems and infrastructure will be less than significant.	
Paleontological Resources	While the potential for uncovering significant paleontological resources is considered remote, in an unlikely event that such resources are discovered during construction of future planned facilities and improvements, compliance with existing laws and regulations will ensure no significant impact. These laws and regulations include: (1) stopping work in the event that a paleontological resource is discovered until a qualified paleontologist can visit the site and assess the significance of the potential resource.; (2) the paleontologist will then conduct on-site archaeological or	Compliance with existing laws and regulations will ensure no significant impact.	Less than significant

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
	paleontological monitoring, including inspection of exposed surfaces to determine if fossils are present, and (3) if such resources are present, the monitor will have the authority to divert grading away from exposed resources temporarily in order to recover the resources.		
Short-term construction effects on water quality	Construction of new facilities and improvements will proceed in compliance with current regulations that require design and implementation of a Storm Water Pollution Prevention Plan (SWPPP), which includes implementation of Best Management Practices (BMPs) throughout construction to reduce impacts on water quality.	With compliance with existing regulations, including implementation of BMPs in all construction of new facilities and improvements on campus, impact will be less than significant, and no mitigation is required.	Less than significant
Growth-inducing impacts	The Campus Master Plan will not foster population growth. Implementation of the Campus Master Plan will result in infill facilities and reinvigoration of the existing CSU San Bernardino campus. The campus is located within a fully urbanized area that is well served by existing infrastructure. The project will not result in excess capacity that may induce growth.	Impact will be less than significant, and no mitigation is required.	Less than significant
Significant Environmental Impacts That Can Be Avoided or Mitigated (CEQA Guidelines Section 15126.4)			
Cultural Resources	***Historic Resources*** The five-story John M. Pfau Library, designed by architect William F. Cody and built in 1971, is eligible for the California Register of Historic Places. The Library is planned for a major 90,000 square-foot addition pursuant to the Campus Master Plan.	John M. Pfau Library: The massing, size, placement, articulation, and materials of the Library's planned addition is critical to avoiding an impact to this historic building. Massing and attachment of the new addition to the Library building will include the following: 1. The south (front) façade will remain free of new construction so that it maintains its prominence on the main quadrangle, particularly given the importance of the view of the building as	Less than significant

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
		one approaches the campus from University Parkway. 2. The north (rear) façade, which mirrors that of the south façade, will also remain free of new construction so that it maintains its visibility from the northern parts of the campus. 3. The addition will be equal to or lower than the original building in height and smaller in footprint in order to appear subordinate to the original building. 4. The addition will be attached only to the rear (north) portion of the east façade, so that a connection between the main building and the addition can be made on each floor, but so that much of the bulk of the addition is pulled away from the east façade to leave a significant amount of the façade – at a minimum 50% of the façade - physically disengaged from the addition. The east façade is defined as the outermost east wall of the building, not including the corners that are stepped back. 5. The colonnade on the east façade's ground floor should remain open and passable where it is not attached to the addition. At the connection of the addition to the original building, the ground floor should be enclosed mainly in glass, similar to the north façade of the connection between the original building and the existing west addition. 6. The plaza to the west of the original building that is encompassed by the west wing addition (on the south side) should be maintained free of additional construction and should not be filled in. This space functions to allow much of the west façade of the original building to remain visible. 7. Respect the symmetrical massing of the original building (when viewed from the south) by maintaining a balance between the new addition and the existing west	

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
	Archaeological Resources The CHRIS records search identified one mapped resource within the campus project area - a historic Devil Canyon Toll Road/Sawpit Creek Road, which was recorded in 2007. Some facilities and improvements are planned for portions of the campus that have historically been paved or developed only with landscaping, such as new facilities in the northwestern portion of the project area and improvements to the existing soccer field in the northeastern portion of the campus. In these locations, there is no native ground surface visible, but it is possible that unknown archaeological resources could be preserved beneath the surface.	addition in their features and massing. A mirror symmetry is not expected. The following avoidance and mitigation measures will be implemented to ensure that potential significant impact to the identified Devil Canyon Toll Road/Sawpit Creek Road site, or a previously unknown archaeological site, is avoided or minimized. 1. *Survey of Undeveloped Areas Prior to Development.* Prior to development or construction of new facilities in portions of the campus which have not previously been developed (particularly the northwestern and eastern portions of campus) archaeological pedestrian survey will be conducted to identify if potentially significant archaeological resources are present. Resources found to be not significant will not require mitigation. If a potentially significant site will be impacted by ground-disturbing activities, either the site should be avoided, or a Phase II investigation will be required to evaluate the site for eligibility for listing in the CRHR. After testing, it may be determined that data recovery will be needed. 2. *Avoidance of Eligible or Potentially Eligible Archaeological Sites through Project Design*. The preferred mitigation is avoidance of the site through project design. If direct impacts to an archaeological site, including, the Devil Canyon Toll Road/Sawpit Creek Road if it is determined that remnants of this road are present, by earth-moving activities cannot be avoided, a Phase II investigation will be necessary to determine significance in accordance with the following measure. 3. *Phase II (Evaluation) and Phase III (Data Recovery) Cultural Resources Investigations.* Ground-disturbing impacts to Devil Canyon Toll Road/Sawpit Creek Road	Less than significant

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
		should be avoided to the extent feasible. If avoidance of this resource, or other previously unknown eligible or potentially eligible resource, is not feasible, CSUSB will ensure that potentially impacted archaeological site is assessed for significance, as defined by PRC Section 21083.2 or State CEQA Guidelines Section 15064.5(a), through implementation of Phase II investigations. Resources found to be not significant will not require mitigation. Should Phase II testing of Devil Canyon Toll Road/Sawpit Creek Road, or a previously unknown archaeological site, exhaust the data potential of the site, impact will be reduced to a less than significant level. Impacts to a site found to be significant under CRHR Criterion 4 will be mitigated through a Phase III data recovery program. For such a site, prior to any ground-disturbing activities, a detailed archaeological treatment plan will be prepared and implemented by a qualified archaeologist. Data recovery investigations will be conducted in accordance with the archaeological treatment plan to ensure collection of sufficient information to address archaeological and historical research questions, and results will be presented in a technical report (or reports) describing field methods, materials collected, and conclusions. Additional testing and/or data recovery phases may involve additional excavation and/or more detailed recordation of resources or more comprehensive archival research. Any cultural material collected as part of an assessment or data recovery effort will be curated at a qualified facility. Field notes and other pertinent materials will be curated along with the archaeological collection. If a resource is found to be significant under CRHR Criterion 1, 2, or 3, alternative mitigation measures will be developed by the qualified archaeologist, in consultation with the CSUSB.	

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
		4. *Construction Monitoring for Archaeological Resources*. Prior to construction, a qualified archaeological monitor will be retained to monitor ground-disturbing activities within portions of the campus that do not currently contain structures. These include areas that are currently paved, landscaped, or undeveloped. The duration and timing of the monitoring will be determined by the qualified archaeologist in consultation with CSUSB. The archaeological monitor will work under the supervision of the qualified archaeologist. 5. *Inadvertent Discoveries*. If previously unknown buried cultural deposits are encountered during any phase of project construction, all construction work within 60 feet of the deposit will cease and the qualified archaeologist will be consulted to assess the find. If the discovery is determined to be not significant, work will be permitted to continue in the area. If a discovery is determined to be significant, a mitigation plan will be prepared and carried out in accordance with state guidelines. If the resource cannot be avoided, a data recovery plan will be developed to ensure collection of sufficient information to address archaeological and historical research questions, with results presented in a technical report describing field methods, materials collected, and conclusions. Any cultural material collected as part of an assessment or data recovery effort will be curated at a qualified facility. Field notes and other pertinent materials will be curated along with the archaeological collection. 6. *Qualified Archaeologist*. A qualified archaeologist, defined as an archaeologist who meets the Secretary of the Interior's Standards for professional archaeology, will be retained to carry out all mitigation measures related to cultural resources.	

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
	Tribal Cultural Resources		
	A search of the Sacred Lands Files by the Native American Heritage Commission (NAHC) failed to identify the presence of Native American cultural resources within the project area. However, since the Native American contact program resulted in information that project area could have a high sensitivity for tribal resources, mitigation measures have been identified to ensure that future campus development pursuant to the Master Plan will not significantly affect the previously unknown tribal cultural resources.	If previously unknown tribal cultural resources are encountered during any phase of construction of the future planned future facilities and improvements, the following measures will be implemented: 1. All earth moving construction activity will be halted until a qualified Native American monitor can visit the site and assess the significance of the potential resource. 2. The Native American monitor will then conduct on-site cultural tribal resources monitoring, including inspection of exposed surfaces to determine if such resources are present. 3. If such resources are present, the Native American monitor will have the authority to divert grading away from exposed resources temporarily in order to recover the resource. 4. If the resource cannot be recovered, the resource site will be covered with a layer of chemically stable soil before constructing project facilities on the site, if feasible; or if data recovery through excavation is the only feasible mitigation, a data recovery plan, which makes provision for adequately recovering the consequential information from and about the tribal cultural resource will be prepared and adopted prior to any excavation being undertaken and implemented during excavation or grading. 5. Such significant resources will be treated with culturally appropriate dignity taking into account the tribal cultural values and meaning of the resource, including protecting the confidentiality of the resource.	Less than significant

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
Traffic impact on study intersections (project-specific and cumulative)	Traffic generated by campus future growth together with cumulative future traffic growth will result in significant impact at 7 study intersections.	Fair share contributions will be provided to the following identified mitigation measures: ***Northpark Boulevard/Devils Canyon & Ash Street:*** • Install traffic signal. • Eastbound: One left-turn lane, one shared through-right lane. • Westbound: One left-turn lane, one shared through-right lane. • Northbound: One left-turn lane, one through lane, one dedicated right-turn lane with an overlap phase. • Southbound: One left-turn lane, one through lane, one shared through-right lane. ***Northpark Boulevard & Sierra Drive:*** ▪ Install traffic signal. ***Northpark Boulevard & University Parkway Eastbound:*** ▪ Provide an additional left-turn lane. ***University Parkway & Kendall Drive Southbound:*** ▪ Modify approach to provide one dedicated right-turn lane. ***University Parkway & College Avenue:*** ▪ Signal modification to provide protected phases in the east-west direction. ***University Parkway & State Street:*** ▪ Optimization of the AM and PM peak hour traffic signal cycle lengths and splits within the coordinated timing plan as part of the University Parkway corridor's Adaptive Traffic Signal System.	Less than significant
Short-term and intermittent construction traffic effects	Construction activity will add trucks and construction equipment to streets in the area. Haul trucks and heavy equipment usually travel more slowly than other traffic on the	1. A flag person will be employed as needed to direct traffic when heavy construction vehicles enter the campus	Less than significant

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
	street network and require more time to enter and exit traffic flows.	2. Construction trucks will avoid travel on residential areas to access campus and use the City of San Bernardino designated truck routes to travel to and from campus. 3. Construction-related truck traffic will be scheduled to avoid peak travel time on the I-215 freeway as feasible. 4. If major pedestrian or bicycle routes on campus are temporarily blocked by construction activities, alternate routes around construction areas will be provided, to the extent feasible. These alternate routes will be posted on campus for the duration of construction. 5. If any bus stop on campus is obstructed by construction activity, the University, in cooperation with the transit service providers, will temporarily relocate such transit facility on campus as appropriate.	
Construction effects on solid and hazardous waste	Demolition of existing facilities and construction of new facilities and associated infrastructure improvements will generate construction materials waste. Some of the existing academic, student housing, and other facilities on campus to be replaced or remodeled may contain some hazardous substances materials.	1. Demolition and construction inert materials, including vegetative matter, asphalt, concrete, and other recyclable materials will be recycled to the extent feasible. 2. Demolition materials that contain hazardous substances will be disposed of at certified disposal facilities in strict compliance with all applicable regulations.	Less than significant
Unavoidable Significant Environmental Impacts (CEQA Guidelines Section 15126[b] – Lead Agency must issue a “Statement of Overriding Considerations” under CEQA Guidelines Section 15093 if the Agency determines these effects are significant and approves the project.)			
Traffic on I-215 freeway (project-specific and cumulative)	Traffic associated with the Master Plan and future area-wide traffic growth will result in significant impact at three segments of I-215 freeway.	Mitigating the identified significant impacts to the freeway mainline segments will require a complete reconstruction of the I-215 freeway to add travel lanes and upgrade the deficient ramp locations. Since the freeways in the study area are interconnected systems, it will not be possible, nor effective, to provide isolated spot improvements of one segment of the freeway where deficient operations are observed. No feasible mitigation measure	Significant

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
		is available to reduce this impact to a level below significance.	
University Parkway & I-215 Northbound Ramps	Under Future Plus Project conditions, this intersection is projected to operate at level of service (LOS) E.	The removal of the pedestrian crossing at the westbound right-turn approach is recommended to allow a true, free movement. The interchange will need to be coordinated with closely spaced intersections such as at State Street, and therefore, the entire University Avenue corridor will need to be optimized. Implementation of this mitigation measure will result in LOS B – reducing the impact to a less than significant level. However, this intersection is under Caltrans responsibility and Caltrans planned improvement to this interchange has not yet been finalized.	Significant
Total Vehicle Miles Traveled (VMT)	The overall VMT is forecast to increase by 416,003 miles on a daily basis at Master Plan's planning horizon due to the increase in enrollment and the associated vehicular trips.	No feasible mitigation measures are available to reduce this impact to a level below significance.	Significant
Noise (cumulative)	The implementation of the Master Plan together with future growth within the surrounding areas and the region will result in additional vehicle trips and overall increase in traffic noise levels, resulting in a significant cumulative noise impact along University Parkway, from I- 215 freeway to Kendall Drive.	No direct feasible mitigation measures are available as most of the residential areas already have 6 to 8-foot noise barriers in place to help reduce traffic noise.	Significant
Long-term air quality impact (project-specific and cumulative)	While the Campus Master Plan is supportive of the goals and objectives and consistent with the regional air quality management plan, the long-term operational emissions could exceed the SCAQMD daily threshold amounts for ROG and NOx.	The University implements, and will continue to implement pursuant to the Master Plan numerous programs and policies to improve air quality in the region, including providing housing for students on campus that reduce commute trips and the associated air pollutant and GHG emissions and minimizing energy use through project design and increased use of renewable energy sources. No additional feasible mitigation strategies are currently available to substantially reduce emissions of ROG and NOx.	Significant

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
Short-term construction effects on air quality and GHG (project-specific and cumulative)	Peak day construction emissions associated with construction of future campus facilities and improvements will be above the South Coast Air Quality Management District (SCAQMD) threshold amounts for ROG. If construction of several major facilities and/or improvements should substantially overlap, the peak day construction emissions may also be above SCAQMD threshold amounts for other pollutants as well.	1. Exposed surfaces are watered as needed. 2. Soils stabilizers are applied to disturbed inactive areas as needed. 3. Ground cover is replaced quickly in inactive areas. 4. All stockpiles are covered with tarps or plastic sheeting. 5. All unpaved haul roads are watered daily and all access points used by haul trucks are kept clean during the site grading. 6. Speed on unpaved roads is reduced to below 15 miles per hour. 7. Trucks carrying contents subject to airborne dispersal are covered. 8. Grading and other high-dust activities cease during high wind conditions (wind speeds exceeding a sustained rate of 25 miles an hour). 9. Diesel particulate filters are installed on diesel equipment and trucks. 10. All construction equipment will be properly tuned. 11. To reduce emissions from idling, the contractor shall ensure that all equipment and vehicles not in use for more than 5 minutes are turned off, whenever feasible. 12. Low VOC-content paint, stucco, or other architectural coatings materials will be utilized to the extent possible. 13. Low VOC-content asphalt and concrete will be utilized to the extent possible. 14. The University will continue to comply with SCAQMD Rule 1403 (Asbestos Emissions from Renovation/ Demolition Activities) and other pertinent regulations when working on structures	Significant

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
		containing asbestos, lead, or other toxic materials. The University will implement the following measures to protect students present at campus. 15. As appropriate, outdoor activities at the campus will be limited during high-dust and other heavy construction activities, including painting. 16. Throughout the construction period of individual facilities and improvements in close proximity to student residence halls, campus academic facilities, health and wellness facilities, and/or other sensitive uses on campus, ventilation systems in those facilities will be tested more frequently to provide for the maintenance schedule that ensures proper ventilation.	
Short-term construction noise effects	Construction of some new facilities and improvements could result in a temporary and intermittent noise audible at the nearby student residence halls, academic facilities, or other campus sensitive uses.	1. Construction hours will be consistent with City of San Bernardino regulations, which limit construction activity to the hours between 7:00 am and 8:00 pm. 2. Muffled heavy construction equipment will be used. 3. Construction staging areas will be located as far as possible from student residence halls, campus academic facilities, health and wellness facilities, and other places where students gather. 4. The contractor will ensure that each piece of operating equipment is in good working condition and that noise suppression features, such as engine mufflers and enclosures, are working and fitted properly. 5. The contractor will locate noisy construction equipment as far as possible from nearby sensitive uses.	Significant
Cumulative lighting effects	The campus' lighting, including lighting of the enhanced athletic facilities, together with lighting used in future development in the surrounding area will result in an	No feasible mitigation measure is available to reduce this impact to a level below significance.	Significant

	Potential Environmental Impact	Mitigation Measures	Level of Impact After Mitigation
	overall increase in lighting levels. This increase in could be considered to be cumulatively significant, even though the future area-wide lighting will be levels at levels commonly associated with urban areas.		

1.0 Introduction

Purpose of the EIR

This Program Environmental Impact Report (EIR) has been prepared to evaluate the environmental effects of the adoption and implementation of the proposed California State University, San Bernardino (CSU San Bernardino) 2016 Campus Master Plan. The 2016 Campus Master Plan constitutes a project for the purposes of the California Environmental Quality Act (CEQA) and the State CEQA Guidelines.

According to the CEQA Guidelines, an "EIR is an informational document which will inform public agencies, decision makers, and the public generally of the significant environmental effects of a project on the environment, identify possible ways to minimize the significant effects, and describe alternatives to the project." This Draft EIR is an informational document to be used by decision makers, public agencies, and the general public. It is not a policy document of CSU San Bernardino.

The EIR will be used by CSU San Bernardino in assessing impacts of the proposed project. During the project implementation process, mitigation measures identified in the EIR may be applied to the project by CSU San Bernardino and/or other involved agencies.

Program EIR

This document is a Program EIR prepared pursuant to the provisions of Section 15168 of the CEQA Guidelines. A Program EIR is an EIR prepared on a series of actions that can be characterized as one large project. The project consists of a series of physical and programmatic actions and improvements pursuant to the updated Campus Master Plan implemented over time to the year 2035 planning horizon.

A Program EIR allows later activities, i.e. a subsequent actions and improvements, to be approved provided that the effects of such projects were examined in the Program EIR, and no new effect could occur or no new mitigation measure would be required upon implementation of such subsequent action or improvement. At the time that each facility improvement or other action pursuant to the Master Plan is carried forward, CSU San Bernardino will review each individual action or improvement to determine whether the Program EIR fully addressed the potential impacts and identified appropriate mitigation measures. If so, no further review will be required.

Legal Requirements

This EIR has been prepared in accordance with the California Environmental Quality Act of 1970 (Public Resources Code, Section 21000 et seq.) and the Guidelines for Implementation of the California Environmental Quality Act (CEQA Guidelines) published by the Public Resources Agency of the State of California (California Code of Regulations, Title 14, Section 15000 et seq.), and in accordance with the CSU CEQA Guidelines. The Board of Trustees of the California State University is the lead agency for this EIR, as defined in Section 21067 of CEQA.

Pursuant to CEQA and the CEQA Guidelines, an Initial Study was prepared for this project. The Initial Study concluded that the project might have a significant effect on the environment. The Initial Study checklist is included in Appendix A of this EIR. A Notice of Preparation (NOP) for this EIR was issued by the University on October 10, 2016 in accordance with the requirements of the CEQA Guidelines Sections 15082(a) and 15375. The NOP indicated that an EIR was being prepared and invited comments on the project from public agencies and the general public.

This EIR was prepared by environmental planning consultants under contract to CSU San Bernardino and under the direction of University staff.

Scope of the Project

The project is the 2016 Campus Master Plan for CSU San Bernardino's main campus. The Master Plan provides a framework for implementation of the University's goals and programs, by identifying needed facilities and improvements to accommodate a gradual growth in student enrollment projected to reach 25,000 FTEs by 2035. The Master Plan is designed to provide new in-fill facilities in the interior of the campus and replace existing aged, obsolete, and inefficient facilities. Associated infrastructure and landscape improvements will also be provided throughout the campus.

The Campus Master Plan improves open spaces, pedestrian corridors, and campus architectural themes. Overall, the Master Plan aims to enhance the University's distinct character, update and expand campus facilities and infrastructure, and preserve the quality of the physical environment.

Scope of the Environmental Analysis

Pursuant to CEQA and the CEQA Guidelines, an Initial Study was prepared for this project. The Initial Study concluded that the Master Plan might have a significant effect on the environment with respect to the following environmental issue areas:

- Aesthetics
- Air quality
- Greenhouse gas
- Public services
- Traffic and circulation
- Utilities and service systems

- Noise
- Short-term construction effects

During the NOP process, the issues of biological and cultural resources were also identified. All these issues are addressed in this EIR in the appropriate section. Appendix A contains the Initial Study and NOP for the project. Appendix B contains cultural resources reports, Appendix C contains the traffic study, and Appendix D contains the air quality worksheets. All other reference documents cited in the EIR are on file with CSU San Bernardino Facilities Planning and Construction Services, 5500 University Parkway, San Bernardino, CA 92407-2393.

Intended Uses of the EIR

The Campus Master Plan and subsequent implementing actions are subject to review and approval by the Board of Trustees of the California State University. This EIR may also be used to provide information to other agencies for their discretionary actions related to the project implementation, including the following:

- City of San Bernardino
  Approval of any improvements within the City rights-of-way
  Approval of new connections and/or increase in quantity of water delivery to campus, as needed

- San Bernardino County Sanitation District
  Approval of new connections and/or increase in quantity of wastewater, as needed

- Regional Water Quality Control Board
  Compliance with MS4 permit for stormwater, and issuance of Construction Storm Water General Permit for construction of new facilities

- State Fire Marshall
  Fire safety review and approval of future facilities and improvements

- Division of State Architect
  Approval of accessibility for future facilities

- Others, as may be necessary

Public Review and Comment

The Draft Program EIR will be circulated for a 45-day public review period. The public is invited to comment in writing on the information contained in this document. Persons and agencies commenting are encouraged to provide information that they believe was missing from the Draft EIR, or to identify where the information could be obtained. All comment letters, and oral comments received at the public meeting on the Draft EIR that will be held by the University, will be responded to in writing, and the comment letters, together with the responses to those comments, will be incorporated into the Final EIR.

Contact Person

The primary contact person regarding information presented in this Draft EIR is Hamid U. Azhand, Director Facilities Planning, Design and Construction, 5500 University Parkway, San Bernardino, CA 92407-2393; fax (909) 537-5989; email: HAzhand@csusb.edu.

2.0 Project Description

The Project

The project is the adoption and implementation of the California State University San Bernardino main campus (CSU San Bernardino) 2016 Campus Master Plan. The current Master Plan provided for campus facilities accommodating up to 20,000 full-time equivalent (FTE) students. The 2016 Campus Master Plan provides a framework for implementation of the University's goals and programs, by identifying needed facilities and improvements to accommodate a gradual growth in student enrollment projected to reach 25,000 FTEs by 2035. Currently, the University's enrollment has already reached 18,070 FTEs, or 20,767 headcount students[1].

Project Objectives

The main objective of the Master Plan is to guide the development of the campus over the next 20 years to accommodate gradual student enrollment growth, through infill development within the existing developed campus area, while enhancing the quality of campus life. To do so, the Master Plan creates a physical campus environment that facilitates the CSU San Bernardino's ability to achieve the following objectives:

- Support students, faculty and staff with appropriate teaching, research and administrative facilities
- Serve as a regional center for intellectual, cultural, and life-long learning
- Reinforce the University's active learning focus by providing opportunities for interactions and collaborations among students, faculty, staff and the greater community
- Support the creation and maintenance of residential and non-residential learning communities on the campus, including the accommodation of smaller learning communities within a variety of campus spaces such as the Pfau Library, classroom/laboratory buildings, the Santos Manuel Student Union, and the Commons
- Support the creation of a range of student learning/research/incubator type spaces through public-private and public-public partnerships
- Where appropriate, offer student learning and community-oriented/outreach programs in University-controlled centers off the main CSU San Bernardino campus
- Reinforce positive intrinsic features of the CSU San Bernardino campus including views to the San Bernardino Mountains, the signature campus gateway/quad lawn, and physical connections with surrounding neighborhoods and facilities
- Make efficient use of developable campus land and preserve a balance between built-up areas and open space

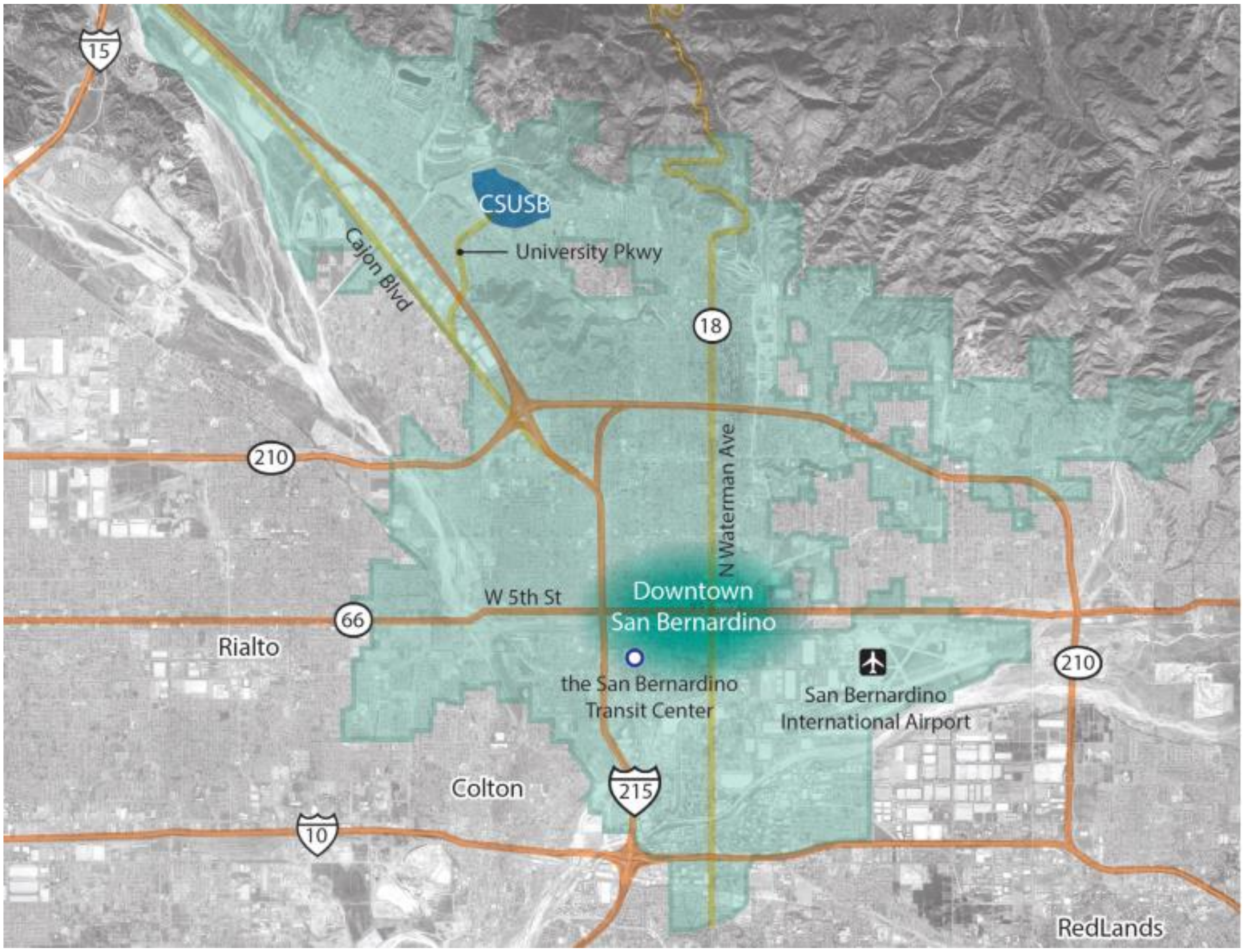
[1] www.csusb.edu/about-csusb/facts-and-stats

- Create a series of campus outdoor spaces framed by buildings and protected from extremes of sun and wind that facilitate student interaction, student learning and passive recreation
- Provide appropriate facilities for informal and organized recreation and intercollegiate athletics
- Serve as an accessible, safe and attractive campus for students, staff, faculty and the community
- Provide for a range of ways for students and the community to access the campus and its facilities including public transportation and distance learning
- Through a comprehensive approach to sustainability, maintain CSU San Bernardino's stewardship of campus landscape and natural resources
- Conserve natural resources while creating and fostering an environmentally, socially, and economically sustainable physical and operational campus
- Create and foster campus facilities that efficiently utilize university human, natural, and financial resources
- Provide for correctly sized and oriented Teaching Resource Center (TRC) to accommodate the range of faculty needs

Project Location and Surrounding Uses

The CSU San Bernardino 441-acre campus is located at the base of the San Bernardino Mountains, and is separated from the existing surrounding residential development to the south, west, and east by Northpark Boulevard. Northpark Boulevard also provides access to the campus from I-215 freeway, as illustrated in Figure 1.

Project Location
Figure 1



Project Characteristics

Key Features

The Campus Master Plan capitalizes on the most vivid, character-defining attributes of the campus - its regal setting at the base of the San Bernardino Mountains and its extensive and well-cared-for landscape setting, and creates a long range plan for strategic infill within the existing campus to accommodate future growth. This approach avoids campus sprawl, reduces pedestrian travel distances, and creates smaller, more human open spaces all connected by a network of shaded, activated pedestrian walkways and paths.

The Master Plan also makes use of some existing surface parking lots for new building sites and proposes other building sites that are currently occupied by facilities that already have or will reach the end of their useful lives within the Master Plan's planning horizon. As illustrated in Figures 2 and 3, this new strategic infill approach provides for the use of the existing campus land to accommodate all needed facilities while preserving campus open space, and utilizes new buildings to frame smaller, more intimate courtyards and open spaces and ultimately create a denser, more walkable and collegial campus environment while at the same time reinforcing existing land uses.

To achieve this, the Master Plan incorporates a series of key features that will transform the campus in a phased manner over the next 20 years. These key features were formulated and designed in response to Master Plan objectives and specific needs identified throughout a comprehensive Master Plan development process guided by a Master Plan Steering Committee representing faculty, administration, students and staff, and by input from the campus community and stakeholders through an extensive series of Town Hall meetings.

With the key features, the Master Plan:

- Locates all new academic facilities to infill along the main campus pedestrian spine ("Coyote Walk") to reinforce this area as the “heart” of the campus.

- Encourages multi-disciplinary shared academic buildings to accommodate future advances in specific program growth and new education/teaching approaches and strategies.

- Creates two campus housing villages and provides for student apartments to encourage a more 24/7 campus environment within the campus core to integrate campus life and activities.

- Transforms "Sycamore Walk" to become the "residential street" within the campus linking all residential villages and the academic core.

- Provides new strategically located parking structures positioned at the terminus of all primary pedestrian pathways to facilitate the transition from parking into the campus.

- Redefines and enhances the main campus gateway through redirection of parking entries to reduce vehicle congestion; and new signage, landscape, and housing to enhance the campus entry identity.

- Enhances campus’ Athletics, Student Recreation, and Kinesiology facilities to include college level baseball and softball fields, soccer fields, expanded tennis courts, basketball courts, and a stadium.

- Provides a series of sustainability initiatives that will make responsible use of campus resources and conserve water and energy.

- Preserves the "Land Lab" area between the San Bernardino Mountains and the campus used extensively by faculty and students for research, and to provide a buffer and a firebreak between the campus and the mountain environment.

- Addresses near term space needs through more efficient use of existing campus space.

These Master Plan features are integrated with and connected through an enhanced campus open space network, clear pedestrian/bicycle circulation system, and a peripheral system of structured and surface parking. The Master Plan also reinforces the current location of the transit center at the main campus entry.

These key Master Plan features are illustrated in Figure 2.

Illustrative Campus Master Plan
Figure 2

Campus Development

To accommodate the projected future campus student enrollment, the Master Plan provides for campus development with approximately 2.9 million gross square feet of needed new facilities and improvements over the next 20 years. These planned facilities include:

Academic Facilities: Approximately 1.2 million square feet of new classrooms, laboratories, library, collaborative, and other instructional space for the University's academic programs. The new facilities include a new engineering academic facility, a performing arts center, physical education, an administrative/student services center, a new science facility, and new offices. In addition, some facilities that have reached the end of their useful life will be remodeled or renovated, including John M. Pfau Library, Sierra and Capistrano Halls, Chaparral Hall, Sierra Hall, Serrano Village, and the administration building. To create a vibrant campus environment for the University's students, the Campus Master Plan also provides for expanding the existing facilities to include a new performing arts center, theater, and new academic spaces such as an interdisciplinary lecture classroom, a dance studio and a theater arts teaching lab.

Student Life and Support Facilities: Providing student housing on campus directly supports academic excellence and a vibrant campus environment. To do so, the Master Plan provides for new housing facilities providing 3,320 additional student beds on campus. Two new student housing precincts are created, one in the south campus area, around the existing campus housing, and a housing village in the north central portion of the campus. Each will have its own dining commons and will be planned around a series of landscaped courtyards for student gathering and recreation. A third component of housing will be located in the Gateway Precinct, on both sides of the main campus entry, framing this gateway into the campus.

Administrative and Support Facilities: Approximately 200,000 square feet of administrative facilities and campus support facilities. The Master Plan also provides for modifications and augmentations of the campus utilities systems to serve the new facilities, including an expansion of the campus' physical plant.

Physical Education and Athletic Facilities: The Master Plan provides for new baseball, basketball, softball, and soccer fields with bleachers; a multi-use stadium for track and field, soccer, and football with 6,000 seats, and expanded tennis courts. A new, approximately 63,000 square-foot physical education facility will be provided adjacent to the existing gymnasium.

Entrepreneurial Facilities: Approximately 200,000 square feet of research, technology, and other space, including a conference center with an 80-room hotel. These facilities will be developed in partnership with public and private organizations through enterprises that support the University's educational mission and generate potential revenue for the University's programs and functions.

Parking: Approximately 3,600 new parking spaces within new parking structures strategically located at the perimeter of the campus, predominantly in the areas currently developed with surface parking lots.

Master Plan New Facilities
Figure 3

- Physical Education
- Assembly & Exhibit
- Student Support
- Instructional
- Library, Media & Collaborative
- Physical Plant
- General Administration
- Housing
  - Residential Halls
  - Residential Suites
  - Apartments
- Lodging
- Discovery/Innovation Park
- Under Development
- 5-min Walking Radius

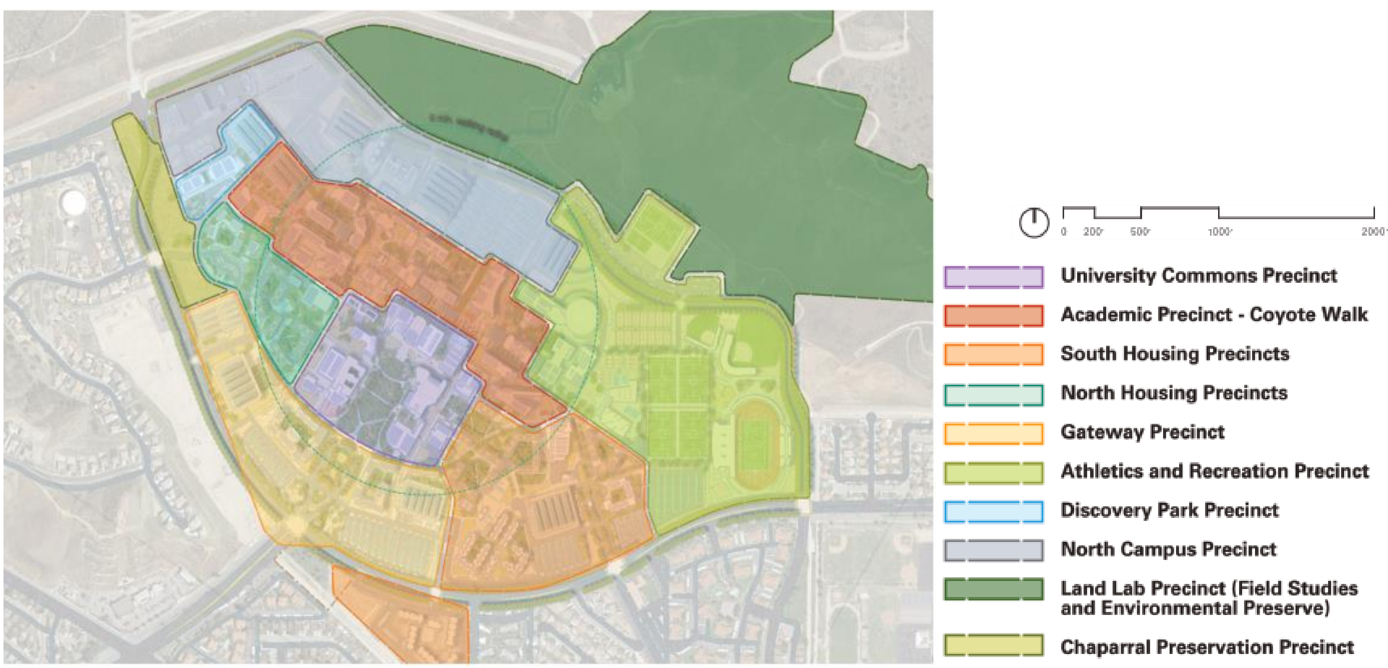
Source: 2016 Campus Master Plan

Campus Development Framework

The Master Plan provides for the integration of the planned campus development and the campus functions into a framework of eight functional and geographic zones (or precincts) as illustrated in Figure 4. The future development within the zones is planned to effectively concentrate the use of land within each zone and provide space for a broad range of programs, to achieve the following objectives:

- Making efficient use of University-owned land currently occupied by facilities that have reached the end of their useful life cycles
- Increasing campus density and reducing walking distances by infilling new facilities to create new smaller, more human-scaled spaces, which avoids using important open spaces for new facilities
- Reinforcing the pedestrian pathway system (Coyote Walk) by orienting buildings entrances to campus walkways
- Linking the precincts by an enhanced pedestrian pathway systems that focuses on Coyote Walk and Sycamore Walk and incorporates major open space and landscape elements

Campus Development Framework
Figure 4

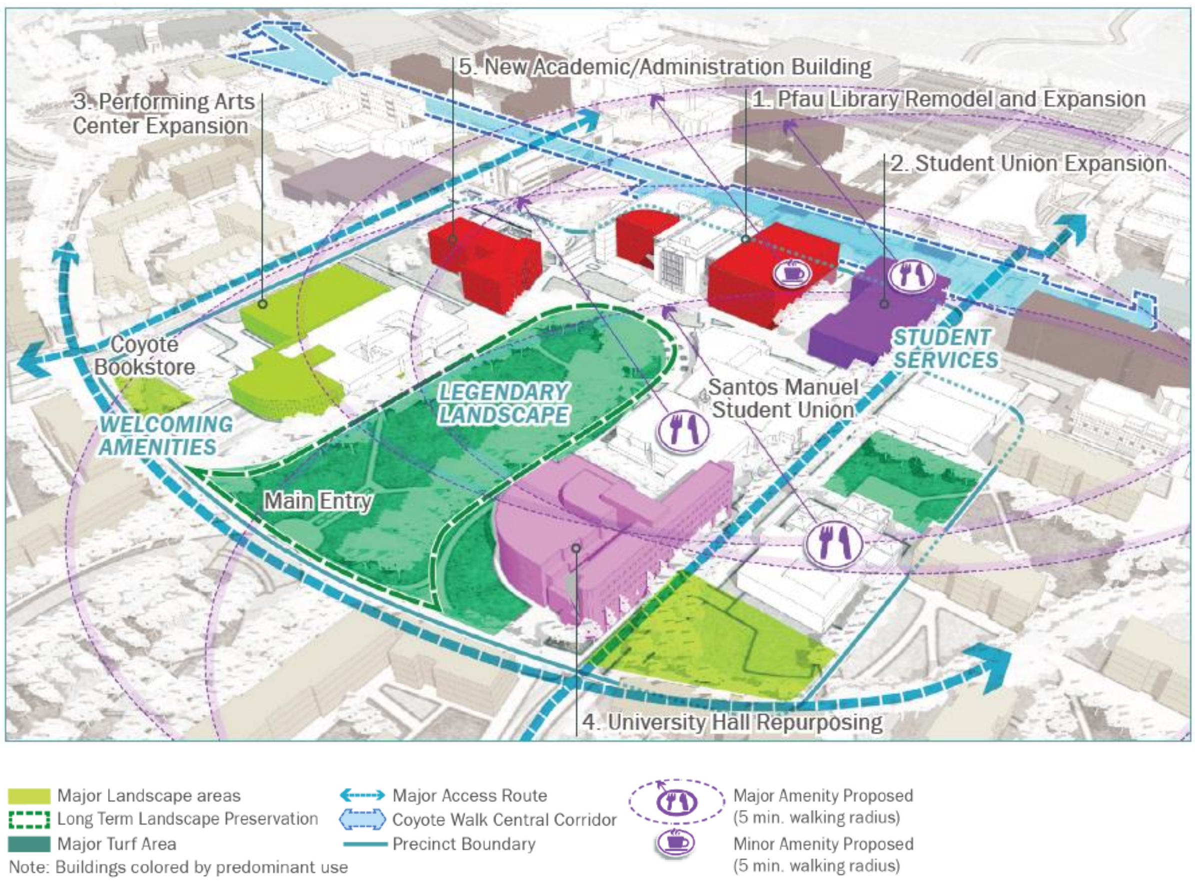


Source: 2016 Campus Master Plan

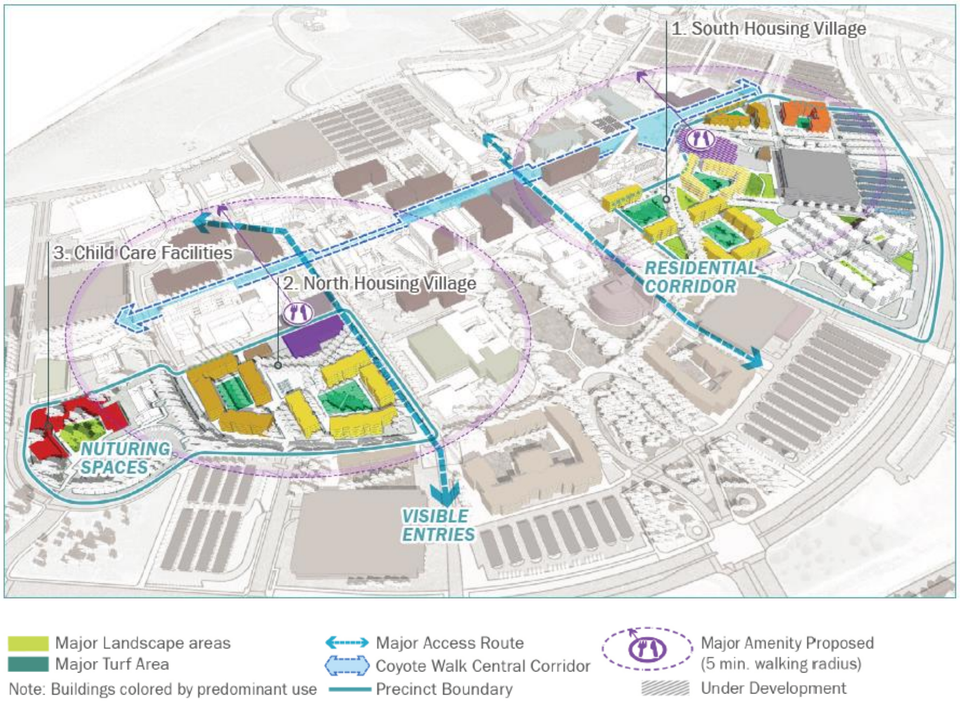
Campus Development Layout

The planned development within each of the precincts is illustrated in Figure 4.1 through Figure 4.7.

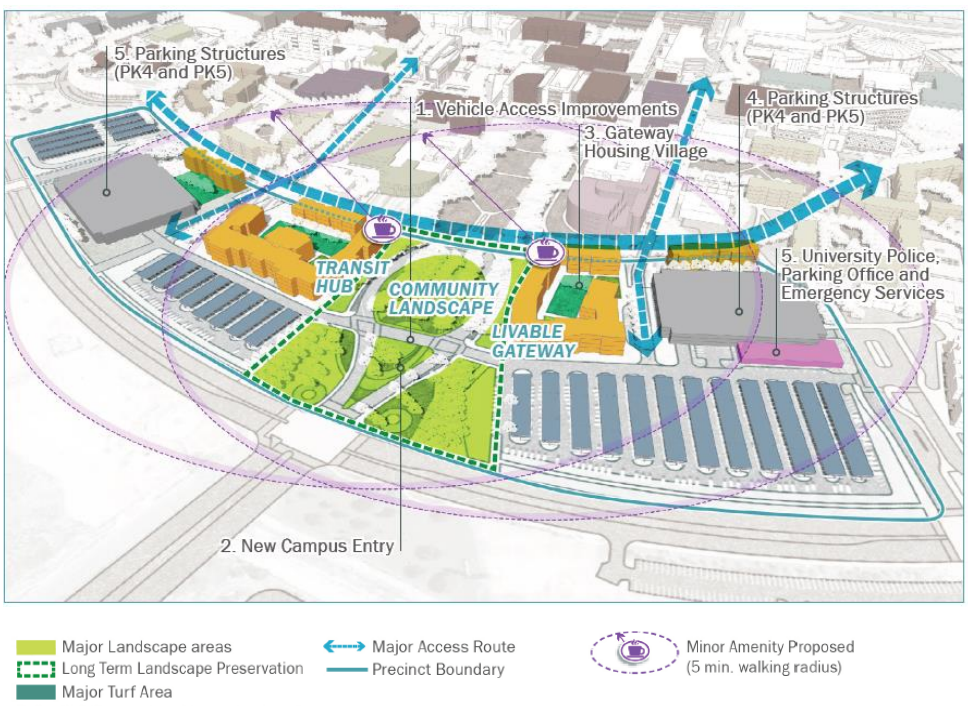
University Commons Precinct Layout
Figure 4.1



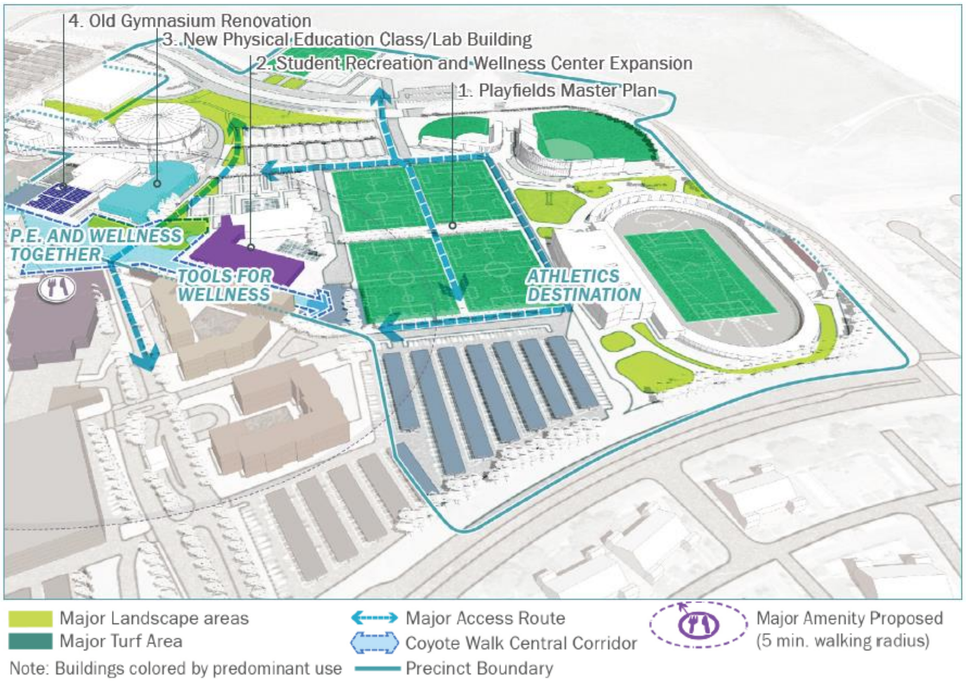
North and South Student Housing Precinct Layout
Figure 4.2



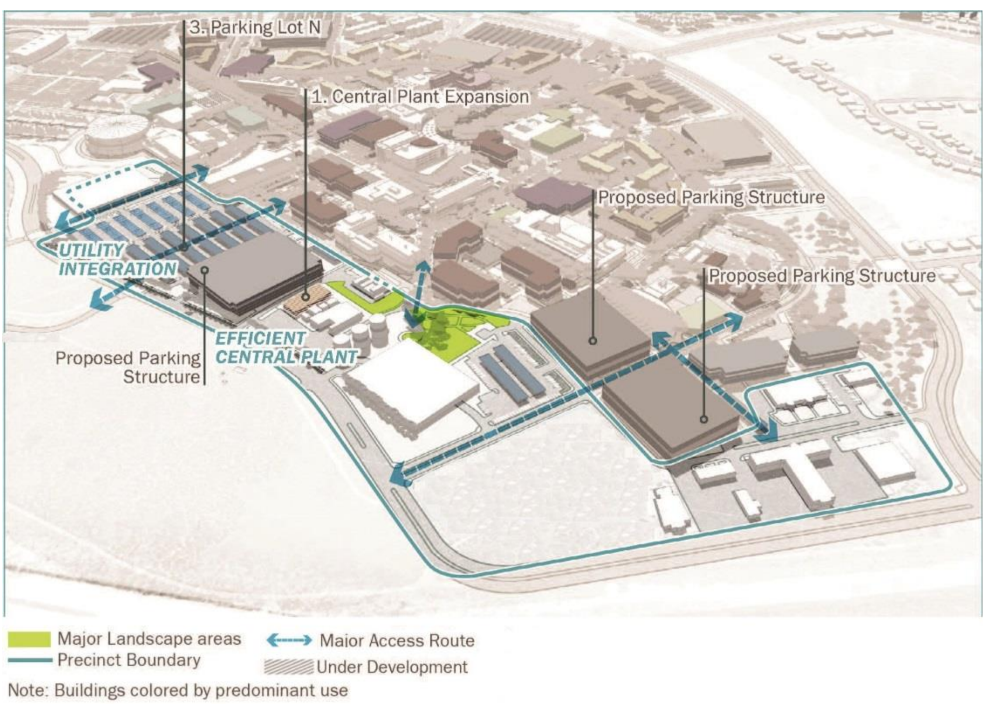
Gateway Precinct Layout
Figure 4.3



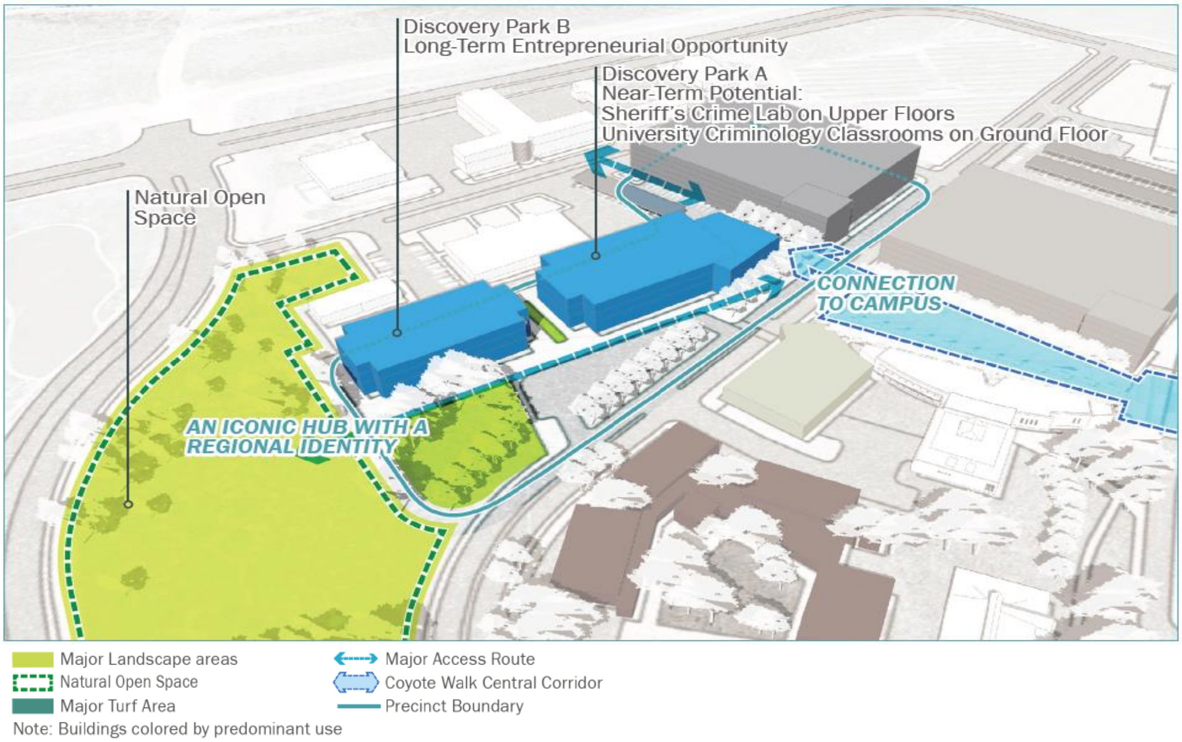
Physical Education and Athletics Precinct Layout
Figure 4.4



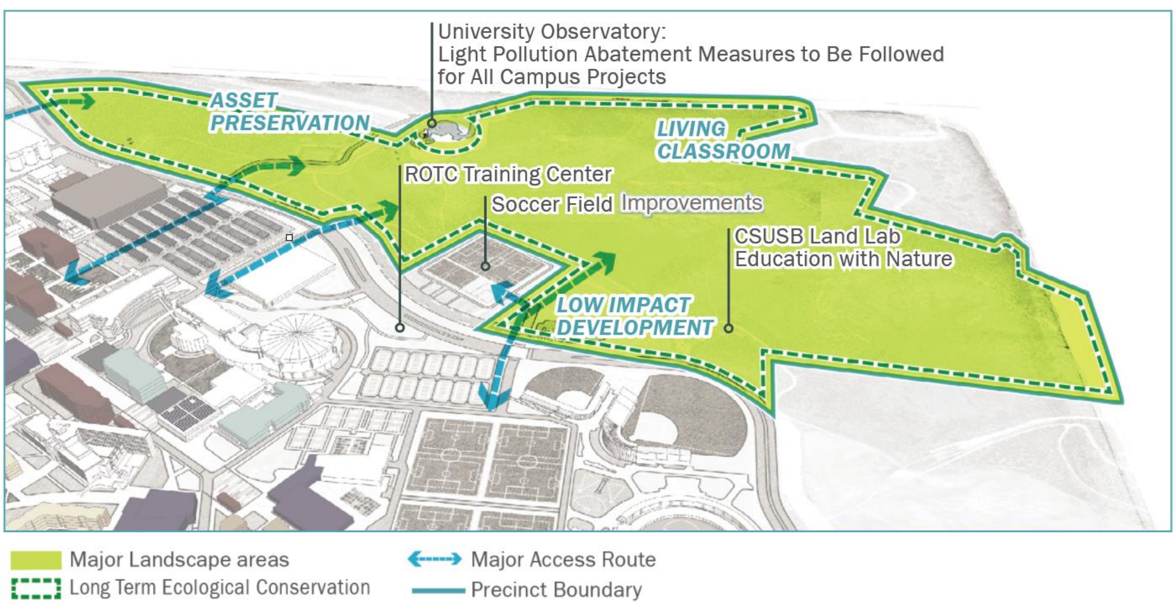
North Campus Precinct Layout
Figure 4.5



Discovery Park Precinct Layout
Figure 4.6



Land Lab Precinct Layout
Figure 4.7



Campus Connectivity

The Campus Master Plan provides for functional enhancements maximizing connectivity to and from the campus and within the campus itself, including:

- Enhancing pedestrian and bicycle routes within the campus, including transforming "Sycamore Walk" to become the "residential street" within the campus linking all residential villages and the academic core.

- Continuing to limit vehicular access to the periphery of the campus.

- Redefining and enhancing the main campus gateway through redirection of parking entries to reduce vehicle congestion.

- Providing new strategically located parking structures positioned at the terminus of all primary pedestrian pathways to facilitate the transition from parking into the campus.

- Reinforcing the use of the bus rapid transit (BRT), known as SBX, that serves the campus

Figure 5 illustrates the transportation and circulation framework plan for the campus.

Transportation and Circulation Framework
Figure 5

Source: 2016 Campus Master Plan

Landscape and Open Space

The Master Plan provides for major open space, landscape, and design enhancements that will elevate the University's presence in the global higher education arena and the academic and living environment of the campus. These include:

- Reinforcing intrinsic features of the campus including views to the San Bernardino Mountains, the signature campus gateway/quad lawn, and physical connections with surrounding neighborhoods and facilities
- Preserving a balance between built-up areas and open space, including preservation of the heritage landscapes and creation of a habitat conservation area
- Augmenting and expanding an integrated network of plazas and promenades, with tree-lined major pedestrian Coyote Walk and Sycamore Walk as major campus promenades
- Developing quads, courtyards, and other outdoor spaces as part of facilities design to encourage social interactions for students, faculty, and staff
- Enhancing the identity of the University and its campus through landscape and identification at campus entries
- Using design guidelines in the development of new facilities and integrating their form and materials with existing outdoor environment.

Figure 6 illustrates the landscape and open space framework plan for the campus.

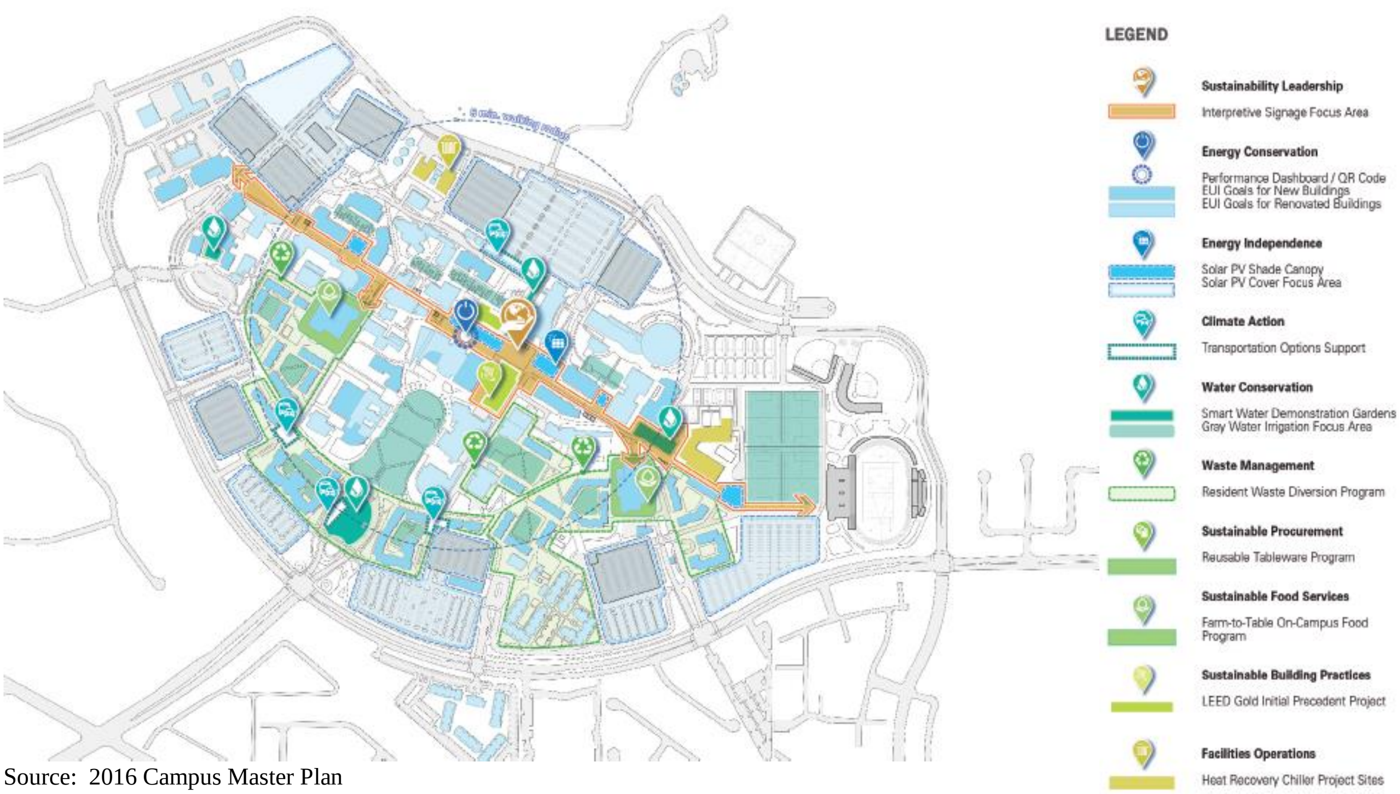
Landscape and Open Space Framework
Figure 6

Source: 2016 Campus Master Plan

Sustainability

The Master Plan builds upon the University's sustainability policies and initiatives by providing the framework, specific recommendations, and future goals for the campus' stormwater runoff and waste management, energy and water conservation, reduction of greenhouse gases emissions, and aligning the University's new buildings with LEED Gold-equivalent criteria. Full implementation of the comprehensive sustainability guidelines over the life of the Master Plan could result in a 46% reduction in energy use, 42% reduction in water use, and 77% of campus' energy derived from renewable solar power. Figure 7 illustrates the sustainability framework plan for the campus.

Sustainability Framework
Figure 7



Source: 2016 Campus Master Plan

Implementation

The campus facilities and improvements pursuant to the Master Plan will be developed incrementally over the next 20 years. The facilities envisioned to be developed in near term, i.e. the earliest within the Master Plan timeframe include:

John M. Pfau Library Renovation and Addition: The Library will be fully renovated, and will include a 90,000 square-foot addition attached to the rear (north) portion of the building's east façade.

Student Housing Phase 2**:** A new dormitory-style student housing residence with 400 beds for freshmen students. The new housing will be located east of the new Dining Commons.

Student Union Expansion: The existing Student Union will be expanded with up to 124,000 square feet to include additional banquet rooms, student meeting rooms, the campus bookstore, lounge areas, and other related functions. This project will extend the existing Student Union north so as to engage the proposed central spine of the campus along Coyote Walk and helping to activate Coyote Walk.

Performing Arts /Theater: The Performing Arts/Theater will be integrated and expanded by approximately 105,000 square feet. It will include a public lobby and classrooms facing the central quad, a theater stage with up to 1,200 seats for spectators, and other academic spaces such as an interdisciplinary lecture classroom, a dance studio, and a theater arts teaching lab.

Baseball and Softball Fields: The existing deteriorating baseball and softball fields will be replaced with college-level baseball and softball fields, complete with bleachers that seat approximately 3,250 at the baseball field and 570 at the softball field.

Forensics Laboratory: The Master Plan provides for a joint development with the County of San Bernardino Sheriff's Department of a forensics laboratory on campus. The approximately 27,500 square-foot laboratory will be located within the Discovery Park precinct.

Parking Structure 3 and Police Station: A new parking structure will be constructed on the existing parking lot D. The parking structure will provide up to 1,200 spaces in three levels above ground and one below grade level. An approximately 27,000 square-foot campus police, parking offices and the Emergency Operations Center will be located adjacent to the parking structure's ground level.

Project Actions

The following actions are anticipated to be required for the project:

- CSU Board of Trustees
  Approval and adoption of 2016 Campus Master Plan

- City of San Bernardino
  Approval of any improvements within the City rights-of-way
  Approval of new connections and/or increase in quantity of water delivery to campus, as needed

- San Bernardino County Sanitation District
  Approval of new connections and/or increase in quantity of wastewater, as needed

- Regional Water Quality Control Board
  Compliance with MS4 stormwater permit
  Issuance of Construction Storm Water General Permit for construction of new facilities

- State Fire Marshall
  Fire safety review and approval of future facilities and improvements

- Division of State Architect
  Approval of accessibility for future facilities

- Others, as may be necessary

3.0 Environmental Impact Analysis

This section of the EIR examines potentially significant effects associated with the CSU San Bernardino 2016 Campus Master Plan as identified through the NOP process (see Section 1.0 and Appendix A) and identifies mitigation measures to avoid or substantially reduce impacts found to be potentially significant in the EIR analysis. Each environmental issue for which the Initial Study (see Appendix A) identified a potentially significant impact is discussed in the following manner:

Environmental Setting describes the existing environmental conditions in the vicinity of the project as it exists before the commencement of the project to provide a baseline for comparing "before the project" and "after the project" environmental conditions.

Impact Criteria defines and lists specific criteria used to determine whether an impact is considered to be potentially significant. Appendix G of the CEQA Guidelines; applicable local, State, federal or other standards; and officially established thresholds of significance are the major sources used in crafting criteria appropriate to the specifics of a project, since "….an ironclad definition of significant effect is not always possible because the significance of an activity may vary with the setting" (CEQA Guidelines Section 15064[b]). Principally, "… a substantial, or potentially substantial, adverse change in any of the physical conditions within an area affected by the project, including land, air, water, flora, fauna, ambient noise, and objects of historic and aesthetic significance" constitutes a significant impact (CEQA Guidelines Section 15382).

Environmental Impact presents evidence, based to the extent possible on scientific and factual data, about the cause and effect relationship between the project and potential changes in the environment. The exact magnitude, duration, extent, frequency, range or other parameters of a potential impact are ascertained to the extent possible to provide facts in support of finding the impact to be or not to be significant. In determining whether impacts may be significant, all the potential effects, including direct effects, reasonably foreseeable indirect effects, and considerable contributions to cumulative effects, are considered. If, after thorough investigation, a particular impact is too speculative for evaluation, that conclusion is noted (CEQA Guidelines Section 15145).

Mitigation Measures identify measures that can reduce or avoid the potentially significant impact identified in the EIR analysis. Standard existing regulations, requirements, and procedures applicable to the project are considered a part of the existing regulatory environment. Mitigation measures are those feasible, project-specific measures that may be needed in addition to compliance with existing regulations and requirements, in order to reduce significant impacts. Mitigation, in addition to measures that the lead agency will implement, can also include measures that are within the responsibility and jurisdiction of another public agency (CEQA Guidelines Section 15091[a][2]).

Level of Impact After Mitigation indicates what effect remains after application of mitigation measures, and whether the remaining effect is considered significant. When these impacts, even with the inclusion of mitigation measures, cannot be mitigated to a level considered less than significant, they are identified as "unavoidable significant impacts." To approve a project with significant unavoidable impacts, the lead agency must adopt a Statement of Overriding Considerations. In adopting such a statement, the lead agency finds that it has reviewed the EIR, has balanced the benefits of the project against its significant effects, and has concluded that the benefits of the project outweigh the unavoidable adverse environmental effects, and thus, the adverse environmental effects may be considered "acceptable" (CEQA Guidelines Section 15093 [a]).

3.1 Aesthetics

Environmental Setting

The most visible and unifying element of the CSU San Bernardino campus visual character is its proximity to the San Bernardino Mountains that provides a visually dramatic backdrop for the entire campus, as illustrated in Figure 8.

Aerial Views of Campus
Figure 8

Other prominent elements defining the campus' aesthetic character are the Gateway Commons open plaza that serves as the primary University gateway, Coyote Walk pedestrian corridor, and the Land Lab area – a natural open space encompassing the campus' most northern area.

Since the campus was established in 1965, a variety of classrooms, laboratories, student services, recreational, housing, and support services facilities have been incrementally added to the campus. These include some visually prominent facilities, such as the John M. Pfau Library. Overall, the existing facilities reflect a wide range of architectural styles, building materials, heights, and massing that does not provide visual continuity. Varied exterior building colors also contribute to a lack of visual continuity, further adding to the heterogeneous nature of the campus' built environment. Many older buildings reflect outdated color schemes using white color palette and materials and many have large blank or nearly blank facades or imposing mass that contribute to an uncongenial environment that is not consistent with human scale. The newer buildings tend to incorporate high proportions of glass and some use metal panels as facade materials. Connections between buildings and the campus' pedestrian pathway system are not well defined, with some buildings' main entries along minor pedestrian pathways, lack of clearly delineated entries, or not taking advantage of views adjacent to open spaces.

Impact Criteria

Impact is considered to be significant if the implementation of the Campus Master Plan will substantially degrade the existing visual character or quality of the University campus or its surroundings, have a substantial adverse effect on a scenic vista, and/or create substantial light and glare that will adversely affect day or nighttime views in the area.

Environmental Impact

The Campus Master Plan aims to transform and elevate the campus' visual "brand" while protecting and enhancing its distinct visual elements. This will be achieved through visual and aesthetic integration of existing and future facilities and expanded landscape, whereby:

- "Signature" buildings on the campus will include the Pfau Library; the future Performing Arts building, and student activity buildings such as the expanded Student Recreation and Wellness Center and the Santos Manuel Student Union.
- The massing and orientation of new facilities will take advantage of the featured views to the campus backdrop of the San Bernardino Mountains.
- Building massing and form is managed by articulating individual identity among the collaboration quads. Distinctive plazas, quads, and other open spaces for facilitating interdisciplinary collaboration and interaction will be created. Each housing village will have its own landscaped courtyards for student gathering and recreation.
- Reinforcing the legacy open space as a visual axis that connects the community and the University, providing open vistas to the John M. Pfau Library and the San Bernardino Mountains.
- Preserving the iconic multi-functional open lawns for campus festivals and events
- Focusing new academic buildings and denser infill along Coyote Walk and other pedestrian walkways, with new buildings framing smaller, more intimate courtyards and open spaces and ultimately creating a denser, more walkable and collegial campus environment.

- Reorganizing the pedestrian pathway system, including the new Coyote Walk and Sycamore Walk, that organizes landscape and activities with the campus' academic core
- Redefining the main campus gateway through creation of the new Gateway Commons to elevate the "brand" and establish the visual identity of the campus

To achieve this, the Master Plan's includes two integral components: Design Guidelines and Landscape Guidelines. The purpose of the Design Guidelines is to establish or reinforce the campus "context", including its architectural character and landscape setting, in order to reinforce the University's education mission and fortify the campus sense of place. To do so, the Design Guidelines establish major goals for campus development, including:

Achieve Visual Integration where each individual building first establishes its identity within the greater whole of the campus and then present its individual identity to ensure all new buildings act as supportive components for enriching and activating the public space network. The site design should maintain and strengthen the campus identity in an integrative approach. Promote the new developments to portray a cohesive character and enhance the overall campus image.

Use Landscape as a Unifying Element where landscape is used to unify the overall character of the campus buildings and to enrich the public spaces. Use a palate of native plants that contribute to a cohesive and uniform aesthetic in the semi-arid climate setting.

Establish Common Visual Design Vocabulary where the collection of all campus buildings, considering all variations of building style, size, function, and age, share a common visual vocabulary. New building development should appear related to the overall campus context and accommodate architectural innovation while remodels of existing buildings should respect the building's authentic character.

Respect Natural Setting by preserving natural open space on campus, including Land Lab, as habitat preservation areas. Establish sustainable landscape that uses drought-tolerant plants in the landscape design for reducing water consumption, integrates low impact design measures on campus for stormwater capture and infiltration and the campus' microclimate. Site design should address energy and water conservation in an integrated approach. Maximize efficiency of orientation, building envelope, glazing, sun-shades, solar roof panels and solar hot water systems for all the campus buildings.

Foster Strong Sense of Urban Community by providing multi-functional outdoor rooms for accommodating events, programs, social interactions, and interdisciplinary collaboration. The building design should aim to strengthen an urban lifestyle and community through providing ample activity uses on the ground floor.

Foster a Sense of Permanence by promoting a high quality design in buildings, landscape, signature and wayfinding as well as campus art installations. Employ enduring designs and materials for campus buildings that evoke a sense of permanence and encourage innovative and sustainable design and construction in all phases of campus development.

Example of Landscape as Unifying Element

Example of Common Visual Design Vocabulary

Example of Campus Respect for Natural Setting

Example of Strong Sense of Urban Community

Example of Fostering New Sense of Permanence

To achieve these goals, the guidelines set a series of parameters for new and remodeled buildings, aspects of the campus landscape and sustainability features, and the campus signage. The guidelines further address the visual aspects of the new and remodeled building exteriors and the connections between the campus structures, landscape and pedestrian and vehicle circulation systems. All aspects of building and site design, from materials, colors, building orientation, building massing and scale, to architectural treatment details and signage are comprehensively addressed. With this, the guidelines help connect existing buildings and open space with the campus context and ensure consistency in the design of future buildings, including the architectural character and landscape setting. Specific guidelines for the planned new adjacent buildings and facilities encourage ground level functions, visual porosities indoor/outdoor shared spaces and activated edges that aim to create a connective urban space. Building colors are identified to help unify the collection of campus buildings with a color palette that is oriented around neutral colors with warm earth tones, and with darker, more intense colors used only as accents. As a result, the campus development will increase visual and aesthetic integration, and unify and enhance the campus' visual environment.

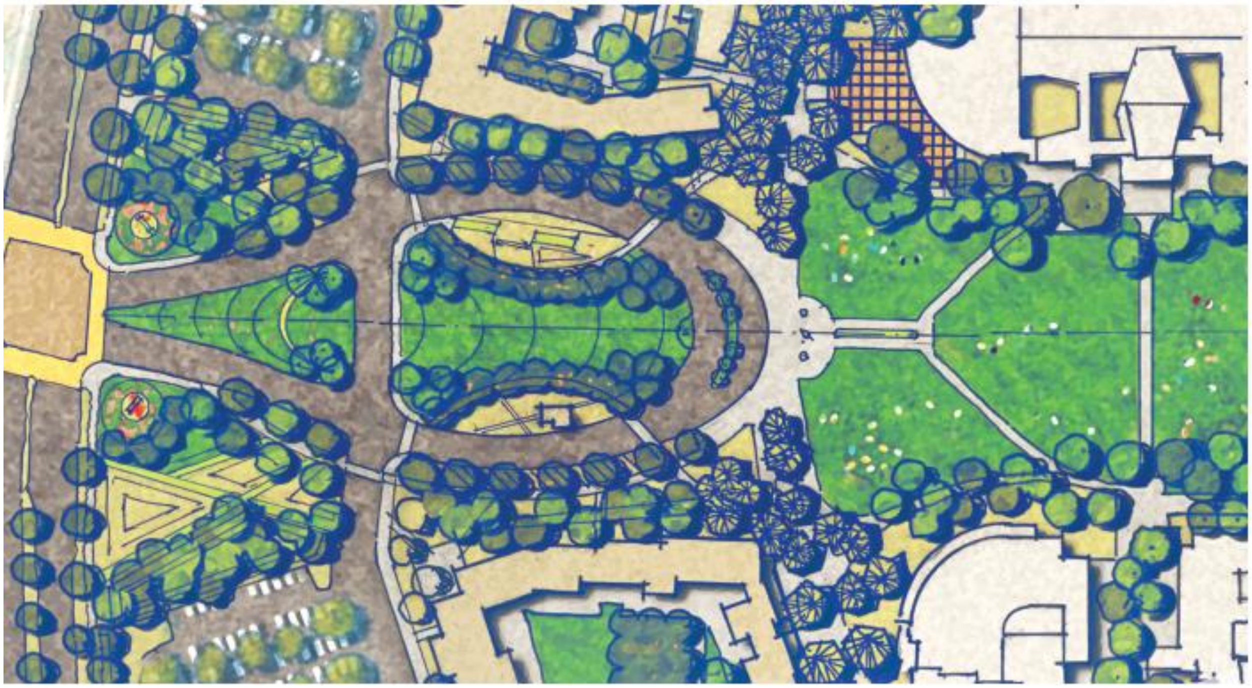
The quality of the campus landscape is a recognizable part of campus "brand." The components of the landscape – mountain views, pedestrian pathways, signature campus gateways, quad lawn, and physical connections with surrounding facilities – are critical features of the campus aesthetic and work to reinforce the integrative role of open space: creating connections between landscape and structures, and a comfortable, human-scaled setting for educational activities. The comprehensive Landscape and Open Space Guidelines aim to create this landscape "brand" for the campus. The guidelines establish functional landscape zones for the Master Plan precincts that define and reinforce the character of specific campus landscape systems, while contributing to the overall visual character and functioning of the campus. The guidelines emphasize specific campus-wide landscape and open space recommendations encompassing sustainable landscaping and ecological resiliency, including stormwater treatment and bioswales, permeable paving, tree canopy, micro-climate controls, and water consumption. The guidelines also provide detailed plant palettes, turf replacement strategies, campus tree/forest succession, irrigation strategies, and site elements and furnishings, including flexible art installations that will be used in all landscaping. The prominent campus visual changes are those associated with a the campus' main gateway and the reorganized pedestrian pathway system; the new Coyote Walk/Promenade and Sycamore Walk that organizes landscape to enhance the unique landscape characteristics of the campus.

The Master Plan aims to redefine the signature main campus entry with respect to the view of the San Bernardino Mountains by dedicating a grand civic-scaled open space, Gateway Commons, as the primary campus gateway, leverages and celebrates the historic civic nature of the campus gateway legacy space. As the most prominent civic space on campus it is recognized, expanded and improved in order to affirm its enduring attributes that set the University's brand and identity. Situated at the terminus of the regional arterial, University Parkway and serving as the primary vehicular Gateway to campus, this axially organized college green will be lengthened and strengthened to create a singular open space stretching from Northpark Boulevard to the Pfau Library. By redefining the main campus' primary gateway to visually frame and welcome pedestrians with informally arranged bosques of large scale canopy trees and palm trees, the impressive uninterrupted open vistas to the Library and the San Bernardino Mountains will be maintained and highlighted. Extending from the Northpark Boulevard intersection to the facade of the Library, the new landscaping will reinforce the iconic nature and functional arrival experience of this focal space, while ensuring its continuous and cohesive character. This change will enhance and elevate the CSU San Bernardino brand and the overall identity of the campus.

Figure 9 displays current views at John M. Pfau Library and Figure 10 illustrates the Master Plan's gateway landscape improvements and its relation to full campus views.

John M. Pfau Library
Figure 9

Campus Gateway Landscape
Figure 10



Campus main entry in relation to full campus view

Additional landscape enhancements along Coyote Walk will help to reinforce this linear space into a campus "main street experience" as well as serve as a shared connective urban space. Focusing denser infill facilities along this walkway will also help create a central corridor lined with shared use facilities, bustling with collaborative interactions and social activity. Together with appropriately scaled canopy trees, palms, other landscape amenities and furnishings, and soaring architectural photovoltaic canopies, this will create inviting and generous areas of shade needed to sustain the high level of activity along Coyote Walk. Figure 11 displays existing conditions of Coyote Walk simulated with future student enrollment. Figure 12 illustrates Coyote Walk, the central plaza and associated landscape zones.

Coyote Walk
Figure 11

Coyote Walk Landscape Zones
Figure 12

These features enhance and extend the campus aesthetics and work to reinforce the integrative role of open space by creating connections between landscape and structures, and by creating a comfortable, human-scaled setting for educational activities. Overall, the Master Plan reinforces and enhances the intrinsic visual features of the CSU San Bernardino campus including views to the San Bernardino Mountains, the signature campus gateway, and open natural spaces. With the Master Plan Design and Landscape and Open Space Guidelines, new and remodeled facilities will help to unify the varied character of campus buildings, establish sustainable landscaping, and create series of trellis and independent architectural and landscape elements which will improve the visual character of the campus in comparison with existing visual environment, as illustrated in Figure 13.

Landscape and Open Space Framework
Figure 13

Light and Glare

The Master Plan provides for future campus development through in-filling the existing developed campus area, which avoids introducing new lighting into the rest of the campus' land. Currently, security lighting is provided on campus in walkways, parking lots, around buildings, and at other key locations. Energy efficient bulbs and other measures are used to the extent feasible to reduce energy use, glare, and illumination of the night sky. Existing campus security lighting will continue to be upgraded throughout the life of the Master Plan, and new lighting will be installed at new facilities, plazas, pedestrian walkways and other locations as necessary to ensure adequate safety. All lighting will be focused, and low-glare, cut-off, and shielded lights will be used as appropriate to continue to maximize safety, minimize spillover lighting, and enhance campus' aesthetic character.

The Master Plan provides for enhancement of campus' athletics facilities, including baseball and softball fields, tennis and basketball courts, and a multi-use stadium within the Physical Education and Athletics Precinct. In accordance with the established University procedures, the design process for lights at these sport facilities will include field-specific lighting analysis and design focusing on avoiding line-of-sight effects. The future designs of each facility's lighting system will incorporate: using the most technological advances relative to glare shield protection and reduced light spillage technology; controlling spill and glare light by advanced fixture housing design; minimum lamp and pole fixtures; long visors for maximum shielding; proper mounting heights to ensure maximum steepness in downward fixture aiming that focuses the light directly into the field; utilizing fencing with glare-blocking protective covering; specific lamp type and position configuration; and use of best available fixtures to provide necessary illumination and at the same time minimize visibility from nearby areas. With these established design procedures impact will not be significant. Overall, the campus' lighting will help to create a vibrant campus environment that fosters a strong sense of urban community and corresponds to the region's urban character.

Mitigation Measures

The Master Plan will result in substantially enhancing the visual and aesthetic campus character and quality. With the Master Plan's Design and Landscape Guidelines, the new and remodeled buildings and other facilities, landscaping, open space, signage, and other elements will create visual appearance of the campus that is both distinct and cohesive. With incorporation of these Master Plan's features and components, and the established University lighting design procedures for new campus facilities, the overall impact will be beneficial; no mitigation is required.

Level of Impact After Mitigation

The Master Plan will result in an overall beneficial impact of substantially enhancing the visual and aesthetic character and quality of the campus; no mitigation is required.

3.2 Biological Resources

Environmental Setting

The 441-acre CSU San Bernardino campus is located at the base of San Bernardino Mountains, and is surrounded by the existing residential development to the south, west, and east. The existing campus development is concentrated within the area between the North Campus Circle Drive and Northpark Boulevard (see Figure 2 in Section 2.0, Project Description).

The campus land contains two sensitive biological areas, one to the far north and one to the far west of the existing developed campus area. The most northern portion of the campus property, comprising approximately 155 acres, is an undeveloped open natural space extending from North Campus Circle Drive to the base of the mountains (see Figure 14). This Badger Hill's area, informally known as the "Land Lab", open natural space is covered with undisturbed vegetation and is used to support academic instruction in a number of University courses conducted by the Departments of Biology, Geology, Kinesiology, and Anthropology, as well as serving as an educational resource for the greater community. To the far west, a relatively small area with natural chaparral vegetation is located south of the existing Administrative Services Building and west of Ash Drive and West Campus Circle (see Figure 14). This area is used as a most important field study site for biology and geography courses. These two areas have intrinsic scientific value providing on-campus natural "laboratories" for the study of local topography, soils, geological formations, vegetation, and animal life. Further, these areas have and continue to support scientific research. This research resulted in discovering a rare Plummer's mariposa lily in the west natural area in 2004 (California Rare Plant Rank 4.2). Subsequently, the University faculty and students co-authored a study of the plant's ecology published in a professional journal, and they continue to regularly monitor the plant's status.

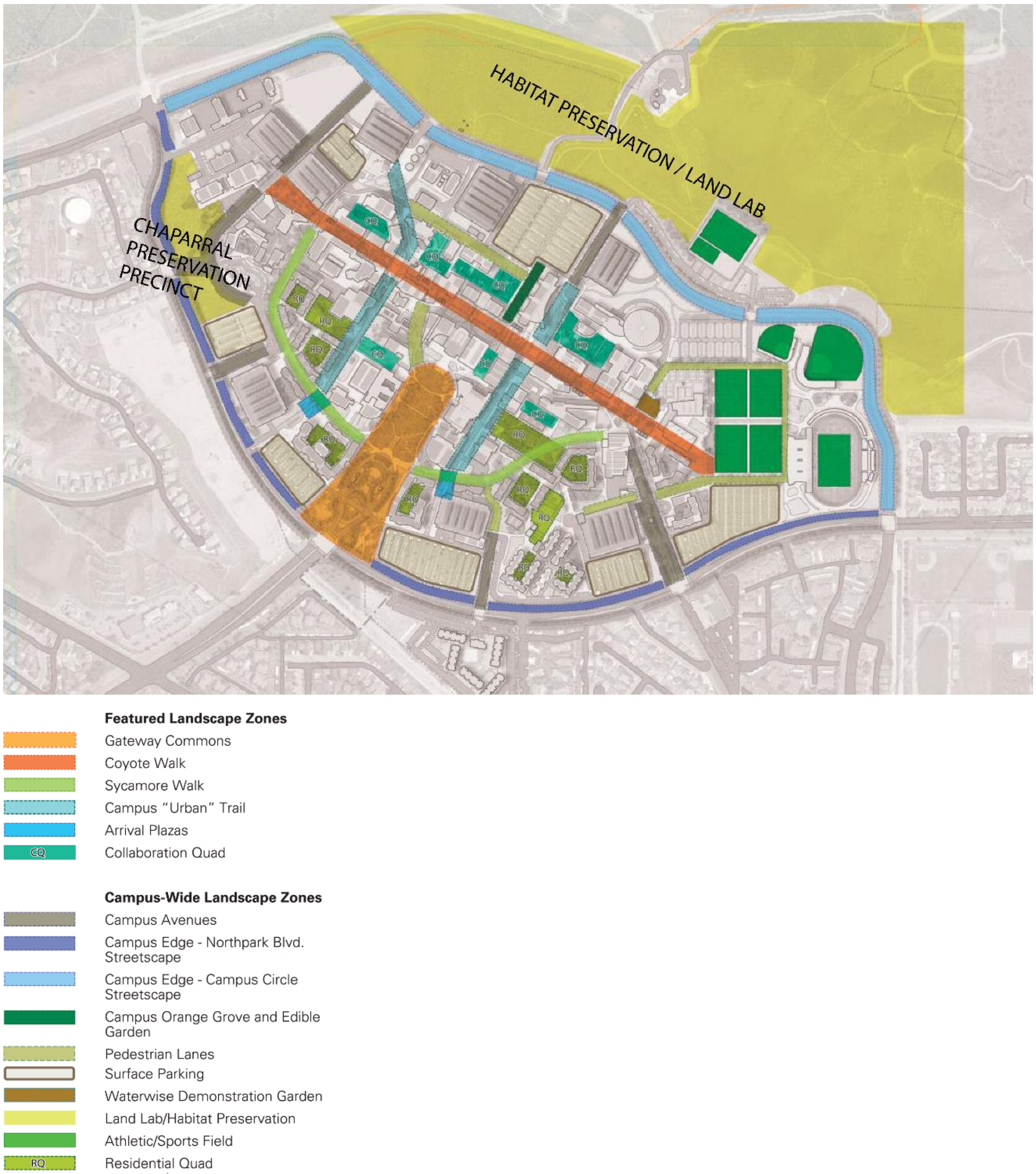
Impact Criteria

Impact on biological resources is considered to be significant if the project will result in a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species; or on wetlands, riparian habitat or other sensitive natural community or habitat; or substantially interfere with the movement of any native resident or migratory fish or wildlife species, or with established native resident or with the species migratory wildlife corridors.

Environmental Impact

The Master Plan provides a new strategic infill approach to the long-term campus development which utilizes the existing developed campus land to provide all needed facilities while preserving campus open space, including the continuing preservation of the Badger Hill most northern campus area and the west sensitive natural area as Land Lab/Habitat Preservation. The west site habitat is further designated in the Master Plan as a Chaparral Preservation Precinct, as illustrated in Figure 14.

Open Space and Landscape
Figure 14



As no development within these habitat preservation areas that could potentially affect sensitive species or habitats is anticipated to occur pursuant to the Master Plan, and these areas will remain in their existing condition, no significant impact is anticipated. However, the Master Plan provides for future development with two facilities nearby these habitat preservation areas - the improved existing soccer field in the northern campus area remaining within its existing footprint and the new Discovery Innovation Park in the western campus area, as illustrated in Figure 3, in Section 2.0, Project Description. To ensure that development of these future facilities does not affect the habitat preservation areas, precautionary mitigation measures have been identified.

Mitigation Measures

Prior to development or construction of the future soccer field improvements in the north campus area and the Discovery Park facilities in the west campus area, the following steps will be taken:

1. ***Work Area Boundaries***: Prior to the start of construction a qualified biologist will mark the boundaries of environmentally sensitive exclusion zones and sensitive habitat features (e.g., chaparral areas adjacent to work areas) that are to be avoided before and during construction with highly visible flagging or fencing to prevent impacts to these areas. The qualified biologist will also inform construction personnel of the applicable work boundaries, communicating that construction personnel conduct work activities outside of the defined avoidance area.

2. ***Nesting Bird Surveys and Avoidance:*** If construction is scheduled to commence during the non-nesting season (September 1 to January 31), no preconstruction surveys or additional measures with regard to nesting birds and other raptors are required. To avoid impacts to native nesting birds in the project area, a qualified wildlife biologist shall conduct preconstruction surveys of all potential nesting habitat within the project site for project activities that are initiated during the breeding season (February 1 to August 31). The survey for special-status raptors shall focus on potential nest sites (e.g., trees and shrubs) on-site and within a 500-foot buffer around the site. Surveys shall be conducted no more than 14 days prior to construction activities. Surveys need not be conducted for the entire project site at one time; they may be phased so that surveys occur shortly before a portion of the site is disturbed. The surveying biologist must be qualified to determine the status and stage of nesting by migratory birds and all locally breeding raptor species without causing intrusive disturbance. Active nests of native bird species will be avoided and monitored, and the qualified biologists will have authority to stop work should it be determined that a nest is being impacted by project activity.

   If active nests of other native birds or common raptors are found, a suitable buffer (e.g., 200-300 feet for common raptors; 50 to 100 feet for passerines; depending on species) shall be established around active nests and no construction within the buffer allowed until a qualified biologist has determined that the nest is no longer active (i.e., the nestlings have fledged and are no longer reliant on the nest). Encroachment into the buffer may occur only at the discretion and/supervision of a qualified biologist.

Level of Impact After Mitigation

With Master Plan's infill development contained within the campus' developed land, continuing preservation of sensitive natural open space areas as habitat preservation areas, and implementation of identified precautionary mitigation measures, impact will be less than significant.

3.3 Cultural Resources

A Historical Resources Evaluation Report was prepared by Architectural Resources Group in January 2017 and a cultural resource record search and analysis was prepared by SWCA Environmental Consultants in February 2017. Findings of these studies are summarized herein and the reports are included in Appendix D of this EIR.

Environmental Setting

The CSU San Bernardino campus is developed with academic, support, student housing, and other facilities. The developed campus area is surrounded by open space.

Impact Criteria

The impact is considered to be significant if the project will cause a substantial adverse change in the significance of a historic resource; archaeological resource; or a tribal cultural resource defined in the Public Resources Code Section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe that is listed or eligible for listing in the California Register of Historical Resources or in a local register of historical resources; or if the project will destroy an unique paleontological resource.

Environmental Impact

Historic Resources

The campus contains several facilities that were built prior to 1985 and will be 50 years of age by the 2035 Master Plan's planning horizon. Several of these buildings do not appear to have the potential to be impacted by the campus development pursuant to the Master Plan. A cluster of three buildings: Sierra Hall, Chaparral Hall, and Administration were the campus' first facilities designed by the Office of the State Architect in 1964-1965. Pursuant to the Master Plan, any potential alterations to these buildings will be minimal. The only historic building identified to be affected by the future campus development is the John M. Pfau Library.

The five-story John M. Pfau Library was designed by architect William F. Cody and built in 1971. In 1982 it was named to commemorate the founding President John M. Pfau. The Library is both the campus' "signature" building, and the most prominent building on campus as it sits at the head of the main quadrangle, as illustrated in Figure 15.

In 1994, a major addition was constructed on the west side of the building. The addition is set back from the original west wall by way of a concave curve.

View of John M. Pfau Library
Figure 15

The Library appears eligible for the California Register under Criterion 3. Criterion 3 requires that a property embodies the distinctive characteristics of a type, period, or method of construction or possesses high artistic values, or represents the work of a master. To be eligible the building must clearly illustrate distinctive characteristics through the following:

- The pattern of features common to a particular resources,
- The individuality or variation of features that occurs within the class,
- The evolution of that class, or
- The transition between classes of resources.

The Library is an example of the Late Modern stay of architecture and work of the architect William F. Cody, FAIA. The building clearly illustrates the pattern of features common to a particular class of resources within Cody's body of work as well as the individuality or variation of features that occurs within the class. The building is a distinguished example among several on the campus within the same Late Modern architectural context. The Library exhibits many key characteristics that define the style, and the characteristics of Late Modernism in its siting, massing, materials, and features. The class of resources in this case is the Late Modern buildings of Southern California and the works of architect William F. Cody, and the distinctive characteristics refer to the building's refined and monumental Late Modern appearance.

Concrete was the favored material for Late Modern institutional buildings; it is present in two contrasting textures and colors: a smooth buff color is used for the columns, window grids, and exterior ceilings and a rougher, light-brown colored concrete is employed for the panels that clad most of the building. The exterior colonnades and breezeways on the sides of the buildings, recessed below the overhanging mass of the upper floors, are also characteristic of Late Modernism. The heaviness of the mass of the building combined with the relatively thin, light columns and openness of the high-ceilinged outdoor spaces produces a kind of tension that is often central to Late Modern architecture. Bronze was used decoratively as an accent on the exterior front and secondary doors; it represents another heavy and durable material and metal color characteristically favored in this type and period of building. Travertine, also popular in the period, adds stone accents with a vertical striation similar to that of the adjacent concrete.

The architect of the Library, William F. Cody, showed a direct relationship to the building site which was characteristic of his work. He set the building at the base of the foothills through the use of battered-profile retaining walls faced in the local stone (appears to be granite). This work appears in Cody's work in Palm Springs, where he is best known and completed most of his projects. In both cases, he made use of local stone that was associated with the local landscape and geology.

As the Library is planned for a major 90,000 square-foot addition pursuant to the Master Plan, mitigation measures addressing the massing, size, placement, articulation, and materials of the addition have been identified to reduce this potentially significant impact.

Archaeological Resources

A records search was conducted in January 2017 of the California Historical Resources Information System (CHRIS) at the South Central Coastal Information Center (SCCIC) located on the campus of California State University, Fullerton. The search included any previously recorded cultural resources and investigations within a 0.5-mile radius of the project area. The search also involved a review of the National Register of Historic Places (NRHP), the California Register of Historical Resources (CRHR), the California Points of Historical Interest list, the California Historical Landmarks list, the Archaeological Determinations of Eligibility list, and the California State Historic Resources Inventory list. In addition, the search included a review of all available historic U.S. Geologic Survey (USGS) 7.5- and 15-minute quadrangle maps.

The CHRIS records search identified six previously recorded cultural resources within a 0.5-mile radius of the project area. Of these resources, one is mapped within the project area. This resource is a historic road, Devil Canyon Toll Road/Sawpit Creek Road, which was recorded in 2007. Mitigation measures have been identified to determine whether remnants of this road are present within the project area, and if the remnants are present, to reduce a potential for an impact to this resource from future campus development. Furthermore, a review of the Master Plan's development components, as well as historic aerial photographs, indicates that the many of the new facilities and improvements will be constructed in areas with existing structures. However, some facilities and improvements are planned for portions of the campus that have historically been paved or developed only with landscaping, such as new facilities in the northwestern portion of the project area and improvements to the existing soccer field in the northeastern portion of the campus. In these locations, there is no native ground surface visible, but it is possible that unknown archaeological resources could be preserved beneath the surface. Therefore, mitigation measures have been identified to reduce the potential impact on such previously unknown archaeological resources.

Tribal Cultural Resources

A search of the Sacred Lands Files was requested from the Native American Heritage Commission (NAHC). The response received stated that the results of the Sacred Lands File search failed to identify the presence of Native American cultural resources within the project area.

However, since the Native American contact program undertaken as part of the study resulted in three individuals indicating that the project area has a high sensitivity for cultural resources, mitigation measures have been identified to ensure that future campus development pursuant to the Master Plan will not significantly affect the previously unknown tribal cultural resources.

Paleontological Resources

There are no known paleontological resources within the campus. While the potential for uncovering such significant resources is considered remote, in an unlikely event that such resources are discovered during construction of future planned facilities and improvements, compliance with existing laws and regulations will ensure no significant impact. These laws and regulations include: (1) stopping work in the event that a paleontological resource is discovered until a qualified paleontologist can visit the site and assess the significance of the potential resource.; (2) the paleontologist will then conduct on-site archaeological or paleontological monitoring, including inspection of exposed surfaces to determine if fossils are present, and (3) if such resources are present, the monitor will have the authority to divert grading away from exposed resources temporarily in order to recover the resources.

Mitigation Measures

Historic Resources

1. ***John M. Pfau Library:*** The massing, size, placement, articulation, and materials of the Library's planned addition is critical to avoiding an impact to this historic building. Massing and attachment of the new addition to the Library building will include the following:

   1.1 The south (front) façade will remain free of new construction so that it maintains its prominence on the main quadrangle, particularly given the importance of the view of the building as one approaches the campus from University Parkway.
   1.2 The north (rear) façade, which mirrors that of the south façade, will also remain free of new construction so that it maintains its visibility from the northern parts of the campus.
   1.3 The addition will be equal to or lower than the original building in height and smaller in footprint in order to appear subordinate to the original building.
   1.4 The addition will be attached only to the rear (north) portion of the east façade, so that a connection between the main building and the addition can be made on each floor, but so that much of the bulk of the addition is pulled away from the east façade to leave a significant amount of the façade – at a minimum 50% of the façade - physically disengaged from the addition. The east façade is defined as the outermost east wall of the building, not including the corners that are stepped back.
   1.5 The colonnade on the east façade's ground floor should remain open and passable where it is not attached to the addition. At the connection of the addition to the original building, the ground floor should be enclosed mainly in glass, similar to the north façade of the connection between the original building and the existing west addition.
   1.6 The plaza to the west of the original building that is encompassed by the west wing addition (on the south side) should be maintained free of additional construction and should not be filled in. This space functions to allow much of the west façade of the original building to remain visible.
   1.7 Respect the symmetrical massing of the original building (when viewed from the south) by maintaining a balance between the new addition and the existing west addition in their features and massing. A mirror symmetry is not expected.

Archaeological Resources

2. The following avoidance and mitigation measures will be implemented to ensure that potential significant impact to the identified Devil Canyon Toll Road/Sawpit Creek Road site, or a previously unknown archaeological site, is avoided or minimized.

   2.1 ***Survey of Undeveloped Areas Prior to Development.*** Prior to development or construction of new facilities in portions of the campus which have not previously been developed (particularly the northwestern and eastern portions of campus) archaeological pedestrian survey will be conducted to identify if potentially significant archaeological resources are present. Resources found to be not significant will not require mitigation. If a potentially significant site will be impacted by ground-disturbing activities, either the site should be avoided, or a Phase II investigation will be required to evaluate the site for eligibility for listing in the CRHR. After testing, it may be determined that data recovery will be needed.

2.2 ***Avoidance of Eligible or Potentially Eligible Archaeological Sites through Project Design.*** The preferred mitigation is avoidance of the site through project design. If direct impacts to an archaeological site, including, the Devil Canyon Toll Road/Sawpit Creek Road if it is determined that remnants of this road are present, by earth-moving activities cannot be avoided, a Phase II investigation will be necessary to determine significance in accordance with the following measure.

2.3 ***Phase II (Evaluation) and Phase III (Data Recovery) Cultural Resources Investigations***.

Ground-disturbing impacts to Devil Canyon Toll Road/Sawpit Creek Road should be avoided to the extent feasible. If avoidance of this resource, or other previously unknown eligible or potentially eligible resource, is not feasible, CSUSB will ensure that potentially impacted archaeological site is assessed for significance, as defined by PRC Section 21083.2 or State CEQA Guidelines Section 15064.5(a), through implementation of Phase II investigations. Resources found to be not significant will not require mitigation.

Should Phase II testing of Devil Canyon Toll Road/Sawpit Creek Road, or a previously unknown archaeological site, exhaust the data potential of the site, impact will be reduced to a less than significant level.

Impacts to a site found to be significant under CRHR Criterion 4 will be mitigated through a Phase III data recovery program. For such a site, prior to any ground-disturbing activities, a detailed archaeological treatment plan will be prepared and implemented by a qualified archaeologist. Data recovery investigations will be conducted in accordance with the archaeological treatment plan to ensure collection of sufficient information to address archaeological and historical research questions, and results will be presented in a technical report (or reports) describing field methods, materials collected, and conclusions. Additional testing and/or data recovery phases may involve additional excavation and/or more detailed recordation of resources or more comprehensive archival research. Any cultural material collected as part of an assessment or data recovery effort will be curated at a qualified facility. Field notes and other pertinent materials will be curated along with the archaeological collection. If a resource is found to be significant under CRHR Criterion 1, 2, or 3, alternative mitigation measures will be developed by the qualified archaeologist, in consultation with the CSUSB.

2.4 ***Construction Monitoring for Archaeological Resources***. Prior to construction, a qualified archaeological monitor will be retained to monitor ground-disturbing activities within portions of the campus that do not currently contain structures. These include areas that are currently paved, landscaped, or undeveloped. The duration and timing of the monitoring will be determined by the qualified archaeologist in consultation with CSUSB. The archaeological monitor will work under the supervision of the qualified archaeologist.

2.5 ***Inadvertent Discoveries***. If previously unknown buried cultural deposits are encountered during any phase of project construction, all construction work within 60 feet of the deposit will cease and the qualified archaeologist will be consulted to assess the find. If the discovery is determined to be not significant, work will be permitted to continue in the area. If a discovery is determined to be significant, a mitigation plan will be prepared and carried out in accordance with state guidelines. If the resource cannot be avoided, a data recovery plan will be developed to ensure collection of sufficient information to address archaeological and historical research questions, with results presented in a technical report describing field methods, materials collected, and conclusions. Any cultural material collected as part of an assessment or data recovery effort will be curated at a qualified facility. Field notes and other pertinent materials will be curated along with the archaeological collection.

2.6 ***Qualified Archaeologist***. A qualified archaeologist, defined as an archaeologist who meets the Secretary of the Interior's Standards for professional archaeology, will be retained to carry out all mitigation measures related to cultural resources.

Tribal Cultural Resources

3. If previously unknown tribal cultural resources are encountered during any phase of construction of the future planned future facilities and improvements, the following measures will be implemented:

3.1 All earth moving construction activity will be halted until a qualified Native American monitor can visit the site and assess the significance of the potential resource.

3.2 The Native American monitor will then conduct on-site cultural tribal resources monitoring, including inspection of exposed surfaces to determine if such resources are present.

3.3 If such resources are present, the Native American monitor will have the authority to divert grading away from exposed resources temporarily in order to recover the resource.

3.4 If the resource cannot be recovered, the resource site will be covered with a layer of chemically stable soil before constructing project facilities on the site, if feasible; or if data recovery through excavation is the only feasible mitigation, a data recovery plan, which makes provision for adequately recovering the consequential information from and about the tribal cultural resource will be prepared and adopted prior to any excavation being undertaken and implemented during excavation or grading.

3.5 Such significant resources will be treated with culturally appropriate dignity taking into account the tribal cultural values and meaning of the resource, including protecting the confidentiality of the resource.

Level of Impact After Mitigation

Compliance with existing laws and regulations and implementation of the identified mitigation measures will ensure that future campus development pursuant to the Master Plan will result in no significant impact on cultural resources.

3.4 Traffic and Circulation

This section discusses overall traffic and circulation issues associated with the CSU San Bernardino 2016 Campus Master Plan. A transportation impact study was prepared for the Campus Master Plan in March 2017 by Fehr & Peers. The study findings are summarized below, and the study is included in Appendix B of this EIR.

Environmental Setting

The CSU San Bernardino 441-acre campus is located at the base of the San Bernardino Mountains to the north, and is generally separated from the existing surrounding residential land uses to the south, west, and east by Northpark Boulevard.

Roadway Network

Primary regional access to the CSU San Bernardino campus is provided by Interstate 215 (I-215) via the I-215/University Parkway interchange. I-215 provides north-south regional connection, and State Route 210 (SR-210) provides east-west regional connection. The major streets and arterials that service the campus and the surround area include: Kendall Drive, Campus Parkway, and University Parkway. The following is a brief description of the roadways.

I-215 is a four-lane uninterrupted highway that is oriented north-south, and is west of the CSU San Bernardino campus. Regional access to CSU San Bernardino is provided via the I-215/University Parkway interchange. I-215 south of the campus, passes through downtown San Bernardino and terminates north of Temecula. I-215 north of the project site, intersects with I-15 for access through the San Bernardino Mountains.

SR-210 also known as the Martin A. Matich Highway, is an east-west connector of Highland and San Dimas. Towards the west, it turns into I-210 and continues on towards Pasadena. The most direct route to campus is via I-215 as there is no arterial road that provides easy access to the University.

Campus Parkway is oriented in the east-west direction and is located west of the CSU San Bernardino campus. Campus Parkway is 78 feet wide with a raised, landscaped median and two lanes in each direction. Access to Northpark Boulevard/Devils Canyon Road is provided by a stop controlled intersection.

Campus Circle loops around the northern half of campus, providing access to the athletic facilities on the east side, maintenance facilities on the west, and the parking structures near academic buildings in between. The 25 mph road consists of four lanes, divided by a raised, landscaped median. Important intersections include Northpark Boulevard and West Ash Street. There are also several access roads off of Campus Circle.

Coyote Drive is a four-lane road that stems off of Northpark Boulevard. Its primary purpose is to provide access to four major surface parking lots (Lots E, F, G, and H). Coyote Drive also connects to Coyote Court, a limited access two-lane road that cuts through the middle of campus. With heavy pedestrian flows on the road, Coyote Drive has a lower speed limit of 15 mph.

Little Mountain Drive is classified as a secondary arterial in the City of San Bernardino's General Plan. Little Mountain Drive is oriented in the north-south direction and is 70 feet wide with a two-way left turn lane in the center. The roadway has two lanes in each direction and provides access to the CSU San Bernardino campus by a stop-controlled intersection at Northpark Boulevard. The posted speed limit is 45 mph.

Northpark Boulevard runs approximately 1.2 miles along the southern rim of campus in an east-west direction. The facility is classified as a major highway in the City of San Bernardino's General Plan and is 84 feet wide. The roadway has two lanes in each direction and a raised, landscaped median. Northpark Boulevard provides signalized and unsignalized access to the CSU San Bernardino campus, including the main entrance of the University at its intersection with University Parkway. The posted speed limit along the roadway is 40 mph.

University Parkway connects the CSU San Bernardino campus with I-215 in a 1.3-mile segment running along both commercial and residential corridors. The road is six lanes, divided by a landscaped median. The speed limit is 45 mph throughout, and the majority of the parkway includes sidewalks and bike lanes on either side of the road. The parkway culminates at the entrance of the University, with a loop that redirects traffic back onto the parkway in the opposite direction. This loop is in place for students, faculty, and commuters to be dropped off on campus and also provides access to several of the major parking lots. The Parkway has a major intersection with Northpark Boulevard as it enters campus, but intersections with Kendall Drive, W. College Avenue, North Varsity Avenue, and I-215 are also significant.

Transit

The CSU San Bernardino campus area is served by rail lines operated by Metrolink and Amtrak, and bus lines operated by Omnitrans. The following is a brief description of the rail and bus lines that provide service in the vicinity of CSU San Bernardino campus:

- ***Metrolink San Bernardino Line*** – Provides weekday service (and limited weekend service) from downtown Los Angeles to San Bernardino with stops in north Pomona and Upland. The route travels parallel to Arrow Highway. There are 12 trains in the morning and seven trains in the afternoon from San Bernardino to Los Angeles. There are five trains in the morning and 14 trains in the afternoon from Los Angeles to San Bernardino.

- ***Metrolink Inland Empire Line*** – Provides weekday service between downtown San Bernardino and Oceanside, though a majority of the trains end service at either Riverside or Laguna Niguel/Mission Viejo.

- ***Amtrak Southwest Chief*** – Runs daily between Chicago and Los Angeles. San Bernardino is the third station after leaving Union Station in Los Angeles.

- ***Omnitrans Route 2*** – Serves CSU San Bernardino and Loma Linda University via Kendall Drive, E Street, Hospitality Lane and Tippecanoe Avenue/Anderson Street. Headways are every 30 minutes during weekdays and 20-30 minutes on Saturdays and Sundays. The route operates from 4:30 AM to 11:15 PM on weekdays, and 6:30 AM to 10:00 PM on the weekend.

- ***Omnitrans Route 5*** – Serves San Bernardino, Del Rosa, and CSU San Bernardino. Popular destinations are the 4th Street Transit Center, Cajon High School, CSU San Bernardino, Carousel Mall, and Pacific High School. Headways are every 30 minutes during weekdays and 60 minutes on Saturdays and Sundays. The route operates from 4:45 AM to 10:40 PM on weekdays, and 6:30 AM to 9:20 PM on the weekend.

- ***Omnitrans Route 7*** – Serves San Bernardino and Verdemont via Sierra Way and Electric Avenue. Headways are between 30-60 minutes during weekdays and 60 minutes on weekends. This route operate from 6:05 AM to 7:50 PM on weekdays, and 7:00 AM to 6:35 PM on the weekend.

- ***Omnitrans Route 11*** – Serves San Bernardino and CSU San Bernardino via Muscoy. Headways are between 30-60 minutes during weekdays and 60 minutes on weekends. This route operates from 5:30 AM to 10:20 PM on weekdays, and 6:50 AM to 7:30 PM on the weekend.

- ***Omnitrans sbX Green Line*** – The sbX Green Line travels a 15.7 mile route along the E Street Corridor, from CSU San Bernardino at the north to Loma Linda University and Medical Center at the south. Service is on weekdays only, with service every 10 minutes during peak hours and every 15 minutes during off-peak hours. The northbound peak period is from 6:00 AM to 9:00 AM and from 3:00 PM to 6:00 PM. The southbound peak period is from 6:00 AM to 9:00 AM and from 2:00 PM to 6:00 PM. Portions of the route have designated lanes for the buses and center boarding stations.

Bicycle and Pedestrian Facilities

Currently, there are Class II bicycle routes located along Campus Parkway, Northpark Boulevard, and University Parkway. According to the SANBAG Non-Motorized Transportation Plan (May 2015), there are plans to add a Class I bicycle route adjacent to Campus Circle.

The pedestrian network within and adjacent to the CSU San Bernardino campus consists of sidewalks, pedestrian crosswalks, and pedestrian crossing controls.

Internal pedestrian facilities are plentiful, with walkways and sidewalks present throughout the inner core of the campus. These serve as primary walkways for student and faculty conducting general activities around campus. Crosswalks are present where vehicle and pedestrian conflicts are likely to occur, although some painted crosswalks are faded. A large number of pedestrian crossings occur at locations between major parking facilities and the inner campus core. In many instances, pedestrians will cross at desired paths instead of demarcated crossings, which can create additional pedestrian and vehicle collisions.

External pedestrian facilities are present in some locations, but missing in others. A sidewalk is provided on the south side of Northpark Boulevard only. Crossing Northpark Boulevard can prove challenging, as there is no striped crosswalk at Ash Street or Sierra Drive along Northpark Boulevard. This could result in conflicts with crossing activity across Northpark Boulevard, especially for those students living at The Glen at University Park.

Existing Traffic Conditions

Traffic operational conditions at intersections are described in terms of Level of Service (LOS) which ranges from LOS A (minimal delay) to LOS F (excessive congestion). LOS E represents at-capacity conditions.

A total of 14 intersections were analyzed based on AM and PM peak hour turning movement volumes, lane configurations, and signal phasing information collected for the project. Figure 16 illustrates the location of the study intersections and Table 1 summarizes the LOS results for each intersection during the AM and PM peak hours. As shown, 4 of the 14 intersections are currently operating at LOS E or F:

4. Northpark Boulevard & University Parkway (LOS E – PM peak hour)
10. University Parkway & College Avenue (LOS F – AM peak hour)
12. University Parkway & I-215 Northbound Ramps (LOS F – PM peak hour)
13. University Parkway & I-215 Southbound Ramps (LOS F – PM peak hour)

Project Location and Study Intersections
Figure 16

Table 1
Existing Peak Hour Intersection LOS Summary

No.	Intersection	Control	Peak Hour	Existing	
				Delay	LOS
1.	Devils Canyon Road & Campus Parkway	ASWC	AM PM	8.2 9.8	A A
2.	Northpark Boulevard/Devils Canyon Road & Ash Street	TWSC	AM PM	4.2 (34.0) 14.0 (34.3)	A (D) B (D)
3.	Northpark Boulevard & Sierra Drive	AWSC	AM PM	9.9 13.8	A B
4.	Northpark Boulevard & University Parkway	Signal	AM PM	45.9 65.3	D **E**
5.	Serrano Village Drive & Northpark Boulevard	Signal	AM PM	12.0 17.7	B B
6.	Coyote Drive & Northpark Boulevard	Signal	AM PM	11.0 14.2	B B
7.	East Campus Circle & Northpark Boulevard	Signal	AM PM	16.3 19.9	B B
8.	Education Lane & North Campus Circle	TWSC	AM PM	1.2 (9.5) 3.6 (15.3)	A (A) A (C)
9.	University Parkway & Kendall Drive	Signal	AM PM	38.1 45.4	D D
10.	University Parkway & College Avenue	Signal	AM PM	124.8 23.7	**F** C
11.	University Parkway & State Street	Signal	AM PM	16.8 33.4	B C
12.	University Parkway & I-215 Northbound Ramps	Signal	AM PM	43.7 111.9	D **F**
13.	University Parkway & I-215 Southbound Ramps	Signal	AM PM	23.1 80.8	C **F**
14.	Little Mountain Drive & Kendall Drive	Signal	AM PM	22.7 22.6	C C

Note:
1. Signal = Signalized intersection; TWSC = Two-way stop-controlled intersection; AWSC = All-way stop-controlled intersection
2. Whole intersection weighted average control delay expressed in seconds per vehicle for signalized intersections and all-way stop-controlled intersections. Total control delay for the worst approach and the worst movement (in parenthesis) are presented for side-street stop-controlled intersections.
3. LOS threshold is the lowest acceptable LOS (the threshold between acceptable and unacceptable LOS). **Bold** indicates unacceptable operations by jurisdiction's level of service.
4. Intersections LOS calculations were conducted using Synchro 9.1 Build 909, LOS calculations were performed using the methods described in the Highway Capacity Manual (HCM) 2010.
5. HCM 2010 methodology does not evaluate custom phasing; HCM 2000 methodology was used to evaluate Intersection 12: University Parkway & I-215 Northbound Ramps.

Impact Criteria

The City of San Bernardino General Plan states that target LOS "D" be maintained at City intersections wherever possible. Mitigation measures are required for roadway intersections where traffic conditions show an LOS worse than the minimum acceptable LOS.

The California State University Transportation Impact Study Manual provides guidance to determine whether the transportation-related impacts of a proposed project will be significant. For intersections, a significant impact will occur when:

- An intersection operates at LOS D or better under a no project scenario and the addition of project trips causes overall traffic operations on the facility to operate at LOS E or F.
- An intersection operates at LOS E or F under a no project scenario and the project adds both 10 or more peak hour trips and five seconds or more of peak hour delay, during the same peak hour.
- If an intersection operates at a very poor LOS F (control delay of 120 seconds or more), the significance criterion shall be an increase in v/c ration of 0.02 or more.
- The addition of project traffic causes an all-way stop-controlled or side street stop-controlled intersection to meet Caltrans signal warrant criteria.

For freeway segments, a significant impact will occur at a freeway mainline segment when the project-related traffic causes:

- A freeway mainline segment to degrade from an acceptable LOS C or better to LOS D, E or F, or
- An increase in density for freeway mainline segments already operating at LOS D, E or F.

For pedestrian, bicycle, and transit, a significant impact will occur when:

- A project significantly disrupts existing or planned bicycle facilities or significantly conflicts with applicable non-automotive transportation plans, guidelines, policies, or standards.
- A project fails to provide safe pedestrian connections between campus buildings and adjacent streets and transit facilities.
- A project significantly disrupts existing or planned pedestrian facilities or significantly conflicts with applicable non-automotive transportation plans, guidelines, policies, or standards.
- A project significantly disrupts existing or planned transit facilities and services or significantly conflicts with applicable transit plans, guidelines, policies, or standards.

Vehicles Miles Traveled

In addition, the traffic analysis also considers vehicle miles traveled (VMT) based on Senate Bill 743 (SB 743). SB 743 will change the way in which transportation impacts are analyzed under CEQA. Under SB 743, the focus of transportation analysis shifted from driver delay to reduction of greenhouse gas emissions, creation of multimodal networks, and promotion of a mix of land uses. Measurements of transportation impacts may include vehicle miles traveled, vehicle miles traveled per capita, automobile trip generation rates, or automobile trips generated.

Environmental Impact

Project Trip Generation and Trip Distribution

As shown in Table 2, a full buildout of the CSU San Bernardino Master Plan is estimated to generate 20,045 net new trips. These trips will result in up to 1,498 AM peak hour trips and 1,837 PM peak hour trips to the existing roadway system (with 1,284 trips in and 214 trips out during the AM peak, and 691 in and 1,144 out during the PM peak). Trip generation rates, and the number of existing and future trips are summarized in Table 2.

Inbound and outbound trip distribution to the campus was estimated using available zip code date of students, faculty and staff, and compared against Census Longitudinal Employer-Household Dynamic (LEHD) data. Campus-wide trips were regionally distributed as follows: 10% to/from Campus Parkway, 10% to/from I-215 North, 40% to/from I-215 South, 20% to/from Northpark Boulevard, 10% to/from Kendall Drive, and 10% to/from Little Mountain Drive.

Table 2
Trip Generation Summary

Trip Generation Rates								
User Type	**Unit**	**Daily Rate**	**AM Peak Hour**			**PM Peak Hour**		
			Rate	**In**	**Out**	**Rate**	**In**	**Out**
On-Campus Student	FTE	1.96	0.02	0.015	0.002	0.05	0.020	0.030
Off-Campus Student	FTE	2.07	0.19	0.163	0.026	0.18	0.072	0.109
Faculty & Staff	FTE	1.83	0.32	0.277	0.045	0.67	0.266	0.401
Research & Development (ITE Code 760)	KSF	8.11	1.22	1.013	0.207	1.07	0.161	0.910

Existing CSUS San Bernardino Trip Generation Estimates								
User Type	**Amount**	**Daily**	**AM Peak Hour**			**PM Peak Hour**		
			Total	**In**	**Out**	**Total**	**In**	**Out**
On-Campus Student (FTE)	1,533	2,997	26	23	4	76	30	46
Off-Campus Student (FTE)	14,945	30,948	2,821	2,429	392	2,707	1,078	1,629
Faculty & Staff (FTE)	1,650	3,027	531	457	74	1,100	438	662
Existing Total		***36,971***	***3,378***	***2,909***	***470***	***3,883***	***1,547***	***2,337***
Master Plan Buildout CSU San Bernardino Trip Generation Estimates								
On-Campus Student (FTE)	4,850	9,482	83	72	12	240	95	144
Off-Campus Student (FTE)	20,150	41,726	3,804	3,275	529	3,650	1,454	2,196
Faculty & Staff (FTE)	2,503	4,592	806	694	112	1,670	665	1,005
Research & Development (ITE Code 760) (KSF)	150	1,216	183	152	31	160	24	136
Master Plan Buildout Total		***57,016***	***4,876***	***4,193***	***684***	***5,720***	***2,238***	***3,481***
Existing Total		***-36,971***	***-3,378***	***-2,909***	***-470***	***-3,883***	***-1,547***	***-2,337***
Total Net New Trips		**20,045**	**1,498**	**1,284**	**214**	**1,837**	**691**	**1,144**

Note:
Source: Fehr and Peers, 2016
ITE *Trip Generation Manual*, 9th Edition, 2012

Existing Plus Project (2015) Conditions

Existing Plus Project (2015) Conditions traffic volumes were forecasted by applying the parking facility redistributions and trip generation as described in the previous section to the existing traffic volumes. The results of the Existing Plus Project (2015) Conditions intersection operations are summarized in Table 3. Nine of the 14 study intersections are projected to operate at deficient LOS during the peak hours:

- Northpark Boulevard/Devils Canyon Road & Ash Street (LOS F – AM and PM peak hours)
- Northpark Boulevard & Sierra Drive (LOS F – PM peak hour)
- Northpark Boulevard & University Parkway (LOS F – AM and PM peak hours)
- Education Lane & North Campus Circle (LOS F – PM peak hour)
- University Parkway & Kendall Drive (LOS E – PM peak hour)
- University Parkway & College Avenue (LOS F – AM peak hour; LOS E PM peak hour)
- University Parkway & State Street (LOS F – PM peak hour)
- University Parkway & I-215 Northbound Ramps (LOS F – AM and PM peak hours)
- University Parkway & I-215 Southbound Ramps (LOS E – PM peak hour)

As summarized in Table 3, 7 of the study intersections are forecast to result in a significant impact based on thresholds of significance for Existing Plus Project (2015) Conditions:

- Northpark Boulevard/Devils Canyon Road & Ash Street
- Northpark Boulevard & Sierra Drive
- Northpark Boulevard & University Parkway
- University Parkway & Kendall Drive
- University Parkway & College Avenue
- University Parkway & State Street
- University Parkway & I-215 Northbound Ramps

Table 3
Existing Plus Project (2015) Conditions Peak Hour Intersection LOS Summary

No.	Intersection	Traffic Control	Peak Hour	Existing Conditions		Existing Plus Project (2015) Conditions		Δ Delay	Δ V/C	Signal Warrant Met?	Impact (Y/N)
				Delay	LOS	Delay	LOS				
1.	Devils Canyon Road & Campus Parkway	AWSC	AM PM	8.2 9.8	A A	8.2 9.8	A A	0.0 0.0	- -	- -	N N
2.	Northpark Boulevard/Devils Canyon Road &Ash Street	TWSC	AM PM	34.0 34.3	D D	>180 >180	F F	** **	- -	No **Yes**	N **Y**
3.	Northpark Boulevard & Sierra Drive	AWSC	AM PM	9.9 13.8	A B	34.9 88.0	D F	25.0 74.2	- -	- **Yes**	N **Y**
4.	Northpark Boulevard & University Parkway	Signal	AM PM	45.9 65.3	D **E**	426.9 410.4	F F	381.0 345.1	- -	- -	**Y** **Y**
5.	Serrano Village Drive & Northpark Boulevard	Signal	AM PM	12.0 17.7	B B	11.6 16.9	B B	-0.4 -0.8	- -	- -	N N
6.	Coyote Drive & Northpark Boulevard	Signal	AM PM	11.0 14.2	B B	9.0 12.5	A B	-2.0 -1.7	- -	- -	N N
7.	East Campus Circle & Northpark Boulevard	Signal	AM PM	16.3 19.9	B B	21.9 23.6	C C	5.6 3.7	- -	- -	N N
8.	Education Lane & North Campus Circle	TWSC	AM PM	9.5 15.3	A C	21.4 >180	C F	11.9 **	- -	- No	N **Y**
9.	University Parkway & Kendall Drive	Signal	AM PM	38.1 45.4	D D	39.0 58.2	D E	0.9 12.8	- -	- -	N **Y**
10.	University Parkway & College Avenue	Signal	AM PM	124.8 23.7	F C	275.9 73.9	F E	151.1 50.2	0.19 -	- -	**Y** **Y**
11.	University Parkway & State Street	Signal	AM PM	16.8 33.4	B C	28.8 80.3	C F	12.0 46.9	- -	- -	N **Y**
12.	University Parkway & I-215 Northbound Ramps	Signal	AM PM	43.7 111.9	D F	118.3 199.4	F F	74.6 87.5	- -	- -	**Y** **Y**

13.	University Parkway & I-215 Southbound Ramps	Signal	AM PM	23.1 80.8	C F	22.6 69.6	C E	-0.5 -11.2	- -	- -	N N
14.	Little Mountain Drive & Kendall Drive	Signal	AM PM	22.7 22.6	C C	22.8 25.8	C C	0.1 3.2	- -	- -	N N

Notes:
1. Signal = Signalized intersection; TWSC = Two-way stop-controlled intersection; AWSC = All-way stop-controlled intersection
2. Impacts are noted in **Bold**.
3. HCM 2010 does not define V/C ratio at the intersection level. HCM 2000 is used to determine V/C ratios for impact determination purposes. ΔV/C is only provided for signalized intersections when delay is 120 seconds or more per the impact criteria guidelines.
4. ">180" is reported for oversaturated conditions in which Synchro is no longer capable of estimating delay. ** is used to denote increases in delay in these cases.

Improvements

The following improvements are identified for the Existing Plus Project scenario.

Northpark Boulevard/Devils Canyon & Ash Street

With the following improvements, the operations at the intersection will improve to LOS C in the AM peak hour, and LOS D in the PM peak hour.

- Install traffic signal.
- Eastbound: One left-turn lane, one shared through-right lane.
- Westbound: One left-turn lane, one shared through-right lane.
- Northbound: One left-turn lane, one through lane, one dedicated right-turn lane with an overlap phase.
- Southbound: One left-turn lane, one through lane, one shared through-right lane.

Northpark Boulevard & Sierra Drive

With the following improvement, the operations at the intersection will improve to LOS A in the AM and PM peak hours.

- Install traffic signal.

Northpark Boulevard & University Parkway

With the following improvement, the operations at the intersection will improve to LOS C in the AM peak hour, and LOS D in the PM peak hour.

- Eastbound: Provide an additional left-turn lane.

Education Lane & North Campus Circle

With the following improvement, the operations at the intersection will improve to LOS B in the PM peak hour.

- Modify the intersection control from a side-street stop-controlled intersection to an all-way stop-controlled intersection.

University Parkway & Kendall Drive

With the following improvement, the operations at the intersection will improve to LOS D in the AM and PM peak hours.

- Southbound: Modify approach to provide one dedicated right-turn lane.

University Parkway & College Avenue

With the following improvement, the operations at the intersection will improve to LOS C in the AM and PM peak hours.

- Signal modification to provide protected phases in the east-west direction.

University Parkway & State Street

With the following improvements, the operations at the intersection will improve to LOS C in the AM peak hour and LOS D in the PM peak hour.

- Optimization of the AM and PM peak hour traffic signal cycle lengths and splits within the coordinated timing plan as part of the University Parkway corridor's Adaptive Traffic Signal System.

University Parkway & I-215 Northbound Ramps

This intersection is part of Caltrans' proposed improvement to install a diverging diamond interchange (DDI). The following additional improvements are identified to bring the LOS to an acceptable level. With the following improvements, the operations at the intersection will improve to LOS B in the AM and PM peak hours.

- Remove the pedestrian crossing at the westbound right-turn approach to allow a true, free movement. The interchange will need to be coordinated with closely spaced intersections such as at State Street, and therefore, the entire University Avenue corridor will need to be optimized.

Future Without Project (2035) Conditions

The San Bernardino Transportation Analysis Model (SBTAM) was used to determine ambient background growth of the general study area and to forecast Future Without Project (2035) Conditions traffic volumes. Under the Future Without Project (2035) Conditions, the following roadway network improvements were included as part of the analyses:

- The interchange of University Parkway at I-215 is assumed to be improved to a Diverging Diamond Interchange (DDI). The major design feature of a DDI is crisscrossing of arterial traffic crossing the freeway. The configuration allows traffic that will be turning left on a conventional diamond interchange to enter or exit the freeway ramps without conflicting with opposing traffic. Signalization is not required to assign right-of-way (ROW) to accommodate these movements.

- A new high occupancy vehicle (HOV) lane is assumed in each direction along I-215 from I-210 to I-15. This project is listed on Southern California Association of Governments (SCAG) Regional Transportation Plan (RTP) in the Financially-Constrained RTP Projects to be completed by 2030.

The results of the Future Without Project (2035) Conditions intersection operations are summarized in Table 4. As shown, one intersection is forecast to operate at LOS E or F: Northpark Boulevard/Devils Canyon Road & Ash Street (LOS F – AM and PM peak hours)

Table 4
Future Without Project (2035) Conditions Peak Hour Intersection LOS Summary

No.	Intersection	Control	Peak Hour	Future Without Project (2035) Conditions	
				Delay	**LOS**
1.	Devils Canyon Road & Campus Parkway	ASWC	AM PM	9.1 10.1	A B
2.	Northpark Boulevard/Devils Canyon Road & Ash Street	TWSC	AM PM	9.2 (77.5) 27.1 (75.7)	A **(F)** D **(F)**
3.	Northpark Boulevard & Sierra Drive	AWSC	AM PM	11.8 16.4	B C
4.	Northpark Boulevard & University Parkway	Signal	AM PM	30.3 39.9	C D
5.	Serrano Village Drive & Northpark Boulevard	Signal	AM PM	12.3 17.9	B B
6.	Coyote Drive & Northpark Boulevard	Signal	AM PM	16.3 12.0	B B
7.	East Campus Circle & Northpark Boulevard	Signal	AM PM	13.8 15.8	B B
8.	Education Lane & North Campus Circle	TWSC	AM PM	1.6 (9.4) 3.2 (12.8)	A (A) A (B)
9.	University Parkway & Kendall Drive	Signal	AM PM	46.7 46.8	D D

10.	University Parkway & College Avenue	Signal	AM PM	34.6 17.4	C B
11.	University Parkway & State Street	Signal	AM PM	28.3 34.8	C C
12.	University Parkway & I-215 Northbound Ramps	Signal	AM PM	33.4 35.3	C D
13.	University Parkway & I-215 Southbound Ramps	Signal	AM PM	11.0 22.6	B C
14.	Little Mountain Drive & Kendall Drive	Signal	AM PM	20.1 20.7	C C

Note:
1. Signal = Signalized intersection; TWSC = Two-way stop-controlled intersection; AWSC = All-way stop-controlled intersection
2. Whole intersection weighted average control delay expressed in seconds per vehicle for signalized intersections and all-way stop-controlled intersections. Total control delay for the worst approach and the worst movement (in parenthesis) are presented for side-street stop-controlled intersections.
3. LOS threshold is the lowest acceptable LOS (the threshold between acceptable and unacceptable LOS). **Bold** indicates unacceptable operations by jurisdiction's level of service.
4. Intersections LOS calculations were conducted using Synchro 9.1 Build 909, LOS calculations were performed using the methods described in the Highway Capacity Manual (HCM) 2010.
5. HCM 2010 methodology does not evaluate custom phasing; HCM 2000 methodology was used to evaluate Intersection 12: University Parkway & I-215 Northbound Ramps.

Future Plus Project (2035) Conditions

Future Plus Project (2035) Conditions traffic volumes were forecasted by applying the parking facility redistributions and trip generation to the Future Without Project (2035) Conditions traffic volumes. The results of the Future Plus Project (2035) Conditions intersection operations are summarized in Table 5. As shown, 8 of the 14 study intersections are projected to operate at deficient LOS during the peak hours:

- Northpark Boulevard/Devils Canyon Road & Ash Street (LOS F – AM and PM peak hours)
- Northpark Boulevard & Sierra Drive (LOS F – AM and PM peak hours)
- Northpark Boulevard & University Parkway (LOS F – AM peak hour; LOS E – PM peak hour)
- Education Lane & North Campus Circle (LOS F – PM peak hour)
- University Parkway & Kendall Drive (LOS F – AM peak hour; LOS E – PM peak hour)
- University Parkway & College Avenue (LOS F – AM peak hour)
- University Parkway & State Street (LOS E – AM and PM peak hours)
- University Parkway & I-215 Northbound Ramps (LOS E – AM peak hour)

As summarized in Table 5, the project is forecast to result in a significant impact on 7 of the study intersections:

- Northpark Boulevard/Devils Canyon Road & Ash Street
- Northpark Boulevard & Sierra Drive
- Northpark Boulevard & University Parkway
- University Parkway & Kendall Drive
- University Parkway & College Avenue

- University Parkway & State Street
- University Parkway & I-215 Northbound Ramps

Table 5
Future Plus Project (2035) Conditions Peak Hour Intersection LOS Summary

No.	Intersection	Traffic Control	Peak Hour	Future Without Project (2035) Conditions		Future Plus Project (2035) Conditions		Δ Delay	Signal Warrant Met?	Impact (Y/N)
				Delay	LOS	Delay	LOS			
1.	Devils Canyon Road & Campus Parkway	AWSC	AM PM	9.1 10.1	A B	21.8 13.0	C B	12.7 2.9	- -	N N
2.	Northpark Boulevard/Devils Canyon Road & Ash Street	TWSC	AM PM	77.5 75.7	**F** **F**	>180 >180	**F** **F**	** **	No **Yes**	**Y** **Y**
3.	Northpark Boulevard & Sierra Drive	AWSC	AM PM	11.8 16.4	B C	70.2 120.4	**F** **F**	58.4 104.0	**Yes** **Yes**	**Y** **Y**
4.	Northpark Boulevard & University Parkway	Signal	AM PM	30.3 39.9	C D	213.3 62.9	**F** **E**	183.0 23.0	- -	**Y** **Y**
5.	Serrano Village Drive & Northpark Boulevard	Signal	AM PM	12.3 17.9	B B	12.7 18.4	B B	0.4 0.5	- -	N N
6.	Coyote Drive & Northpark Boulevard	Signal	AM PM	16.3 12.0	B B	11.0 11.7	B B	-5.3 -0.3	- -	N N
7.	East Campus Circle & Northpark Boulevard	Signal	AM PM	13.8 15.8	B B	17.5 17.5	B B	3.7 1.7	- -	N N
8.	Education Lane & North Campus Circle	TWSC	AM PM	9.4 12.8	A B	16.8 116.5	D **F**	7.4 103.7	- No	N **Y**
9.	University Parkway & Kendall Drive	Signal	AM PM	46.7 46.8	D D	113.3 62.2	**F** **E**	66.6 15.4	- -	**Y** **Y**
10.	University Parkway & College Avenue	Signal	AM PM	34.6 17.4	C B	125.1 19.7	**F** B	90.5 2.3	- -	**Y** N
11.	University Parkway & State Street	Signal	AM PM	28.3 34.8	C C	55.4 62.7	**E** **E**	27.1 27.9	- -	**Y** **Y**
12.	University Parkway & I-215 Northbound Ramps	Signal	AM PM	33.4 35.3	C D	76.6 55.0	**E** D	43.2 19.7	- -	**Y** N
13.	University Parkway & I-215 Southbound Ramps	Signal	AM PM	11.0 22.6	B C	13.9 22.1	B C	2.9 -0.5	- -	N N
14.	Little Mountain Drive & Kendall Drive	Signal	AM PM	20.1 20.7	C C	21.3 24.2	C C	1.2 3.5	- -	N N

Notes:
1. Signal = Signalized intersection; TWSC = Two-way stop-controlled intersection; AWSC = All-way stop-controlled intersection
2. Impacts are noted in **Bold**.
3. HCM 2010 does not define V/C ratio at the intersection level. HCM 2000 is used to determine V/C ratios for impact determination purposes. ΔV/C is only provided for signalized intersections when delay is 120 seconds or more per the impact criteria guidelines.
4. ">180" is reported for oversaturated conditions in which Synchro is no longer capable of estimating delay. ** is used to denote increases in delay in these cases.

I-215 Freeway

Existing Plus Project (2015) Conditions

A total of two freeway basic segments (one northbound and one southbound) and four ramp locations (two northbound and two southbound) were analyzed along I-215. Table 6 summarizes the LOS results for the study locations during the AM and PM peak hours. As show in Table 6, the following freeway mainline segments are forecast to operate unacceptably (LOS D, E, or F) during the AM or PM peak hours under the Existing Plus Project (2015) Conditions:

- I-215 Northbound Diverge Segment (LOS D – AM peak hour; LOS F PM peak hour)
- I-215 Northbound Basic Segment (LOS E – PM peak hour)
- I-215 Northbound Merge Segment (LOS F – PM peak hour)
- I-215 Southbound Diverge Segment (LOS E – AM peak hour)
- I-215 Southbound Basic Segment (LOS D – AM peak hour)
- I-215 Southbound Merge Segment (LOS D – AM peak hour; LOS F – PM peak hour)

Based on the thresholds of significance, the following freeway mainline segments are forecast to result in a significant impact for the Existing Plus Project (2015) Conditions:

- I-215 Northbound Diverge Segment
- I-215 Northbound Basic Segment
- I-215 Northbound Merge Segment
- I-215 Southbound Diverge Segment
- I-215 Southbound Basic Segment
- I-215 Southbound Merge Segment

Table 6
Existing Plus Project (2015) Peak Hour Freeway LOS Summary

Segment	Type	Existing Conditions				Existing Plus Project (2015) Conditions				Δ Density		Impact (Y/N)	
		AM		PM		AM		PM					
		Density	LOS	Density	LOS	Density	LOS	Density	LOS	AM	PM	AM	PM
I-215 Northbound													
University Pkwy Off-Ramp	Diverge	24.4	C	38.0	**E**	27.9	**D**	-	**F**	3.5	-	**Y**	**Y**
University Pkwy Off-Ramp to University Pkwy On-Ramp	Basic	19.3	C	34.6	**D**	19.3	C	40.3	**E**	0.0	5.7	N	**Y**
University Pkwy On-Ramp	Merge	25.2	C	38.1	**E**	25.3	C	-	**F**	0.1	-	N	**Y**
I-215 Southbound													

University Pkwy Off-Ramp	Diverge	34.9	**D**	23.6	C	36.2	**E**	24.4	C	1.3	0.8	**Y**	N
University Pkwy Off-Ramp to University Pkwy On-Ramp	Basic	27.9	**D**	17.2	B	28.1	**D**	17.4	B	0.2	0.2	**Y**	N
University Pkwy On-Ramp	Merge	26.1	**D**	21.1	C	26.6	**D**	-	**F**	0.5	-	**Y**	**Y**

Notes:
1. Calculated using methodologies consistent with the 2010 Highway Capacity Manual.
2. Density reported as passenger cars per mile per lane.
3. **Bold** indicates unacceptable operations.

Future Plus Project (2035) Conditions

Two freeway basic segments (one northbound and one southbound) and four ramp locations (two northbound and two southbound) were analyzed along I-215. Table 7 summarizes the LOS results for the study locations during the AM and PM peak hours. As shown, the following freeway mainline segments operate unacceptably (LOS D, E, or F) during the AM or PM peak hours under the Future Plus Project (2035) Conditions:

- I-215 Northbound Diverge Segment (LOS D – PM peak hour)
- I-215 Northbound Basic Segment (LOS D – PM peak hour)
- I-215 Northbound Merge Segment (LOS E – PM peak hour)
- I-215 Southbound Merge Segment (LOS F – PM peak hour)

The following freeway mainline segments are forecast to be significantly impacted under Future Plus Project (2035) Conditions:

- I-215 Northbound Diverge Segment
- I-215 Northbound Merge Segment
- I-215 Southbound Merge Segment

Table 7
Future Plus Project (2035) Peak Hour Freeway LOS Summary

Segment	Type	Future Without Project (2035) Conditions				Future Plus Project (2035) Conditions				Δ Density		Impact (Y/N)	
		AM		PM		AM		PM					
		Density	LOS	Density	LOS	Density	LOS	Density	LOS	AM	PM	AM	PM
I-215 Northbound													
University Pkwy Off-Ramp	Diverge	20.8	C	32.3	**D**	23.8	C	34.7	**D**	3.0	2.4	N	**Y**
University Pkwy Off-Ramp to University Pkwy On-Ramp	Basic	13.6	B	26.8	**D**	13.6	B	26.8	**D**	0.0	0.0	N	N

University Pkwy On-Ramp	Merge	20.0	C	34.2	**D**	20.1	C	35.1	**E**	0.1	0.9	N	**Y**
I-215 Southbound													
University Pkwy Off-Ramp	Diverge	26.5	C	17.2	B	27.7	C	18.0	B	1.2	0.8	N	N
University Pkwy Off-Ramp to University Pkwy On-Ramp	Basic	18.5	C	11.4	B	18.5	C	11.4	B	0.0	0.0	N	N
University Pkwy On-Ramp	Merge	20.2	C	-	**F**	20.5	C	-	**F**	0.3	-	N	**Y**

Notes:
1. Calculated using methodologies consistent with the 2010 Highway Capacity Manual.
2. Density reported as passenger cars per mile per lane.
3. **Bold** indicates unacceptable operations.

Vehicle Miles Traveled (VMT)

Vehicle miles traveled (VMT) is measured by multiplying the number of trips generated by the project by the average trip length. For this assessment, project VMT was calculated by multiplying the number of daily trips generated by the project by the estimated average trips lengths; after accounting for the different trip lengths associated with different types of campus users (on-campus students, off-campus students, Discovery Park employees, and campus faculty and staff).

The average trip lengths were estimated for off-campus commuter students, faculty and staff using zip code data of those users provided by the University. The average trip lengths for on-campus students and the Discovery Park were estimated from SBTAM model runs by extracting trip length data from the output skim matrices. Model skim matrices track origin and destination trip length data for each traffic analysis zone (TAZ) in the model by trip type. The home-based other production trip purpose was used to estimate the average trip length of on-campus students. The home-based work attraction trip purpose was used to estimate the average trip length of the Discovery Park employees. The existing and future FTE and associated average trip lengths, daily trips generated, and estimated VMT is summarized in Table 8. As illustrated, the VMT estimates show that the VMT due to the increase in enrollment is forecast to increase by 416,003 miles on a daily basis. However, due to the increase in the ratio of on-campus students, the VMT at the Master Plan buildout is projected to decrease on a per person basis.

Table 8
Daily VMT Estimate

User Type	FTE	Daily Trips	Average Trip Length (miles)	Daily VMT Estimate
Existing Enrollment				
On-Campus Student	1,533	2,997	10.9	32,670
Off-Campus Student	14,945	30,948	26.4	816,968
Faculty/Staff	1,650	3,027	23.9	72,385

			Total VMT	***922,023***
			VMT per FTE	***50.9***
Master Plan Enrollment				
On-Campus Student	4,850	9,482	10.9	103,358
Off-Campus Student	20,150	41,726	26.4	1,101,499
Faculty/Staff	2,503	4,592	23.9	109,821
Discovery Park Employees	405	1,216	19.2	23,347
			Total VMT	***1,338,025***
			VMT per FTE	***47.9***

Notes:
1. Average trip length for on-campus students and Discovery Park employees were estimated from SBATM. Average trip length for off-campus students and faculty and staff were estimated from available zip code data from CSUSB enrollment.
2. Discovery Park Employees were estimated by three employees per thousand square feet of research and development space.

Pedestrian, Bicycle and Transit Facilities

The addition of traffic and redistribution of vehicle traffic associated with the parking lots is not expected to cause any pedestrian, bicycle or transit impacts. The project does not disrupt any existing or planned bicycle, pedestrian, or transit facilities; nor does the project conflict with any plans, guidelines, policies, or standards related to the aforementioned modes.

Mitigation Measures

1. A fair-share contribution will be made to the City of San Bernardino toward the following improvements at the time conditions warrant the improvement.

Northpark Boulevard/Devils Canyon & Ash Street

With the following mitigation measure, the operations at the intersection will improve to LOS B in the AM peak hour, and LOS C in the PM peak hour, and the impact will be reduced to a less than significant level.

- Install traffic signal.
- Eastbound: One left-turn lane, one shared through-right lane.
- Westbound: Two left-turn lanes, one shared through-right lane.
- Northbound: One left-turn lane, one through lane, one dedicated right-turn lane with an overlap phase.
- Southbound: One left-turn lane, one through lane, one shared through-right lane.

Northpark Boulevard & Sierra Drive

With the following mitigation measure, the operations at the intersection will improve to LOS A in the AM and PM peak hours, and the impact will be reduced to a less than significant level.

- Install traffic signal.

Northpark Boulevard & University Parkway

With the following mitigation measure, the operations at the intersection will improve to LOS C in the AM peak hour, and LOS D in the PM peak hour, and the impact will be reduced to a less than significant level.

- Eastbound: Provide an additional left-turn lane.

University Parkway & Kendall Drive

With the following mitigation measure, the operations at the intersection will improve to LOS D in the AM and PM peak hours, and the impact will be reduced to a less than significant level.

- Southbound: Modify approach to provide one dedicated right-turn lane.

University Parkway & College Avenue

With the following mitigation measure, the operations at the intersection will improve to LOS B in the AM peak hour and LOS C in the PM peak hour, and the impact will be reduced to a less than significant level.

- Signal modification to provide protected phases in the east-west direction.

University Parkway & State Street

With the following mitigation measure, the operations at the intersection will improve to LOS C in the AM peak hour and LOS D in the PM peak hour, and the impact will be reduced to a less than significant level.

- Optimization of the AM and PM peak hour traffic signal cycle lengths and splits within the coordinated timing plan as part of the University Parkway corridor's Adaptive Traffic Signal System.

2. The University will mitigate the project impact at ***Education Lane & North Campus Circle*** by modifying the intersection control from a side-street stop-controlled intersection to an all-way stop-controlled intersection. With implementation of the mitigation measure the operations at the intersection will improve to LOS B in the PM peak hour, and the impact will be reduced to a less than significant level.

3. Caltrans Facilities

University Parkway & I-215 Northbound Ramps
With the following mitigation measure, the operations at the intersection will improve to LOS B in the AM and PM peak hours.

- The removal of the pedestrian crossing at the westbound right-turn approach is recommended to allow a true, free movement. The interchange will need to be coordinated with closely spaced intersections such as at State Street, and therefore, the entire University Avenue corridor will need to be optimized.

However, this intersection is under Caltrans responsibility – whose mission is to provide a safe, sustainable, integrated and efficient transportation system, and Caltrans planned improvement to this interchange has not been finalized yet; as such this impact is considered significant and unavoidable.

I-215 Freeway

Mitigating the identified significant impacts to the freeway mainline segments will require a complete reconstruction of the I-215 freeway to add travel lanes and upgrade the deficient ramp locations. Since the freeways in the study area are interconnected systems, it will not be possible, nor effective, to provide isolated spot improvements of one segment of the freeway where deficient operations are observed.

HOV lanes are proposed in both directions along I-215 between I-210 and I-15 according to the SCAG Regional Transportation Plan (RTP) in the Financially-Constrained RTP Projects to be completed by 2030. These lanes are forecast to improve traffic conditions along the corridor but still result in deficient operations according to Caltrans methodology and impact thresholds. As such, this impact is considered to be significant and unavoidable.

Level of Impact After Mitigation

Implementation of identified mitigation measures will reduce the impacts at most of the affected intersections to a less than significant level. However, since the intersection of University Parkway and I-215 Northbound Ramps is under Caltrans' responsibility – whose mission is to provide a safe, sustainable, integrated and efficient transportation system, and Caltrans planned improvement to this interchange has not been finalized yet, this impact is considered significant and unavoidable. Impact on I-215 freeway will be significant and unavoidable since to reduce this impact to a less than significant level would require a complete reconstruction of the freeway.

3.5 Air Quality and Greenhouse Gases (GHG)

This section examines the potential long-term air quality impacts, including greenhouse gases (GHG), associated with the 2016 Campus Master Plan project. Short-term impacts from construction of the project are discussed in Section 3.9, Construction Effects.

Environmental Setting

The California State University San Bernardino campus is located within the South Coast Air Basin. The portion of the Basin where the campus is located continues to exceed Federal and State ambient air quality standards for ozone (O_3), particulate matter (PM_{10}), and ultra-fine particulate matter ($PM_{2.5}$).

Air Pollution Control Efforts

Both the federal and state governments have set health-based ambient air quality standards for the following 6 pollutants:

- Sulfur dioxide (SO_2)
- Lead (Pb)
- Carbon monoxide (CO)
- Fine particulate matter (PM_{10})
- Ultrafine particular matter ($PM_{2.5}$)
- Nitrogen dioxide (NO_2)
- Ozone (O_3)

Standards for these pollutants have been designed to protect the most sensitive persons from illness or discomfort with a margin of safety. The California standards are more stringent than federal standards, especially in the case of PM_{10} and SO_2.

Table 9 outlines current federal and state ambient air quality standards, and sources and health effects of these pollutants. Additional information about health effects associated with each pollutant is provided in the South Coast Air Quality Management District (SCAQMD) CEQA Air Quality Handbook, which is hereby incorporated by reference.

Table 9
Air Pollution Standards, Sources, and Effects

Air Pollutant	State Standards	National Standards (Primary)	Sources	Health Effect
Ozone (O_3)	0.07 ppm, 8-hr. avg. 0.09 ppm, 1-hr. avg.	0.070 ppm, 8-hr. avg.	Atmospheric reaction of organic gases with nitrogen oxides in sunlight.	Aggravation of respiratory and cardiovascular diseases, irritation of eyes, impairment of cardiopulmonary function, plant leaf injury.
Respirable Particulate Matter (PM_{10})	50 $\mu g/m^3$, 24-hr. avg. 20 $\mu g/m^3$, AAM	150 $\mu g/m^3$, 24-hr. avg.	Stationary combustion of solid fuels, construction activities, industrial processes, industrial chemical reactions.	Reduced lung function, aggravation of the effects of gaseous pollutants, aggravation of respiratory and cardio-respiratory diseases, increased coughing and chest discomfort, soiling, reduced visibility.
Particulate Matter less than 2.5 Microns in Diameter ($PM_{2.5}$)	12 $\mu g/m^3$, AAM	35 $\mu g/m^3$, 24-hr. avg. 12 $\mu g/m^3$, AAM	Combustion from mobile and stationary sources, atmospheric chemical reactions.	Health problems, including asthma, bronchitis, acute and chronic respiratory symptoms such as shortness of breath and painful breathing, and premature deaths.
Carbon Monoxide (CO)	9.0 ppm, 8-hr. avg. 20 ppm, 1-hr. avg.	9 ppm, 8-hr. avg. 35 ppm, 1-hr. avg.	Incomplete combustion of fuels and other carbon-containing substances such as motor vehicle exhaust, natural events, such as decomposition of organic matter.	Reduced tolerance for exercise, impairment of mental function, impairment of fetal development, death at high levels of exposure, aggravation of some heart diseases (angina).
Nitrogen Dioxide (NO_2)	0.18 ppm, 1-hr. avg. 0.03 ppm, AAM	0.10 ppm, 1-hr. avg. 0.053 ppm, AAM	Motor vehicle exhaust, high-temperature stationary combustion, atmospheric reactions.	Aggravation of respiratory illness, reduced visibility, reduced plant growth, formation of acid rain.
Sulfur Dioxide (SO_2)	0.04 ppm, 24-hr avg. 0.25 ppm 1-hr. avg.	0.03 ppm, AAM 0.14 ppm, 24-hr. avg. 75 ppb, 1-hr. avg.	Combustion of sulfur-containing fossil fuels, smelting of sulfur-bearing metal ores, industrial processes.	Aggravation of respiratory diseases (asthma, emphysema), reduced lung function, irritation of eyes, reduced visibility, plant injury, deterioration of metals, textiles, leather, finishes, coating, etc.
Lead (Pb)	1.5 $\mu g/m^3$, 30 day avg.	0.15 $\mu g/m^3$, calendar quarter	Contaminated soil.	Increased body burden, impairment of blood formation and nerve conduction.
Visibility-Reducing Particles	Extinction coefficient of 0.23 per km, visibility of 10 miles or more due to particles when relative humidity is less than 70%..	No Federal Standards		Visibility impairment on days when relative humidity is less than 70%.

Notes:
ppm = parts per million by volume $\mu g/m^3$ = micrograms per cubic meter
AAM = annual arithmetic mean
Source: California Air Resources Board, https://www.arb.ca.gov/research/aaqs/aaqs2.pdf

Monitored Air Quality

The South Coast Air Quality Management District (SCAQMD) monitors air quality throughout the Basin at various locations. The SCAQMD's Central San Bernardino Valley 2 monitoring station No. 5203 located at 24302 E. 4th St, San Bernardino CA 92410, is the closest station to the CSU San Bernardino campus. The number of days that State and/or Federal ambient air quality standards for ozone and particulate matter were exceeded at this location are shown in Table 10.

Table 10
Federal and State Ozone and Particulate Matter Exceedances at Central San Bernardino Valley 2 Monitoring Station

Year	Ozone (O_3)			Suspended Particulates (PM_{10})		Fine Particulates ($PM_{2.5}$)	
	Days Federal 8-hour Standard Exceeded	Days State 8-hour Standard Exceeded	Days State 1-Hour Standard Exceeded	% of Samples Exceeding Federal 24-hour Standard	% of Samples Exceeding State 24-hour Standard	% of Samples Exceeding Federal Standard	% of Samples Exceeding State Standard
2010	40	63	27	0	5.1	1.7	1.7
2011	39	66	40	0	5	2.0	2.0
2012	54	74	41	0	1	0	0
2013	36	53	22	0	5	0.9	0.9
2014	21	76	38	0	4	0.9	0.9
2015	29	79	52	0	5	1.8	1.8

Note: ppm = parts per million parts of air, by volume
ppb = parts per billion
Source: http://www.aqmd.gov/home/library/air-quality-data-studies/historical-data-by-year
Data for 2010-2015 from Station No. 5203.

Impact Criteria

The South Coast Air Quality Management District (SCAQMD) has established thresholds for certain criteria pollutants for projects within the South Coast Air Basin. SCAQMD considers projects in the South Coast Air Basin that exceed any of these emission thresholds to have a significant air quality impact. Thresholds for operation-related emissions are shown in Table 11.

Table 11
SCAQMD Long Term Operational Thresholds

Criteria Pollutant	Pounds per Day
Reactive Organic Gases (ROG)	55
Oxides of Nitrogen (NO_x)	55
Carbon Monoxide (CO)	550
Fine Particulate Matter (PM_{10})	150
Ultrafine Particulate Matter ($PM_{2.5}$)	55
Source: South Coast Air Quality Management District http://www.aqmd.gov/docs/default-source/ceqa/handbook/scaqmd-air-quality-significance-thresholds.pdf	

The SCAQMD adopted a "Policy on Global Warming and Stratospheric Ozone Depletion" in 1990. The policy commits the SCAQMD to consider global impacts in rulemaking and in drafting revisions to the Air Quality Management Plan. In 1992, the SCAQMD Governing Board reaffirmed this policy and adopted amendments to the policy.

In 2008, the SCAQMD Governing Board adopted an interim greenhouse gas (GHG) significance threshold for stationary source/industrial projects where the SCAQMD is the lead agency. However, SCAQMD has yet to adopt a GHG significance threshold for land use development projects (e.g., residential/commercial projects) and has formed a GHG Significance Threshold Working Group to further evaluate potential GHG significance thresholds[2] and provide guidance to local lead agencies on determining significance for GHG emissions in their CEQA documents. Members of the working group include government agencies implementing CEQA and representatives from various stakeholder groups. The working group is currently discussing multiple methodologies for determining project significance. These methodologies include categorical exemptions, consistency with regional GHG budgets in approved plans, a numerical threshold, performance standards, and emissions offsets. Also, the State Office of Planning and Research (OPR) is currently finalizing a Technical Advisory to provide guidance on specific topics related to climate action planning and the use of plans for the reduction of greenhouse gases in a CEQA analysis [3].

Environmental Impact

The Master Plan creates a long range plan for strategic infill within the existing campus to accommodate future growth in student enrollment and avoiding campus sprawl. As illustrated in Figures 1 and 2, this new strategic infill approach provides for the use of the existing campus land to accommodate all needed facilities while preserving campus open space, and utilizes new

[2] South Coast Air Quality Management District, Greenhouse Gases CEQA Significance Thresholds, http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/ghg-significance-thresholds
[3] The Governor's Office of Planning & Research, CEQA and Climate Change https://www.opr.ca.gov/s_ceqaandclimatechange.php

buildings to frame smaller, more intimate courtyards and open spaces and ultimately create a denser, more walkable and collegial campus environment while at the same time reinforcing existing land uses. The Master Plan provides for new student housing facilities with over 3,200 new beds, associated dining and support facilities, new and upgraded academic, administrative, support facilities, as well new and upgraded athletic fields and facilities, and infrastructure improvement within the developed campus area.

The project's long-term operational emissions associated with the Campus Master Plan were calculated and are summarized in Table 12. A "worst-case" scenario is used to analyze these long-term air quality impacts. Area ROG and NOx emissions were calculated for both winter and summer with the higher emissions estimate reported and GHG emissions were calculated on an annual basis, using the CalEEMod model Version 2016.3.1.

Table 12
Project Operational Emissions, Year 2035

	Reactive Organic Gases (ROG)	**Oxides of Nitrogen (NO_X)**	**Carbon Monoxide (CO)**	**Respirable Particulate Matter (PM_{10})**	**Ultrafine Particulate Matter ($PM_{2.5}$)**	**GHG (CO_{2e}) Tons/year**
Area Sources	64.7	1.0	2.5	1.0	1.0	1.0
Energy	1.2	10.8	9.1	0.8	0.8	9,619
Vehicular Emissions	21.3	171.0	235.7	128.8	34.8	22,440
Total	87.2	182.8	247.3	130.6	36.6	32,060
SCAQMD Threshold	55.00	55.00	550.00	150.00	55.00	-
Exceeds Threshold?	**Yes**	**Yes**	**No**	**No**	**No**	**-**

Note:
Source: CalEEMod, Version 2016.3.1

As shown, the pollutant emissions will exceed the SCAQMD daily threshold amounts for ROG and NOx, primarily due to vehicular traffic associated with accommodating 25,000 FTE student enrollment on campus.

Consistency with Regional Air Quality Plans

The SCAQMD suggests that the EIR discuss a project's consistency with the current regional Air Quality Management Plan (AQMP) and other regional plans. The purpose of this discussion is to determine if the project is consistent with assumptions and objectives of the regional AQMP, and thus, would not interfere with the region's ability to comply with federal and state air quality standards.

A project is considered to comply with the AQMP if it is consistent with the growth assumptions of the AQMP. The AQMP assumes development throughout the region will occur as outlined in the Southern California Association of Governments (SCAG) Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS). The Master Plan provides for continuing use of the campus for educational purposes to accommodate planned future area-wide growth in student population. The Master Plan will significantly increase student housing on campus, which will work to reduce student commuter trips on the existing roadway networks. The Master Plan is consistent with SCAG's growth projections and land use policies, including the policies of focusing growth and development within urban areas, encouraging infill development, and encouraging sustainable development that contributes to reducing adverse air quality and GHG impacts. The University implements, and will continue to implement pursuant to the Master Plan numerous programs and policies to improve air quality in the region, including providing housing for more than 3,000 students on campus that reduce commute trips and the associated air pollutant emissions, and minimizing energy use through project design, increased efficiencies equivalent to the LEED gold standard in new facilities, and use of renewable energy sources. Therefore, the Master Plan is both supportive of the AQMP goals and objectives and consistent with the AQMP.

However, since the emissions of ROG and NOx could exceed the SCAQMD daily threshold amounts, impact is considered to be significant.

Mitigation Measures

The University implements, and will continue to implement pursuant to the Master Plan numerous programs and policies to improve air quality in the region, including providing housing for students on campus that reduce commute trips and the associated air pollutant and GHG emissions and minimizing energy use through project design and increased use of renewable energy sources. No additional feasible mitigation strategies are currently available to substantially reduce emissions of ROG and NOx, and therefore, this impact is considered significant and unavoidable.

Level of Impact After Mitigation

The Master Plan's comprehensive sustainability programs and features guiding the future development of the campus needed to accommodate the area-wide student population growth will reduce emissions to the extent feasible. However, since no additional feasible mitigation strategies are currently available to substantially reduce emissions of ROG and NOx, this impact is considered significant and unavoidable.

3.6 Noise

This section evaluates long-term noise impact associated with the 2016 Campus Master Plan (the project). Short-term noise impact from construction of individual facilities pursuant to the Master Plan is evaluated in Section 3.9, Construction Effects, of this EIR.

Environmental Setting

Sound levels are expressed on a logarithmic scale of decibels (abbreviated as dB), in which a change of 10 units on the decibel scale reflects a 10-fold increase in sound energy. A 10-fold increase in sound energy roughly translates to a doubling of perceived loudness.

In evaluating human response to noise, acousticians compensate for people's response to varying frequency or pitch components of sound. The human ear is most sensitive to sounds in the middle frequency range used for human speech, and is less sensitive to lower and higher-pitched sounds. The "A" weighting scale is used to account for this sensitivity. Thus, most community noise standards are expressed in decibels on the "A"-weighted scale, abbreviated dB(A). Zero on the decibel scale is set roughly at the threshold of human hearing. Common sounds in the environment include office background noise at about 50 dB(A); human speech at 10 feet at about 60 to 70 dB(A); cars driving by at 50 feet at 65 to 70 dB(A); trucks at 50 feet at 75 to 80 dB(A); and aircraft overflights directly overhead a mile from the runway at about 95 to 100 dB(A).

The community noise environment consists of wide varieties of sounds, some near and some far away, which vary over the 24-hour day. People respond to the 24-hour variation in noise but are most sensitive to noise at night. California standards for community noise use the Community Noise Equivalent Level (CNEL), in which a 5-decibel penalty is added to the evening 7:00 PM to 10:00 PM period, and a 10-decibel penalty to the night 10:00 PM to 7:00 AM period.

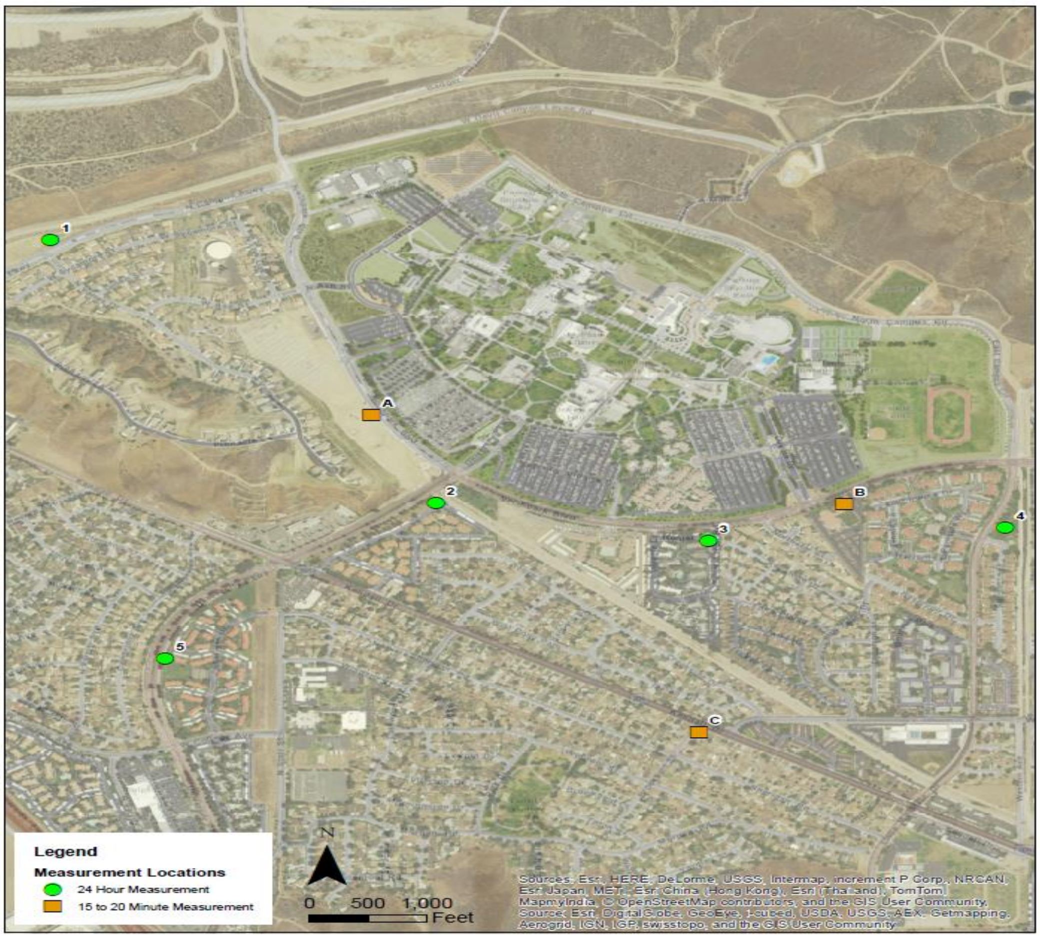
Noise-Sensitive Uses

Some land uses are considered more sensitive to noise than others. Noise-sensitive land uses include homes, schools, day care facilities, hospitals, and similar uses. Commercial and industrial uses generally are not considered noise sensitive because people do not rest or sleep there. The CSU San Bernardino campus is located at the base of the San Bernardino Mountains. The campus is bordered and separated from the existing surrounding residential development to the south, west, and east by campus parking and perimeter streets. Therefore, there are no sensitive uses adjacent to the campus.

Existing Noise Levels

Traffic on local streets is the major source of noise in the study area. Five 24-hour noise measurements and three 15-minute measurements were taken in the project vicinity to ascertain the existing noise levels (see Figure 17).

Noise Measurement Locations
Figure 17



There are three main access routes to the campus, University Parkway, Campus Parkway, and Little Mountain Drive. These three access routes are connected by two other major roadways, Kendall Drive and Northpark Boulevard. The results of noise measurements along these roadways indicate that in the existing noise levels in the project vicinity range from 55.1 to 69 dB(A), as summarized in Table 13.

Table 13
Existing Noise Levels

Roadway	Cross Streets	Existing Ldn*, dBA
Campus Parkway	Kendall to Northpark Blvd	56.6
Northpark Blvd	Campus to Ash	55.1
Northpark Blvd	Ash to Sierra Drive	55.1
Northpark Blvd	Sierra Drive to University Pkwy	59
Northpark Blvd	University Pkwy to Serrano Village	65.6
Northpark Blvd	Serrano Village to Coyote Drive	65
Northpark Blvd	Coyote Drive to Little Mountain	64.8
University Parkway	Kendall Drive to Northpark Blvd	66.6
University Parkway	I-215 to Kendall Drive	68.8
Little Mountain	Northpark Blvd to Kendall Drive	62.3
Kendall Drive	University Pkwy to Little Mountain Drive	69

* Ldn is a 24-hour average noise level with 10 decibel penalty added to the night period from 10:00 p.m. to 7:00 a.m.

As shown, the existing noise levels with sound levels 65 dBA exceed the criteria for compatible residential land use or above along Kendall Drive, University Parkway, and Northpark Boulevard between University Parkway and Little Mountain Drive. Noise levels along Little Mountain Drive are at 62 to 63 dBA. Noise levels range from 55.1 to 56.6 dBA along Northpark Boulevard and Campus Parkway, between University Parkway and Campus Parkway.

Impact Criteria

The City of San Bernardino Noise Ordinance (Section 19.20.030.15 of the Development Code) specifies that the exterior noise levels at residential locations should not exceed a CNEL of 65 dBA while the interior levels should not exceed CNEL of 45 dBA.

While the City does not have specific noise impact criteria, the Federal Interagency Committee on Noise (FICON) established significance criteria for noise impacts using a sliding scale based on the existing Ldn noise levels, where Ldn is a 24-hour average noise level with 10 decibel penalty added to the night period from 10:00 p.m. to 7:00 a.m. The level of significance under the criteria changes with increasing noise exposure, such that smaller changes in ambient noise levels result in significant impacts at higher existing noise levels. These criteria, considered applicable to all noise sources that use the Ldn or CNEL noise exposure metrics, are shown in Table 14.

Table 14
Noise Significance Criteria

Existing Ldn	Significant Impact
Below 60 dBA	+5.0 dBA or more
60 - 65 dBA	+3.0 dBA or more
Above 65 dBA	+1.5 dBA or more

Source: Federal Government's Method of Assessing Noise Impacts. July 14, 2000.

Environmental Impact

Based on data in the traffic study prepared for the Campus Master Plan, analyses were conducted to identify the future traffic noise levels with and without the project. Future traffic noise levels and the contribution of the project-generated traffic to these future noise levels were calculated for 11 study street segments. The results of the analysis illustrating the changes in noise levels due to the project and cumulative future growth in the area are summarized in Table 15.

Table 15
Change in Noise Levels

Roadway	Cross Streets	Existing Ldn, dBA	Future Ldn, dBA (Project)	Future Ldn, dBA (Cumulative)	Change in Ldn, dBA (Project)	Change in Ldn, dBA (Cumulative)	Significant Impact?
Campus Parkway	Kendall to Northpark Blvd	56.6	57.9	59.7	1.3	3.1	No
Northpark Blvd	Campus to Ash	55.1	56.8	57.6	1.7	2.5	No
Northpark Blvd	Ash to Sierra Drive	55.1	58.9	59.8	3.8	4.7	No
Northpark Blvd	Sierra Drive to University Pkwy	59	62.3	63.7	3.3	4.7	No
Northpark Blvd	University Pkwy to	65.6	65.7	66.7	0.1	1.1	No

Roadway	Cross Streets	Existing Ldn, dBA	Future Ldn, dBA (Project)	Future Ldn, dBA (Cumulative)	Change in Ldn, dBA (Project)	Change in Ldn, dBA (Cumulative)	Significant Impact?
	Serrano Village						
Northpark Blvd	Serrano Village to Coyote Drive	65	65.3	66.4	0.3	1.4	No
Northpark Blvd	Coyote Drive to Little Mountain	64.8	65.1	66.1	0.3	1.3	No
University Parkway	Kendall to Northpark Blvd	66.6	66.7	67.7	0.1	1.1	No
University Parkway	I-215 to Kendall	68.8	70	70.3	1.2	1.5	Yes
Little Mountain Drive	Northpark Blvd to Kendall	62.3	63.5	63.7	1.2	1.4	No
Kendall Drive	University Pkwy to Little Mountain	69	69	69.8	0	0.8	No

Note: Ldn is a 24-hour average noise level with 10 decibel penalty added to the night period from 10:00 p.m. to 7:00 a.m.

As shown, the noise level at the study roadway segment along Campus Parkway, between Kendall Drive and Northpark Boulevard, is projected to increase from 56.6 dBA to 59.7 dBA as a result of the future growth, including the project. The project's contribution to the increase in noise levels will be 1.3 dBA. Based on the significance criteria, the project-related and cumulative impact at this study segment is not projected to be significant.

There are six study roadway segments along Northpark Boulevard. Based on the analysis, noise levels will range from 57.6 dBA to 66.7 dBA are projected along these segments as a result of future growth, including the project. The project's contribution to the increase in these noise levels ranges from 0.1 dBA to 3.8 dBA. Based on the significance criteria, the project-related and cumulative impact is not projected to be significant at any of the six study roadway segments.

There are two study roadway segments along University Parkway. Based on the analysis, University Parkway noise levels of 67.7 dBA and 70.3 dBA are projected along these segments as a result of future growth, including the project. The project's contribution to the increase in noise levels ranges from 0.1 dBA to 1.2 dBA. Based on the significance criteria, the project-related impact is not projected to be significant at either of these two segments along University Parkway. However, the cumulative increase in noise levels from overall regional growth, including the project, are projected to range from 1.1 to 1.5 along the two study roadway segments. Based on the significance criteria, the cumulative impact on the segment of University Parkway between I-215 to Kendall Drive will be significant.

The noise level along the Little Mountain Drive study roadway segment, between Northpark Boulevard and Kendall Drive, is projected to be of 63.7 dBA as a result of future growth, including the project. The project's contribution to the increase in noise level is 1.2 dBA. Based on the significance criteria, the project-related and cumulative impact at this study segment is not projected to be significant.

Mitigation Measures

No direct feasible mitigation measures are available to reduce the project-related traffic noise impact. As most of the residential areas already have 6 to 8-foot noise barriers in place to help reduce traffic noise, additional noise attenuation is not required. Along Campus Parkway and Northpark Boulevard between Campus Parkway and University Parkway, the future noise levels are below the City criteria, so additional noise attenuation is not required. Furthermore, sound barriers would not be feasible, due to the need for access to and from the roadways.

Level of Impact After Mitigation

The cumulative noise impact along University Parkway, from I-215 to Kendall Drive, will remain significant and unavoidable.

3.7 Fire and Police Protection Services

Environmental Setting

Fire protection for CSU San Bernardino campus is provided by the San Bernardino County Fire Department (SBCFD). Police protection for the campus is provided by the University Police.

Fire Protection

University buildings are equipped with smoke detectors and fire alarms which are set to provide both visual and audio alarms in the event a fire is detected or a fire alarm pull station is activated. Standard operating procedures are identified and disseminated on a regular basis to faculty, staff, and students to address a variety of different fire scenarios that may occur on campus. If a fire situation is identified, University Police will institute an emergency response and contact the SBCFD, if necessary.

Fire Prevention

All fire equipment at the campus is maintained in accordance with State and local regulations. Fire equipment is inspected on a regular schedule and re-charged, repaired, or replaced as needed. The University holds two fire drills per complex per year (fall and winter) which require the complete evacuation of all campus buildings. All student staff are trained in fire drill and alarm protocol. Resident assistants hold quarterly hall meetings to inform students of evacuation procedures, and multiple programs are held throughout the year to address fire safety[4].

San Bernardino County Fire Department

The San Bernardino County Fire Department (SBCFD) provides emergency response services for more than 60 communities, cities, and unincorporated areas within San Bernardino County.[5] SBCFD has approximately 977 fire personnel and 56 active fire stations.[6]

Fire Station No. 225 is located about ¼-mile from the southwest corner of campus, at 1640 Kendall Drive, providing service to campus with minimal response time. Other stations in the vicinity include Fire Stations No. 232 and 227, both within 2 miles of campus.

[4] *CSUSB Annual Security and Fire Safety Report 2015* (https://police.csusb.edu/documents/ASR.pdf)
[5] San Bernardino County Fire Department (http://www.sbcfire.org/about/AboutSBCFire.aspx)
[6] *San Bernardino County Fire Department Annual Report 2014-2015* (https://www.joomag.com/magazine/2014-2015-annual-report/0449969001440452548)

Police Protection

The University Police Department is located on Fairview Drive, near Lot A on the northwestern corner of campus. The Department has 17 sworn officers and approximately 40 non-sworn support employees. University police officers conduct foot, vehicular, and bicycle patrols on campus and in the residence community 24 hours a day. The police officers also work closely with both the San Bernardino Police Department and the San Bernardino County Sheriff Department under the mutual aid agreements to assist them with incidents involving campus community members that may occur off campus.[7]

The San Bernardino Police Department has 312 sworn officers and 150 support staff.[8] The City police station is located about 6 miles to the south of the campus, at 710 North D Street.

The San Bernardino County Sheriff Department has a staff of approximately 3,571 employees[9]. The closest facility to the campus, Central Station, is located approximately 8 miles to the south, at 655 East Third Street.

Impact Criteria

Impact on police and/or fire protection services will be significant if the project will require construction of new facilities or expansion of existing facilities, the construction of which would result in significant adverse effects, in order to maintain acceptable service ratios, response times, and other performance objectives.

Environmental Impact

Fire Protection

The Campus Master Plan provides for infill development of the campus with new academic, administrative, student housing, student life support and other facilities to accommodate the gradual increase in student enrollment over the next 20 years.

As with the existing buildings on campus, all new and remodeled campus buildings will be equipped with smoke detectors and fire alarms which are set to provide both visual and audio alarms in the event a fire is detected or a fire alarm pull station is activated. All fire equipment at the campus will continue to be maintained in accordance with State and local regulations, and will be inspected on a regular schedule and re-charged, repaired, or replaced as needed. The University will continue to implement fire safety training and response procedures to facilitate fire

[7] *CSUSB Annual Security and Fire Safety Report 2015* (https://police.csusb.edu/documents/ASR.pdf)
[8] The City of San Bernardino – Police Department (https://www.ci.sanbernardino.ca.us/cityhall/police_department/about_sbpd/about_sbpd/default.asp)
[9] *San Bernardino County Sheriff Department 2015 Annual Report* (http://cms.sbcounty.gov/Portals/34/AnnualReports/Sheriff_2015_AR.pdf?ver=2016-03-18-145858-567)

suppression. New buildings and other facilities will continue to include all necessary ingress and egress for traffic circulation and emergency response, and will comply with all applicable requirements for construction, access, water mains, fire flows, and life safety requirements. If a fire situation is identified, University Police will continue to institute an emergency response and contact the San Bernardino County Fire Department, if necessary.

Therefore, while the Master Plan provides for new facilities to accommodate the gradual growth in student enrollment, thus contributing to an incremental increase in demand for fire prevention and suppression services, it does not result in the need for new fire protection facilities, the construction of which would result in significant adverse effects, in order to maintain acceptable response times, service ratios, or other performance objectives. Enhanced operating procedures, incorporation of required fire suppression and safety features, and continued emergency response training will work to minimize increased demand for services. Therefore, impact is considered to be less than significant.

Police Protection

The gradual growth in student enrollment on campus will result in an incremental increase in demand for police protection services, and therefore, the University will ensure appropriate staffing of the University Police Department with additional personnel. The University will continue to cooperate and participate in mutual aid arrangements with the San Bernardino Police Department and the San Bernardino County Sheriff Department.

All new campus facilities, including access and internal site circulation plans, will be reviewed with regards to security objectives and police mobilization purposes, and to ensure adequate ingress/egress for emergency vehicles. New buildings and other facilities will be incorporated into the University's security and emergency response plans to ensure appropriate access for police and emergency response. New campus facilities may include passive and/or active security systems, and/or other measures, to minimize the need for new security personnel.

While the enrollment growth is anticipated to result in an incremental increase in demand for police protection services, this increase will be minimized through enhanced operating procedures, continued campus safety training, and appropriate staffing of the University Police Department. Therefore, no major new local or regional facilities will be required, the construction of which would result in significant adverse effects, and impact is considered less than significant.

Mitigation Measures

Impact will be less than significant and no mitigation beyond continued compliance with all applicable existing regulations, requirements, and procedures is required.

Level of Impact After Mitigation

Impact will be less than significant and no mitigation beyond continued compliance with all applicable existing regulations, requirements, and procedures is required.

3.8 Utilities and Service Systems

This section addresses the impact of the California State University, San Bernardino 2016 Campus Master Plan on public utility infrastructure and services. Much of the information presented in this section is derived from the Master Plan Utility Infrastructure Report[10].

Environmental Setting

Water

Water service is provided to the CSU San Bernardino campus by the San Bernardino Municipal Water Department (SBMWD). The campus also uses well water from a series of its wells that run approximately diagonally across the campus, from the northwest corner to the southeast[11]. As of 2016, the campus water use was approximately 958 acre-feet per year (AFY). This includes 571 AFY from the existing wells on campus and 386 AFY purchased water from SBMWD[12].

Sewer

The City of San Bernardino manages sanitary sewer service for the campus. Wastewater generated by the campus is treated at the Water Reclamation Plant, located in the City of San Bernardino. The sanitary sewer system has three points of connection for the main campus and a fourth connection for the residential housing complex south of West Northpark Boulevard. Though the sanitary sewer system primarily operates or drains by gravity, the campus has nine sewage lift stations that are necessary to get enough fall for the sewage to flow out to the relatively shallow sewer main connection out in West Northpark Boulevard. Each pump station houses a minimum of two ejector grinding pumps and an emergency back-up generator. Most of the central and west campus drains to the manhole just southeast of the residence Halls in West Northpark and is metered. The system starts at the upstream end at the western side of campus with a 4" line that snakes around the facilities buildings with a mix of original vitrified clay pipe (VCP) and plastic SDR-35 plastic sewer pipe and a 6" line that serves the Admin Services building. It heads east and then works its way between the Central Plant, Animal House and Geology Lab buildings and turns south to cut through Chemical and Biological Sciences and the first pump station.

[10] CSU San Bernardino Utilities Master Plan, P2S Engineering, Inc. December 2016
[11] Draft San Bernardino Valley Regional Urban Water Management Plan. June 2016
[12] CSUSB

Stormwater Drainage

The campus vicinity is served by the San Bernardino County Flood Control District. The campus is surrounded by various flood control percolation, debris basins and channels. Stormwater drainage is collected by on-campus facilities and conveyed off-site to city and regional drainage facilities and systems. The campus has an extensive webbed network of storm drain pipes in the central and east portions of campus, with the west side that houses the facility buildings and operations sheet flowing southeast to West Northpark Boulevard and the University Village Housing sheet flowing north to the boulevard. Besides the Facilities Complex at the west side and the UV sheet flow drainage, storm water enters the San Bernardino County Flood Control network at four to five locations around the perimeter of campus. The campus recently installed the north perimeter road North Campus Circle with an open trapezoidal channel just north and parallel to the street. This channel collects all the stormwater that flows south of the foothills and drains east and then south to outlet to the City/County system south of the intersection of East Campus Circle and West Northpark Boulevard.

Solid Waste

The waste services for the campus are provided by the City of San Bernardino. Waste is collected on campus for recycling, reuse, and/or disposal. As of 2015, 2,327 tons of solid waste was generated on campus. Out of this total amount, 999 tons of waste was disposed[13], resulting from the campus' current diversion rate of approximately 57% with the on-going campus-wide consolidated waste management program that includes waste diversion and recycling efforts. Recyclable and specified solid waste is transported to the East Valley Transfer and Recycling Facility in the City of San Bernardino for recycling or solid waste. The Class III landfills that currently accept waste generated within the County of San Bernardino are: Mid-Valley Landfill, San Timoteo Landfill, Victorville Landfill, Barstow Landfill, and Landers Landfill[14].

Impact Criteria

Impact on public utility services will be significant if the project will exceed the utility's capacity to provide services and/or will require construction of new facilities or expansion of existing facilities, the construction of which would cause significant physical effects on the environment.

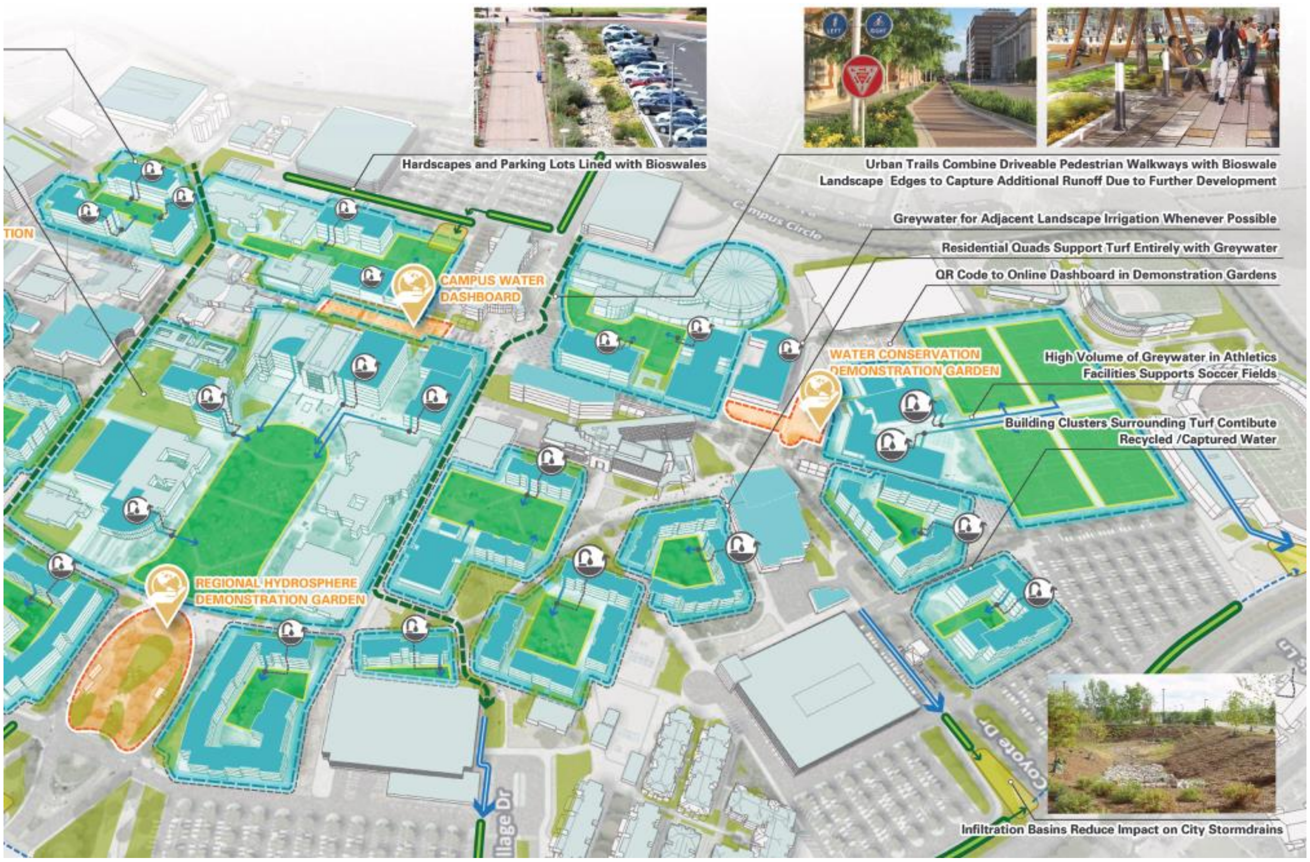
Environmental Impact

Comprehensive sustainability guidelines and features are essential part of the Master Plan. The Master Plan aims at creating a sustainable campus that conserves water, and reduces generation of

[13] CSUSB, 2015
[14] County of San Bernardino, Department of Public Works Waste Disposal Sites http://cms.sbcounty.gov/dpw/SolidWasteManagement/WasteDisposalSites.aspx

wastewater, stormwater, and solid waste. Major sustainability features of the Master Plan are illustrated in Figure 18.

Campus-Wide Water Sustainability Strategies
Figure 18



Source: 2016 Campus Master Plan

Water

As previously discussed, the campus has two water supply sources, the San Bernardino Municipal Water District (SBMWD) and a series of wells on campus. Tables 16 and 17 illustrate the SBMWD projected future water demand and supplies for an average normal year and multiple dry years[15].

15 2015 San Bernardino Valley Regional Urban Water Management Plan.

Table 16
Normal Year Supply and Demand Comparison

Normal Year Supply and Demand Comparison (AF)					
Totals	**2020**	**2025**	**2030**	**2035**	**2040**
Supply Totals	58,271	66,830	75,466	84,082	90,582
Demand Totals	45,969	49,094	53,339	57,623	59,449
Difference	12,302	17,736	22,127	26,459	31,133

Source: 2015 San Bernardino Valley Regional Urban Water Management Plan

Table 17
Multiple Dry Years Supply and Demand Comparison

Multiple Dry Years Supply and Demand Comparison (AF)						
Year	**Totals**	**2020**	**2025**	**2030**	**2035**	**2040**
First Year	Supply Totals	58,271	66,830	75,466	84,082	90,582
	Demand Totals	50,566	54,003	58,673	63,386	65,394
	Difference	7,705	12,827	16,793	20,696	25,188
Second Year	Supply Totals	58,271	66,830	75,466	84,082	90,582
	Demand Totals	45,969	49,094	53,339	57,623	59,449
	Difference	12,302	17,736	22,127	26,459	31,133
Third Year	Supply Totals	58,271	66,830	75,466	84,082	90,582
	Demand Totals	41,372	44,184	48,005	51,861	53,504
	Difference	16,899	22,646	27,461	32,221	37,078

Source: 2015 San Bernardino Valley Regional Urban Water Management Plan

Based on the current water use of 0.05 AFY per FTE student, the future water use pursuant to the Campus Master Plan with 25,000 FTE student enrollment level will be approximately 1,325 AFY.

Based on current pattern of water use, the water use from the campus' wells is projected to be approximately 790 AFY, with the purchased domestic water supplying approximately 535 AFY. This 535 AFY water use represents only 2% of the SBMWD's projected 2035 surplus water supplies during a normal year and 2.6% during dry years (first year).

Under the "worst case" scenario should the campus' well water become unavailable, the 1,325 AFY would need to be supplied by the SBMWD. With the SBMWD's projected water supplies, even under this "worst case" scenario the campus' water use will represent only 5% of the 2035 surplus water supplies during a normal year and 6.4% during dry years.

Furthermore, the campus water use is anticipated to decrease with the implementation of the Campus Master Plan. The Master Plan's Sustainability Guidelines include a wide range of water conservation programs and measures, with high water efficiency in indoor building design and renovation and in landscape design and renovation, with a target of 42% reduction in the campus' total water use. Therefore, impact associated with water supply will be less than significant.

The existing water infrastructure on campus will be expanded and improved as necessary to serve the new facilities developed pursuant to the Master Plan. Therefore, the project's implementation of water conservation designs, features, and measures and payment of all legally required capital facilities fees pursuant to and in compliance with the California Government Code Section 54999, including connection fees and user fees, will mitigate any potential impact on the regional water system and infrastructure to a less than significant level.

Sewer

Assuming that 95% of potable water used becomes wastewater, the current wastewater generation at the campus is approximately 0.81 million gallons per day. With the same pattern of water use, the future 25,000 FTE student enrollment and campus development pursuant to the Master Plan will result in 1.12 million gallons of wastewater per day. Wastewater generated by the campus is treated at the Water Reclamation Plant, located in the County of San Bernardino. The project's wastewater represents 3.4% of the Plant's current capacity of 33 million gallons per day.

Furthermore, the campus water use and therefore, the subsequent generation of wastewater is anticipated to decrease with the implementation of the Campus Master Plan. The Master Plan's Sustainability Guidelines include a wide range of water conservation programs and measures, with high water efficiency in indoor building design and renovation and in landscape design and renovation, with a target of 42% reduction in the campus' total water use. This reduction in water use will result in a subsequent proportional reduction, with a target of 42% reduction, in generation of wastewater.

The Utility Master Plan includes plans for new sewerage infrastructure on campus to accommodate wastewater flows, including peak flows, including new and replacement lines to address root intrusion, cracking, and joint displacement. To avoid potential conflicts with proposed new and replacement facilities, rerouted lines will be installed and new service laterals will be constructed to connect the new buildings to meet their sewer needs. Service laterals will be sized based on the function and size of the proposed buildings planned pursuant to the Master Plan. Some domestic sewer lines will be relocated to accommodate the proposed buildings. The relocated lines will be SDR-35 and will replace the existing VCP piping. In addition, to accommodate the future campus development pursuant to the Master Plan, the campus is currently undertaking replacement of the aging lift stations and the identified pipes that have zero or negative slopes and chronic blockage.

Therefore, with the project's implementation of water conservation designs, features, and measures that reduce wastewater generation; and with payment of all legally required capital facilities fees pursuant to and in compliance with the California Government Code Section 54999, including connection fees and user fees, will mitigate any potential impact on the regional sewer system and infrastructure to a less than significant level.

Stormwater Drainage

The existing storm drainage system for the campus will be augmented with new storm drain piping extensions constructed to connect the new buildings to meet their drainage needs. Service laterals will be sized based on the function and size of the proposed buildings planned pursuant to the Master Plan. Some of the existing storm drain lines will be relocated to accommodate the proposed buildings.

The Master Plan's Sustainability Guidelines incorporate water strategies and plans to prioritize stormwater to ensure the longevity of the campus' well water supply and also help future-proof the campus from flash flood threats. According to the Utility Infrastructure Failure Analysis, the capacity of the existing storm sewer system is at 50% for a 10-year storm, which adheres to both city and county code. Future campus development implementing the sustainability guidelines and features will result in the net increase in the amounts of pervious surfaces along with the use of natural stormwater management strategies, including bioswales and infiltration, resulting in an overall reduction in the piped stormwater conveyance requirement to meet the demands of a 10-year storm event.[16]

Furthermore, in compliance with existing requirements on-site structural or treatment control Best Management Practices (BMPs) will be included in all future campus development. The Master Plan Utility Infrastructure Report's enumerates the BMPs with an aim to effectively prohibit non-storm water discharges and reduce discharge of pollutants from stormwater conveyance systems to the maximum extent practicable, and these BMPs are incorporated in the 2016 Campus Master Plan. These BMPs include:[17]

- Use permeable materials for sidewalks, driveways, parking lots, or interior roadway surfaces (e.g. hybrid lots, parking groves, permeable overflow parking, etc.).
- Use open space development that incorporates smaller lot sizes (e.g. multi-story construction)
- Use green roofs on top of buildings
- Reduce overall imperviousness associated with parking lots by providing compact car spaces, minimizing stall dimensions, incorporating efficient parking lanes, and using pervious materials in spillover parking areas.
- Direct rooftop runoff to pervious areas such as yards, open channels, or vegetated areas and avoid routing rooftop runoff to the roadway or the storm water conveyance system.
- Vegetated swales (bioswales) and strips
- Extended/dry detention basins
- Infiltration basins
- Infiltration trenches
- Wet ponds
- Constructed wetlands
- Oil/water separators
- Catch basin and/or storm drain inserts

[16] 2016 Campus Master Plan
[17] Master Plan Utility Infrastructure Report

- Continuous flow deflection/separation systems
- Media filtration
- Bioretention facility
- Dry-wells
- Cisterns
- Foundation planting
- Normal flow storage/separation systems
- Clarifiers
- Filtration systems

Therefore, with the implementation of the Master Plan's sustainable features and measures that reduce stormwater generation; and mandatory compliance with existing regulations that include payment of all legally required capital facilities fees pursuant to and in compliance with the California Government Code Section 54999, including connection fees and user fees, will mitigate any potential impact on the regional stormwater system and infrastructure to a less than significant level.

Solid Waste

The University's commitment to a campus-wide consolidated waste management program has resulted in diverting up to 57% of waste from landfills through recycling and other waste diversion measures. With this waste diversion program, which includes providing dedicated bins in high-generation areas, recovery of recyclable materials is increased, contamination from liquid residues to recyclable paper products in the dry commingled recycling program is reduced, and redemption fund revenues are captured to help maintain and grow waste management programs on campus. The bins are located in public areas and offices around campus, as well as special events. These refined materials are quality feedstock for manufacturers, resulting in reduced mining and processing of finite raw resources with net reductions in energy used and pollution.18

This waste reduction and diversion is anticipated to continue to grow consistent with the State law of diverting at least 75%[19], and the California State University's goal of diverting 80% of waste by 2020[20].

The estimated project's solid waste generation is summarized in Table 18. As shown, the project will generate approximately 3,219 tons of solid waste per year. With a continuing increase in recycling and waste reduction and the goal of 80% waste diversion, the amount of non-recyclable waste generated by the project is anticipated to be approximately 2,479 tons per year.

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[18] CSU San Bernardino Facilities Services http://sustainability.csusb.edu/performance/BeverageRecycling.html
[19] Assembly Bill No. 75 and Assembly Bill No. 341
[20] The California State University, Sustainability Report 2014.

Table 18
Estimated Project Solid Waste Generation
(tons per year)

Generation Rate	Size	Solid Waste Generated
0.29/FTE student (with current 57% solid waste diversion)	25,000 FTE students	3,219
80% Solid Waste Diversion		(-740)
Total		**2,479**

Source: CSUSB
*FTE: Full Time Equivalent Student

Currently, the remaining permitted Class III landfill capacity in the County is estimated at 6,000,000 tons[21]. The project's solid waste represent 0.4% (four-tenths of one percent) of the landfills' capacity. As the project will generate a relatively small amount of solid waste and implement comprehensive waste reduction and diversion programs in compliance with existing laws and requirements that will divert 80% of waste from landfills, this impact is considered less than significant.

Mitigation Measures

The Master Plan's sustainability guidelines will guide future campus development resulting in reduced water use, reduced wastewater generation, reduced stormwater generation and improved stormwater quality, and reduced generation of non-recyclable waste. With these features, compliance with existing requirements, and payment of all legally required capital facilities fees pursuant to and in compliance with the California Government Code Section 54999, impact on the regional public utilities system and infrastructure will be less than significant. No additional mitigation is required.

Level of Impact After Mitigation

The Master Plan's sustainability guidelines will guide future campus development resulting in reduced water use, reduced wastewater generation, reduced stormwater generation and improved stormwater quality, and reduced generation of non-recyclable waste. With these features, compliance with existing requirements, and payment of all legally required capital facilities fees

[21] http://www.calrecycle.ca.gov/SWFacilities/Directory/36-AA-0057/Detail

pursuant to and in compliance with the California Government Code Section 54999, impact on the regional public utilities system and infrastructure will be less than significant. No additional mitigation is required.

3.9 Construction Effects

This section examines short-term effects associated with construction of buildings, facilities, and improvements on the campus pursuant to the Master Plan. Construction impact from each individual facility project is considered short-term as it will cease upon completion of construction activities. Due to the long-term comprehensive nature of the Master Plan, construction activities for specific facilities or improvements may overlap and/or result in continuous activities on-campus throughout the life of the Master Plan.

Environmental Setting

Generally, construction activities result in short-term noise, dust, air, and water pollution impacts, as well as increased truck and construction worker trips and localized traffic congestion. In most cases, general disturbance and annoyance associated with construction affects uses in close proximity to the specific construction site. However, other construction impacts, such as those on air and water quality, can affect areas at great distances from a specific construction site. The existing facilities include traditional academic buildings, administrative offices, student services, student housing, athletic facilities, maintenance, support, and other facilities, and surface parking.

Sensitive Uses

The CSU San Bernardino 441-acre campus is located at the base of the San Bernardino Mountains. The campus is self-contained and is separated from the existing surrounding residential development to the south, west, and east by campus parking and Northpark Boulevard, a major highway. No sensitive uses adjoin the campus.

Impact Criteria

Construction activities are considered to have a significant impact if they substantially disrupt or interfere with day-to-day operations of surrounding land uses, substantially affect sensitive uses, or create public health and/or safety hazards.

Environmental Impact

Construction Effects on Air Quality

The existing air quality in the project area is discussed in Section 3.5, Air Quality and Greenhouse Gases (GHG). Air pollutants emitted by construction activities include oxides of nitrogen (NO_x), and reactive organic gases (ROG). In addition, grading and demolition activities release dust and fine particulate matter less than 10 and 2.5 microns in diameter (PM10 and PM 2.5) into the atmosphere.

Criteria Pollutant Emissions

Construction emissions, including demolition and grading, were calculated using the current version of the California Emissions Estimator Model (CALEEMod), version 2016.3.1. The model uses current CARB emission factors for automobile and truck emissions and EPA emission factors for equipment emissions and fugitive dust emissions. To account for a “worst-case” peak day construction emissions, the highest number of equipment pieces on any given day is used and all equipment pieces are assumed to operate full 8 hours a day, even though in practice, not all this equipment will be in use simultaneously for 8 hours during any single construction day. The estimated peak day emissions are summarized in Table 19. The worksheets and calculations are included in Appendix C.

Table 19
Estimated Peak Day Criteria Air Pollutant Emissions from Construction
(pounds per day)

	Reactive Organic Gases (ROG)	Oxides of Nitrogen (NO_x)	Carbon Monoxide (CO)	Fine Particulate Matter (PM10)	Fine Particulate Matter (PM 2.5)	Max GHG (metric tons /year)
Daily Maximum	112	79	41	29	17	7,272
SCAQMD Thresholds	75	100	550	150	55	
Exceed Threshold?	**Yes**	**No**	**No**	**No**	**No**	

As shown, short-term typical peak day construction emissions associated with construction of future campus facilities and improvements will be above the South Coast Air Quality Management District (SCAQMD) threshold amounts for ROG. If construction of several major facilities and/or improvements should substantially overlap, the peak day construction emissions may also be above SCAQMD threshold amounts for other pollutants as well. Therefore, this impact is considered significant.

Toxic Air Pollutants

Toxic air contaminants are a group of pollutants defined by the Federal Clean Air Act and the California Health and Safety Code. Federal, State, and local governments have implemented a number of programs to control air toxic emissions. For example, the Federal Clean Air Act regulates emissions of nearly 200 hazardous air pollutants. The California Legislature has implemented regulation to limit toxic emissions, such as the Tanner Toxics Act (AB1807), the Air

Toxics Hot Spot Assessment Program (AB2588), the Toxics Emissions Near Schools Program (AB305), and the Disposal Site Air Monitoring Program (AB374).

The Master Plan provides for replacement of existing aged, obsolete, and inefficient facilities on campus, which may contain asbestos, lead paint, or other toxic materials. All construction activities will comply with existing rules and regulations concerning toxic air pollutants, including Rule 1403 (Asbestos Emissions from Renovation/Demolition Activities) for proper handling and disposal of asbestos-containing materials. Other known hazardous substances and toxic emissions are controlled by SCAQMD, federal, and State rules and regulations. Mandatory compliance with these regulations regarding asbestos, lead-based paint, and other toxic materials during demolition will ensure a less than significant impact related to the removal of these materials during construction.

The California Air Resources Board has identified diesel particulate emissions as carcinogenic air toxics. No safe threshold for the emissions has been established. However, the amount of diesel emissions associated with a modest amount of replacement and new facility construction within campus provided for in the Master Plan will be relatively small and will not involve massive or prolonged operations of diesel trucks or equipment. While diesel exposure from construction of facilities and infrastructure improvements at the campus is not expected be a significant impact, nonetheless, because there are existing residences nearby and students present on campus, mitigation measures will be required to reduce diesel particulate emissions from construction equipment.

Construction Effects on Water Quality

Construction operations can impact water quality in several ways. First, to comply with SCAQMD guidelines, most construction sites are required to be watered to reduce emissions of PM10. This water can result in runoff from the site laden with construction debris (including trash, cleaning solvents, cement wash, asphalt and car fluids like motor oil, grease, and fuel) and sediment, potentially affecting local waterways. Second, during rain storms, stormwater runoff from construction sites can carry construction debris and sediment into local waterways. Third, construction activities, although not anticipated, can result in dewatering, which can carry contaminants into nearby waterways.

For construction in areas of 1 acre or more in size, current regulations require design and implementation of a Storm Water Pollution Prevention Plan (SWPPP), which focuses on the implementation of Best Management Practices (BMPs). SWPPPs may include the following BMPs to reduce impacts on water quality:

- Schedule excavation and grading work for dry weather
- Use as little water as possible for dust control
- Never hose down dirty pavement of impermeable surfaces where fluids have spilled
- Utilize re-vegetation, if feasible, for erosion control after clearing, grading, or excavating
- Avoid excavation and grading activities during wet weather
- Construct diversion dikes to channel runoff around the site, and line channels with grass or roughened pavement to reduce runoff velocity

- Cover stockpiles and excavated soil with wraps or plastic sheeting
- Remove existing vegetation only when absolutely necessary
- Consider planting temporary vegetation for erosion control on slopes where construction is not immediately planned

With implementation of these BMPs impact will be less than significant, and no additional mitigation measures beyond compliance with existing regulations are required.

Noise

Construction activities will result in a temporary increase in ambient noise levels in the vicinity of each individual construction site. During the construction period, noise from heavy equipment, power and air tools, compressors, trucks, and other noises from loading and unloading will occur with varying frequency and intensity. At a distance of 50 feet from the noise source, construction equipment noise levels (principally from engine exhaust and engine noise) range from 75 to 95 dB(A) for tractors, up to 95 dB(A) for construction trucks, up to 88 dB(A) for concrete mixers, and up to 87 dB(A) for compressors. These temporary noise levels will not be continuous but will vary as equipment is used for varying lengths of time throughout the construction period. During grading and other construction, peak noise levels at 50 feet would range from 75 to 90 dB(A), with occasional higher peaks.

Noise levels fall substantially with increasing distance from the noise source, both as a result of spherical spreading of sound energy and absorption of sound energy by the air. Spherical spreading of sound waves reduces the noise of a point source by 6 decibels for each doubling of distance from the noise source. Absorption by the atmosphere typically accounts for a loss of 1 decibel for every 1,000 feet. Thus, high levels of construction noise usually are limited to the immediate vicinity of construction activities. Nonetheless, since construction of some new facilities and improvements could be audible at the nearby residence halls, academic facilities, or other campus sensitive uses, mitigation measures have been identified to reduce this impact.

Traffic/Circulation

Construction activity will add trucks and construction equipment to streets in the area. Haul trucks and heavy equipment usually travel more slowly than other traffic on the street network and require more time to enter and exit traffic flows. When heavy equipment enters or exits a construction site, it may interrupt vehicular or pedestrian traffic. Construction activities on campus will involve the use of trucks, usually for short periods of time, to haul away demolition and construction debris and deliver construction materials. These trucks and equipment may cause localized congestion at some locations in the surrounding area, which is a potentially significant impact if not properly mitigated.

Due to the pedestrian character of the campus with students walking from one building to another throughout the day, construction activity for specific facilities could adversely affect pedestrian flows in some areas of the campus. Construction activities also may temporarily affect bus and bicycle circulation routes on campus. Mitigation measures have been identified to reduce these potential impacts.

Solid and Hazardous Waste

Demolition of existing facilities and construction of new facilities and associated infrastructure improvements will generate construction materials waste. Even though the construction of individual campus facilities and infrastructure improvements will be phased over the 20-year span of the Campus Master Plan - thus representing relatively small amount of construction at any given time which do not involve massive construction activities that could generate significant amounts of solid waste, mitigation measures have been identified to reduce this potential impact.

Some of the existing academic, student housing, and other facilities on campus have reached the end of their functional life and therefore, replacement and provision of remodeled facilities are large components of the Campus Master Plan. Some of those obsolete facilities may contain some hazardous substances materials and therefore, demolition materials that contain such hazardous substances will be disposed of at certified disposal facilities in strict compliance with all existing applicable regulations. Mandatory compliance with the existing regulations will ensure that impact will be less than significant.

Mitigation Measures

Compliance with existing regulations and requirements will ensure that impact on water quality will be less than significant and no additional mitigation is required. The University will implement the following mitigation measures to reduce identified significant impacts by imposing conditions on the construction contractor.

Air Quality and GHG

1. Exposed surfaces are watered as needed.

2. Soils stabilizers are applied to disturbed inactive areas as needed.

3. Ground cover is replaced quickly in inactive areas.

4. All stockpiles are covered with tarps or plastic sheeting.

5. All unpaved haul roads are watered daily and all access points used by haul trucks are kept clean during the site grading.

6. Speed on unpaved roads is reduced to below 15 miles per hour.

7. Trucks carrying contents subject to airborne dispersal are covered.

8. Grading and other high-dust activities cease during high wind conditions (wind speeds exceeding a sustained rate of 25 miles an hour).

9. Diesel particulate filters are installed on diesel equipment and trucks.

10. All construction equipment will be properly tuned.

11. To reduce emissions from idling, the contractor shall ensure that all equipment and vehicles not in use for more than 5 minutes are turned off, whenever feasible.

12. Low VOC-content paint, stucco, or other architectural coatings materials will be utilized to the extent possible.

13. Low VOC-content asphalt and concrete will be utilized to the extent possible.

14. The University will continue to comply with SCAQMD Rule 1403 (Asbestos Emissions from Renovation/ Demolition Activities) and other pertinent regulations when working on structures containing asbestos, lead, or other toxic materials.

The University will implement the following measures to protect students present at campus.

15. As appropriate, outdoor activities at the campus will be limited during high-dust and other heavy construction activities, including painting.

16. Throughout the construction period of individual facilities and improvements in close proximity to student residence halls, campus academic facilities, health and wellness facilities, and/or other sensitive uses on campus, ventilation systems in those facilities will be tested more frequently to provide for the maintenance schedule that ensures proper ventilation.

Noise

17. Construction hours will be consistent with the City of San Bernardino regulations, which limit construction activity to the hours between 7:00 am and 8:00 pm.

18. Muffled heavy construction equipment will be used.

19. Construction staging areas will be located as far as possible from student residence halls, campus academic facilities, health and wellness facilities, and other places where students gather.

20. The contractor will ensure that each piece of operating equipment is in good working condition and that noise suppression features, such as engine mufflers and enclosures, are working and fitted properly.

21. The contractor will locate noisy construction equipment as far as possible from nearby sensitive uses.

Traffic and Parking

22. A flag person will be employed as needed to direct traffic when heavy construction vehicles enter the campus

23. Construction trucks will avoid travel on residential areas to access campus and use the City of San Bernardino designated truck routes to travel to and from campus.

24. Construction-related truck traffic will be scheduled to avoid peak travel time on the I-215 freeway as feasible.

25. If major pedestrian or bicycle routes on campus are temporarily blocked by construction activities, alternate routes around construction areas will be provided, to the extent feasible. These alternate routes will be posted on campus for the duration of construction.

26. If any bus stop on campus is obstructed by construction activity, the University, in cooperation with the transit service providers, will temporarily relocate such transit facility on campus as appropriate.

Solid and Hazardous Waste

27. Demolition and construction inert materials, including vegetative matter, asphalt, concrete, and other recyclable materials will be recycled to the extent feasible.

28. Demolition materials that contain hazardous substances will be disposed of at certified disposal facilities in strict compliance with all applicable regulations.

Level of Impact After Mitigation

Compliance with existing regulations and implementation of the identified measures will reduce construction impact on solid and hazardous waste facilities to a less than significant level. However, even with incorporation of identified feasible mitigation measures, peak emissions of NOx could remain above the threshold amount and, thus, this impact is considered significant and unavoidable. The impact of noise from construction activity on the campus' closest sensitive uses in the vicinity of some facilities construction sites of new facilities, albeit reduced and intermittent, could remain significant and unavoidable.

4.0 Cumulative and Long-Term Effects

Cumulative Effects

The CEQA Guidelines (Section 15355) define a cumulative impact as "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts." The Guidelines [Section 15130(a)(1)] further state that "an EIR should not discuss impacts which do not result in part from the project."

Section 15130(a) of the CEQA Guidelines provides that "[A]n EIR shall discuss cumulative impacts of a project when the project's incremental effect is cumulatively considerable..." Cumulatively considerable, as defined in Section 15065(a)(3), "means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects."

An adequate discussion of significant cumulative impacts requires either (1) "a list of past, present, and probable future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the agency, or (2) "a summary of projections contained in an adopted general plan or related planning document, or in a prior environmental document which has been adopted or certified, which described or evaluated regional or area-wide conditions contributing to the cumulative impact." Due to the 20-year planning horizon of the Campus Master Plan, this cumulative impact analysis evaluates impacts based on a long-term area-wide regional growth, including future development within the City of San Bernardino pursuant to the City's General Plan.

The CEQA Guidelines recognize that cumulative impacts may require mitigation – such as new rules and regulations that go beyond project-by-project measures. An EIR may also determine that a project's contribution to a significant cumulative impact will be rendered less than cumulatively considerable and thus is not significant. A project's contribution is less than cumulatively considerable if the project is required to implement or fund its fair share of a mitigation measure or measures designed to alleviate the cumulative impact. The Lead Agency must identify facts and analysis supporting its conclusion that the contribution will be rendered less than cumulatively considerable [CEQA Guidelines, Section 15130(a)(3)].

Traffic and Circulation

The traffic analysis in this EIR (see Section 3.4) addresses both project-specific and cumulative traffic and circulation impacts that account for background traffic associated with long-term regional growth and addition of traffic generated by related projects. At project buildout, when the University enrollment reaches 25,000 FTE students, the project's contribution to traffic will result

in significant cumulative traffic and circulation impact at 7 intersections. With implementation of the identified mitigation measures, impact may be reduced to a less than significant level at all seven intersections.
Similarly, at buildout, the project's contribution to future traffic volumes will result in significant cumulative traffic and circulation impact at three freeway segments along I-215. No feasible mitigation measures are available to reduce this impact to a level below significance. Widening and/or other improvements to interstate freeways to provide additional capacity are within the jurisdiction of regional transportation agencies (Caltrans) and these are regional issues requiring region-wide solutions. Thus, mitigation requiring the University to widen a major regional freeway is not considered feasible. Cumulative impact at the three identified freeway segments will be significant and unavoidable.

As discussed in Section 3.4, Traffic and Circulation, the Master Plan provides for adequate parking for campus activities, as well as the gradually growing student enrollment. Provisions of these facilities will work to preclude the potential for significant cumulative parking impact off-campus.

Air Quality and Greenhouse Gases (GHG)

As discussed in this EIR (Section 3.5, Air Quality and Greenhouse Gases (GHG)), the implementation of the Master Plan together with future growth within the surrounding areas and the region will result in additional vehicle trips and the resultant air pollutant emissions within the South Coast Air Basin. Operational emissions, primarily from vehicular trips associated with growth in student enrollment, will exceed the SCAQMD daily threshold amounts, resulting in significant unavoidable impact.

Region-wide implementation of local and regional growth management policies, a reasonable jobs/housing balance, new technologies (e.g., in vehicle emission control equipment and fuel), and programs to encourage alternative modes of transportation, including public transit, will work toward attaining long-term emissions reductions. However, even with full implementation of those measures, the cumulative impact will be significant.

Noise

As discussed in this EIR (Section 3.6, Noise), the implementation of the Master Plan together with future growth within the surrounding areas and the region will result in additional vehicle trips and overall increase in traffic noise levels. At buildout, the project's contribution to the noise level, together with the long-term regional growth, will result in a cumulative increase in noise levels ranging from 0.8 dBA to 4.7 dBA. The increase in noise levels will result in significant cumulative noise impact at one study roadway segment, specifically along University Parkway between I-215 to Kendall Drive. No direct feasible mitigation measures are available to reduce the cumulative noise impacts. Most of the residential areas already have 6- to 8-foot noise barriers in place to help reduce traffic noise, and additional sound barriers will not be feasible, due to the need for access to and from the roadways. Therefore, the cumulative noise impact is considered significant.

Fire and Police Protection Services

Cumulative future growth will incrementally increase demand for fire protection services. Given that the surrounding area is largely developed, the University's contribution to cumulative demand will be relatively minor. The University, the City of San Bernardino, the County of San Bernardino, and other local jurisdictions review fire protection issues regularly to ensure adequate levels of service. In addition to incorporating fire safety features in design and operations of its campus facilities, the University will continue to educate students, faculty, and staff to increase awareness about fire prevention and emergency preparedness, and will continue to cooperate with the San Bernardino County Fire Department to minimize demand for service. Continued oversight of fire protection services will ensure that cumulative impact will be less than significant.

The Master Plan and future development within the surrounding areas will incrementally increase demand for police protection services. Given that the campus is located within a developed urban area, the City of San Bernardino, the Master Plan's contribution to cumulative demand will be relatively minor. The City and County of San Bernardino and the University review police protection needs and resources regularly to ensure appropriate levels of service. In addition to incorporating safety features in the design and operation of campus facilities, continued oversight of police services, including the provision of resources for the University Police and cooperation in mutual aid agreements with the City of San Bernardino Police Department and San Bernardino County Sheriff Department, will ensure a less than significant cumulative impact.

Utilities and Service Systems

Water

The campus water use is anticipated to decrease with the implementation of the Master Plan. The Master Plan's Sustainability Guidelines include a wide range of water conservation programs and measures, including high water efficiency in indoor building design and renovation and in landscape design and renovation, with a target of 42% reduction in the campus' total water use. The area's water provider, the San Bernardino Municipal Water District (SBMWD) has ample water supplies projected through the year 2040, with surplus water supplies in comparison to the demand from future cumulative growth within the San Bernardino Valley[22]. As the future water use pursuant to the Campus Master Plan represents only 2% of the SBMWD's projected 2035 surplus water supplies during a normal year and 2.6% during dry years, cumulative impact will not be significant.

The existing water infrastructure on campus will be expanded and improved as necessary to serve the new facilities developed pursuant to the Master Plan. The project will implement water conservation designs, features, and measures and be responsible for all payments of legally required capital facilities fees, including connection fees and user fees. Similarly, other development within the surrounding areas will be required to provide all necessary onsite improvements in compliance with existing City regulations including all mandated water

[22] San Bernardino Valley Regional Urban Water Management Plan. 2015.

conservation measures and payments of connection fees and user fees. With these components and payment of all legally required capital facility fees, cumulative impact will be less than significant.

Sewer

The Master Plan and future development within the surrounding area will increase the generation of sewage flows. The University campus is part of a developed area that is served by extensive existing sewerage systems. Implementation of Master Plan's water conservation measures will continue to work to reduce wastewater flows. The future campus development includes new and improved sewer infrastructure to accommodate wastewater flows, including peak flows. Future development within the City and County of San Bernardino in areas surrounding the campus will be required to provide all necessary sewer improvements to accommodate additional wastewater flows in compliance with existing City and County regulations and contribute to the necessary area-wide improvements, including through payment of capital facilities fees. With compliance with these existing requirements, cumulative impact will be less than significant.

Stormwater Drainage

The Master Plan and future development within the highly urbanized surrounding area will largely result in infill development and/or reuse of urban sites that are already largely covered with buildings, pavement, and other impervious surfaces. Therefore, no substantial increase in stormwater flows is anticipated to occur. The Master Plan provides for maintenance and enhancement of the open space areas on campus that provide permeable surfaces, including bioswales, which will reduce stormwater runoff and improve stormwater quality. Reuse of urban sites by other development in the surrounding area may include additional landscaping may overall increase pervious surfaces, thereby allowing greater percolation of stormwater into the ground and reducing stormwater flows into the local and regional stormwater drainage systems. All future development will implement of most current stormwater requirements mandated by NPDES and other stormwater regulations to improve water quality. With the implementation of the Master Plan's sustainable features and measures that reduce stormwater generation, and mandatory compliance with existing regulations, which include payment of all legally required capital facilities fees, including connection fees and user fees, by all future development within the area will reduce cumulative impact on the regional stormwater system and infrastructure to a less than significant level.

Solid Waste

The University is committed to a campus-wide consolidated waste management program which has resulted in diverting up to 57% of waste from landfills through recycling and other waste diversion measures. With implementation of the Master Plan's sustainability programs and features, more than 80% of waste will be diverted from landfills. With this waste diversion program, which includes providing dedicated bins in high-generation areas, recovery of recyclable materials is increased, contamination from liquid residues to recyclable paper products in the dry commingled recycling program is reduced, and redemption fund revenues are captured to help maintain and grow waste management programs on campus. The project's solid waste represents 0.4% (four-tenths of one percent) of the landfill capacity in the County of San Bernardino. Other future development within the area surrounding the campus will be required to comply with the City's Environmental Projects and programs including mandatory commercial recycling and the City's Construction & Demolition (C&D) ordinance to meet the State's mandates to reduce solid waste disposal to landfills. Therefore, no significant cumulative impact will occur as a result of the Master Plan.

Cultural Resources

Historic Resources

Campus development pursuant to the Master Plan includes an addition to the campus' only historic building, the John M. Pfau Library. Mitigation measures have been identified to address the massing, size, placement, articulation, and materials of the addition, reducing the potential impact to a less than significant level. Similarly, future development in the surrounding area will be required to identify any historic resources that could be potentially affected by those developments, and implement mitigation measures in compliance with existing laws and regulations, including the City of San Bernardino requirements for historic assessments and detailed mitigation plans based on the recommendations of historic preservation experts, to ensure that potential impact is reduced to a less than significant level. With these measures no significant cumulative impact will occur as a result of the Master Plan.

Archaeological Resources

The CHRIS records search identified one resource within the campus project area. This resource is a historic road, Devil Canyon Toll Road/Sawpit Creek Road, recorded in 2007. Mitigation measures have been identified to determine whether remnants of this road are present within the project area, and if the remnants are present, to reduce a potential for an impact to this resource from future campus development. For some facilities and improvements that are planned for portions of the campus that have historically been paved or developed with landscaping, where no native ground surface is visible, there is a possibility of unknown archaeological resources being preserved beneath the surface. Therefore, precautionary mitigation measures have been identified to reduce the potential impact on such previously unknown archaeological resources. Similarly, if there are such resources identified within the sites of future development in in the City or County of San Bernardino in the area surrounding the campus, those future projects will implement similar mitigation measures in compliance with existing laws and regulations, including the City of San Bernardino requirements, to ensure potential impact is reduced to a less than significant level. With these measures potential cumulative impact will be reduced to a less than significant level.

Tribal Cultural Resources

A search of the Sacred Lands Files requested from the NAHC failed to identify the presence of Native American cultural resources within the campus study area planned for future development pursuant to the Master Plan. Nonetheless, mitigation measures have been identified to ensure that future campus development pursuant to the Master Plan will not significantly affect a previously unknown tribal cultural resources. Other future development within the area and the region that involves construction or deconstruction will be required to follow similar procedures and, if there are such resources identified within the sites such future development, mitigation measures will be implemented in compliance with existing laws and regulations to ensure that potential impact is reduced to a less than significant level. With compliance with these existing requirements, cumulative impact is anticipated not to be significant.

Paleontological Resources

There are no known paleontological resources within the campus. While the potential for uncovering such significant resources is considered remote, in an unlikely event that such resources are discovered during construction of future planned facilities and improvements, compliance with existing laws and regulations will ensure no significant impact. Similarly, if there are such resources identified within the sites of other future development in the surrounding area, mitigation in compliance with existing laws and regulations will be required to ensure potential impact is reduced to a less than significant level. These laws and regulations include: (1) stopping work in the event that a paleontological resource is discovered until a qualified paleontologist can visit the site and assess the significance of the potential resource, (2) the paleontologist will then conduct on-site archaeological or paleontological monitoring, including inspection of exposed surfaces to determine if fossils are present, and (3) if such resources are present, the monitor will have the authority to divert grading away from exposed resources temporarily in order to recover the resources. With compliance with these requirements, cumulative impact will not be significant.

Biological Resources

The Master Plan provides a new strategic infill approach to the long-term campus development which utilizes the existing developed campus land to provide all needed facilities while preserving campus open space, including the continuing preservation of the most northern campus area and the west site sensitive natural open space as habitat preservation. To further ensure that the development of future facilities nearby the habitat preservation areas, the identified precautionary mitigation measures will be implemented prior to any construction. Therefore, no significant cumulative impact on biological resources will occur as a result of the Master Plan.

Aesthetics

The Master Plan will result in infill replacement and new facilities within the interior of the campus, preserving open space and views toward San Bernardino Mountains. All campus future facilities and improvements, developed in accordance with the Master Plan's design guidelines and landscape guidelines, will result in the overall substantial enhancement of the visual and aesthetic character and quality of the campus. All future development in the surrounding area will be reviewed by the City of San Bernardino for adherence to planning and zoning regulations, working to ensure aesthetic compatibility with surrounding development, and ensuring less than significant cumulative visual impact.

All new lighting associated with future development within the City will comply with existing requirements, including shielding and focusing away from the surrounding uses, and other requirements and regulations (including height, setback, landscaping, and other measures) that ensure appropriate and compatible lighting and design within the existing urban environment. The campus existing security lighting will continue to be upgraded as necessary throughout the life of the Master Plan, and new lighting will be installed at new facilities, plazas, and pedestrian corridors as necessary to ensure adequate safety. Low-glare, cut-off, and shielded lights will be used as appropriate. This will continue to ensure appropriate lighting levels to maximize safety while minimizing spillover into surrounding areas and the night sky. However, the campus' lighting, including lighting of the enhanced athletic facilities, together with lighting used in future development in the surrounding area will result in an overall increase in lighting levels. This increase in could be considered to be cumulatively significant, even though the future area-wide lighting will be levels at levels commonly associated with urban areas.

Short-term Construction Impacts

Construction activities associated with the Master Plan will result in significant, albeit short-term and intermittent, air pollutant emissions even with full implementation of all mitigation measures identified in this EIR. Potential overlap of project construction may occur with construction of some of other future development in the surrounding area. If so, the combined construction effects could be cumulatively significant even with full implementation of the mitigation measures identified in this EIR as well as those required of other future development projects in the surrounding area.

Growth-Inducing Impacts

The CEQA Guidelines [Section 15126.2(d)] require a discussion of "… ways in which the proposed project could foster economic or population growth … in the surrounding environment," including the project's potential to remove obstacles to population growth. For example, the extension of infrastructure may encourage or facilitate other activities that could significantly affect the environment.

In compliance with the State Legislative mandate expressed in the State master Plan for Education, the CSU system is responsible to continue to accommodate fully eligible graduates from California high schools and community college transfer students. To do so, CSU San Bernardino campus is responsible to accommodate the 25,000 FTE student enrollment in response to future demand for higher education within California. The Master Plan is designed to accommodate additional students generated by growth within the Inland Empire region and beyond, and thus by itself will not induce population growth in the region. Thus, the Master Plan will not foster economic or population growth beyond the growth already anticipated in the region.

Significant Irreversible Effects

Implementation of the Master Plan will commit non-renewable resources during construction and operation. During construction, the use of building materials (e.g., aggregate, sand, cement, steel, glass, etc.) and energy resources (e.g., gasoline, diesel fuel, electricity) largely would be irreversible and irretrievable. Energy would be consumed in processing building materials and for transporting these materials and construction workers to the individual facility sites.

The new buildings at the campus provided pursuant to the Master Plan can be expected to have a life span of approximately 50 to 70 years. Resources consumed during buildout of the Master Plan, (such as fuel, building materials, water, etc.) will be used in quantities proportional to similar development in Southern California. While title 24 (Part 6 of the California Building Standards Code) energy conservation standards are mandatory and will be applied to the construction and operation of all campus facilities, with implementation of the Master Plan's comprehensive sustainability features and programs is anticipated to exceed these standards to a considerable degree. Students, faculty, and employees will consume motor fuel and water; however, these activities are part of normal operations and are not considered a wasteful use of resources. With the Master Plan's comprehensive sustainability features and programs, the use of nonrenewable resources will be substantially reduced, and the consumption of these resources will likely be smaller than, or comparable to, the use of resources for other major universities and colleges throughout the region and the country.

5.0 Alternatives to the Project

The following discussion considers alternative scenarios to the 2016 Campus Master Plan. Through comparison of these alternatives, the relative advantages of each can be weighed and analyzed.

The CEQA Guidelines state that an EIR need not consider every conceivable alternative to the project [Section 15126.6(a)], or an alternative whose effect cannot be reasonably ascertained and whose implementation is remote and speculative [Section 15126.6(f)(3)]. The Guidelines require that a range of alternatives be addressed “governed by ‘a rule of reason’ that requires the EIR to set forth only those alternatives necessary to permit a reasoned choice.” The discussion of alternatives must focus on alternatives that are potentially feasible and capable of achieving major project objectives while avoiding or substantially lessening any significant environmental effects of the project [CEQA Guidelines, Section 15126.6(f)].

The primary objective of the Master Plan is to guide the development of the campus accommodate gradual student enrollment growth, through infill development within the existing developed campus area, while enhancing the quality of campus life. To do so, the Master Plan creates a physical campus environment that facilitates the CSU San Bernardino's ability to achieve the following objectives:

- Support students, faculty and staff with appropriate teaching, research and administrative facilities
- Serve as a regional center for intellectual, cultural, and life-long learning
- Reinforce the University's active learning focus by providing opportunities for interactions and collaborations among students, faculty, staff and the greater community
- Support the creation and maintenance of residential and non-residential learning communities on the campus, including the accommodation of smaller learning communities within a variety of campus spaces such as the Pfau Library, classroom/laboratory buildings, the Santos Manuel Student Union, and the Commons
- Support the creation of a range of student learning/research/incubator type spaces through public-private and public-public partnerships
- Where appropriate, offer student learning and community-oriented/outreach programs in University-controlled centers off the main CSU San Bernardino campus
- Reinforce positive intrinsic features of the CSU San Bernardino campus including views to the San Bernardino Mountains, the signature campus gateway/quad lawn, and physical connections with surrounding neighborhoods and facilities
- Make efficient use of developable campus land and preserve a balance between built-up areas and open space

- Create a series of campus outdoor spaces framed by buildings and protected from extremes of sun and wind that facilitate student interaction, student learning and passive recreation
- Provide appropriate facilities for informal and organized recreation and intercollegiate athletics
- Serve as an accessible, safe and attractive campus for students, staff, faculty and the community;
- Provide for a range of ways for students and the community to access the campus and its facilities including public transportation and distance learning
- Through a comprehensive approach to sustainability, maintain CSU San Bernardino's stewardship of campus landscape and natural resources
- Conserve natural resources while creating and fostering an environmentally, socially, and economically sustainable physical and operational campus
- Create and foster campus facilities that efficiently utilize university human, natural, and financial resources

The EIR analysis indicates that the implementation of the Master Plan will result in significant and unavoidable impacts with regards to project-specific and cumulative air quality, traffic impact on I-215 freeway, cumulative traffic noise, and short-term cumulative and project-specific peak construction day air quality. All other impacts analyzed in this EIR were found to be either beneficial, less than significant, or can be mitigated to less than significant levels with mitigation measures identified in the EIR. Thus, the following analysis focuses on identifying alternatives that can reduce or avoid the identified significant and unavoidable impacts. Environmental effects after full implementation of mitigation measures are used as a basis for comparison.

Alternatives Considered

The following alternatives to the Campus Master Plan are considered:

Alternative 1: “No Project” alternative required by CEQA
Alternative 2: Smaller Facility Development
Alternative 3: Development with More Student Housing on Campus

Alternative 1: No Project – Continuation of Current Campus Master Plan

The “No Project” alternative, required to be evaluated in the EIR, considers ”existing conditions…as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services” [CEQA Guidelines Section15126.6(e)(2)]. Pursuant to this alternative, the current Campus Master Plan would continue to be implemented.

Campus Development: Pursuant to this alternative, development according to the current Master Plan (adopted in 1965 and revised in 2004) would continue, with student enrollment level at the campus capped at 20,000 FTE students. As most of the current Master Plan facilities have already been developed, this alternative would basically retain the existing conditions on campus. Existing facilities, including obsolete and inefficient buildings would not be renewed or replaced with the needed modern facilities, and no new on-campus housing for students, faculty, and staff would be provided. Also, no infrastructure improvements, enhanced open space and landscaping, stormwater management system, enhanced pedestrian and bicycle circulation, comprehensive sustainability features and programs, and other improvements provided for in the 2016 Master Plan would be provided pursuant to this alternative.

Environmental Effects: This alternative would eliminate new vehicle trips associated with the growth in student enrollment, and the related exhaust emissions and vehicular noise. However, since the No Project alternative would not include new student housing to accommodate demand for on-campus housing, no potential would be realized for reducing commute trips and the resulting reduction vehicle miles travelled (VMTs) on a per–person basis.

In compliance with the State Legislative mandate expressed in the State Master Plan for Education, the CSU system is responsible to continue to accommodate fully eligible graduates from California high schools and community college transfer students. Therefore, if no student enrollment growth is accommodated at the CSU San Bernardino campus, those 5,000 FTE students projected to seek enrollment at the CSU San Bernardino campus would be accommodated at other universities elsewhere in Southern California. As a result, this alternative would relocate the environmental effects associated with accommodating those students elsewhere, including vehicular trips and the associated traffic impacts, exhaust emissions and the resultant air quality impacts, traffic noise impacts, as well as demand for fire and police protection services, water and other public utilities, and others. Overall, these indirect effects of accommodating the students at another locations together with accommodating fewer students at the CSU San Bernardino campus would likely result in either similar or greater overall environmental impacts than those associated with the updated Campus Master Plan.

Furthermore, if the current Master Plan is not updated, some additional facilities and improvements would still be needed to provide an adequate level of support and academic facilities for the academic and other programs, including classroom space and on-campus housing, for the current Master Plan's 20,000 FTE student enrollment level. Accordingly, the current Master Plan would likely be updated in the future anyway to provide for replacement and rehabilitation of the existing campus buildings, and some new facilities.

Relation to Campus Master Plan Objectives: The No Project alternative would not achieve the principal objective of the 2016 Campus Master Plan to accommodate gradual student enrollment growth through infill development within the existing developed campus area, while enhancing the quality of campus life. This alternative would not achieve any of the other major Master Plan objectives, including to support students, faculty and staff with appropriate teaching, research, and administrative facilities; serve as a regional center for intellectual, cultural, and life-long learning; make efficient use of developable campus land and preserve a balance between built-up areas and open space; serve as an accessible, safe and attractive campus for students, staff, faculty and the community; conserve natural resources while creating and fostering an environmentally, socially, and economically sustainable physical and operational campus, among others. With this alternative, no design guidelines, sustainability guidelines, or landscape and open space features, programs and guidelines would be implemented to provide frameworks and tools needed to achieve the project objectives.

Most of all, the continuation of the current Master Plan is not feasible because it does not provide for the facilities and programs needed to support projected student enrollment that the CSU San Bernardino campus is responsible to accommodate. To adequately support future student enrollment requires providing facilities, improvements, and programs beyond those considered in the current Master Plan.

Alternative 2: Smaller Facility Development

This alternative considers the provision of fewer facilities and improvements on campus to avoid or reduce the identified significant air quality and other impacts.

Campus Development: A smaller project could potentially reduce some environmental impacts. Reducing unavoidable significant impact on air quality below SCAQMD significance thresholds would require reducing mobile source emissions of criteria pollutants by roughly 70%. To do so, a commensurate reduction in vehicular trips would be required. To achieve this reduction, the University would have to limit growth in student enrollment to 1,500 new FTE students. Pursuant to this alternative, new and modified facilities would also be reduced to less than 1 million square feet. As with the project, the Master Plan's design guidelines, sustainability guidelines, and landscape and open space features, programs and guidelines would be implemented.

Environmental Effects: This alternative would reduce long-term emissions of criteria pollutants to below the SCAQMD's daily threshold amounts, resulting in a less than significant impact under the SCAQMD criteria. This alternative might also reduce the peak day construction-related air quality impact to a less than significant level. Even though vehicular trips would be reduced under this alternative, the 70% reduction in student enrollment growth would not be sufficient to avoid significant impacts on 4 of the 7 identified affected study intersections since most of these intersections are projected to operate at LOS D or below due to ambient traffic growth and traffic generated by other future development in the area. With fewer trips, a significant vehicular noise impact at one intersection would most likely be avoided.

Demand for police or fire protection services would be proportionately reduced, and as with the project, impacts would be less than significant. Demand for utilities and service systems would be also proportionally reduced under this alternative, and would continue to be less than significant.

However, as with the No Project Alternative, if 3,500 fewer FTE students are accommodated at the CSU San Bernardino campus, those students would be accommodated at other universities elsewhere in Southern California because in compliance with the State Legislative mandate expressed in the State Master Plan for Education, the CSU system is responsible to continue to accommodate fully eligible graduates from California high schools and community college transfer students. As a result, this alternative would relocate the environmental effects associated with accommodating 3,500 FTE students elsewhere, including vehicular trips and the associated traffic impacts, exhaust emissions and the resultant air quality impacts, demand for fire and police protection services, water and other public utilities, and others. Overall, these indirect effects of accommodating the students at another locations together with accommodating fewer students at the CSU San Bernardino campus would likely result in either similar or greater overall environmental impacts than those associated with the Campus Master Plan.

Relation to Master Plan Objectives: While this alternative would work to provide adequate facilities on campus, it would not achieve the major Master Plan objective to accommodate the future growth in student enrollment within the surrounding area and the greater Inland Empire region. Therefore, this alternative would fall short of working to fulfill the State Legislature's commitment to accommodating higher education needs of California residents, as well as the University's aims of serving as a regional center for intellectual, cultural, and life-long learning; or creating a vibrant and inviting campus.

Alternative 3: More Student Housing on Campus

Under this alternative, more housing would be provided on campus for students, staff, and faculty. As with the Campus Master Plan, the campus enrollment level would reach 25,000 FTE students pursuant to this alternative.

Campus Development: Pursuant to this alternative, approximately 10,000 new student beds would be provided on campus, tripling the number of student beds provided for by the Master Plan. Other components provided for in the Master Plan would remain the same pursuant to this alternative, including new academic, administrative, athletic, support and other facilities, as well as the implementation of architectural guidelines, and sustainability and landscape features and programs.

Environmental Effects: Provision of more on-campus housing would reduce daily trips by nearly 65%, to approximately 7,100 daily trips. As a result, peak hour trips will also be proportionally reduced. However, due to the projected future poor operating conditions, and the share of campus-generated trips at the 7 affected study intersections, this alternative would not avoid significant impacts at 4 of those locations. Even with the reduced share of peak hour traffic, this alternative would not measurably reduce the unavoidable significant impact on the I-215 freeway. The vehicle miles travelled (VMTs) would be proportionally reduced as well due to the increase in the ratio of on-campus students, and the VMTs would also decrease on a per person basis to a greater extent than with the Master Plan, resulting a greater beneficial impact.

Even though vehicular trips would be reduced by nearly 65% under this alternative, this reduction in daily trips would not be sufficient to avoid the significant long term air quality impact, and this impact would remain significant and unavoidable. However, with fewer daily trips, the cumulative significant traffic noise impact at one of the study locations would likely be avoided.

Pursuant to this alternative, with additional student housing the demand for fire protection services would increase but as with the Master Plan, impact would be less than significant. Demand for police services would increase in greater proportion, and may require an expansion of campus police facilities. Demand for utilities and service systems would increase as well, but with sustainability features, compliance with existing requirements, and payment of all legally required capital facilities, the impact would be less than significant.

With tripling of new student housing facilities on campus, the magnitude of the significant unavoidable construction-related air quality impact would be greater pursuant to this alternative. This alternative would also likely result in a new significant aesthetic impact associated with constructing additional buildings, to provide student housing and associated dining facilities and other amenities, would result in a substantially denser development that could affect the visual character of the campus, including the existing campus open space and views. If the placement of these additional student housing facilities would encroach on the campus' natural open space preservation areas, new significant impact on biological resources could result from this alternative. Other impacts would be similar to those associated with the Master Plan.

Relation to Master Plan Objectives: This alternative would achieve most of the Master Plan's objectives, including those to share in the need to accommodate the demand for higher education, providing the necessary facilities and improvements to support future student enrollment, and creating vibrant and sustainable campus. However, since more student housing facilities would be constructed on campus, this alternative could achieve the primary Master Plan's objectives of providing needed facilities and improvement through infill development within the existing developed campus area, to a much lesser degree. This alternative may also not achieve the objective of preserving the campus open space to the same degree as with the Master Plan.

Environmentally Superior Alternative

Among the alternatives considered, the More Student Housing on Campus Alternative could be considered environmentally superior to the project because it would substantially reduce the magnitude of significant unavoidable traffic and air quality impact, avoid a significant traffic noise impact, and reduce student commute trips and associated vehicle miles travelled. However, since funding for tripling the amount of student housing on campus over the life of the Master Plan is not in place, this alternative may not be fiscally viable at this time.

6.0 Preparers of the EIR

Lead Agency

The Board of Trustees of the California State University;
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Appendices

Appendix A
NOP and Responses

Initial Study

2016 Master Plan

California State University, San Bernardino

CALIFORNIA STATE UNIVERSITY
SAN BERNARDINO

October 2016

WSP | PARSONS BRINCKERHOFF

Initial Study

2016 Master Plan

California State University, San Bernardino

October 2016

Lead Agency
The Board of Trustees of the California State University;
California State University, San Bernardino

Consultant to Lead Agency
WSP **|** Parsons Brinckerhoff

Initial Study

1. **Project Title:** California State University San Bernardino 2016 Master Plan

2. **Lead Agency Name and Address:** The Board of Trustees of the California State University;
California State University, San Bernardino
5500 University Parkway
San Bernardino, CA 92407-2393

3. **Contact Person and Phone Number:** Hamid Azhand, Director
Facilities Planning, Design and Construction
(909) 537-5136

4. **Project Location:** California State University San Bernardino, Main Campus, San Bernardino, San Bernardino County

5. **Project Sponsor's Name and Address:** Same as Lead Agency

6. **Campus Master Plan Designation:** Various academic, student housing, sport and recreation, support, administrative, and other designations

7. **Project Description:** The project is the adoption and implementation of the California State University San Bernardino main campus (CSUSB) 2016 Master Plan. The current Master Plan provided for campus facilities accommodating up to 20,000 full-time equivalent (FTE) students. The 2016 Master Plan provides a framework for implementation of the University's goals and programs, by identifying needed facilities and improvements to accommodate a gradual growth in student enrollment projected to reach 25,000 FTEs by 2035.

   University Objectives: The main objective of the Master Plan is to guide the development of the campus over the next 20 years to accommodate gradual student enrollment growth while enhancing the quality of campus life. To do so, the Master Plan creates a physical campus environment that facilitates the CSUSB's ability to achieve the following objectives:

   - Support students, faculty and staff with appropriate teaching, research and administrative facilities
   - Serve as a regional center for intellectual, cultural, and life-long learning
   - Reinforce the University's active learning focus by providing opportunities for interactions and collaborations among students, faculty, staff and the greater community
   - Support the creation and maintenance of residential and non-residential learning communities on the campus, including the accommodation of smaller learning communities within a variety of campus spaces such as the Pfau Library, classroom/laboratory buildings, the Santos Manuel Student Union, and the Commons

- Support the creation of a range of student learning/research/incubator type spaces through public-private and public-public partnerships
- Where appropriate, offer student learning and community-oriented/outreach programs in University-controlled centers off the main CSUSB campus
- Reinforce positive intrinsic features of the CSUSB campus including views to the San Bernardino Mountains, the signature campus gateway/quad lawn, and physical connections with surrounding neighborhoods and facilities
- Make efficient use of developable campus land and preserve a balance between built-up areas and open space
- Create a series of campus outdoor spaces framed by buildings and protected from extremes of sun and wind that facilitate student interaction, student learning and passive recreation
- Provide appropriate facilities for informal and organized recreation and intercollegiate athletics
- Serve as an accessible, safe and attractive campus for students, staff, faculty and the community;
- Provide for a range of ways for students and the community to access the campus and its facilities including public transportation and distance learning
- Through a comprehensive approach to sustainability, maintain CSUSB's stewardship of campus landscape and natural resources
- Conserve natural resources while creating and fostering an environmentally, socially, and economically sustainable physical and operational campus
- Create and foster campus facilities that efficiently utilize university human, natural, and financial resources
- Provide for correctly sized and oriented Teaching Resource Center (TRC) to accommodate the range of faculty needs

Project Characteristics: The Master Plan capitalizes on the most vivid, character-defining attributes of the campus - its regal setting at the base of the San Bernardino Mountains and its extensive and well-cared-for landscape setting, and creates a long range plan for strategic infill within the existing campus to accommodate future growth. This approach avoids campus sprawl, reduces pedestrian travel distances, and creates smaller, more human open spaces all connected by a network of shaded, activated pedestrian walkways and paths.

The Master Plan also makes use of some existing surface parking lots for new building sites and proposes other building sites that are currently occupied by facilities that already have or will reach the end of their useful lives within the Master Plan's planning horizon. As illustrated in Figures 1 and 2, this new strategic infill approach provides for the use of the existing campus land to accommodate all needed facilities while preserving campus open space, and utilizes new buildings to frame smaller, more intimate courtyards and open spaces and ultimately create a denser, more walkable and collegial campus environment while at the same time reinforcing existing land uses.

To achieve this, the Master Plan incorporates a series of key features that will transform the campus in a phased manner over the next 20 years. These key features were formulated and designed in response to Master Plan objectives and specific needs identified throughout a comprehensive Master Plan development process guided by a Master Plan Steering Committee representing faculty, administration, students and staff, and by input from the campus community and stakeholders through an extensive series of Town Hall meetings.

With the key features, the Master Plan:

- Locates all new academic facilities to infill along the main campus pedestrian spine ("Coyote Walk") to reinforce this area as the “heart” of the campus.
- Encourages multi-disciplinary shared academic buildings to accommodate future advances in specific program growth and new education/teaching approaches and strategies.
- Creates two campus housing villages and provides for student apartments to encourage a more 24/7 campus environment within the campus core to integrate campus life and activities.
- Transforms "Sycamore Walk" to become the "residential street" within the campus linking all residential villages and the academic core.
- Provides new strategically located parking structures positioned at the terminus of all primary pedestrian pathways to facilitate the transition from parking into the campus.
- Redefines and enhances the main campus gateway through redirection of parking entries to reduce vehicle congestion; and new signage, landscape, and housing to enhance the campus entry identity.
- Enhances campus Athletics, Student Recreation, and Kinesiology facilities to include college level baseball and softball fields, soccer fields, expanded tennis courts, basketball courts, and a stadium.
- Provides a series of sustainability initiatives that will make responsible use of campus resources and conserve water and energy.
- Preserves the "Land Lab" area between the San Bernardino Mountains and the campus used extensively by faculty and students for research, and to provide a buffer or firebreak for the threat of brush fires from the mountain environment.
- Addresses near term space needs through more efficient use of existing campus space.

These Master Plan features are integrated with and connected through an enhanced campus open space network, clear pedestrian/bicycle circulation system, and a peripheral system of structured and surface parking. The Master Plan also reinforces the current location of the transit center at the main campus entry.

Figure 1 illustrates the Master Plan and Figure 2 illustrates planned uses for all new buildings included in the Master Plan.

Illustrative 2016 Master Plan
Figure 1

Master Plan New Facilities
Figure 2

Legend

- Physical Education
- Assembly & Exhibit
- Student Support
- Instructional
- Library, Media & Collaborative
- Physical Plant
- General Administration
- Housing
  - Residential Halls
  - Residential Suites
  - Apartments
- Lodging
- Discovery/Innovation Park
- Under Development
- 5-min Walking Radius

8. **Surrounding Land Uses and Setting:** The CSU San Bernardino 441-acre campus is located at the base of the San Bernardino Mountains, and is separated from the existing surrounding residential development to the south, west, and east by Northpark Boulevard. Northpark Boulevard also provides access to the campus from I-215 freeway.

9. **CSU and Other Public Agencies whose approval will be sought:**

- CSU Board of Trustees
  Approval and adoption of the Campus Master Plan

- City of San Bernardino
  Approval of any improvements within the City rights-of-way
  Approval of new connections and/or increase in quantity of water delivery to campus, as needed

- San Bernardino County Sanitation District
  Approval of new connections and/or increase in quantity of wastewater, as needed

- Division of State Architect
  Approval of accessibility for future facilities

- State Fire Marshall
  Fire safety review and approval of future facilities and improvements

- Others, as may be necessary

Environmental Factors Potentially Affected

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☒ Aesthetics	☐ Agriculture and Forestry Resources	☒ Air Quality
☒ Biological Resources	☐ Cultural Resources	☒ Greenhouse Gas Emissions
☐ Geology /Soils	☐ Hazards & Hazardous Materials	☒ Hydrology / Water Quality
☐ Land Use / Planning	☐ Mineral Resources	☒ Noise
☐ Population / Housing	☒ Public Services	☐ Recreation
☒ Transportation/Traffic	☒ Utilities / Service Systems	☒ Mandatory Findings of Significance

Determination

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☒ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect (1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and (2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Hamid U. Azhand (signature) Signature Hamid U. Azhand	9/26/2016 Date

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
I. AESTHETICS -- Would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a State scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☒	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☒	☐	☐	☐
a through c. New development pursuant to the Master Plan 2035 will be located within the interior of the campus and primarily out of sight of the adjacent street and off-campus uses to the south and west. The new campus facilities will infill the existing campus core, with no potential to obstruct views to the San Bernardino Mountains to the north of the campus. Overall, implementation of the Master Plan is anticipated to improve the visual and aesthetic character of the campus through preservation and enhancement of open space, targeted infill development, and innovative design. However, since the new facilities will create additional lighting at the campus, this issue will be addressed in the EIR.				
II. AGRICULTURE AND FOREST RESOURCES: In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement technology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:				

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined in Public Resources section 4256) or timberland zoned Timberland Production (as defined by Government Code section 51104(g)?	☐	☐	☐	☒
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒
a through e. The campus does not contain farmland or forest land. No property under Williamson Act contract or land designated as forest land exists on the campus. Future development pursuant to the Master Plan will not involve any changes to the existing environment that could result in conversion of farmland or forest land to other uses. No adverse impact will result and these issues will not be addressed in the EIR.				
III. AIR QUALITY -- Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	☒
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☒	☐

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☒	☐	☐	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☒	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒

a. The implementation of the Master Plan will not conflict with nor obstruct the implementation of the South Coast Air Quality Management Plan. The Master Plan will not create additional regional growth but accommodates the projected growth in student enrollment caused by the regional population, housing, and employment growth. The Air Quality Management Plan is based on these regional growth projects and the implementation of the Master Plan at the campus will not affect these regional projections. In addition, the Master Plan includes additional student housing that will have a beneficial effect of reducing vehicular commute trips to and from the campus, as well as energy conservation initiatives, and thus reducing vehicular and stationary emissions.

b through d. Accommodating the projected growth in student enrollment on the campus pursuant to the Master Plan, even with the provision of additional student housing on campus, has the potential to generate additional vehicular trips that produce exhaust emissions, and short-term emissions associated with development of new facilities and improvements. These issues will be addressed in the EIR.

e. The campus development and operations are not associated with the generation of objectionable odors that could affect a substantial number of people. No adverse impact will result.

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
IV. BIOLOGICAL RESOURCES -- Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	☐	☐	☒	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Wildlife or US Fish and Wildlife Service?	☐	☐	☒	☐

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☐	☒
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☐	☒
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☒
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒
a through f. The Master Plan provides a new strategic infill approach to the long-term campus development which utilizes the existing campus land to provide all needed facilities while preserving campus open space, including the continuing preservation of the Badger Hill natural area. As no new development within undeveloped natural land that could potentially affect sensitive species or habitats is anticipated to occur pursuant to the Master Plan, no significant impact is anticipated. Nonetheless, since some new facilities are planned at the edges of the developed campus, these of issues will be further addressed in the EIR.				
V. CULTURAL RESOURCES -- Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☒	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☐	☐	☒
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☒

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☒

a through d. There are no known historic resources within the campus and therefore, the Master Plan is not anticipated to result in a significant impact to such resources. However, since the Master Plan will result in removal and/or replacement of some functionally obsolete facilities, including the Administration building and the Chaparral and Sierra Halls that were built in mid-1960s as temporary facilities, this issue will be addressed in the EIR.

No known paleontological or archaeological resources are located on campus. The potential for uncovering such significant resources is considered remote, given that no such resources have been discovered during prior development activity within the campus, and that the Master Plan consolidates new facilities and development within the developed campus area. While the potential for uncovering such significant resources is considered remote, in an unlikely event that such resources are discovered during project construction, compliance with existing laws and regulations will ensure no significant impact. These laws and regulations include: (1) stopping work in the event that a paleontological resource is discovered until a qualified paleontologist can visit the site and assess the significance of the potential paleontological resource.; (2) the paleontologist will then conduct on-site paleontological monitoring, including inspection of exposed surfaces to determine if fossils are present, and (3) if fossils are present, the monitor will have the authority to divert grading away from exposed fossils temporarily in order to recover the fossil specimens. In addition, in an unlikely event that containing human remains are inadvertently discovered during construction, compliance with existing laws and regulations will ensure no significant impact. These laws and regulations include: (1) ceasing construction in the vicinity of the discovery or any nearby area, and (2) immediately notifying the Los Angeles County Coroner's Office. Furthermore, if the county coroner determines that the remains are Native American, then (1) contacting the Native American Heritage Commission within 24 hours, (2) the Native American Heritage Commission will then designate a most likely descendent who may make recommendations concerning the disposition of the remains and associated grave goods in consultation, and (3) if the Native American Heritage Commission is unable to identify a most likely descendant or if the most likely descendent failed to make a recommendation within 24 hours, reburying the remains and associated grave goods on the property in a location that will not be disturbed. Compliance with these existing laws and regulations will ensure a less than significant impact in an unlikely event that such resources are uncovered. No adverse impact is anticipated and these issues will not be addressed further in the EIR.

VI. GEOLOGY AND SOILS -- Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒	☐
ii) Strong seismic ground shaking?	☐	☐	☒	☐

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐
iv) Landslides?	☐	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☒	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☒	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒

a. through d. The campus is located in the seismically active Southern California region and therefore all design and construction of new facilities and improvements will be in compliance with the California State University seismic safety rules and regulations, Development pursuant to the Master Plan will be infill development on land that is already developed with University facilities and all facilities will be designed and use engineering techniques for the specific soil conditions on campus, and the site of each new facility. The Master Plan consolidates new development with the existing campus area located on relatively flat terrain away from hillsides; thereby it is not at risk for landslides. Impact will be less than significant and these issues will not be addressed further in the EIR.

e. The campus is served by sewer systems and no septic tanks or alternative wastewater disposal systems are needed. No impact will result.

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
VII. GREENHOUSE GAS EMISSIONS -- Would the project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☒	☐	☐
b) Conflict with applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	☒

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
a and b. Accommodating the projected growth in student enrollment on the campus pursuant to the Master Plan has the potential to generate additional vehicular trips that produce exhaust emissions and short-term emissions associated with development of new facilities and improvements, which include greenhouse gas. These issues will be addressed in the EIR. The implementation of the Master Plan will not conflict nor obstruct the implementation of the South Coast Air Quality Management Plan which aims at reducing overall emissions, including greenhouse gas (GHG) emissions. The Master Plan will not create additional regional growth but accommodate the projected growth in student enrollment caused by the regional population, housing and employment growth. The Air Quality Management Plan is based on these regional growth projects and the implementation of the Master Plan at campus will not affect these regional projections. In addition, the Master Plan enhances connectivity to the existing transit center to facilitate the use of transit that reduces commute trips.				
VIII. HAZARDS AND HAZARDOUS MATERIALS -- Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☒	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☒	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☒	☐
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☒	☐
a through c. For most of the new facilities on-site use and storage of hazardous materials will be limited to small amounts of everyday household cleaners and common chemicals used for landscaping and maintenance. Materials used for laboratory academic research and instructions will be handled and disposed of in accordance with established University safety procedures. The University's environmental health and safety staff will continue to monitor the use of such materials in research and science instructions to ensure safe and lawful handling, movement, storage, and disposal. Impact will be less than significant and these issues will not be addressed further in the EIR.				
d. The campus is not included on the Department of Toxic Substances Control Hazardous Waste and Substance List (Cortese List) or any other list of hazardous materials sites. No impact will result.				
e and f. The campus is not located within two miles of a public use airport or private airport. No adverse impact will result.				
g. All new facilities developed pursuant to the Master Plan will include the provision of all necessary emergency access in compliance with existing regulations. Therefore, the project will not impair implementation nor physically interfere with any adopted emergency response or evacuation plans. No adverse impact will result.				
h. The Master Plan provides a new strategic infill approach to the long-term campus development which utilizes the existing developed campus land to provide all needed facilities. Therefore, no new development within undeveloped land separating the developed campus from San Bernardino Mountains - which are subject to wildfire hazards, is anticipated to occur pursuant to the Master Plan. The Master Plan also preserves the open space areas between the San Bernardino Mountains and the campus to provide a buffer/firebreak for the threat of brush fires from the mountain environment. In addition, as with the existing campus facilities, all new facilities, and landscaping as well, will be designed to reduce the risk of fire with proper choice of building materials and landscaping, provision of interior sprinklering systems, and appropriate fire hydrants and water flows. As with all University facilities, the new facilities developed pursuant to the Master Plan are subject to review and approval by State Fire Marshall, ensuring that fire protection equipment and facilities within the campus are adequate. With compliance with these regulations and design procedures impact will be less than significant, and this issue will not be addressed further in the EIR.				
IX. HYDROLOGY AND WATER QUALITY -- Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☐	☒

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☒	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☐	☐	☒	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☐	☐	☒
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☒	☐
f) Otherwise substantially degrade water quality?	☐	☐	☐	☒
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☒	☐
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☒	☐

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☒	☐

a, c through f. New facilities and improvements developed pursuant to the Master Plan will predominantly replace and/or re-use existing impervious surfaces, including the existing surface parking lots and thus, no major changes to the existing drainage patterns within the campus are anticipated. All new facilities will include any necessary drainage improvements, including appropriate stormwater retention measures, including bioswales. While impact is considered less than significant, drainage utilities issue will be further addressed in the EIR.

b. Water use on campus pursuant to the Master Plan is not expected to result in substantially increased water ground water pumping such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level. Nonetheless, since the increased student enrollment on campus will result in additional water use, this issue will be addressed in the EIR.

g and h. The National Flood Insurance Rate Maps do not identify 100-year flood hazard areas within the existing campus area where new facilities will be located pursuant to the Master Plan. The closest designated flood areas are to the northwest and northeast along the campus boundary. Since the Master Plan consolidates new facilities away from those zones, the project will not place structures or housing within a flood zone area. No significant impact will result.

There are a number of percolation basins (Badger, West Badger, North Badger, and Devils Canyon) within a vicinity of the campus to the north. Therefore, the campus was designed to ensure appropriate protection from potential failure of these basins, including the construction of an approximate 6-foot wide "V" ditch located along the north side of North Campus Circle, which was designed to handle flows from areas north of the campus. Therefore, potential impact from flooding is considered less than significant.

j. The campus is located inland and is not subject to tsunamis, nor is it subject to a seiche as it is not located near a large body of water. The existing campus area is not subject to mudflows as it is relatively flat and not located adjacent to hillsides. No significant impact will result.

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
X. LAND USE AND PLANNING -- Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
a through c. The Master Plan provides for new facilities and improvements within the campus and will not physically divide an established community. No other land use plans apply to the campus and no adverse impact will result.				
XI. MINERAL RESOURCES -- Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒
a and b. No mineral resources are known to exist on the CSU San Bernardino campus. No adverse impact will result.				
XII. NOISE -- Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☒	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☒
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☒	☐	☐	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
a through d. Implementation of the Master Plan will result in noise associated with **c**onstruction of new facilities and improvements, and with day-today campus activities. These issues will be addressed in the EIR.				
b. The long-term facilities and improvements provided pursuant to the Master Plan will continue the University uses and functions that do not involve generating excessive vibration or groundborne noise. No adverse impact will result and this issue will not be addressed in the EIR.				
e and f. The campus is not located within an airport land use plan, within two miles of an airport or public use airport, or within the vicinity of a private airstrip. No impact will result.				
XIII. POPULATION AND HOUSING -- Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☒	☐
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
a. The implementation of the Master Plan will provide additional on-campus student housing, and will not displace any housing or people. The Master Plan is designed to accommodate the projected gradual increase in student enrollment resulting from growth and development within the area and the region and by itself, will not induce substantial population growth or housing demand. The University is primarily a commuter campus with the majority of students and faculty already residing within San Bernardino and Riverside counties and commuting to campus from their residences; this pattern will continue under the proposed Master Plan. Nearby residential areas are fully urbanized and served by existing infrastructure, and the provision of University facilities and improvements within the campus has no potential to induce substantial growth in the surrounding areas or the region. No significant impact will result and this issue will not be addressed in the EIR.				
b and c. The project does not involve the removal of housing or displacement of people. No impact will result.				

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
XIV. PUBLIC SERVICES				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
Fire protection?	☒	☐	☐	☐
Police protection?	☒	☐	☐	☐
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☐	☒

a. The Master Plan provides for needed facilities and improvements to accommodate the projected student enrollment over the next 20 years, which will generate additional demand for fire and police protection services. Potential impact on these services will be evaluated in the EIR.

The Master Plan provides needed facilities and improvements to accommodate the projected student enrollment and has no potential to generate a substantial demand for schools. The Master Plan also provides for new and enhanced sports and recreation facilities, protection and maintenance of open space, and landscape improvements within the campus, as well as for adequate student and faculty support services, including student housing, parking, and other facilities. Thus, the Master Plan will not generate a need for construction of new public facilities in the surrounding community. No adverse impact will result and these issues will not be addressed in the EIR.

XV. RECREATION				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
a and b. Implementation of the Master Plan will not induce substantial new population growth that will require the construction of new parks or recreational facilities that might have an adverse physical effect on the environment. The Master Plan provides for new and improved sports and recreation facilities within the campus, including college level baseball and softball fields, soccer fields, expanded tennis courts, and basketball courts. No adverse impact will result and these issues will not be addressed in the EIR.				
XVI. TRANSPORTATION/TRAFFIC -- Would the project:				
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	☒	☐	☐	☐
b) Conflict with applicable congestion management program, including but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	☒	☐	☐	☐
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location which results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☐	☐	☒
f) Conflict with adopted policies plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the safety of such facilities?	☐	☐	☐	☒

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
a and b. The Master Plan provides for additional student housing on campus and continued use of public transit which will reduce commuter vehicular trips to campus. However, since the gradual increase in student enrollment accommodated by the Master Plan will result in vehicular trips in vicinity of the University, a traffic study will be prepared as part of the EIR to address these issues.				
c through f. The provision of University facilities and improvements will not affect air traffic patterns. The new facilities and improvements pursuant to the Master Plan will include the provision of all required emergency access in compliance with existing regulations. No design features or uses that could result in increased hazards are part of the Master Plan. The Master Plan provides for continuing use of public transit and enhanced bicycle and pedestrian circulation within the campus. No adverse impact will result and these issues will not be addressed further in the EIR.				
XVII. UTILITIES AND SERVICE SYSTEMS -- Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☒	☐
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☒	☐
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☒	☐	☐	☐
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☒	☐
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☒	☐

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
g) Comply with federal, State, and local statutes and regulations related to solid waste?	☐	☐	☐	☒

a. The new facilities and uses developed pursuant to the Master Plan will generate wastewater similar to existing flows. The quality of the wastewater flows associated with these typical urban educational uses meet all applicable requirements. No adverse impact will result and this issue will not be addressed in the EIR.

b. Implementation of the Master Plan will result in infill development on sites currently developed as surface parking lots and other impervious surfaces and therefore, no substantial increase in stormwater will result. While upgrades or improvements to the existing infrastructure serving the campus may occur, the project will not require the construction of new off-campus drainage facilities. Impact will be less than significant. Construction effects associated with utility infrastructure improvements on campus will be evaluated in the EIR.

c through e. The new facilities and improvements developed pursuant to the Master Plan accommodating the projected growth in student enrollment will use water and generate wastewater. These issues will be addressed in the EIR.

f and g. The University implements a recycling program to minimize the amount of solid waste disposed at the County landfills. The recycling program and other waste-reduction measures will continue to be implemented in additional uses and facilities developed pursuant to the Master Plan. Nonetheless, since the development pursuant to the Master Plan will generate solid waste, these issues will be further addressed in the EIR.

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVIII. MANDATORY FINDINGS OF SIGNIFICANCE				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☒	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☒	☐	☐	☐

Issues:	Potentially Significant Impact	Less Than Significant Impact with Mitigation Incorporated	Less Than Significant Impact	No Impact
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☒	☐

a. Implementation of the Master Plan will result in infill development within an existing campus primarily in areas currently developed with surface parking lots and other impervious surfaces. The Master Plan preserves the Badger Hill natural area other open space resources on campus, and is not anticipated to affect biological resources. No known important examples of California history or prehistory are present on the portions of the campus where new development may occur. Therefore, no significant impact is anticipated to occur.

b. The area-wide growth, and the growth and development within the City of San Bernardino may result in significant air quality, traffic, and other impacts. While the effects of the Master Plan itself will be relatively limited, when combined together with the effects of the area-wide growth and development the cumulative impact may be significant. This issue will be addressed in the EIR.

c. The Master Plan will result in the provision of needed facilities and improvements at the CSU San Bernardino campus. These facilities and improvements are necessary to continue the University functions and the provision of higher education opportunities to the residents of the surrounding area and the state as reflected by the projected student enrollment, with no potential to result in substantial adverse effects on people.

Preparers of the Initial Study

Lead Agency

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EDMUND G. BROWN JR.
GOVERNOR

KEN ALEX
DIRECTOR

Notice of Preparation

October 10, 2016

To: Reviewing Agencies

Re: 2016 Master Plan
SCH# 2016101025

Attached for your review and comment is the Notice of Preparation (NOP) for the 2016 Master Plan draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Hamid Azhand
California State University, San Bernardino
5500 University Parkway
San Bernardino, CA 92407-2393

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Director, State Clearinghouse

Attachments
cc: Lead Agency

Document Details Report
State Clearinghouse Data Base

SCH# 2016101025
Project Title 2016 Master Plan
Lead Agency California State University, San Bernardino

Type NOP Notice of Preparation

Description The 2016 Master Plan provides a framework for implementation of the University's goals and programs, by identifying needed facilities and improvements to accommodate a gradual growth in student growth in student enrollment projected to reach 25,000 full-time equivalent (FTE) students by 2035 at Cal State San Bernardino.

Lead Agency Contact

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Project Location

County San Bernardino
City San Bernardino
Region
Cross Streets Within CSUSB campus
Lat / Long
Parcel No. various
Township **Range** **Section** **Base**

Proximity to:

Highways I 215
Airports
Railways Metrolink
Waterways Devil Canyon Creek
Schools various
Land Use Master plan: various academic, student housing, sport and recreation, support, administrative, and other designations for Cal State San Bernardino campus.

Project Issues Aesthetic/Visual; Agricultural Land; Air Quality; Archaeologic-Historic; Drainage/Absorption; Flood Plain/Flooding; Forest Land/Fire Hazard; Geologic/Seismic; Minerals; Noise; Population/Housing Balance; Public Services; Recreation/Parks; Schools/Universities; Sewer Capacity; Soil Erosion/Compaction/Grading; Solid Waste; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Wetland/Riparian; Wildlife; Growth Inducing; Landuse; Cumulative Effects

---

Reviewing Agencies Resources Agency; Department of Parks and Recreation; Department of Water Resources; Department of Fish and Wildlife, Region 6; Office of Emergency Services, California; Native American Heritage Commission; Public Utilities Commission; California Highway Patrol; Caltrans, District 8; Department of Toxic Substances Control; Regional Water Quality Control Board, Region 8

Date Received 10/10/2016 **Start of Review** 10/10/2016 **End of Review** 11/08/2016

Note: Blanks in data fields result from insufficient information provided by lead agency.

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, PO Box 3044, Sacramento, CA 95812-3044 916/445-0613

2016101025

Project Title: 2016 Master Plan

Lead Agency: The Trustees of the California State University and California State University, San Bernardino

Contact Person: Hamid Azhand, Director, Facilities Planning, Design and Construction

Street Address: 5500 University Parkway

Phone: (909) 537-5136

City: San Bernardino Zip: 92407-2393 County: San Bernardino

Project Location:

County: San Bernardino City/Nearest Community: San Bernardino

Cross Streets: Within the CSU San Bernardino campus Zip Code 92407-2393 Total Acres: Approx. 430

Assessor's Parcel No. Various Section: ____ Twp. ____ Range: ____ Base: ____

Within 2 Miles: State Hwy # I-215 Waterways: Devil Canyon Creek

Airports none Railways: Metrolink Schools: Various

Document Type:

CEQA: ☒ NOP ☐ Early Cons ☐ Neg Dec ☐ Draft EIR ☐ Supplement/Subsequent EIR (Prior SCH No.) ____ ☐ Other ____

NEPA: ☐ NOI ☐ EA ☐ Draft EIS ☐ FONSI

Other: ☐ Joint Document ☐ Final Document ☐ Other ____

Governor's Office of Planning & Research

OCT 10 2016

STATE CLEARINGHOUSE

Local Action Type:

☐ General Plan Update ☐ General Plan Amendment ☐ General Plan Element ☐ Community Plan
☐ Specific Plan ☒ Master Plan ☐ Planned Unit Development ☐ Site Plan
☐ Rezone ☐ Prezone ☐ Use Permit ☐ Land Division (Subdivision, etc.)
☐ Annexation ☐ Redevelopment ☐ Coastal Permit ☐ Other ____

Development Type:

☐ Residential: *Units* ____ *Acres* ____
☐ Office: *Sq.ft.* ____ *Acres* ____ *Employees* ____
☐ Commercial: *Sq.ft.* ____ *Acres* ____ *Employees* ____
☐ Industrial: *Sq.ft.* ____ *Acres* ____ *Employees* ____
☒ Educational ____
☐ Recreational ____
☐ Water Facilities: *Type* ____ *MGD* ____
☐ Transportation: *Type* ____
☐ Mining: *Mineral* ____
☐ Power: *Type* ____ *Watts* ____
☐ Waste Treatment: *Type* ____
☐ Hazardous Waste: *Type* ____
☐ Other: ____

Funding (approx.): Federal $ ____ State $ ____ Total $ ____

Project Issues Discussed in Document:

☒ Aesthetic/Visual ☒ Agricultural Land ☒ Air Quality ☒ Archeological/Historical ☐ Coastal Zone ☒ Drainage/Absorption ☐ Economic/Jobs ☐ Fiscal
☒ Flood Plain/Flooding ☒ Forest Land/Fire Hazard ☒ Geologic/Seismic ☒ Minerals ☒ Noise ☒ Population/Housing Balance ☒ Public Services/Facilities ☒ Recreation/Parks
☒ Schools/Universities ☐ Septic Systems ☒ Sewer Capacity ☒ Soil Erosion/Compaction/Grading ☒ Solid Waste ☒ Toxic Hazardous ☒ Traffic/Circulation ☒ Vegetation
☒ Water Quality ☒ Water Supply/Groundwater ☒ Wetland/Riparian ☒ Wildlife ☒ Growth Inducing ☒ Landuse ☒ Cumulative Effects ☐ Other ____

Present Land Use/Zoning/General Plan Designation: Master Plan: various academic, student housing, sport and recreation, support, administrative, and other designations for Cal State San Bernardino campus.

Project Description: The 2016 Master Plan provides a framework for implementation of the University's goals and programs, by identifying needed facilities and improvements to accommodate a gradual growth in student enrollment projected to reach 25,000 full-time equivalent (FTE) students by 2035 at Cal State San Bernardino.

2016101025
2016101025

NOP Distribution List

County: San Bernardino

SCH# 2016101025

Resources Agency

- [x] **Resources Agency**
Nadell Gayou
- [ ] **Dept. of Boating & Waterways**
Denise Peterson
- [ ] **California Coastal Commission**
Elizabeth A. Fuchs
- [ ] **Colorado River Board**
Lisa Johansen
- [ ] **Dept. of Conservation**
Elizabeth Carpenter
- [ ] **California Energy Commission**
Eric Knight
- [ ] **Cal Fire**
Dan Foster
- [ ] **Central Valley Flood Protection Board**
James Herota
- [ ] **Office of Historic Preservation**
Ron Parsons
- [x] **Dept of Parks & Recreation**
Environmental Stewardship Section
- [ ] **California Department of Resources, Recycling & Recovery**
Sue O'Leary
- [ ] **S.F. Bay Conservation & Dev't. Comm.**
Steve Goldbeck
- [x] **Dept. of Water Resources**
Resources Agency
Nadell Gayou

Fish and Game

- [ ] **Depart. of Fish & Wildlife**
Scott Flint
Environmental Services Division
- [ ] **Fish & Wildlife Region 1**
Curt Babcock
- [ ] **Fish & Wildlife Region 1E**
Laurie Harnsberger
- [ ] **Fish & Wildlife Region 2**
Jeff Drongesen
- [ ] **Fish & Wildlife Region 3**
Craig Weightman
- [ ] **Fish & Wildlife Region 4**
Julie Vance
- [ ] **Fish & Wildlife Region 5**
Leslie Newton-Reed
Habitat Conservation Program
- [x] **Fish & Wildlife Region 6**
Tiffany Ellis
Habitat Conservation Program
- [ ] **Fish & Wildlife Region 6 I/M**
Heidi Calvert
Inyo/Mono, Habitat Conservation Program
- [ ] **Dept. of Fish & Wildlife M**
William Paznokas
Marine Region

Other Departments

- [ ] **Food & Agriculture**
Sandra Schubert
Dept. of Food and Agriculture
- [ ] **Depart. of General Services**
Public School Construction
- [ ] **Dept. of General Services**
Cathy Buck/George Carollo
Environmental Services Section
- [ ] **Delta Stewardship Council**
Kevan Samsam
- [ ] **Housing & Comm. Dev.**
CEQA Coordinator
Housing Policy Division

Independent Commissions, Boards

- [ ] **Delta Protection Commission**
Erik Vink
- [x] **OES (Office of Emergency Services)**
Monique Wilber
- [x] **Native American Heritage Comm.**
Debbie Treadway
- [x] **Public Utilities Commission**
Supervisor
- [ ] **Santa Monica Bay Restoration**
Guangyu Wang
- [x] **State Lands Commission**
Jennifer Deleong
- [ ] **Tahoe Regional Planning Agency (TRPA)**
Cherry Jacques

Cal State Transportation Agency CalSTA

- [ ] **Caltrans - Division of Aeronautics**
Philip Crimmins
- [ ] **Caltrans – Planning HQ LD-IGR**
Terri Pencovic
- [x] **California Highway Patrol**
Suzann Ikeuchi
Office of Special Projects

Dept. of Transportation

- [ ] **Caltrans, District 1**
Rex Jackman
- [ ] **Caltrans, District 2**
Marcelino Gonzalez
- [ ] **Caltrans, District 3**
Eric Federicks – South
Susan Zanchi - North
- [ ] **Caltrans, District 4**
Patricia Maurice
- [ ] **Caltrans, District 5**
Larry Newland
- [ ] **Caltrans, District 6**
Michael Navarro
- [ ] **Caltrans, District 7**
Dianna Watson
- [x] **Caltrans, District 8**
Mark Roberts
- [ ] **Caltrans, District 9**
Gayle Rosander
- [ ] **Caltrans, District 10**
Tom Dumas
- [ ] **Caltrans, District 11**
Jacob Armstrong
- [ ] **Caltrans, District 12**
Maureen El Harake

Cal EPA

Air Resources Board

- [ ] Airport & Freight
Cathi Slaminski
  - [ ] Transportation Projects
  Nesamani Kalandiyur
  - [ ] Industrial/Energy Projects
  Mike Tollstrup
- [ ] **State Water Resources Control Board**
Regional Programs Unit
Division of Financial Assistance
- [ ] **State Water Resources Control Board**
Cindy Forbes – Asst Deputy
Division of Drinking Water
- [ ] **State Water Resources Control Board**
Div. Drinking Water #________
- [ ] **State Water Resources Control Board**
Student Intern, 401 Water Quality Certification Unit
Division of Water Quality
- [ ] **State Water Resouces Control Board**
Phil Crader
Division of Water Rights
- [x] **Dept. of Toxic Substances Control**
CEQA Tracking Center
- [ ] **Department of Pesticide Regulation**
CEQA Coordinator

Regional Water Quality Control Board (RWQCB)

- [ ] **RWQCB 1**
Cathleen Hudson
North Coast Region (1)
- [ ] **RWQCB 2**
Environmental Document Coordinator
San Francisco Bay Region (2)
- [ ] **RWQCB 3**
Central Coast Region (3)
- [ ] **RWQCB 4**
Teresa Rodgers
Los Angeles Region (4)
- [ ] **RWQCB 5S**
Central Valley Region (5)
  - [ ] **RWQCB 5F**
  Central Valley Region (5)
  Fresno Branch Office
  - [ ] **RWQCB 5R**
  Central Valley Region (5)
  Redding Branch Office
- [ ] **RWQCB 6**
Lahontan Region (6)
  - [ ] **RWQCB 6V**
  Lahontan Region (6)
  Victorville Branch Office
- [ ] **RWQCB 7**
Colorado River Basin Region (7)
- [x] **RWQCB 8**
Santa Ana Region (8)
- [ ] **RWQCB 9**
San Diego Region (9)

- [ ] Other ________________
____
____

- [ ] ________________
Conservancy

Last Updated 7/19/2016

DEPARTMENT OF TRANSPORTATION
DISTRICT 8
IGR/COMMUNITY & REGIONAL PLANNING
464 WEST 4th STREET, 6th FLOOR (MS 725)
SAN BERNARDINO, CA 92401-1400
PHONE (909) 383-4557
TTY 711
www.dot.ca.gov/dist8

Serious Drought.
Help save water!

February 16, 2017

Mr. Hamid Azhand
California State University, San Bernardino
5500 University Parkway
San Bernardino, CA 92407-2393

Dear Mr. Azhand:

CSUSB Palm Desert Campus 2016 Master Plan,
SCH 2017011059
08-RIV 10, PM 46.853

Thank you for providing the California Department of Transportation (Caltrans) the opportunity to review and comment on the Notice of Preparation (NOP) for the CSUSB Palm Desert Campus 2016 Master Plan Draft Environmental Impact Report. The 2016 Master Plan will identify needed facilities and improvements to accommodate a gradual growth in enrollment, projected to reach 8,000 full time equivalent students by 2035. The current 169-acre campus is located south of Interstate 10 (I-10), east of Cook Street, between Gerald Ford Drive and Frank Sinatra Drive, in the City of Palm Desert.

As the owner and operator of the State Highway System (SHS), it is our responsibility to coordinate and consult with local jurisdictions when proposed development may impact our facilities. As the responsible agency under the California Environmental Quality Act, it is also our responsibility to make recommendations to offset associated impacts with the proposed project. Although the project is under the jurisdiction of the California State University, San Bernardino, due to the project's potential impact to the State facilities, it is also subject to the policies and regulations that govern the SHS.

The Initial Study XVI – Transportation/Traffic (a,b), indicates there potentially could be impacts from vehicular trips to the campus; therefore a Traffic Impact Study (TIS) will be prepared as part of the EIR. Since the primary regional access to the campus will utilize the I-10 Cook Street Interchange north/south off-ramps we request that it be analyzed as a part of the study.

The TIS should be prepared in accordance with the Caltrans's "Guide for the Preparation of Traffic Impact Studies" (Guide), updated December 2002. A copy of the Guide can be downloaded at: http://www.dot.ca.gov/hq/tpp/offices/ocp/igr_ceqa_files/tisguide.pdf

Please submit three hard copies and two CDs of the TIS and appendices for review and further comment.

Thank you for providing us the opportunity to review the Notice of Preparation for the CSUB Palm Desert Campus. If you have questions concerning these comments, please contact Rebecca Forbes at (909) 388-7139 or myself at (909) 383-4557.

Sincerely,

MARK ROBERTS
Office Chief
Intergovernmental Review, Community and Regional Planning

CITY OF SAN BERNARDINO
MUNICIPAL WATER DEPARTMENT

November 7, 2016

"Trusted, Quality Service since 1905"

Mr. Hamid Azhand, Director
Facilities Planning, Design and Construction
California State University, San Bernardino
5500 University Parkway
San Bernardino, CA 92407

Dear Mr. Azhand:

RE: INITIAL STUDY FOR THE CALIFORNIA STATE UNIVERSITY, SAN BERNARDINO 2016 CAMPUS MASTER PLAN

The San Bernardino Municipal Water Department (Department) has reviewed the above-referenced Initial Study. The Department has no comments on the Initial Study, as it indicates that the project will result in an overall "Less than Significant Impact", referenced in both the section titled "Hydrology and Water Quality," and the section titled "Utilities and Service Systems." The Department has noted that when the project reaches ultimate build-out, the new campus facilities and increase in student population will result in an increase in water demand. The Initial Study indicates that the projected increased water demand, and the corresponding required new services will be addressed in the forthcoming EIR.

Please contact me at (909) 522-3414 with any further questions regarding this project.

Sincerely,

Ted Brunson
Associate Engineer
San Bernardino Municipal Water Department

TB:aew
Attachment

cc: Greg Gage (w/o attach)

300 North "D" Street, San Bernardino, California 92418 P.O. Box 710, 92402 Phone: (909) 384-5141
FACSIMILE NUMBERS: Administration: (909) 384-5215 Engineering: (909) 384-5532 Customer Service: (909) 384-7211
Corporate Yards: (909) 384-5260 Water Reclamation Plant: (909) 384-5258

STATE OF CALIFORNIA Edmund G. Brown Jr., Governor

NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
Phone (916) 373-3710
Fax (916) 373-5471
Email: nahc@nahc.ca.gov
Website: http://www.nahc.ca.gov
Twitter: @CA_NAHC

October 12, 2016

Hamid Azhand
California State University, San Bernardino
5500 University Parkway
San Bernardino, CA 92407-2393

sent via e-mail:
Hazhand@csusb.edu

RE: SCH# 2016101025; 2016 Master Plan, California State University, San Bernardino Main Campus Project, Notice of Preparation for Draft Environmental Impact Report, San Bernardino County, California

Dear Mr. Azhand:

The Native American Heritage Commission has received the Notice of Preparation (NOP) for the project referenced above. The California Environmental Quality Act (CEQA) (Pub. Resources Code § 21000 et seq.), specifically Public Resources Code section 21084.1, states that a project that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.1; Cal. Code Regs., tit.14, § 15064.5 (b) (CEQA Guidelines Section 15064.5 (b)). If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, an environmental impact report (EIR) shall be prepared. (Pub. Resources Code § 21080 (d); Cal. Code Regs., tit. 14, § 15064 subd.(a)(1) (CEQA Guidelines § 15064 (a)(1)). In order to determine whether a project will cause a substantial adverse change in the significance of a historical resource, a lead agency will need to determine whether there are historical resources with the area of project effect (APE).

CEQA was amended significantly in 2014. Assembly Bill 52 (Gatto, Chapter 532, Statutes of 2014) (AB 52) amended CEQA to create a **separate category of cultural resources**, "tribal cultural resources" (Pub. Resources Code § 21074) and provides that a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.2). Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource. (Pub. Resources Code § 21084.3 (a)). **AB 52 applies to any project for which a notice of preparation or a notice of negative declaration or mitigated negative declaration is filed on or after July 1, 2015.** If your project involves the adoption of or amendment to a general plan or a specific plan, or the designation or proposed designation of open space, on or after March 1, 2005, it may also be subject to Senate Bill 18 (Burton, Chapter 905, Statutes of 2004) (SB 18). **Both SB 18 and AB 52 have tribal consultation requirements**. If your project is also subject to the federal National Environmental Policy Act (42 U.S.C. § 4321 et seq.) (NEPA), the tribal consultation requirements of Section 106 of the National Historic Preservation Act of 1966 (154 U.S.C. 300101, 36 C.F.R. § 800 et seq.) may also apply.

The NAHC recommends **lead agencies consult with all California Native American tribes** that are traditionally and culturally affiliated with the geographic area of your proposed project as early as possible in order to avoid inadvertent discoveries of Native American human remains and best protect tribal cultural resources. Below is a brief summary of portions of AB 52 and SB 18 as well as the NAHC's recommendations for conducting cultural resources assessments. **Consult your legal counsel about compliance with AB 52 and SB 18 as well as compliance with any other applicable laws.**

AB 52

AB 52 has added to CEQA the additional requirements listed below, along with many other requirements:

1. Fourteen Day Period to Provide Notice of Completion of an Application/Decision to Undertake a Project: Within fourteen (14) days of determining that an application for a project is complete or of a decision by a public agency to undertake a project, a **lead agency** shall provide formal notification to a designated contact of, or tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, to be accomplished by at least one written notice that includes:
    - **a.** A brief description of the project.
    - **b.** The lead agency contact information.
    - **c.** Notification that the California Native American tribe has 30 days to request consultation. (Pub. Resources Code § 21080.3.1 (d)).
    - **d.** A "California Native American tribe" is defined as a Native American tribe located in California that is on the contact list maintained by the NAHC for the purposes of Chapter 905 of Statutes of 2004 (SB 18). (Pub. Resources Code § 21073).

2. Begin Consultation Within 30 Days of Receiving a Tribe's Request for Consultation and Before Releasing a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report: A **lead agency** shall begin the consultation process within 30 days of receiving a request for consultation from a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project. (Pub. Resources Code § 21080.3.1, subds. (d) and (e)) and prior to the release of a negative declaration, mitigated negative declaration or environmental impact report. (Pub. Resources Code § 21080.3.1(b)).
    a. For purposes of AB 52, "consultation shall have the same meaning as provided in Gov. Code § 65352.4 (SB 18). (Pub. Resources Code § 21080.3.1 (b)).

3. Mandatory Topics of Consultation If Requested by a Tribe: The following topics of consultation, if a tribe requests to discuss them, are mandatory topics of consultation:
    a. Alternatives to the project.
    b. Recommended mitigation measures.
    c. Significant effects. (Pub. Resources Code § 21080.3.2 (a)).

4. Discretionary Topics of Consultation: The following topics are discretionary topics of consultation:
    a. Type of environmental review necessary.
    b. Significance of the tribal cultural resources.
    c. Significance of the project's impacts on tribal cultural resources.
    d. If necessary, project alternatives or appropriate measures for preservation or mitigation that the tribe may recommend to the lead agency. (Pub. Resources Code § 21080.3.2 (a)).

5. Confidentiality of Information Submitted by a Tribe During the Environmental Review Process: With some exceptions, any information, including but not limited to, the location, description, and use of tribal cultural resources submitted by a California Native American tribe during the environmental review process shall not be included in the environmental document or otherwise disclosed by the lead agency or any other public agency to the public, consistent with Government Code sections 6254 (r) and 6254.10. Any information submitted by a California Native American tribe during the consultation or environmental review process shall be published in a confidential appendix to the environmental document unless the tribe that provided the information consents, in writing, to the disclosure of some or all of the information to the public. (Pub. Resources Code § 21082.3 (c)(1)).

6. Discussion of Impacts to Tribal Cultural Resources in the Environmental Document: If a project may have a significant impact on a tribal cultural resource, the lead agency's environmental document shall discuss both of the following:
    a. Whether the proposed project has a significant impact on an identified tribal cultural resource.
    b. Whether feasible alternatives or mitigation measures, including those measures that may be agreed to pursuant to Public Resources Code section 21082.3, subdivision (a), avoid or substantially lessen the impact on the identified tribal cultural resource. (Pub. Resources Code § 21082.3 (b)).

7. Conclusion of Consultation: Consultation with a tribe shall be considered concluded when either of the following occurs:
    a. The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource; or
    b. A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached. (Pub. Resources Code § 21080.3.2 (b)).

8. Recommending Mitigation Measures Agreed Upon in Consultation in the Environmental Document: Any mitigation measures agreed upon in the consultation conducted pursuant to Public Resources Code section 21080.3.2 shall be recommended for inclusion in the environmental document and in an adopted mitigation monitoring and reporting program, if determined to avoid or lessen the impact pursuant to Public Resources Code section 21082.3, subdivision (b), paragraph 2, and shall be fully enforceable. (Pub. Resources Code § 21082.3 (a)).

9. Required Consideration of Feasible Mitigation: If mitigation measures recommended by the staff of the lead agency as a result of the consultation process are not included in the environmental document or if there are no agreed upon mitigation measures at the conclusion of consultation, or if consultation does not occur, and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, the lead agency shall consider feasible mitigation pursuant to Public Resources Code section 21084.3 (b). (Pub. Resources Code § 21082.3 (e)).

10. Examples of Mitigation Measures That, If Feasible, May Be Considered to Avoid or Minimize Significant Adverse Impacts to Tribal Cultural Resources:
    a. Avoidance and preservation of the resources in place, including, but not limited to:
        i. Planning and construction to avoid the resources and protect the cultural and natural context.

    II. Planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.
- **b.** Treating the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:
    - **I.** Protecting the cultural character and integrity of the resource.
    - **II.** Protecting the traditional use of the resource.
    - **III.** Protecting the confidentiality of the resource.
- **c.** Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.
- **d.** Protecting the resource. (Pub. Resource Code § 21084.3 (b)).
- **e.** Please note that a federally recognized California Native American tribe or a nonfederally recognized California Native American tribe that is on the contact list maintained by the NAHC to protect a California prehistoric, archaeological, cultural, spiritual, or ceremonial place may acquire and hold conservation easements if the conservation easement is voluntarily conveyed. (Civ. Code § 815.3 (c)).
- **f.** Please note that it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated. (Pub. Resources Code § 5097.991).

11. Prerequisites for Certifying an Environmental Impact Report or Adopting a Mitigated Negative Declaration or Negative Declaration with a Significant Impact on an Identified Tribal Cultural Resource: An environmental impact report may not be certified, nor may a mitigated negative declaration or a negative declaration be adopted unless one of the following occurs:
- **a.** The consultation process between the tribes and the lead agency has occurred as provided in Public Resources Code sections 21080.3.1 and 21080.3.2 and concluded pursuant to Public Resources Code section 21080.3.2.
- **b.** The tribe that requested consultation failed to provide comments to the lead agency or otherwise failed to engage in the consultation process.
- **c.** The lead agency provided notice of the project to the tribe in compliance with Public Resources Code section 21080.3.1 (d) and the tribe failed to request consultation within 30 days. (Pub. Resources Code § 21082.3 (d)).

This process should be documented in the Cultural Resources section of your environmental document.

The NAHC's PowerPoint presentation titled, "Tribal Consultation Under AB 52: Requirements and Best Practices" may be found online at: http://nahc.ca.gov/wp-content/uploads/2015/10/AB52TribalConsultation_CalEPAPDF.pdf

SB 18

SB 18 applies to local governments and requires **local governments** to contact, provide notice to, refer plans to, and consult with tribes prior to the adoption or amendment of a general plan or a specific plan, or the designation of open space. (Gov. Code § 65352.3). Local governments should consult the Governor's Office of Planning and Research's "Tribal Consultation Guidelines," which can be found online at: https://www.opr.ca.gov/docs/09_14_05_Updated_Guidelines_922.pdf

Some of SB 18's provisions include:

1. Tribal Consultation: If a local government considers a proposal to adopt or amend a general plan or a specific plan, or to designate open space it is required to contact the appropriate tribes identified by the NAHC by requesting a "Tribal Consultation List." If a tribe, once contacted, requests consultation the local government must consult with the tribe on the plan proposal. **A tribe has 90 days from the date of receipt of notification to request consultation unless a shorter timeframe has been agreed to by the tribe.** (Gov. Code § 65352.3 (a)(2)).
2. No Statutory Time Limit on SB 18 Tribal Consultation. There is no statutory time limit on SB 18 tribal consultation.
3. Confidentiality: Consistent with the guidelines developed and adopted by the Office of Planning and Research pursuant to Gov. Code section 65040.2, the city or county shall protect the confidentiality of the information concerning the specific identity, location, character, and use of places, features and objects described in Public Resources Code sections 5097.9 and 5097.993 that are within the city's or county's jurisdiction. (Gov. Code § 65352.3 (b)).
4. Conclusion of SB 18 Tribal Consultation: Consultation should be concluded at the point in which:
    - **a.** The parties to the consultation come to a mutual agreement concerning the appropriate measures for preservation or mitigation; or
    - **b.** Either the local government or the tribe, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached concerning the appropriate measures of preservation or mitigation. (Tribal Consultation Guidelines, Governor's Office of Planning and Research (2005) at p. 18).

Agencies should be aware that neither AB 52 nor SB 18 precludes agencies from initiating tribal consultation with tribes that are traditionally and culturally affiliated with their jurisdictions before the timeframes provided in AB 52 and SB 18. For that reason, we urge you to continue to request Native American Tribal Contact Lists and "Sacred Lands File" searches from the NAHC. The request forms can be found online at: http://nahc.ca.gov/resources/forms/

NAHC Recommendations for Cultural Resources Assessments

To adequately assess the existence and significance of tribal cultural resources and plan for avoidance, preservation in place, or barring both, mitigation of project-related impacts to tribal cultural resources, the NAHC recommends the following actions:

1. Contact the appropriate regional California Historical Research Information System (CHRIS) Center (http://ohp.parks.ca.gov/?page_id=1068) for an archaeological records search. The records search will determine:
    - **a.** If part or all of the APE has been previously surveyed for cultural resources.
    - **b.** If any known cultural resources have been already been recorded on or adjacent to the APE.
    - **c.** If the probability is low, moderate, or high that cultural resources are located in the APE.
    - **d.** If a survey is required to determine whether previously unrecorded cultural resources are present.

2. If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
    - **a.** The final report containing site forms, site significance, and mitigation measures should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum and not be made available for public disclosure.
    - **b.** The final written report should be submitted within 3 months after work has been completed to the appropriate regional CHRIS center.

3. Contact the NAHC for:
    - **a.** A Sacred Lands File search. Remember that tribes do not always record their sacred sites in the Sacred Lands File, nor are they required to do so. A Sacred Lands File search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with the geographic area of the project's APE.
    - **b.** A Native American Tribal Consultation List of appropriate tribes for consultation concerning the project site and to assist in planning for avoidance, preservation in place, or, failing both, mitigation measures.

4. Remember that the lack of surface evidence of archaeological resources (including tribal cultural resources) does not preclude their subsurface existence.
    - **a.** Lead agencies should include in their mitigation and monitoring reporting program plan provisions for the identification and evaluation of inadvertently discovered archaeological resources per Cal. Code Regs., tit. 14, section 15064.5(f) (CEQA Guidelines section 15064.5(f)). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American with knowledge of cultural resources should monitor all ground-disturbing activities.
    - **b.** Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the disposition of recovered cultural items that are not burial associated in consultation with culturally affiliated Native Americans.
    - **c.** Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the treatment and disposition of inadvertently discovered Native American human remains. Health and Safety Code section 7050.5, Public Resources Code section 5097.98, and Cal. Code Regs., tit. 14, section 15064.5, subdivisions (d) and (e) (CEQA Guidelines section 15064.5, subds. (d) and (e)) address the processes to be followed in the event of an inadvertent discovery of any Native American human remains and associated grave goods in a location other than a dedicated cemetery.

Please contact me if you need any additional information at gayle.totton@nahc.ca.gov.

Sincerely,

Gayle Totton, M.A., PhD.
Associate Governmental Program Analyst

cc: State Clearinghouse

Appendix B
Cultural Resource Reports

California State University San Bernardino

Historical Resources Evaluation Report

Prepared for:

Facilities Planning, Design and Construction
California State University San Bernardino

Prepared by:

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January 27, 2017

Architectural Resources Group

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1. Introduction

In response to a request from the Facilities Planning, Design and Construction office, Architectural Resources Group (ARG) has conducted a Historical Resources Evaluation of buildings on the campus of the California State University, San Bernardino (CSU San Bernardino, or CSUSB) that have the potential to be impacted under the campus Master Plan. The Master Plan horizon extends through the year 2035; therefore, campus buildings that will be fifty years of age by that time, i.e., those constructed prior to 1985, have been evaluated for potential eligibility against California Register of Historical Resources criteria in this report.

The following Historic Resources Evaluation Report (HRER) provides historical background, a discussion of the regulatory setting, an evaluation of the buildings potentially impacted by the Master Plan, and impacts and mitigation measures. This study has been completed to determine whether historical resources will be impacted by the Master Plan, and serves as a Historic Resources Technical Report for the Master Plan EIR to fulfil the requirements of the California Environmental Quality Act (CEQA) as they relate to historical resources.

1.1 Methodology

For preparation of this report, ARG performed the following tasks for research, documentation, and analysis:

- Conducted a site visit on December 8, 2016 for photography and evaluation purposes, in accordance with State Office of Historic Preservation guidelines.
- Reviewed state and federal technical bulletins, ordinances, and other materials related to the evaluation of historical resources.
- Conducted primary and secondary source research related to the history of the campus and reviewed Project documents that indicate the scope of the Master Plan.
- Evaluated potential historical resources against eligibility criteria of the California Register of Historical Resources (California Register).

- Analyzed the potential of the Master Plan to impact historical resources in accordance with significance thresholds delineated in Section 15064.5 of the CEQA Guidelines (Cal. Code Regs., tit 14, §15000, et seq.). Determined impacts and mitigation measures for potentially impacted historic resources in discussion with the EIR preparer and the University.

ARG staff consulted the following archives and repositories as part of their research for this project: CSU San Bernardino Library Special Collections; CSU San Bernardino Facilities Office Archives; Cal Poly San Luis Obispo Special Collections (the William F. Cody papers); University of Southern California (USC) Digital Archives (the Carl Maston papers); Proquest, including historic Los Angeles Times databases; and ARG's in-house library. A complete bibliography is included in Section 9 of this report.

This Historical Resources Evaluation Report was prepared by Jennifer Trotoux, Senior Associate, and Andrew Goodrich, Associate, both ARG architectural historians and historic preservation planners, with contributions and oversight by Katie Horak, Principal. All ARG professional staff meet the *Secretary of the Interior's Professional Qualifications Standards* in Architectural History.

1.2 Summary of Findings

The following buildings or clusters of buildings were evaluated for their historical significance, for reasons based on the project description as explained in the following section. The determinations for each are as follows:

Properties that are not historical resources:

- Sierra Hall, Chaparral Hall, Administration Hall
- Serrano Village Housing
- Performing Arts Center

Properties that are historical resources due to eligibility for the California Register of Historical Resources:

- John M. Pfau Library

The Library appears eligible for the California Register under Criterion 3 as an example of the Late Modern style of architecture and as a work of the architect William F. Cody, FAIA. It stands as the campus's most prominent early building. The building is 45 years old, and will be 64 years old by 2035, when the term of the current Master Plan expires. The California Register has no specific age limit for considering a property's historical significance, but enough evidence must be present to demonstrate that a style or an architect's body of work is significant and contributes to our understanding of the architectural culture and design of the period. In this case, the building is a distinguished example among several on the campus within the same Late Modern architectural context. The importance of the architects and the buildings is a reflection of the significance of the commissions for a major regional educational institution.

Due to its eligibility for the California Register, the Library is considered an historical resource for the purposes of CEQA.

1.3 Proposed Project Description

The proposed Project is the Master Plan for the Cal State University San Bernardino campus. Based on the projected facilities and programming needs of the campus over the coming two decades (through 2035), the Master Plan consists of the partial redevelopment of certain zones of the campus with replacement buildings as well as additions and renovations proposed to other existing buildings.

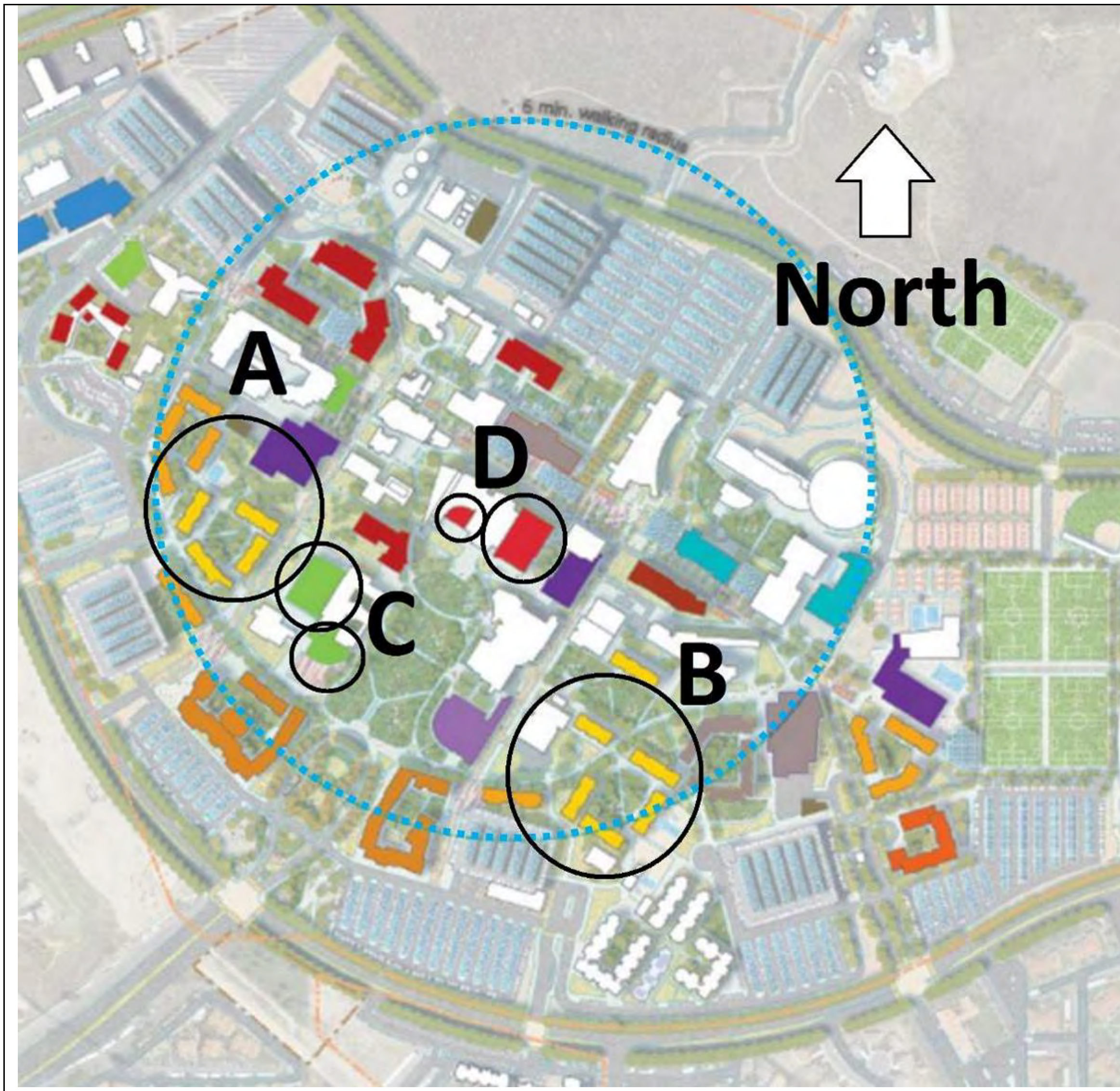
Several buildings constructed prior to 1985 (that will be fifty years of age by 2035) were not evaluated in this study because they do not appear to have the potential to be impacted by the Project. While some of these other buildings may be impacted by renovations and upgrades that will occur throughout the period of the Master Plan, this document has been prepared to address those projects that have the clearest potential impacts at the current level of the Master Planning process.

Please refer to the diagram on the following page for the locations of these buildings. Two groupings of buildings are proposed to be demolished and replaced with new construction:

- Earliest Administration/Academic Buildings, 1965 (proposed replacements shown at "A" on map below)
    - Administration Building
    - Sierra Hall
    - Chaparral Hall
- Serrano Village Housing Group, 1972 (Proposed replacements shown at "B" on map below)

Two buildings are proposed to be expanded through major additions:

- John M. Pfau Library, 1971 (proposed additions marked at “D” on map below)
- Performing Arts Center, 1977 (proposed additions marked at “C” on map below)



Campus Master Plan Map with projected areas of potential impact indicated.

2. Regulatory Framework

According to Section 21084.1 of the California Public Resources Code, a project that may cause a substantial adverse change in the significance of a historical resource is a project that may have a significant effect on the environment.

2.1 Definition of Historical Resources

For the purposes of CEQA, the term "historical resources" shall include the following as set forth in Section 15064.5 of the CEQA Guidelines (Cal. Code Regs., tit 14, §15000, et seq.):

> A resource listed in, or determined to be eligible by the State Historical Resources Commission, for listing in the California Register of Historical Resources.
>
> A resource included in a local register of historic resources, as defined in section 5020.1(k) of the Public Resources Code or identified as significant in an historical resource survey meeting the requirements of section 5024.1(g) of the Public Resources Code, shall be presumed to be historically or culturally significant. Public agencies must treat any such resource as significant unless the preponderance of evidence demonstrates that it is not historically or culturally significant.
>
> Any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California, may be considered to be an historical resource, provided the lead agency's determination is supported by substantial evidence in light of the whole record. Generally, a resource shall be considered by the lead agency to be "historically significant" if the resource meets the criteria for listing in the California Register of Historical Resources.[1]

2.2 Definition of "Substantial Adverse Change"

[1] California Code of Regulations, Title 14, Chapter 3, Section 15064.5.

A “substantial adverse change” in the significance of a historical resource is defined as “physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired.” Further, the significance of an historical resource is “materially impaired” when a project:

- “demolishes or materially alters in an adverse manner those physical characteristics of an historical resource that convey its historical significance and that justify its inclusion in, or eligibility for inclusion in the California Register of Historical Resources; or

- “demolishes or materially alters in an adverse manner those physical characteristics that account for its inclusion in a local register of historical resources... or its identification in an historical resources survey..., unless the public agency reviewing the effects of the project establishes by a preponderance of evidence that the resource is not historically or culturally significant; or

- “demolishes or materially alters in an adverse manner those physical characteristics of a historical resource that convey its historical significance and that justify its eligibility for inclusion in the California Register of Historical Resources as determined by a lead agency for purposes of CEQA.”[2]

CEQA effectively requires preparation of a Mitigated Negative Declaration or an EIR whenever a project may adversely impact historic resources. Current CEQA law provides that an EIR must be prepared whenever it can be fairly argued, on the basis of substantial evidence in the administrative record, that a project may have a significant effect on a historical resource.[3] A Mitigated Negative Declaration may be used where all potentially significant effects can be mitigated to a level of insignificance.[4] For example, a Mitigated Negative Declaration may be adopted for a project that mitigates significant effects on an historical resource by meeting the *Secretary of the Interior’s Standards for the Treatment of Historic Properties*.

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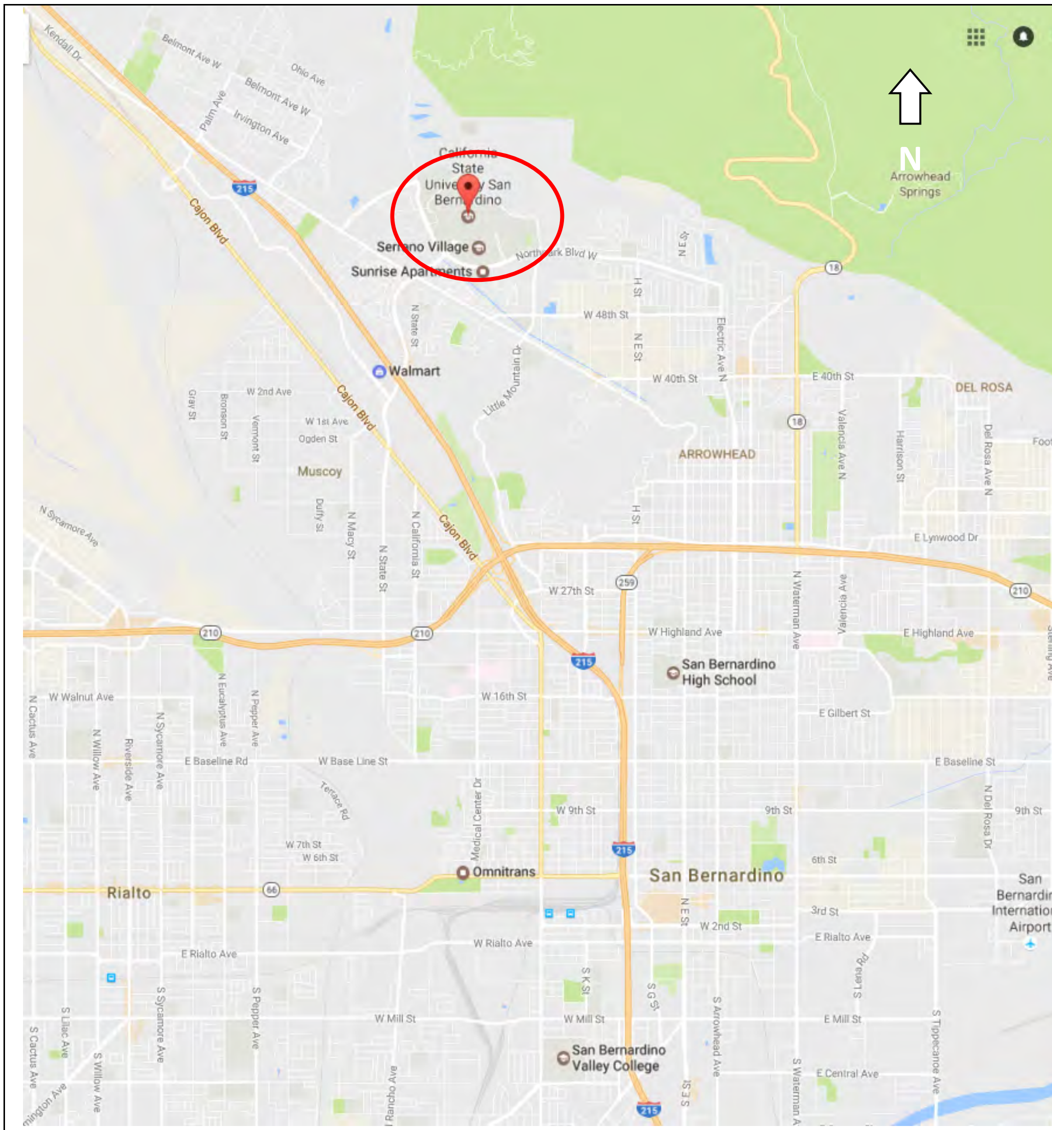
[2] California Code of Regulations/Guidelines for Implementation of CEQA, Section 15064.5(b).
[3] CEQA Guidelines Section 15064(f)(1).
[4] CEQA Guidelines Section 15064(f)(2).

3. Campus and Building Descriptions

3.1 Campus Location and Aerial View



Location map. (Base image source: Google Maps)

Aerial view of campus with boundary shown in red. (Base image source: Google Earth)

3.2 General Description of Campus and Setting

The campus of CSU San Bernardino is located at the base of the foothills of the San Bernardino Mountains, north of the edge of the city of San Bernardino on land that remained undeveloped until the establishment of the campus. The general shape of the campus is an irregular circle, with a ring road dividing the central area of buildings and landscaped areas from an outer ring of parking lots. The layout generally follows the original master plan, created in the mid-1960s, but development has not yet extended around the north side of the projected circle. The campus is approached via University Parkway from the south, which connects the campus to the I-215 freeway. The curve of Northpark Blvd. forms the southern boundary. University Parkway leads straight toward a main quadrangle around which some of the major buildings are arrayed. The John M. Pfau Library is at the northern head of the quad, and the Performing Arts Center, Student Union, and University Hall round out the sides.

The campus has clusters of older buildings that date to its early period of growth and construction, generally 1964-1977, but there is no designed cluster that makes up a cohesive district of such buildings, mainly due to later infill and alterations. While some early buildings, such as the original buildings of the campus - Sierra, Chaparral, and Administration Hall - are minor, many of the early buildings of the campus were completed by significant architects of the period and are strong examples of the scale, style, and materials of institutional architecture in the period.

While the layout of the campus is attributable to the Albert C. Martin and Associates master plan, the landscape design is the work of Eckbo, Dean, Austin & Williams. The landscape is informal and consists of rolling lawns dotted with now-mature trees. Closer to the buildings, alignments and allées of trees sometimes follow the more rectilinear lead of the architecture and punctuate adjoining plazas. The landscape is typical of the period and sets a relaxed tone for the suburban campus that sets off the large-scale, mostly concrete buildings which are typical of institutional architecture of the period. The scale of the landscape is created with a broad brush, forming wide vistas that reflect the suburban-edge location and the corresponding generous use of land.

Campus growth has been steady throughout the past five decades, with the slowest growth occurring in the decade of the 1980s. About half of the buildings date from the 1990s and 2000s, including two parking garages that are likely to continue to supplement or supplant the surface parking. Athletic facilities have continued to expand on the east end of the campus.

3.3 Chronology of Campus Development

1960 A new state college campus is chartered at San Bernardino.

1963 After weighing several potential sites in the San Bernardino Valley, the CSC Board of Trustees selects a site for the new campus at the base of the foothills north of San Bernardino.

1964 Albert C. Martin and Associates develops a master plan to guide the physical development of the new campus. The master plan is approved by the CSC Board of Trustees in early 1965.

1965 The first three campus buildings – now known as the Administration Building, Chaparral Hall, and Sierra Hall – are constructed. These buildings are intended to be "temporary" structures while the new campus is taking shape. The first group of students begins taking classes that fall.

1966 California State College at San Bernardino is formally dedicated.

1967 The campus's first two permanent buildings are completed: the Biological Sciences Building (A.C. Martin and Associates), and the Physical Sciences Building (Heitschmidt and Thompson).

1968 The Physical Education Building (Ladd and Kelsey) is constructed.

1968 Dorman-Munselle Associates, architects from Beverly Hills, replace A.C. Martin and Associates as consulting master plan architects for the campus.

1971 A Library and Classroom Building (William F. Cody, with Criley & McDowell) is completed, and is intended to serve as a focal point of the young campus. The library was named to commemorate founding President John M. Pfau following his retirement in 1982.

1972 CSCSB becomes a residential campus with the completion of eight student residence halls (known collectively as Serrano Village) and the adjacent Commons building (Dorman-Munselle).

1977 The Creative Arts Building (Carl Maston), now known as the Performing Arts Building, is constructed to the south of the campus library. The Santos Manuel Student Union is also completed that year, though this building has been substantially remodeled.

1977 By this point, all of the major buildings of the campus's early period have been completed and the landscape by Eckbo, Dean, Austin and Williams is established.

1984 CSCSB satisfies the statutory requirements needed to become a university. The institution is re-named California State University, San Bernardino.

3.4 Sierra Hall, Chaparral Hall and Administration

This cluster of three buildings, designed by the Office of the State Architect in 1964-65, constitutes the earliest physical development of the campus. Each of the buildings has a slightly different footprint and configuration, but they share common architectural features, materials, and interiors. They are configured around a plaza, with Sierra Hall to the west, Administration to the north, and Chaparral Hall to the south; the east side of the plaza is open to the remainder of the campus. The main quad is located some distance to the east, so that these buildings are not related directly to the central landscape feature.

All buildings are one story in height with a flat roof and built-up roofing surface. The flat eaves are faced in wood boards set perpendicular to the wall, with extended joists punctuating the eaves at each column line. The main wall material is a light brown concrete brick that provides texture to the wall surface. The exterior walls have a modular rhythm with the vertical structural framework of smooth, gray concrete piers expressed on the exterior, each pier flanked to either side with narrow, vertical panels of glass, and the infill of each bay consisting of a brick-clad wall panel.

Fenestration around the perimeter of the buildings consists of the narrow floor-to-ceiling windows described above. The interiors consist mostly of hallways and offices, with little in the way of common space or reception areas.

The Administration building's plan incorporates a courtyard within the rectangular plan, open to the central plaza that provides access to multiple points of entry and contains some planted areas. Originally, the west two-thirds of the plan contained a library, but this open space was subdivided for additional office space early in the life of the building as additional campus facilities for specific purposes were constructed.

Chaparral Hall also includes a courtyard within its rectangular plan, open to the plaza on its north side. The more sheltered courtyard facades have continuous fenestration between the concrete columns, framed with what appears to be bronze-finished aluminum with a square profile.

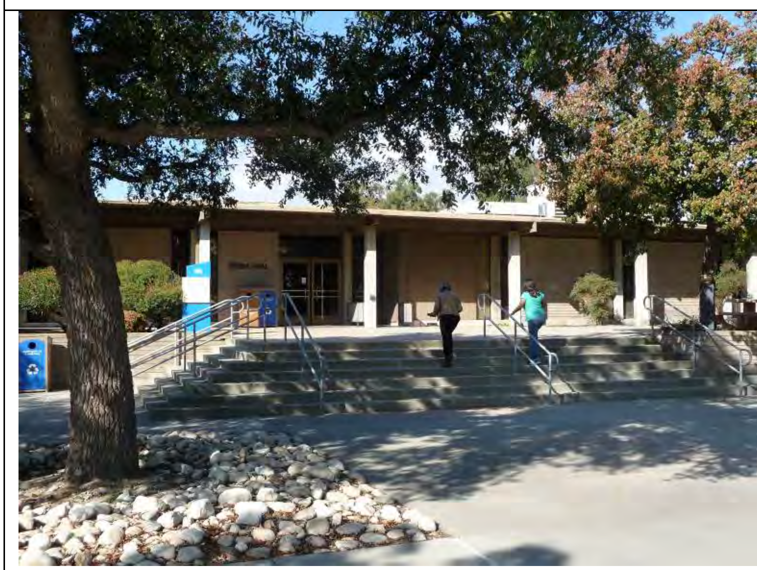
Sierra Hall is elevated with respect to the other two in the cluster with a front retaining wall of brick and a large concrete staircase in the center leading to the entrance.

The trees that punctuate the plaza and other interstitial spaces are oak trees and pear trees that were a part of the original landscape plan for the campus. The design of the plaza's paving also appears to be an original feature. It consists of a large-scale pattern of squares and rectangles set out with the concrete joints, some of integrally colored concrete (reddish in color), and square planters at grade for the trees. The foundation plantings along the buildings are mainly pygmy palms (which may be original) and shrubs such as Nandina and a limited few others.

Any alterations to the buildings that would impact their design are minimal. Rooftop air conditioning handlers and ducts visible on the flat roofs are the most prominent alteration.

SIERRA, CHAPARRAL, AND ADMINISTRATION

Location of cluster within the southwest area of the campus is indicated.

	**SIERRA HALL** View north from parking lot entrance; building elevated on retaining wall.
	**SIERRA HALL** Front steps and entrance, view west.

CHAPARRAL HALL

View across plaza toward building frontage on plaza and walled courtyard entrance at left.

CHAPARRAL HALL

View east within walled courtyard.

	**ADMINISTRATION** Detail of colonnade and expressed structure, typical of all three buildings. View east.
	**ADMINISTRATION** View north of central atrium.

	**ADMINISTRATION** East façade, view northwest.

3.5 John M. Pfau Library

The John M. Pfau Library (William F. Cody and Criley & McDowell, 1971), named for the founding president of the University, is a five-story building prominently sited in the center of the campus and at the head (north end) of the main quadrangle. It has an elevated position relative to surrounding buildings, with plazas and exterior colonnades running under the east and west wings of the main structure. The entrances from the south and north are handled similarly, with open two-bay entrances recessed into the main structure under the banks of fenestrated bays. The plinth on which the building stands incorporates a broad staircase in front, rock-clad retaining walls for the plazas that relate the building to its natural environment, and side walls alongside the stairs. A large, low planter is set into the front of the main staircase to a height of the first four steps.

The basic parti of the front and rear exterior consists of the contrast of solid concrete corners framing open, vertically articulated panels of grouped fenestration. The four solid corners, running from the plaza level to the top floor, are clad in concrete that has a varied relief striation molded into the surface. Horizontal expansion joints at each floor provide scale, and the concrete has an integral light brown color. The lighter center “panels” of fenestration on each façade consist of an expressed, smooth, buff concrete grid of vertical window openings, again with horizontal elements of the grid marking each floor. The panels have an open void on the ground floor, where the colonnades are recessed, with four stories of the tighter grid of fenestration above, giving the panels a floating quality. The solid, textured concrete corners ground the building in contrast.

The longer side facades of the building have four-story pop-out wings that are carried on square-section, painted concrete columns. The ceilings within these colonnades are an exposed structural concrete waffle slab. Concrete benches throughout are original features. The long sides of the wings on the four upper floors have facing panels of textured concrete alternating with seven bays of windows framed in lighter, buff concrete (single windows in the end bays and five pairs of windows stacked in the center bays). Each pair of windows is split at the gap that defines the breaks between the panels; the columns extend up through these breaks, recessed from the face of the panels. The south and north faces of the wings are filled with a buff concrete grid defining the windows, similar to the central bays on the north and south short sides.

Various entrance doors throughout the ground floor are bronze and appear custom designed for the building. The main entrance doors on the south and north sides consist of a floor to ceiling bronze decorative feature set over the glass on the exterior that forms a sort of stacked transom and double doors. This feature is intact on the north side but has been altered on the south side at the main entrance from the campus (transoms remain; doors replaced with automated sliding doors).

The main interior space of the ground floor is an open grid of columns with a translucent plastic illuminated ceiling articulated by a grid that echoes that of the waffle slab on the exterior covered areas. The elevator bank is faced in the ribbed concrete pattern of the exterior on its side; on its front it is clad in stone. Finishes are simpler at the elevators on the upper floors and have been covered with later fabric panels.

The building has a major addition dating to 1994 on its west side that rises the full height of the original building. The addition is set back from the original west wall by way of a concave curve in plan that allows the side windows and colonnade to remain unengaged, facing the plaza that is embraced by the new wing. The wing connects to the building on the interior at each level. The features, materials and colors of the addition are highly compatible with the main building, yet they are distinguishable from the original.

	**JOHN M. PFAU LIBRARY** Location of building indicated at north end of the main quadrangle.
	**JOHN M. PFAU LIBRARY** General view northeast from quad with addition at left.

JOHN M. PFAU LIBRARY

Main entrance on south façade, view north.

	**JOHN M. PFAU LIBRARY** Main south entrance with original recessed lighting and transom grilles, view north. Altered entrance doors.
	**JOHN M. PFAU LIBRARY** North side; addition at right, view south. The recessed “hyphen” between them is a part of the original building.

JOHN M. PFAU LIBRARY

Interior, main floor reading room, view south.

JOHN M. PFAU LIBRARY

Interior, main floor elevator bank, view north.

	**JOHN M. PFAU LIBRARY** Early photo (view northwest) of the library as it neared completion, CSUSB Facilities Archives.
	Early photo (east or west colonnade) of the library as it neared completion, CSUSB Facilities Archives.

3.6 Serrano Village Housing

The earliest housing group on the campus is known as Serrano Village. It dates to 1972 and was built by the housing contractor Viking Co. with no designer credited. Located directly east of the main quadrangle, behind the Commons, it consists of eight identical buildings located in four facing pairs set within an irregular layout. The arrangement of the complex avoids a “front” or any apparent hierarchy.

Each building is essentially the same. They are two stories in height and irregular in plan. Each of the three masses that comprises each building has a shed roof sloping toward the outside of the pair of buildings, clad in tile shingles. The short sides of the masses are faced in diagonal painted wood board siding. The long sides are faced in stucco. On the long outside façade of each cluster, the second story overhangs the first and the fenestrated portion of the wall is recessed; the lower portion of the wall may represent a continuous shallow balcony.

The entrances to the buildings are within recessed open vestibules with aluminum frame, glazed doors. Fenestration of the buildings consists of rectangular aluminum sliders spaced evenly across the long facades. The short facades faced in diagonal wood have no fenestration and they present a distinctive wedge-shaped profile defined by the rake of the shed roof, which has no overhang on these sides.

The landscape of the complex is consistent with that of the rest of the campus and consists of swelling lawns, asphalt paths and mature trees.

SERRANO VILLAGE

Location of cluster at southeast area of the campus is indicated.

	**SERRANO VILLAGE** Setting of buildings.
	**SERRANO VILLAGE** Setting and adjacency of buildings within the cluster.

SERRANO VILLAGE

Detail of typical fenestration and facing materials on an outer façade.

SERRANO VILLAGE

Exterior materials and asphalt paving at an entrance on outer facade of Shandin Hall.

3.7 Performing Arts Center

The Performing Arts Center (1977, by Carl Maston) is situated on the west side of the main quadrangle, facing east. The building is characterized by a number of separate, largely unfenestrated volumes. Its massing is defined by a main auditorium volume clad in exposed-aggregate concrete on the east side in the center of the plan, flanked by low, horizontally oriented, glass-fronted connectors to the north and south, capped by deep, wood-clad fascias. The fenestration has bronze-colored metal (likely aluminum) frames and smoked glass, and appears to have been replaced. A long two-story wing running north to south dominates the west-facing rear of the building, with a flat roof and a row of windows along the second story.

The plan of the building is generally symmetrical with the main performance space in the center. The south side contains a secondary auditorium ("experimental stage"); the southwest corner contains a scenery workshop and adjacent patio to the east; and the northwest corner contains an instrumental rehearsal room. The northeast part of the plan holds offices, and the west side contains classrooms. Within this circuit of spaces, the auditorium bisects the center of the plan and two open courtyards lie to the north and south of it, combining private and semi-public spaces as well as indoor and outdoor spaces.

The plaza outside of the building is paved in exposed-aggregate concrete bordered in brick. Pear trees used in the plazas of the Sierra/Chaparral/Administration cluster are also planted here. The roses in the large beds in front of the building do not appear to be not a part of the early landscape plan.

PERFORMING ARTS

Location of building on west side of the main quadrangle is indicated.

	**PERFORMING ARTS** General view northwest of plaza and building front.
	**PERFORMING ARTS** Materials and volumes surrounding north entrance (east façade), view west.

PERFORMING ARTS

North front side wing with offices, view southwest.

PERFORMING ARTS

South façade. Added box office at right and added fenced area at left, expanding the patio of the scenery and property shop (far left).

PERFORMING ARTS

South side wing of primary façade, later addition for a box office, circa 1990, view southwest.

4. Historic Context

4.1 Institutional Development: the Cal State University System

The present-day California State University (CSU) system is the descendent of an early institution known as Minns' Evening Normal School. Lawyer-turned-educator George Washington Minns had founded the normal school in 1857 to provide job training for public school teachers.[5] Under Minns' tutelage, the school turned out 54 graduates, "all of whom were women."[6] In 1862, the State of California acquired Minns' vocational academy for the purpose of training new teachers for the public elementary schools of the state. The institution was re-named the California State Normal School, and in 1871 it was moved from its original location in San Francisco to a new campus in the community of San Jose.

[5] State of California, "Twentieth Biennial Report of the Superintendent of Public Instruction for the School Years Ending June 30, 1901, and June 30, 1902," transmitted to the Governor Sept. 15, 1902, 61.
[6] Ibid.

Other branches of the California State Normal School were subsequently opened to keep pace with California's growing population and the demand it imposed on public education. In 1882, a branch of the State Normal School opened in Los Angeles to serve the southern part of the state. It was originally sited atop a hill in downtown Los Angeles before evolving eventually into the University of California at Los Angeles in Westwood in the 1920s. "Tuition was free, and the three-year course of study included courses in penmanship, botany, and vocal music."[7] Other branches of the State Normal School were eventually opened in the communities of Chico (1887) and San Diego (1897). While the normal schools all fell under the umbrella of the state and all worked toward the same objective of training future teachers, the campuses did not collectively operate as a streamlined system, but were rather a loosely associated network of semi-autonomous institutions.

At about the same time, the State of California had been working on creating a new public university for the people of California. Originally known as the Agriculture, Mining, and Mechanical Arts College, the institution existed on paper only for many years as the state worked on assembling the land and other resources that were needed to get the university up and running. The institution was named the University of California, and a permanent campus opened in the community of Berkeley, across the bay from San Francisco, in 1873.[8] The University of California differed from the State Normal School in that it provided a broad, liberal arts-based curriculum, whereas the latter focused solely on vocational training.

The purview of California's State Normal Schools necessarily evolved as these institutions matured. As part of a comprehensive reform package for California's education system, the State Normal Schools were re-branded as "State Teacher's Colleges" in 1921.[9] This name change reflected how many of these institutions had evolved from normal schools, whose primary focus was imparting basic literacy skills on children, into teacher's colleges, which provided a broader-based and more robust curriculum that drew upon various disciplines in the liberal arts. As more time passed, the primary focus of State Teacher's Colleges shifted even further away from pure vocational training in favor of a well-rounded, liberal arts-

[7] Nathan Masters, "CityDig: When UCLA was a Downtown Teaching College," *Los Angeles Magazine*, Mar. 5, 2013.
[8] UC Berkeley, "History and Discoveries," accessed Dec. 2016.
[9] California State University, "History," accessed Dec. 2016.

oriented education. In 1935, the institutions were once again re-branded, this time as "State Colleges."[10]

The evolution of these campuses led to some confusion about the organization and governance of public education in California. As the state colleges broadened their purview and focused increasingly on the liberal arts, the distinction between these institutions and the University of California – whose purpose was to provide a liberal arts-based education – was muddled. Many UC administrators looked at the state colleges with disdain for "intruding" upon what they saw as their institution's liberal arts prerogative. To address these concerns and cast some clarity on the matter, state officials hired the Carnegie Foundation for the Advancement of Teaching to review the organization of California's public institutions of higher learning. In 1932, its findings were synthesized into a report that "provided a long list of recommendations to bring greater coherence and efficiency" to the system.[11] The report included "the recommendation that the University of California Regents absorb the state colleges;" however, this suggestion was resolutely rejected by administrators and faculty of the state colleges, who saw it as a power grab and rallied, successfully, to maintain their independence from the UC Regents.[12]

Tensions between UC and state colleges were compounded by the fact that not one, but two state colleges defected from the system to become a part of the University of California. The first instance involved the state normal school at Los Angeles, which in 1919 was transferred to the UC Regents by state law and became the University of California, Los Angeles (UCLA). The second instance took place in 1944, when state legislators and California Governor Earl Warren adopted legislation allowing the UC Regents to take over the operations of Santa Barbara City College and re-open it as UC Santa Barbara.

Considerable strain was placed on all of California's public colleges and universities after World War II. The state's population was steadily growing and showed no signs of slowing down; military veterans who returned home from World War II were reaping the education benefits provided to them by the G.I.

[10] Ibid; "The History and Future of the California Master Plan for Education," accessed Dec. 2016.
[11] Ibid; "State Higher Education in California: Report of the Carnegie Foundation for the Advancement of Teaching," printed by the State Printer of California, 1932.
[12] "The History and Future of the California Master Plan for Education," accessed Dec. 2016.

Bill; and the "Baby Boomers," which, at the time, was the largest generation in American history, was about to come of college age. Amid this period of remarkable growth, a number of new state colleges were founded to accommodate the scores of Californians desirous of a post-secondary education. These new campuses were sited in areas of the state that bore the brunt of population growth including Los Angeles (1947), Sacramento (1947), and Long Beach (1949). An additional seven campuses were authorized between 1957 and 1960, including one to be located in the greater San Bernardino Valley.[13] Unlike the University of California, which was overseen by the Board of Regents, these state colleges continued to operate as independent entities and did not fall under the umbrella of a central agency.

Efforts were undertaken to systematize the disparate elements of the state college and university systems in the late 1950s. Developing a more structured and coherent framework, argued proponents, was needed to ensure that the quality of public education would be maintained in the face of rising demand. These efforts culminated in a policy document known as the California Master Plan for Higher Education, which divided the state's public colleges and universities into a three-tiered system consisting of the University of California (UC), the California State Colleges (CSC), and the California Community Colleges.[14] Tiers were assigned differential function in terms of the degrees awarded and the types of programs sponsored, by the level of applicants in their high school graduating class, and by the mission embodied in the population of learners that each was intended to service. The Plan also championed the idea that all qualified California residents should be able to attend a public institution free of tuition expense, and would only be responsible for paying fees not directly related to instruction.[15]

The Plan stipulated that state colleges would be teaching institutions that provided "instruction for undergraduates and graduate students, through the Master's degree, in the liberal arts and sciences, in applied fields and in the

[13] California State University, "History," accessed Dec. 2016.
[14] University of California Office of the President, "Major Features of the California Master Plan for Higher Education," accessed Dec. 2016.
[15] Ibid.

professions."[16] State colleges, then, struck a sort of middle ground between the prestigious University of California, which was designated as "the primary state-supported academic agency for research" and the sole issuer of doctoral, law, and medicine degrees, and the more accessible community colleges, which offered general education courses and vocational and technical curricula.[17] Students at community colleges were primed to transfer to a UC or CSC campus after two years of study.

Many provisions of the Plan were codified by the State Legislature in a bill known as the Donahoe Higher Education Act, which was signed into law by California Governor Pat Brown in 1960. Named for state assemblywoman Dorothy Donahoe, who played an instrumental role in steering the Plan through the legislative process, the bill was touted by Governor Brown as "the most significant step California has ever taken in the planning for the education of our youth."[18] Adoption of the bill effectively marked the birth of the present-day CSU system by taking the individual state colleges that had been founded across the state and bringing them together as a single, unified entity known as the California State Colleges (CSC). It also centralized the operations of the state colleges by authorizing the appointment of a Board of Trustees and a Chancellor, who would preside over the entire CSU system and its operations.

The centralization of state colleges under the 1960 Master Plan brought a sense of order to what had historically been a loosely organized and somewhat incongruent network of institutions. Reinforcing CSC's overarching purpose as a four-year teaching institution (as opposed to the research functions of UC, or the vocational training provided by community colleges), adopting uniform admission standards, and streamlining curricular requirements permitted campuses within the CSC system to accommodate more new students without compromising the quality of education. CSCs were an attractive option for students who either lacked the qualifications to be admitted into a UC school, or were more interested in a liberal arts-based education than one in either academia or the "elite" pursuits of law or medicine.

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[16] Neil J. Smelser and Gabriel Almond, eds., *Public Higher Education in California* (Berkeley: University of California Press, 1974), 28.
[17] Smelser and Almond (1974), 28-29.
[18] Kevin Starr, *Golden Dreams: California in an Era of Abundance, 1950-1963* (New York: Oxford University Press, 2009).

However efficient it was, California's tiered approach to higher education struck a sour note among some faculty and administrators at CSC campuses. "Stung by what they considered to be the second-class status to which the Master Plan relegated them, the colleges continued to strive to redress their deprivation by pressing for equivalent salary schedules, time and support for research, lower teaching loads, and designation as universities."[19] In 1972, the CSC Board of Trustees and the Coordinating Council for Higher Education adopted criteria relating to the structure and curricula of each college, and then applied these criteria to "promote" fourteen of its nineteen campuses to the title of "university." The system as a whole was re-branded as the "California State University and Colleges." These actions appear to have had little impact on the function of each campus, but were rather used as a tool to bestow a sense of rigor and prestige. At the time, the other five campuses, including San Bernardino, did not yet meet the criteria needed to become universities and continued to be known as "colleges."

The remaining five campuses were conferred the title of "university" in subsequent years, and in 1982 the name "college" was stricken from the system entirely when it was again re-branded, this time as the California State University, or CSU.[20] While enrollment never reached the sky-high figures that had been projected at the beginning of the postwar era, the CSU system nonetheless experienced steady growth as California's population continued to increase and federal and state financial aid programs rendered it possible for more people to pursue a post-secondary education. CSU accommodated this growth both by increasing capacity at its existing campuses and by establishing new campuses throughout the state, bringing the total number of campuses in the CSU system to its present-day number of twenty-three. In contrast to earlier CSU campuses, most of which were built from the ground up, newer campuses in the system such as Monterey Bay (1994, formerly Fort Ord) and Channel Islands (2002, formerly Camarillo State Hospital) have taken existing, underused institutions and given them new life as college campuses.

4.2 Establishment of a College at San Bernardino

[19] T.R. McConnell, "Can the Elite University Survive?" *The Research Reporter* 8.2 (1973): 1-7.
[20] California State University, "History," accessed Dec. 2016.

California State University, San Bernardino (CSUSB) was among the many new state colleges that were founded at the apex of California's postwar population boom. Amid the rapid suburbanization of the San Bernardino Valley after World War II, state officials deemed it a priority to develop a new state college in the area to ensure that its residents, many of whom had recently settled in San Bernardino and other communities nearby, had access to a post-secondary education. Plans to develop the new campus became official in April 1960 when a bill introduced by State Senator Stanford C. Shaw of Ontario was approved by the state legislature. At this time it was known as San Bernardino-Riverside State College.[21]

Selecting a site for the new college was a drawn-out and politically-charged process. At the time, many of the communities in the San Bernardino Valley were pining for new revenue streams as the citrus groves that had long sustained the local economy were giving way to housing tracts and suburban malls, and the prospect of a four-year college presented a prime opportunity to grow and sustain the local economy in new ways. These communities lobbied hard to have their names thrown into the hat of prospective sites for the new campus. By the early 1960s, a total of twenty-six sites had been submitted for consideration by a board composed of CSC Trustees and architect Charles Luckman; however, most of these sites were eliminated "on the basis that they were too far to the west and not close enough to the center of population from which the college expected to draw its students."[22] Others were tossed aside either because they were not served by public transit, or because the acquisition of land would be too difficult.

By 1962, the committee had whittled the roster of potential sites down to five: two abutted the City of Colton, the third was adjacent to the San Bernardino-Riverside County Line, the fourth was located near Rialto, and the fifth sat at the base of the foothills north of San Bernardino. After weighing the costs and benefits of each, the committee voted in favor of the option near San Bernardino, which was then taken to the Board of Trustees and won formal approval in 1963.[23] The site selected for the college consisted of 430 undeveloped acres on an alluvial slope, sandwiched between the San Bernardino Mountains and a smaller

[21] "Master Education Plan Passed by Assembly," *Los Angeles Times*, Apr. 6, 1960.
[22] "State College Sites Cut to 5," *San Bernardino Daily Sun*, Jul. 13, 1962.
[23] Harvey Feit, "S.B. Foothill Site Picked for College," *San Bernardino Daily Sun*, Feb. 9, 1963.

range to the south known as the Shandin Hills. It was easily accessed by the new Barstow Freeway (I-215), and sat against a dramatic backdrop of majestic mountains and rugged terrain. The college became known as California State College at San Bernardino after the site selection was ratified.

In early 1962, the CSC Board of Trustees selected Dr. John M. Pfau to serve as the founding President of the new college.[24] An alumnus of the University of Chicago and seasoned educator and administrator, Pfau had held faculty positions and leadership posts at institutions in both Illinois and California prior to being recruited to the new inland campus. Pfau had come to California in 1959 with his wife and two daughters, initially chairing the Division of Social Sciences at Chico State College and then holding the same position at Sonoma State College. When he arrived in Southern California, he worked hard to "put the pieces together for the opening of the new campus" in San Bernardino, and played an instrumental role in assembling the site, recruiting faculty, and building a core curriculum.[25]

Pfau was known as an innovative thinker and a staunch advocate of academic rigor, believing that the principal responsibility of any post-secondary institution was to enrich the mind.[26] Pfau's scholastic bent shaped the curricular framework and atmosphere of the new campus over which he was presiding. He aspired to model San Bernardino-Riverside State College "on the best traditions of the great Ivy League schools and the small elite private liberal arts colleges in the East."[27] He successfully advocated to implement a non-traditional curricular structure known as the 3:3 Plan or the Dartmouth Plan, so named because of its implementation at Dartmouth College. This plan divided the academic year into three years each composed of three terms (instead of four years composed of two semesters), limited each student to three courses per term, organized courses into a combination of large lectures and smaller seminars, and called upon students to complete more coursework outside of the classroom.[28] The plan, at the time, was seen as more rigorous than the conventional, four-year approach to higher education.

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[24] Michael Burgess, *The Coyote Chronicles: A Chronological History of California State University, San Bernardino 1960-2010* (Rockville: The Borgo Press, 2010), 24.
[25] Iwona Contreras, "CSUSB to Pay Tribute to John M. Pfau," Nov. 1, 2012, accessed Dec. 2016.
[26] Burgess (2010), 24.
[27] Iwona Contreras, "CSUSB to Pay Tribute to John M. Pfau," Nov. 1, 2012, accessed Dec. 2016.
[28] "Dartmouth Plan Eyed for S.B. State College," *San Bernardino Daily Sun,* Sept. 6, 1963.

Meanwhile, an effort was being undertaken to plan the physical environment of the new college. Albert C. Martin and Associates, an esteemed architectural practice based in Los Angeles, was commissioned to study the site and prepare a master plan charting the future development of the campus. Bringing on someone with as much name recognition as A.C. Martin – whose career several spanned decades and culminated in a number of iconic buildings in the Los Angeles area – instilled a sense of pride among campus officials, and particularly among President Pfau, who in a 1962 memorandum stated:

> When Albert C. Martin began to talk about future meetings with members of our planning staff in which we would discuss such things as the purpose of the institution, the moods we would like to create, the relationships of light and shadows…all of which are basic ingredients in developing the proper architectural vocabulary, I felt myself getting really excited. When you people arrive and join him in similar discussions, I feel certain that you too will begin to salivate.[29]

Completed in 1964, the Campus Master Plan was developed under the assumption that San Bernardino State College would eventually accommodate 20,000 students when it was fully built out. The plan was sent to the Board of Trustees and was approved in January 1965. It envisioned the campus as a pedestrian-friendly environment that was oriented around a set of concentric rings. The inner ring, at the center of campus, functioned as the core of campus and included all of its academic buildings. The outer ring was composed of parking lots, ancillary structures, utilities, athletic fields, and other uses that were considered to be "secondary" functions of the college. Though residence halls were not yet in the immediate plans, they were slated to eventually be located in the outer ring as well. The inner and outer rings were delineated by an access road that charted a circular course around the entire campus.

Pedestrian circulation was a priority of the Campus Master Plan, so accordingly it included provisions to ensure that the quality and integrity of pedestrian travel would be maintained over time. Cars, for instance, were prohibited from entering the inner ring, and were instead relegated to the roads and parking lots on the campus perimeter. Buildings were placed in such a matter "that students may

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[29] "Bulletin #1," correspondence from John M. Pfau to Charter Members of the San Bernardino-Riverside State College, Apr. 5 1962.

walk between any two classes in seven-and-a-half minutes."[30] In addition, buildings were to be oriented around inner courts to provide protection from the heat and high winds that often swept through the area.[31]

Landscaping for the new campus was overseen by the Los Angeles-based firm of Eckbo, Dean, Austin and Williams (known after 1973 as EDAW). The firm, and particularly principal Garrett Eckbo, had earned national recognition for its progressive approach to landscape architecture, and created outdoor environments for many of the most widely-acclaimed Modern architecture commissions in Southern California. For the San Bernardino campus, the firm introduced a simple, yet thoughtfully-composed palette of trees, lawns, shrubs, and hardscape features that complemented its architectural vocabulary and ecological context. Axial walks and spaces around buildings took on a more formal character, while open spaces featured trees and broad lawns with contours that conformed to the campus's alluvial slope. Plans called for an abundance of trees, "to provide shade and a windbreak" and bestow upon the campus a "park-like atmosphere."[32]

Ground was broken on the campus in December, 1964. This initial phase of development involved the construction of three single-story buildings, oriented in a small cluster near the southwest corner of the campus. Campus administrators intended for this triad of buildings to "house all the functions of the college, except physical education, during the first two years of operation," and their construction was hastened so that the college could get up and running as quickly as possible.[33] One of the buildings was used for campus administration and faculty offices; the second was occupied by classrooms and the original campus library; and the third housed laboratories and a cafeteria.[34] Each building employed the same vernacular architectural vocabulary of stacked concrete blocks, slit windows, and minimal articulation. They were completed in mid-1965, in time for the first cohort of students to arrive that fall.

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[30] "State College Construction Due to Start in 4-5 Months," *San Bernardino Sun/Telegram*, Jul. 30, 1964.
[31] Ibid; "Plans Proceeding for State College at SB," *Daily Enterprise,* Jun. 23, 1964.
[32] "State College Construction Due to Start in 4-5 Months," *San Bernardino Sun/Telegram*, Jul. 30, 1964.
[33] "San Bernardino Campus Work to Start Soon," *Los Angeles Times*, Nov. 29, 1964.
[34] Ibid.

Planning documents stress that these three original buildings were intended to be "temporary" while a new, permanent campus was being developed. Dr. Kenneth Phillips, executive dean of the college, later clarified that this did not mean that the buildings would be immediately razed when permanent buildings were completed, but were rather temporary in the sense "that the eventual campus of 20,000 enrollment will compel their replacement with higher structures" at an unspecified point in the future.[35] Until that occurs, Phillips indicated that the buildings would continue to be used as classrooms. Indeed, all three of the original campus buildings are extant and are known today as the Administration Building, Chaparral Hall, and Sierra Hall. The latter two have since been converted into classrooms and offices.

California State College at San Bernardino admitted its first group of students in the fall of 1965. Its inaugural class consisted of 273 students, all of whom were either freshmen or juniors; sophomores and seniors were not admitted until the next fall.[36] Classes and all other activities were held in the three temporary buildings that had recently been completed. Since at the time, the campus consisted entirely of academic and administrative spaces and did not yet have any on-site housing, this first round of students were of a transient nature, commuting to campus for class and then returning home at the end of the day. The campus was formally dedicated at the end of the school year, in May 1966.[37]

Work began on the college's first "permanent" buildings in March, 1966. This first round of permanent improvements included two concrete buildings near the center campus that provided new, state-of-the-art facilities for the college's physical and natural science programs. The Biological Sciences Building was the first building to break ground, followed shortly thereafter by the Physical Sciences Building. Both were completed in 1967, and both employed a similar architectural vocabulary of blocky massing, unadorned concrete walls, narrow windows delineated by projecting concrete fins, and minimal ornamentation, which drew upon the tenets of Brutalism and rendered them rather bold architectural statements upon completion. As the first permanent structures to be erected, the two science buildings played an important role in setting the architectural tone for the rest of the campus in years to come.

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[35] "Plans Proceeding for State College at SB," *Daily Enterprise*, Jun 23, 1964.
[36] Burgess (2010), 36.
[37] "New College Dedication Set May 4," *Los Angeles Times,* Apr. 21, 1966.

Reflecting the energy and enthusiasm that was going into building up California's network of colleges and universities at the time, architectural commissions at new campuses were often awarded to architects who were highly acclaimed and brought considerable name recognition. This was certainly true of the new campus that was being developed at San Bernardino. Albert C. Martin and Associates, who had developed the Campus Master Plan and also continued on as the consulting campus architect, was selected to design the Biological Sciences Building. Similarly, the commission for the Physical Sciences Building was awarded to a well-known architectural practice, Heitschmidt and Thompson of Los Angeles. Earl T. Heitschmidt was a prolific architect who was involved in many high-profile commissions including CBS Radio City in Hollywood and the Park La Brea residential complex in the Fairfax district of Los Angeles.[38] In 1969, the Biological Sciences Building was identified by *College and University Business* magazine as "one of the top fifteen college buildings in the country" on the merits of its design.[39]

The next major building project to commence was the construction of a physical education complex. This was seen by many as a curious and somewhat ironic decision, given Pfau's prioritization of academics and his eschewing of athletics and other non-intellectual pursuits. Campus officials, in turn, were quick to point out that "the reason for early priority of the gymnasium does not indicate an early dedication to leadership in athletics"; rather, its construction was hastened due to a legislative mandate that required all undergraduate students enrolled in state colleges to complete physical education credits.[40] Architects Ladd and Kelsey of Pasadena were selected to design the new Physical Education Building, which was constructed in 1968. Its boxy massing and abundance of concrete followed in the Brutalist footsteps that had been planted by the two science buildings completed the year before.

In 1968, ground was broken on what was envisioned as the centerpiece of the campus: a new library and classroom building. Conceptual plans for the building had been in the works for several years and had been drafted by a team of noted local architects composed of William F. Cody of Palm Springs, and Theodore Criley

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[38] Burgess (2010), 55.
[39] "San Bernardino College Expands," *Los Angeles Times*, Feb. 6, 1966.
[40] "State College Construction Due to Start in 4-5 Months," *San Bernardino Sun/Telegram*, Jul. 30, 1964.

& Fred McDowell of Claremont.[41] When it was completed in 1971, the building marked a notable new addition to the campus and, at five stories tall, it towered over the few other buildings and site improvements comprising the college at the time. Space within the new building was divided between the library and academic departments; the library occupied the building's ground level and upper three floors, while the basement and second floor included classrooms, offices, a computer center, and other academic uses. After the library's 150,000-volume collection was moved to its new quarters, the original library, now known as Sierra Hall, was remodeled to accommodate offices.[42] The building was later named to commemorate President Pfau following his retirement in 1982.

In addition to engineering the original master plan for the campus, Albert C. Martin and Associates had continued on for several years as Consulting Master Plan Architect, presiding over campus development and ensuring that new construction abided by the principles and architectural vocabulary set forth in the document. In 1968, the CSC Board of Trustees elected not to renew A.C. Martin's contract, instead appointing the Beverly Hills architectural firm of Dorman-Munselle Associates to serve as the campus's consulting architect.[43] The firm and its partners, architects Richard Dorman and Peter Munselle, brought considerable experience in designing institutional buildings and campuses.

In its early years, California State University at San Bernardino was known exclusively as a commuter school given its absence of on-site housing and dearth of student amenities. However, by the late 1960s college administrators began flirting with plans to add a residential component to the college to make it more attractive to a broader group of prospective students, many of whom expressed an interest in living on campus and reaping the "full college experience." Ground was broken on a new residential complex southeast of the campus core in 1971. Plans called for the construction of eight residence halls and a multi-purpose building known as the Commons, which would house "cafeteria dining facilities, conference rooms, and multi-purpose facilities" for those living in the adjacent dorms.[44] Dorman-Munselle Associates was selected to design the Commons building. Though they carried on the same basic architectural vocabulary of other

[41] Burgess (2010), 76.
[42] Burgess (2010), 17, 76.
[43] "Beverly Hills Firm Named Consulting Master Plan Architects," *The Bulletin*, Jul. 12, 1968.
[44] "Construction on $1 Million CSCSB Commons Underway," *San Bernardino Daily Sun,* Jun. 10, 1971.

campus buildings, the architects designed the Commons on a more human scale and incorporated features such as wide expanses of glass, likely to soften its image.

The residence halls were constructed at the same time as the Commons building and were financed, in part, by a federal grant that was administered to the college from the Department of Housing and Urban Development (HUD). The grant was associated with a HUD program that was intended "to help colleges provide adequate housing facilities for their students and faculty."[45] Rather than consolidating students into one or two high-rise dormitories, as had been done at other state college campuses, the plan for San Bernardino called for the construction of eight smaller-scale residence halls that held fifty students apiece and more closely resembled small apartment houses than large institutional buildings. Designing on-site housing in this way reflected the will of students to maintain within the complex "a personalized, home-like atmosphere."[46] The complex was named "Serrano Village," and its eight residence halls were named for topographical features near San Bernardino. One residence hall was reserved exclusively for female students, and another was set aside for male students; the other six dormitories were co-ed. The eight residence halls and the Commons building were all completed in September 1972.[47]

Reflecting Pfau's commitment to academics and a well-rounded, liberal arts education, the bar was held high for the college's early enrollees. To graduate, students were required to complete a large number of general education credits, participate in a college-wide reading program, pass a writing proficiency examination, demonstrate proficiency in a foreign language and, finally, pass comprehensive exams for subjects associated with their respective major.[48] These requirements had been implemented at the college's inception to distinguish it from other state colleges and build its reputation as an academically rigorous

[45] "County Receives Housing Aid Loan," *San Bernardino Daily Sun,* Jul. 5, 1969.
[46] "CSCSB Becomes Residential Campus," *San Bernardino Evening Telegram*, Sept. 27, 1972.
[47] Burgess (2010), 87.
[48] "3-3 Plan Approved for New College," *Los Angeles Times*, Sept. 6, 1963; William Trombley, "Growth Eases Anxiety on Cal State Campus," *Los Angeles Times*, Nov. 27, 1972.

institution, or, as one faculty member put it, "the Dartmouth of the state college system."[49]

However, by the early 1970s it had become clear that these lofty aspirations simply did not coincide with the needs of the college's applicant pool, most of whom came from wither working or middle-class backgrounds and were seeking a career-oriented degree rather than a liberal arts education. Bluntly stated by one biology professor, "we had a white collar college in a blue collar town," and the college, which was intended to provide opportunities to the residents of nearby communities, was seen by the people it was supposed to serve as elite and "snobbish."[50] This identity crisis was compounded by the fact that enrollment at the college fell far below initial projections that had been set forth by the state. Little by little, the college's rigorous academic requirements were lifted and replaced with a more conventional curricular framework. The campus-wide reading program, the writing proficiency test, and all comprehensive exams had been shelved just a few years after they were first implemented. In 1972, campus officials announced a major restructuring of the institution's graduation requirements to better accommodate the practical, career-oriented goals of prospective students and bolster enrollment.

New construction on campus essentially ground to a halt as the 1970s progressed, owing to enrollment numbers that were far less than projected and sharp reductions in state funding. Nonetheless, plans moved forward for a new complex near the main entrance to campus that would be a center for the visual and performing arts. Named the Creative Arts Building, the complex was designed by Carl Maston of Los Angeles, a prolific architect who was "known for his stark modern style and inventive use of concrete structural solutions."[51] Maston's portfolio included an array of residential, commercial, and institutional commissions, and in addition to his work at the San Bernardino campus he had recently designed the School of Environmental Design at Cal Poly Pomona, which was completed in 1971. For the Creative Arts Building, Maston utilized a simple palette of exposed aggregate juxtaposed by wood trim that complemented the architecture of the adjacent library and other early structures on campus. The

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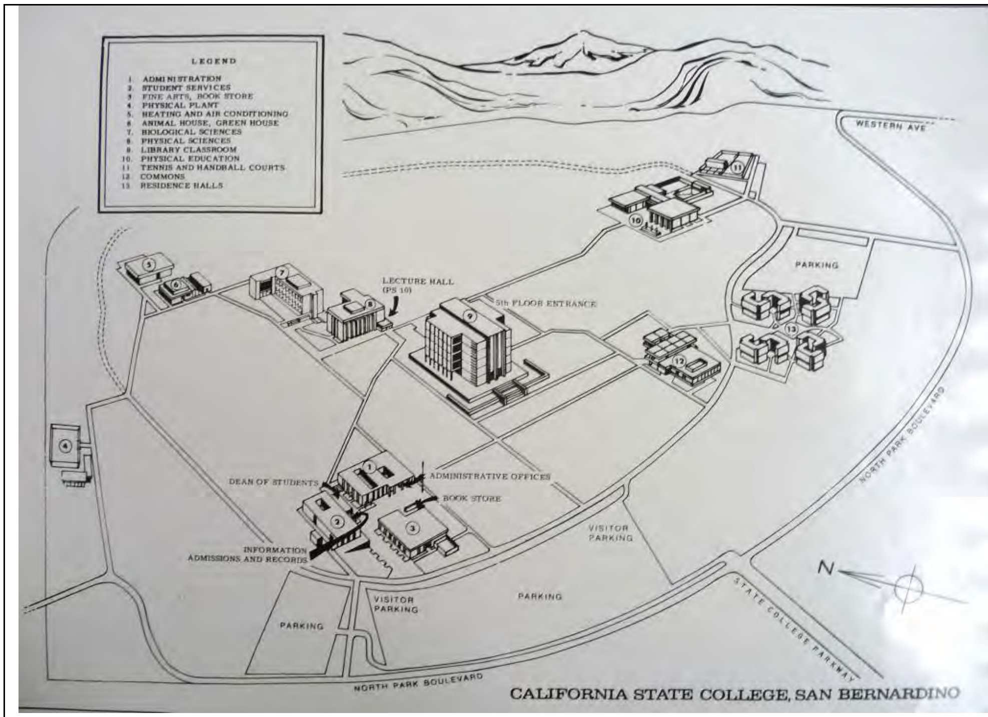
[49] William Trombley, "Growth Eases Anxiety on Cal State Campus," *Los Angeles Times*, Nov. 27, 1972.
[50] Ibid.
[51] "Finding Aid for the Carl Maston Papers," University of Southern California, 2011.

complex was designed to house "a 250-seat recital hall, classrooms, an experimental theater, music and drama faculty and staff offices, and choral and instrumental rehearsal rooms."[52] When it was completed in 1977, the complex marked a notable new addition to the campus and anchored the mall to the south of the campus library – a feature of campus that had been called out in the original master plan.

Also in 1977, the Santos Manuel Student Union was completed on the east side of the main quadrangle. This building has since been completely remodeled.

Aside from the Health Clinic in 1979 and the Children's Center built in 1980, there was little or no major new construction after that point until 1988, when the construction of the Faculty Office Building kicked off a new era of construction. The campus grew steadily with larger buildings throughout the 1990s and 2000s. At this point in time, over half of the square footage on the campus has been constructed since 1990, including University Hall on the main quadrangle, a Visual Arts Center, Chemical Sciences Building, Arroyo Village housing, and two large parking structures in the northeast and northwest corners of the campus.

[52] "Creative Arts Building Funds Allocated in State's 1974-75 Budget," *The Bulletin*, Jul. 12, 1974.



Birds-eye view of buildings that were present on the campus as of c. 1975 (CSUSB Facilities Archives)

4.3 Architectural Context

Like many college campuses that were developed after World War II, the architectural context of California State University, San Bernardino is rooted in the tenets of Late Modern architecture. The term “Late Modern” is used to describe an offshoot of Modernism that came about in the late 1950s and remained popular into the 1980s. It developed as a reaction to trends in Modernism, and particularly to the immense popularity of Mid-Century Modernism in the years after World War II. As Mid-Century Modern architecture became increasingly popular and could be found in virtually every city across the nation, some architects grew weary of its ubiquity. These practitioners experimented with a new take on Modernism that incorporated more sculptural qualities, overtly bold geometries, and a rich variety of materials and textures. Their experiments coalesced into an identifiable aesthetic that became known as the Late Modern style. The style was almost always applied to commercial and institutional buildings and was championed by architects such as Marcel Breuer, Philip Johnson, and Cesar Pelli.

Several buildings on the campus are best described as Brutalist in style. Brutalism is a subset of Late Modern architecture that was commonly applied to public and private institutions between the late 1950s and early 1970s. The style takes its name from the French phrase *béton brut* or "raw concrete," a concept that was made popular through the pioneering work of Le Corbusier. Buildings designed in the Brutalist style are generally characterized by monumental massing and a "heavy" appearance; the use of fluid and rough-textured concrete as a signature design element; the integration of bold, angular shapes and geometric forms; the expression of structural materials; and the integration of building and environment.[53]

Albert C. Martin and Associates' master plan for California State College, San Bernardino called for a cohesive architectural vocabulary that would be replicated across the campus, and would help to tie its various buildings and facilities together as a unified whole. President Pfau described the architectural vision for the campus in 1964, before any buildings or site improvements had been built. "We want a softer feeling to blend the college into the mountain background…[and] we're trying to stay away from shiny, glossy, metallic materials."[54] Poured concrete was selected as the basic material that would be incorporated into all campus and would act as the fundamental element of its architecture.[55] Not only was concrete a remarkably durable material that would withstand the test of time and the area's notorious winds; it also commanded a sense of respect that was seen as appropriate for an institution that prided itself on academic excellence and aspired to position itself as one of California's most elite public colleges.

The architectural vocabulary articulated in the master plan is manifest in the campus's first round of permanent buildings. The Biological Sciences Building (Albert C. Martin and Associates, 1967), the adjacent Physical Sciences Building (Heitschmidt and Thompson, 1967), and the Physical Education Building (Ladd and Kelsey, 1968) are all defined by their heavy, blocky massing and their abundance of concrete. Each building was designed by one or more noted architects who were known for their skillful application of Modernism,

[53] "Brutalist Architecture," accessed Dec. 2016.
[54] Harvey Feit, "New State College Seen as Area's 'Showplace,'" *San Bernardino Daily Sun,* Oct. 15, 1964.
[55] Ibid.

underscoring the importance that architecture and design had on the early campus. These buildings are all best described as Brutalist in style, owing to their raw and imposing appearance.

Responding to criticism that the college was too elite, campus officials rolled back many of the stringent graduation requirements in the early 1970s and sought to soften the college's image and make it appealing to a broader cross-section of students. This shift is reflected in the design of major campus buildings that were erected at this time. The John M. Pfau Library (1971, William F. Cody, with Criley & McDowell), the Commons Building (1972, Dorman-Munselle Associates), and the Creative Arts Building (1977, Carl Maston) all continue to utilize cast concrete as a basic building block as specified in the Campus Master Plan. However, these buildings incorporate a variety of other textures, materials, and geometric forms that render them less imposing than their Brutalist counterparts. These buildings are all examples of the Late Modern style as applied to an institutional campus.

The CSU San Bernardino campus dates to a period of explosive growth in California's institutions of higher education. There was a corresponding boom in institutional architecture, which produced a number of campuses of architectural note. Other campuses statewide followed similar patterns, to varying degrees of success in the designs themselves.

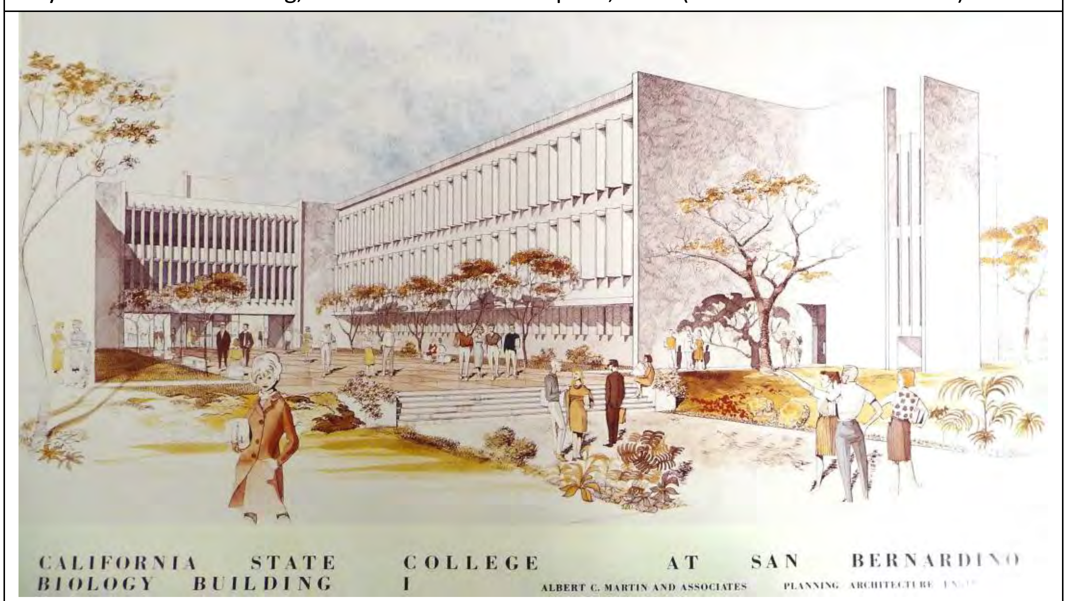
The campus master plan for the California State College at San Bernardino, designed by the noted Los Angeles architectural firm of Albert C. Martin and Associates, envisioned a generally circular campus ringed almost entirely by surface parking lots. In its growth to date, campus development has followed this plan. The entrance to the campus from the south via University Parkway leads to a northward view across the main quadrangle, with the John M. Pfau library situated prominently at the head of the quad with a dramatic backdrop of the San Bernardino Mountains behind.

The following illustrations, starting with the Master Plan diagram, are renderings from the CSUSB Facilities Dept. archives that were created for each building as they were proposed. The consistent style of the renderings draws the architects' concepts for the various buildings together into a cohesive vision of the atmosphere on campus that would be created by the Late Modern architecture. Most reveal some importance placed on the setting of the buildings adjacent to the mountains, the extension of building space into plazas and courtyards, and the character of trees of distinctive shapes and textures to set off planar surfaces.

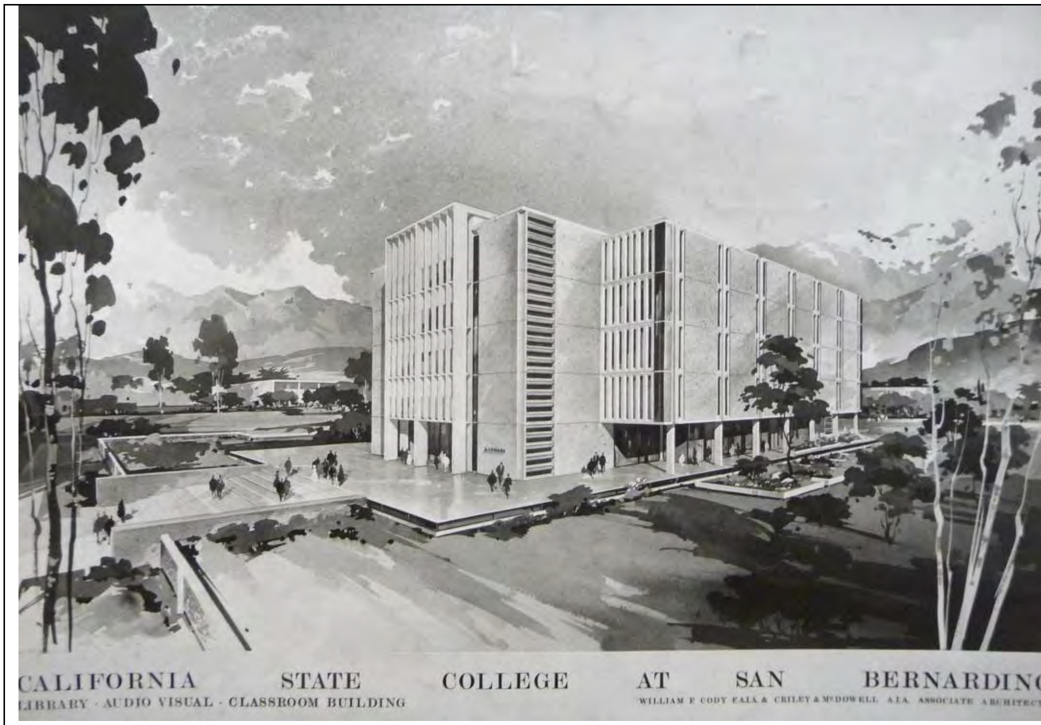
Campus Master Plan, Albert C. Martin and Assoc., 1967 (CSUSB Facilities Archives)

Sierra, Chaparral, and Administration Halls, General Services Dept., 1964 (CSUSB Facilities Archives)

Physical Sciences Building, Heitschmidt and Thompson, 1967 (CSUSB Facilities Archives)



Biological Sciences Building, Albert C. Martin and Assoc., 1967 (CSUSB Facilities Archives)



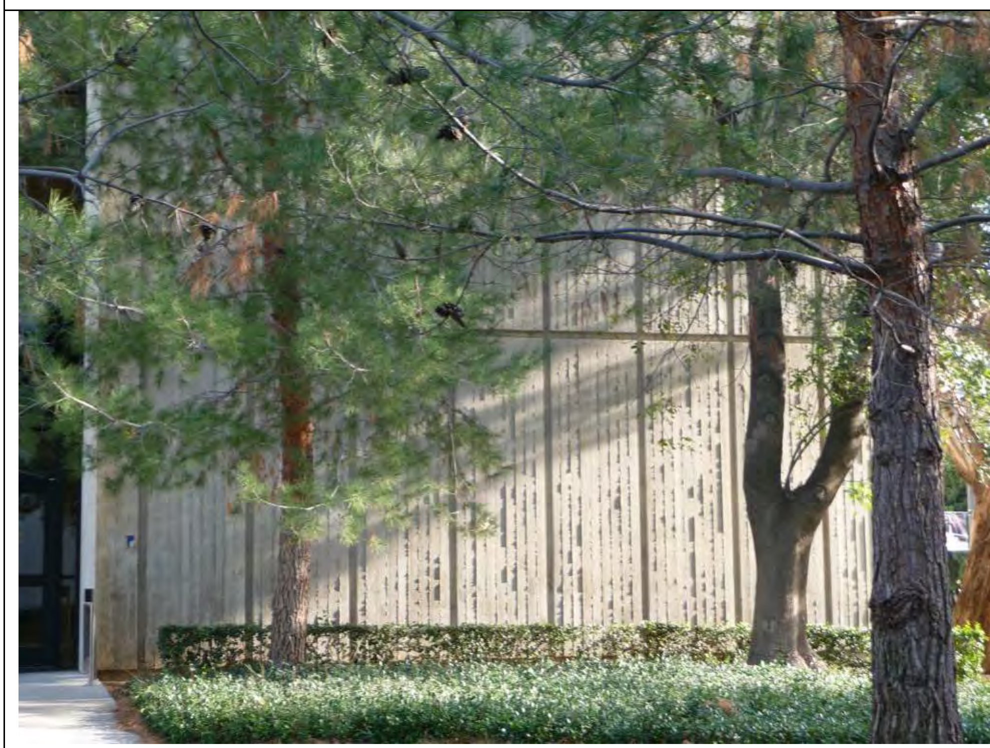
Library, Audio Visual and Classroom Building (John M. Pfau Library), William F. Cody, FAIA (Criley & McDowell, Associate Architect), 1971 (CSUSB Facilities Archives)

Creative Arts Building (Performing Arts), Carl Maston, FAIA, Architect, 1977 (Carl Maston Papers, USC)

The following images illustrate the current appearance and details of the Biological and Physical Sciences buildings and the Commons (Dorman-Munselle, 1972). While these buildings are not impacted by the Master Plan, they are important for understanding the architectural context of the John M. Pfau Library and the Performing Arts Center, and as points of comparison with those two properties. The Physical Sciences and Biological Sciences buildings in particular are excellent examples of Brutalist institutional architecture and may also be eligible for the California Register for their architectural significance. The Commons represents a different strain of Modernism and dates to a period when the original Master Plan architects, Albert C. Martin and Associates, ceased to control the direction of campus architecture; they were replaced as campus architect in 1968 by Dorman-Munselle.

Physical Sciences building, 1967, as approached from Library, view northwest.

Physical Sciences, courtyard enclosed by stone walls at east entrance to building, view north.



Physical Sciences, detail of concrete texture on west side of the building.

Biological Sciences building, 1967, main facades view north.

Biological Sciences, detail of concrete finish and "fins" at windows, west façade.

Commons, 1972, view west.

Commons, view southeast.

4.4. Significant Campus Architects

This section discusses primarily those architects whose work is evaluated for significance as resources under CEQA. Other architects' work was present on the early campus, and some of their work may be significant, such as the Physical Sciences Building (1967) by Heitschmidt and Thompson and the campus landscape by Eckbo, Dean and Williams. Those potential resources are not impacted by the Master Plan, however, so they are not profiled here.

William F. Cody, FAIA

William Francis Cody (1916-1978) was an influential architect who is best known for designing a number of distinctive Modern buildings in and around Palm Springs. Cody studied architecture at the University of Southern California and received his bachelor's degree in 1942. He then worked as a draftsman for Cliff May, considered to be the "father of the modern Ranch house." During the time he spent with May, Cody developed an appreciation and aptitude for functional and efficient design – both hallmarks of Modern architecture. Cody's career in Palm Springs began when he was hired as a staff architect for the Desert Inn, a popular tourist destination, in 1946. He opened his known architectural practice, William F. Cody and Associates, in 1947. Also that year, Cody designed his own residence in Palm Springs, which embodied the architectural qualities he valued the most: openness, variation, simplicity, and elegance.

Cody capitalized on Palm Springs's growing reputation as a retreat for the rich and famous in the postwar era. His practice became one of the most prolific in the area, and Cody became well-known for his impeccable attention to detail and his eccentric style, which blurred the lines between indoor and outdoor spaces and often incorporated quirky or dramatic elements such as broad, extended rooflines or sculptural canopies. He became intimately acquainted with the "country club" culture of the Coachella Valley, and accordingly many of his commissions consisted of custom residences, clubhouses and recreational facilities, hotels, restaurants, and other tourist-oriented attractions. Cody had joined the American Institute of Architects (AIA) in 1948, and in 1965 was inducted as an AIA Fellow.

Cody's career is most closely associated with the mid-century residential and commercial architecture of Palm Springs. However, his portfolio of country clubs and custom residences led to other commissions elsewhere in California, and also in places as far away as Arizona, Texas, Mexico, and Cuba. Later in his career, he designed a handful of notable institutional projects including St. Theresa Catholic

Church and Covent (1966-68) and the Palm Springs Public Library (1973), both in Palm Springs. Cody, however, was not known as an institutional architect, and his institutional commissions were somewhat few and far between. The Library-Classroom Building at California State College, San Bernardino (1971) was one of relatively few large institutional commissions attributed to Cody. He suffered a debilitating stroke in 1973, which brought an untimely end to his architectural career. Cody died in 1978.

Criley & McDowell

Criley & McDowell was a Claremont-based architectural practice that designed numerous buildings in and around Claremont after World War II. At the helm of the firm were architects Theodore Criley, Jr. (1905-1984) and Fred McDowell (1922-2002), both of whom were versed in Modernism. Criley, the son of a well-known painter, studied at Stanford University, the USC School of Architecture, and the Massachusetts Institute of Technology. He opened his own architectural practice in Los Angeles in 1936, but left his practice during World War II to work as a draftsman for the military. After the war, Criley returned to his practice and moved it to Claremont in 1951. The following year, a young architect named Fred McDowell came to work in Criley's office. A native of Riverside, McDowell matriculated at the University of Southern California, and after receiving his degree in architecture he worked briefly in the office of renowned architect Richard Neutra. McDowell became Criley's business partner in 1957.

Criley & McDowell designed numerous buildings in Claremont and its environs, and became known as purveyors of a local iteration of Modernism. Criley was primarily focused on institutional projects, while McDowell was more interested in the design of custom residences, so the firm's portfolio consisted almost entirely of residential and institutional commissions. Most of the residences that are attributed to the firm are custom-designed, single-family dwellings that incorporate the post-and-beam method of construction and other popular elements of Mid-Century Modern design. In 1964, the firm undertook one of its most notable commissions: a house in Claremont that was built entirely of precast concrete and glass. Known as the Claraboya House, it was one of several houses in Southern California that were built as part of the Horizon Homes program, a design competition that was sponsored by cement companies in the early 1960s and emulated the popular Case Study program. The Claraboya House won accolades for its innovative design, and received the Western States Horizon Homes Award in 1964.

On the institutional front, Criley & McDowell designed a number of churches and were involved in planning and design projects at several of the Claremont Colleges. In the late 1950s, the firm worked in collaboration with noted architects Pereira and Luckman of Los Angeles to develop a master plan for the Claremont School of Theology, and later played a similar role in the master planning of Pitzer College. Between the 1960s and 1970s, the firm also designed new buildings at Pitzer College, Scripps College, and the Claremont Graduate University, and renovated several buildings at Pomona College. Criley & McDowell, then, had considerable experience working in institutional settings when they were selected to work with architect William F. Cody on the Library-Classroom Building (1971) at California State College, San Bernardino. Criley & McDowell's partnership remained active until Criley's death in 1984.

Carl Maston, FAIA

Carl Louis Maston (1915-1992) was a prolific architect who left an indelible imprint on the architectural landscape of post-World War II Los Angeles. Born Carl Mastopietro, he received a Bachelor's degree in architecture from the University of Southern California in 1937. He was later honored by the school with a Distinguished Alumni Award in 1989 for his myriad contributions to the field. He worked with several noted local architects including Floyd Rible, A. Quincy Jones, and Frederick Emmons, and became versed in architectural Modernism before opening his own practice, based in Beverly Hills, in 1946.

Over the next forty years, Maston designed hundreds of buildings in Southern California for a range of clients. Unlike some of his peers, Maston refused to be pigeon-holed into any particular type of project, but rather incorporated residential, commercial, and institutional commissions into his repertoire. Early in his career, Maston dabbled in the design of garden apartments, a housing prototype that was seen as uniquely suited to the context and climate of Southern California, and in collaboration with architect Ray Kappe he designed a pair of garden apartments in West Los Angeles that featured a small, enclosed courtyard for each unit. He also designed a number of custom residences, apartments, corporate office buildings and industrial plants, banks, grocery stores, shopping centers, military housing, and an ice skating rink in the San Fernando Valley that is considered to be one of his more notable works. Maston's style was defined by its starkness, and for its frequent and inventive application of structural concrete. Maston appears to have been most prolific in the 1950s and '60s, though his career spanned decades.

Maston was certainly no stranger to institutional work, and as his career progressed many of his commissions were completed for large institutional clients. Notable projects in this vein include the campus of Emelita Elementary School in Encino for the Los Angeles Unified School District (1970), and a building for Cal Poly Pomona's School of Environmental Design (1971). The latter is regarded as one of the finest examples of Maston's work, demonstrating how through various scales, textures, and volumes he used structural concrete to create spaces that were both functional and aesthetically pleasing.

Most likely due to the accolades that his work at Cal Poly Pomona won, Maston was selected to design the Creative Arts building for California State University, San Bernardino, which was completed in 1977. Maston remained active, teaching at USC and accepting the occasional project, until his death in 1992.

Albert C. Martin and Associates

Based in Los Angeles, Albert C. Martin and Associates is widely recognized as one of Southern California's oldest and most prolific architectural practices. The firm began in the early twentieth century when its namesake, Albert C. Martin, Sr. (1879-1960), moved from Illinois to Los Angeles. Martin arrived with a degree in architectural engineering from the University of Illinois and some construction experience. His first big job came in 1906, when he oversaw construction of the massive Hamburger's Department Store in Downtown Los Angeles. By 1908, Martin founded his own architecture and engineering firm, which subsequently received dozens of high-profile commissions for churches, offices, and municipal buildings across Los Angeles. Working on projects such as the Million Dollar Theatre (1918), Los Angeles City Hall (1928), and the May Company Department Store on Wilshire Boulevard (1938) solidified Martin's reputation as one of Southern California's go-to architects.

The postwar development boom in Southern California provided ample new work for A.C. Martin. The firm had emerged from the Great Depression as one of the most recognized and trusted names in architectural in Los Angeles, as proven by the numerous commissions it was awarded in the post-World War II period. Its portfolio included everything from churches and offices, to municipal buildings, corporate office plazas, industrial plants, and institutional campuses. The firm was known for taking on projects that were complex and multi-faceted. Martin gradually ceded control of the firm to sons Albert Jr. and Edward, who took control of the practice after the senior A.C. Martin died in 1960.

Under the direction of Albert Jr. and Edward, the firm became well-known for its rational and austere approach to architecture that took the tenets of the International Style and adapted them to corporate and institutional contexts. Colleges and universities also constituted a sizable portion of A.C. Martin's client base in the postwar period. In addition to developing the first campus master plan for California State College, San Bernardino (1960), the firm was engaged to design new buildings for the University of Southern California, Loyola Marymount University, and other institutions. In the 1960s, A.C. Martin received a notable commission when it was retained to develop a master plan for a planned community of 70,000 in the western reaches of Los Angeles County, which is now known as Westlake Village. The firm is now in its third generation of family leadership and is known today as A.C. Martin Partners.

5. State Eligibility Criteria

5.1 California Register of Historical Resources

The California Register of Historical Resources (California Register) is the authoritative guide to the state's significant historical and archeological resources. In 1992, the California legislature established the California Register "to be used by state and local agencies, private groups, and citizens to identify the state's historical resources and to indicate what properties are to be protected, to the extent prudent and feasible, from substantial adverse change."[56] The California Register program encourages public recognition and protection of resources of architectural, historical, archaeological and cultural significance; identifies historical resources for state and local planning purposes; determines eligibility for historic preservation grant funding; and affords certain protections under CEQA. All resources listed on or formally determined eligible for the National Register are automatically listed in the California Register. In addition, properties designated under municipal or county ordinances, or through local historic resources surveys, are eligible for listing in the California Register.

[56] California Public Resource (CPR) Code, Section 5024.1 (a).

For inclusion in the California Register, a historical resource must be significant at the local, state, or national level under one or more of the following criteria:

1. It is associated with events or patterns of events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States; or

2. It is associated with the lives of persons important to local, California, or national history; or

3. It embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of a master, or possesses high artistic values; or

4. It has yielded, or has the potential to yield, information important to the prehistory or history of the local area state or the nation.[57]

For listing in the California Register, a property must be eligible against one or more of the above criteria, and it must retain integrity. Integrity is the authenticity of a historical resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance. For inclusion in the California Register, "historical resources must retain enough of their historic character or appearance to be recognizable as historical resources and to convey the reasons for their significance."[58] Integrity is evaluated with regard to the retention of the following seven aspects: location, design, setting, materials, workmanship, feeling, and association.

There is no prescribed age limit for listing in the California Register, although California Register guidelines state that "sufficient time must have passed to obtain a scholarly perspective on the events or individuals associated with the resource."[59]

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[57] California Public Resources Code SS5024.1, Title 14 CCR, Section 4852.
[58] California Office of Historic Preservation, *Technical Assistance Series #6,* 2.
[59] California Office of Historic Preservation, *Technical Assistance Series #6,* 3. According to the *Instructions for Recording Historical Resources* (Office of Historic Preservation, March 1995), "Any physical evidence of human activities over 45 years old may be recorded for purposes of inclusion in the OHP's filing system. Documentation of resources less than 45 years old may also be filed if those

Resources may be nominated directly to the California Register. They are also automatically listed in the California Register if they are listed in or have been officially determined eligible for the National Register. State Historic Landmarks #770 and forward are also automatically listed in the California Register.[60]

5.2 City of San Bernardino Historical Criteria

In addition to federal and state programs, the City of San Bernardino administers a historic preservation program that applies to the treatment and management of significant historic and cultural resources that are located in the city. The City does not have eligibility criteria as such, but maintains an inventory of historic properties based on a historic resources survey that was completed in 1991 and includes only properties constructed prior to 1942. The earliest CSUSB campus buildings were constructed over twenty years after that time. While CSU San Bernardino is located within the San Bernardino city limits, it is an entity of the state and is not subject to local land use controls. Therefore, ARG did not evaluate resources on the CSU San Bernardino campus for their local eligibility.

6. Evaluation of Historical Significance

6.1 Previous Evaluations and Studies

A search of California's Historic Resources Inventory (HRI) did not reveal any properties on the CSUSB campus that have been identified as potential historic resources. No surveys or other evaluations of campus buildings have been prepared previously.

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resources have been formally evaluated, regardless of the outcome of the evaluation." This 45-year threshold is intended to guide the recordation of potential historical resources for local planning purposes, and is not directly related to an age threshold for eligibility against California Register criteria.

[60] State of California, Office of Historic Preservation, Department of Parks and Recreation, California Office of Historic Preservation, *Technical Assistance Series #5: California Register of Historical Resources: The List Process,* 1.

The oldest buildings on the campus date to 1964, and so are now over 45 years of age. This age is a common threshold for consideration of a building's historical significance under the California Register, but the program does not have an age limit as such. The National Register of Historic Places, by comparison, requires that a resource be fifty years old or older for listing unless it is demonstrated to be exceptionally significant. The intent of an age threshold is to ensure that enough time has passed to consider a property in its proper historical context with the attendant body of scholarly work having developed to guide its interpretation.

Four buildings or clusters of buildings were identified for evaluation in this report due to the age they will attain during the horizon of the Master Plan, through 2035. Included in this evaluation are only those properties that will be fifty years of age at that time – i.e., constructed prior to 1985 – and which appear to have potential impacts under the Master Plan. No properties on the campus constructed close to the 1985 threshold are known to have any potential for exceptional significance. The properties are discussed below in order of their construction, as follows:

Sierra, Chaparral and Administration Halls	1964	(currently 52 years old)
John M. Pfau Library	1971	(currently 45 years old)
Serrano Village	1972	(currently 44 years old)
Performing Arts Center	1977	(currently 39 years old)

6.2 Evaluation of Significance

6.2.1 Sierra, Chaparral and Administration Halls

These three original buildings of the campus, built in 1964, are evaluated together as a complex due to their having been designed and built as a unit to provide the initial building space for the functioning of the campus in its earliest years. Further, these buildings were not meant to be permanent; a 1966 article notes that the upcoming Biological Sciences building, designed by Albert C. Martin and Associates, would be "the first permanent structure for the campus."[61]

Criterion 1: Association with a significant event or pattern of events.

The founding era of a college or university is, naturally, a significant milestone in its institutional development. However, only in a few cases do the buildings associated with this milestone convey significant information about the institution and its greater potential importance. These three buildings were not intended to form the identity of the institution over the long term or to reflect its future capacity. This is evidenced by their modest size and their secondary location in the original Master Plan for the campus. While the establishment of the college was significant for the local culture and development of the region, these three buildings do not convey any such significance in a meaningful way. Therefore, this early complex of buildings does not appear significant under Criterion 1.

Criterion 2: Association with the life of a significant person.

While John M. Pfau was clearly the driving force behind the formation of San Bernardino State, his work in shaping the institution is not reflected in these buildings, which are a fairly utilitarian product of their use and their time and, as noted above, were not intended to form the identity of the institution over the long term. Therefore, they do not appear significant under Criterion 2.

Criterion 3: Embodies the distinctive characteristics of a type, period, or method of construction or possesses high artistic values, or represents the work of a master.

Sierra, Chaparral, and Administration Hall were designed by the Office of the State Architect to serve as a modest, functional fulfillment of the earliest facilities needs of the college. They appear on the Master Plan by Albert C. Martin and Associates (at which point they were already planned or built) but they are not a part of the more visible main quadrangle, where buildings like the library, performing arts center, and student union were more prominently located. While they have been altered very little and retain their early 1960s appearance, they

[61] "March Aim for State College Construction," *Los Angeles Times*, Jan. 2, 1966.

are not prominent campus buildings, they are not associated with a significant architect, and they do not represent any significant achievement from an aesthetic or innovative standpoint. They are typical of the period and indistinguishable from many other similar buildings at other high school and colleges campuses throughout the state. Therefore, they do not appear significant under Criterion 3.

6.2.2 John M. Pfau Library

Criterion 1: Association with a significant event or pattern of events.

The Library is an important feature of the campus and contains a significant function for the University. However, nearly every higher education campus has such a building, and generally they are not "associated with events that have made a significant contribution" to local or regional history. A single building is generally unable to convey any significance of the institution as a whole that would be meaningful under Criterion 1 beyond the institution itself. While construction of the Library was the result of the establishment of the state university system, for instance, the building does not represent a "significant contribution" to our understanding of that context, and was built in 1971, not at the inception of the program. The building is not significant under Criterion 1.

Criterion 2: Association with the life of a significant person.

John M. Pfau was clearly a significant figure in the early history of the University. However, this building bears his name for commemorative purposes -- dedicated to him upon his retirement in 1982 -- and not because of any special connection to his active professional life at the University. His involvement with the library was not any more notable than his involvement and leadership in other areas of academic resources or in the construction of other campus buildings. The building is not significant under Criterion 2.

Criterion 3: Embodies the distinctive characteristics of a type, period, or method of construction or possesses high artistic values, or represents the work of a master.

The John M. Pfau Library stands as the most prominent building on campus at the head of the main quadrangle with a backdrop of the San Bernardino Mountains.

The Library is a significant building by William F. Cody, most of whose work is located in the Palm Springs area. His work spans a number of building types, notably residences and hotels, with some commercial and institutional buildings.

This is one of his larger commissions, and shows an attention to detail within a large institutional building that brings a human quality to the building type.

The Library is also a very good example of the Late Modern style of architecture, exhibiting many key characteristics that define the style. The characteristics of Late Modernism are in evidence in the siting, massing, materials, and features of the building, as described below.

Determining Significance Thresholds

To determine whether a property rises to a level of architectural significance under Criterion 3, we refer to the National Park Service literature for applying the National Register of Historic Places criteria (particularly for Criterion C which is similar to California Register Criterion 3), which form the basis for the California Register criteria. The National Register is thought to have a higher threshold for significance, and notes that under Criterion C, a property must “represent the work of a master.” It is not necessary that it be, for example, an *exceptionally* significant work by a particular architect, but it must be *a work that effectively communicates why and in what way that architect’s work is notable*, what it consisted of, and how the office approached a particular problem.

Regarding “Distinctive Characteristics of Type, Period, and Method of Construction,” National Register Bulletin 15 notes the following:

> This is the portion of Criterion C under which most properties are eligible, for it encompasses all architectural styles and construction practices. To be eligible under this portion of the Criterion, a property must clearly illustrate, through "distinctive characteristics," the following:
>
> - The pattern of features common to a particular class of resources,
> - The individuality or variation of features that occurs within the class,
> - The evolution of that class, or
> - The transition between classes of resources.
>
> *Distinctive Characteristics*: "Distinctive characteristics" are the physical features or traits that commonly recur in individual types, periods, or methods of construction. To be eligible, a property must clearly contain enough of those characteristics to be considered a true representative of a particular type, period, or method of construction.
>
> Characteristics can be expressed in terms such as form, proportion, structure, plan, style, or materials. They can be general, referring to ideas of design and

construction such as basic plan or form, or they can be specific, referring to precise ways of combining particular kinds of materials.[62]

The Library clearly "illustrates…the pattern of features common to a particular class of resources" as well as "the individuality or variation of features that occurs within that class." The relevant "class of resources" in this case is the Late Modern buildings of Southern California and the works of the architect William F. Cody. The "distinctive characteristics" referred to above are described below under the heading **An Example of Late Modernism.**

An Example of the Work of William F. Cody

In order to be significant within a class of resources, a property must provide significant information about the characteristics of that class. Within Cody's body of work, for example, there are few institutional buildings, and so an intact, substantial institutional commission such as the CSUSB Library is important to understanding the full output of his office.

Cody himself was involved in the correspondence over the development of the Library's design, and attended meetings to remain involved even as his collaborators, Theodore Criley & Fred McDowell, chastised him for running up the budget by doing so.[63] Correspondence indicates that Cody's office was involved in the initial designs and many revisions, and produced drawings that were passed on (late and over-budget, but with the attention to detail that Cody required) to Criley & McDowell throughout 1968.[64]

An Example of Late Modernism

The John M. Pfau Library is one of a small number of campus buildings that are critical to understanding the role that architecture played in defining the developing campus. While some are Brutalist in style with an expressive raw

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[62] National Park Service, "National Register Bulletin 15: How to Apply the National Register Criteria."
[63] Letter of Transmittal from William F. Cody to Criley and McDowell, 29 August 1969. William F. Cody Papers, Cal Poly San Luis Obispo Special Collections.
[64] Letter from Fred McDowell to William F. Cody, 11 March 1968. Letter from William F. Cody to Fred McDowell, 12 March 1968. William F. Cody Papers, Cal Poly San Luis Obispo Special Collections.

concrete exterior, such as the Biological and Physical Sciences Buildings, the Library has a more refined and monumental Late Modern appearance.

The Library served as the most important (as well as the first) component of the developing central quadrangle, due to its size, placement, and orientation. The campus was established on essentially raw land on the northern edge of San Bernardino between the incorporated city and the foothills, outside of the established street grid. The central quadrangle was conceived as part of the original Master Plan with a significant building at the head. A large building with a suitably monumental appearance was required to convey the appropriate image for the recently established institution. The symmetrical primary facade has an entrance at the top of broad steps; combined with battered, stone clad retaining walls and large planters, these form a plinth for the building on the front, where the land subtlety slopes southward. The entrance is on axis with the centerline of the quad. These architectural devises are used effectively to form the image and substance of the most prominent building on the campus.

Concrete was the favored material for Late Modern institutional buildings; here it is present in two contrasting textures and colors: a smooth buff color is used for the columns, window grids, and exterior ceilings and a rougher, light brown-colored concrete is employed for the panels that clad most of the building. The vertical striations cast into the concrete show a similar attention to concrete textures exhibited in the Brutalist-style science buildings constructed in the prior two to three years adjacent to the Library, but they are different from the raw quality associated with Brutalism. Here, the color is warmer, not the natural gray of concrete, and the striations are carefully patterned to produce a varied plane of ribs of differing widths and depths. This detail can be appreciated up close in the interior, where the same material and treatment is employed to clad the elevator core.

The exterior colonnades and breezeways on the sides of the building, recessed below the overhanging mass of the upper floors, are also characteristic of Late Modernism. Architects working in this mode often used abstracted classical elements to lend monumentality to a building, creating grand spaces that exhibit the emerging structural approaches to the use of concrete and other advanced materials or methods. When carried farther this type of 1960s abstract classicism is known as New Formalism, but in this example it is clearly recognizable as an element of the period and style that was also applied in a more generally Late Modern mode. The heaviness of the mass of the building combined with the relatively thin, light columns and openness of these high-ceilinged outdoor spaces produces a kind of tension that is often central to Late Modern architecture.

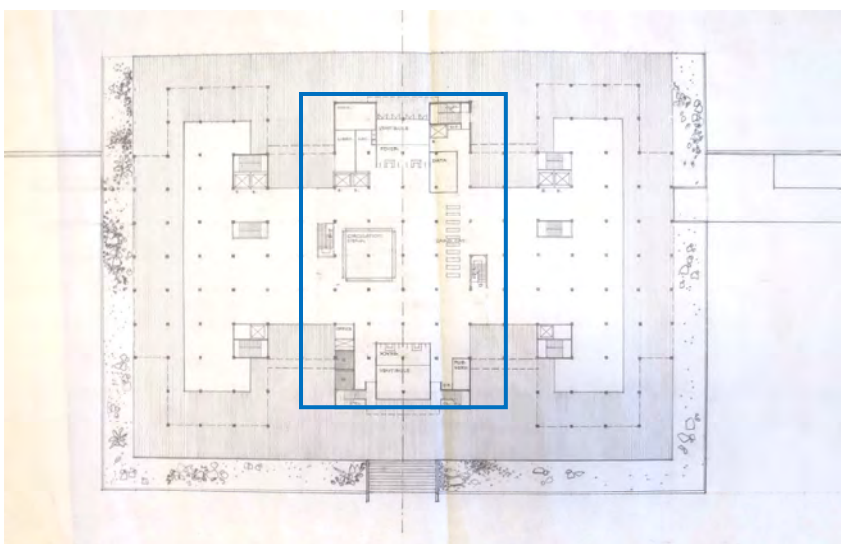
Bronze was used decoratively as an accent on the exterior for front and secondary doors; it represents another heavy and durable material and metal color characteristically favored in this type and period of building. Travertine, also popular in the period, adds stone accents with a vertical striation similar to that of the adjacent concrete, provides further variation in color and texture at the elevator core.

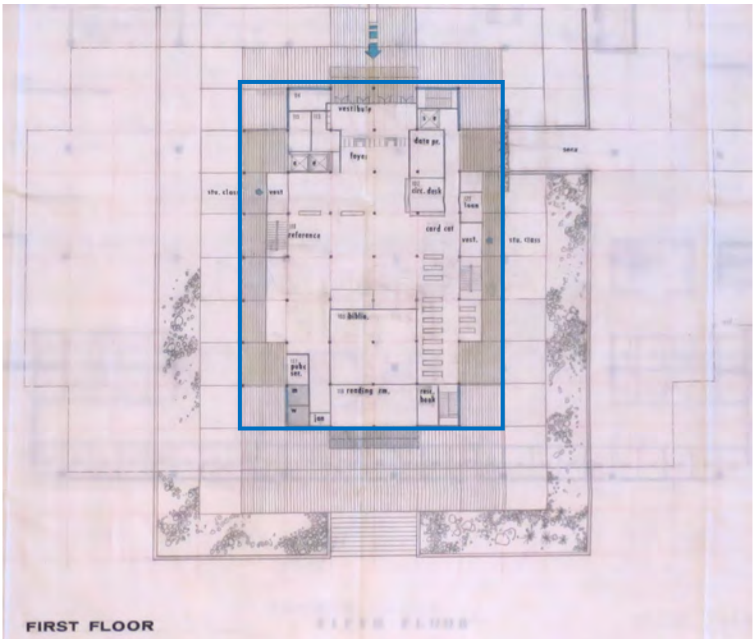
Characteristic of Cody's work, and somewhat unusual for Late Modernism, the building shows a direct relationship to its site and setting at the base of the foothills through the use of battered-profile retaining walls faced in the local stone (appears to be granite). While this motif was carried over from the earlier Physical Sciences building behind it, it also appears in Cody's work in Palm Springs, where he is best known and completed most of his projects. In both cases, he made use of local stone that was associated with the local landscape and geology.

Design of the West Side Addition

In 1994 a major addition was completed on the west side of the Library. Although it is attached to the original building and extends its full height, the addition is remarkably successful at leaving the volume of the original building and significant exterior features such as the west colonnade and the west side volume mostly intact. The architectural language of a light-colored, smooth-textured concrete for the expressed window grids (contrasted with the heavier corners in vertically striated, colored concrete) is derived from the original building and pulls away from the façade on the lower floors to shade a portion of the plaza. The addition takes many cues from the design of the original building (massing of the façade, materials, colors, fenestration treatment) in order to be compatible with it without being imitative, yet it also defers to the original building while creating its own identity through a convex curved front that embraces a plaza. The curving façade is both its own distinctive feature and also the device that allows it leave most of the original west façade disengaged. Therefore, although the addition is very large, it maintains the Library's historical integrity of design.

It appears from archival evidence that the Library was, in fact, designed for future additions to the east and west sides. An early first-floor plan for the Library included among other early plans in the William F. Cody Papers (the rest of which show the plan closer to the footprint and plan that were actually built) depicts the sides of the building expanded to provide a much larger continuous floor plate (the original building footprint, nine by seven column lines, is shown outlined in blue, added):





It must be noted, however, that the approach to expansion planned for the building in the late 1960s and the approach that is applicable to avoid significant adverse impacts under CEQA are not at all the same. While the plan above provides interesting information about the intent for the Library's future growth, it cannot be justified as a treatment for an historic resource. Its application to the current situation is limited. However, it can be seen in a view of the north façade of the building that the fenestrated panel of the recessed end of the building acts as a "hyphen" between the old building and the west addition in a way not unlike what was probably intended by the architects.

The John M. Pfau Library is the only building on the campus within the scope of this study that appears to be a historical resource for purposes of CEQA. As this building is planned for major additions, adverse impacts to the historical resource are anticipated according to the schematic proposal indicated in the Master Plan. Mitigation Measures in Section 7, below, discuss how an expansion of the library can avoid such impacts.

Character-Defining Features of the John M. Pfau Library

The library's architectural significance is defined by the features and materials of the building as described below. The National Park Service offers the following definition of character-defining features:

> Character refers to all those visual aspects and physical features that comprise the appearance of every historic building. Character-defining elements include the overall shape of the building, its materials, craftsmanship, decorative details, interior spaces and features, as well as the various aspects of its site and environment.[65]

The character-defining features of the John M. Pfau Library include the following:

- Site features: battered stone retaining walls (south side) and planters, including large planter (no historic plant material noted) integrated with front steps.
- Rectangular box-shaped massing, stepped in plan.
- Flat roof with parapet
- Contrasting color of exterior concrete, light brown (unpainted) and buff
- Contrasting textures of rough, striated light brown concrete and smooth buff concrete
- Contrast of solid wall surfaces and gridded panels of fenestration and their articulation

[65] Lee H. Nelson, Preservation Brief #17: Architectural Character—Identifying the Visual Aspects of Historic Buildings as an Aid to Preserving their Character, (Washington DC: National Park Service) 1.

- Open breezeways at ground floor (all sides) under the overhang of upper floors, supported at outer edge by simple columns
- Concrete waffle grid ceilings exposed in exterior covered areas
- Bronze, wood, and glass decorative entrance doors at north entrance; missing at south entrance
- Bronze decorative secondary entrance doors, throughout (e.g., at stairwell egresses)
- Bronze transom panels over main doors (intact on north and south sides)
- Interior: open central main floor with gridded, illuminated ceiling
- Interior: striated concrete facing at elevator block
- Interior: stone facing at elevator block
- Interior: display case east of elevator block on main floor

6.2.3 Serrano Village Housing Complex

Criterion 1: Association with a significant event or pattern of events.

Information available about the Serrano Village complex indicates that it was designed around the latest functional concepts in student housing. A series of communal "houses" were accommodated within the larger buildings to house up to ten students each, "emphasiz(ing) individuality and personal freedom as much as possible in a young adult community." The complex broke from the traditional dormitory model (described as a "massive impersonal hall") in which individual or shared rooms might be located off a central corridor with communal spaces used by all residents. The more "home-like" model offered was intended to combat the anonymity of the dormitory and create more intimate associations among smaller groups of students while still providing the opportunity for a broader social circle within the wider complex.[66]

The college was clearly aware of this important change in student housing models. On other contemporary public university campuses such as UC Santa Cruz and UC San Diego, the state's leading architects were giving form to the new

66 "San Bernardino State gets first housing," Daily Facts (Redlands, Calif), 29 September 1972, A3.

structure and organization of college life from academics to residential life. While Serrano Village was designed for social interaction, it cannot be held up as a model or an innovative example of this trend, and more accurately indicates that statewide academic trends were present here as the campus thought about how to organize its first residential grouping. Serrano Village is not significant under Criterion 1.

Criterion 2: Association with the life of a significant person.

Research did not reveal any particular person who is associated with Serrano Village in its conception or in its use as a residential housing group. The complex is not significant under Criterion 2.

Criterion 3: Embodies the distinctive characteristics of a type, period, or method of construction or possesses high artistic values, or represents the work of a master.

Serrano Village was a part of a trend, as noted under Criterion 1, that brought students together in more home-like settings within the larger institutional context. At the same time, it was modest and functional on an architectural level, and appears to have been built very inexpensively to fill the earliest housing needs of the college. The housing facilities buildings that appear on the Master Plan by Albert C. Martin and Assoc. in this location were to be more ambitious cruciform towers. While Serrano Village appears to have been altered very little and retains its late 1970s appearance, these are not prominent campus buildings, they are not associated with a known architect or designer, and they do not represent any significant achievement from an aesthetic or innovative standpoint; they are credited to a construction company, Viking Co. of Laguna Beach, but no designer is noted. The level of architectural interest in the buildings is comparable to that of an apartment building of the period set within an ample and attractive landscape. They are typical of the period and contain some characteristic flourishes of the 1970s in basic materials, such as the diagonal siding, but they are not a good example of general trends in architectural design from the period. Therefore, they do not appear significant under Criterion 3.

6.2.4 Performing Arts Center

The Performing Arts Center is thirty-nine years old; it will be 58 years old in 2035 at the end of the current Master Plan period.

Criterion 1: Association with a significant event or pattern of events.

A Performing Arts Center can be an important component of a university's academic program. It is not clear, however, that the program at CSU San Bernardino achieved an unusual level of distinction or local importance during the early years of the institution, which can be defined as its early period of establishment and growth prior to 1977. The property is not significant under Criterion 1.

Criterion 2: Association with the life of a significant person.

There is no known singular figure in the arts at the University whose leadership or prominence is associated with this facility or the programs that it has housed. Therefore, the property is not significant under Criterion 2.

Criterion 3: Embodies the distinctive characteristics of a type, period, or method of construction or possesses high artistic values, or represents the work of a master.

The Performing Arts Center was built later in the college's early building period, but a building for this use appears in schematic form on the Master Plan by Albert C. Martin and Assoc. in this location as one of the principal buildings on the main quadrangle. The building's exterior appears to have been little altered aside from the addition on the front of a box office c. 2000. It generally retains its late 1970s appearance. The building was designed by Carl Maston, who is widely regarded as a master architect of the post-WWII period. Full documentation of the building is included in the Carl Maston Papers housed at the USC Architecture and Fine Arts Library. From these documents, the original concepts for the building's function and appearance can be discerned.

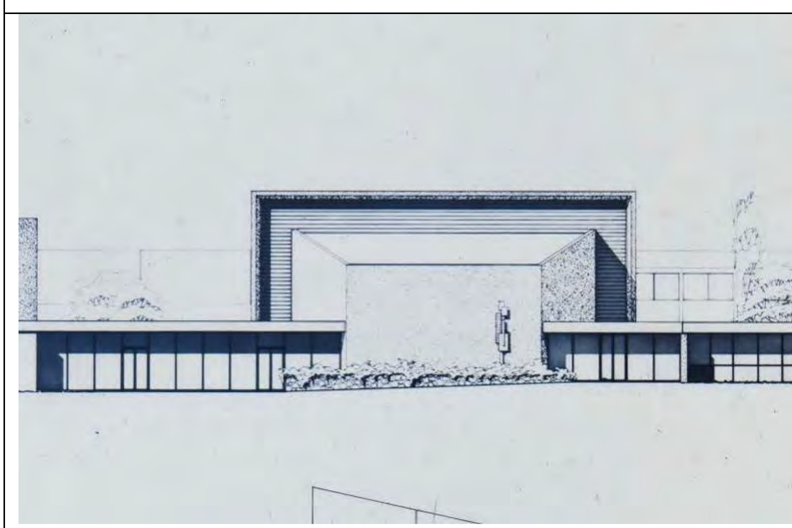
The CSU San Bernardino Creative Arts Building was planned, through its massing, to provide expression to the disparate functions that serve the performing arts. The major volume of the auditorium is the building's centerpiece and expresses the most important element of the program. The secondary volumes contain secondary spaces and functions – rehearsal, set construction, etc. - that serve the performance function of the main volume. Two sheltered courtyards were incorporated into the plan and provide social spaces as well as physically setting apart the free volume of the auditorium. The courtyards are set within the outer, rectangular ring of subsidiary spaces (mostly offices and classrooms) that forms the bulk of the building.

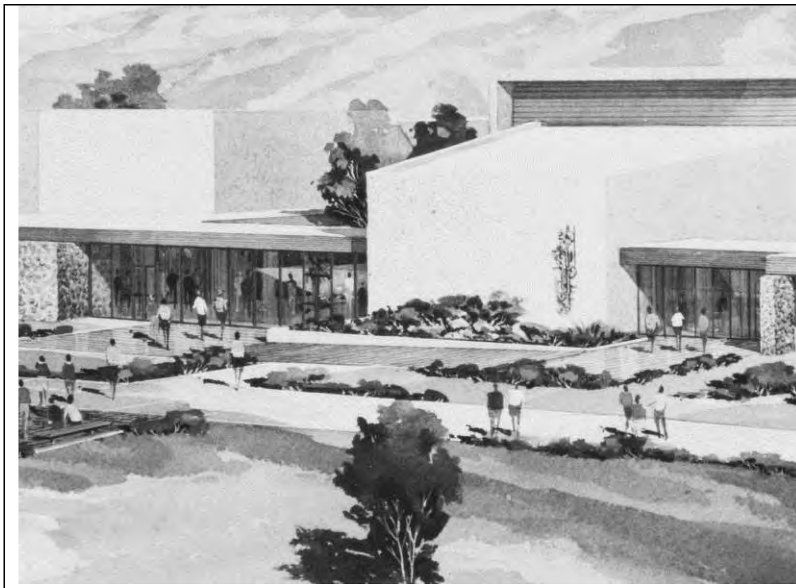
The Performing Arts Building has undergone some alterations, and it also deviates from the architect's original plans. Alterations include the addition of a box office on the south end of the main façade. The exterior of the box office is clad in concrete block in two colors and its front façade is capped by an angled canopy supported by triangular knee braces. Its massing, overhanging canopy, and modular effect of the blocks make it out of step with the formal and material language of the original building, detracting from the unity of the original design. Another notable alteration is what appears to be replacement of the fenestration of the horizontal "connectors" that serve as entrances to the auditorium lobby and as screens to the internal courtyards. The original drawings show a cleanly modulated expanse of windows and doors within vertical framing. At a later date, new doors seem to have been added without regard for the existing rhythm of the fenestration.

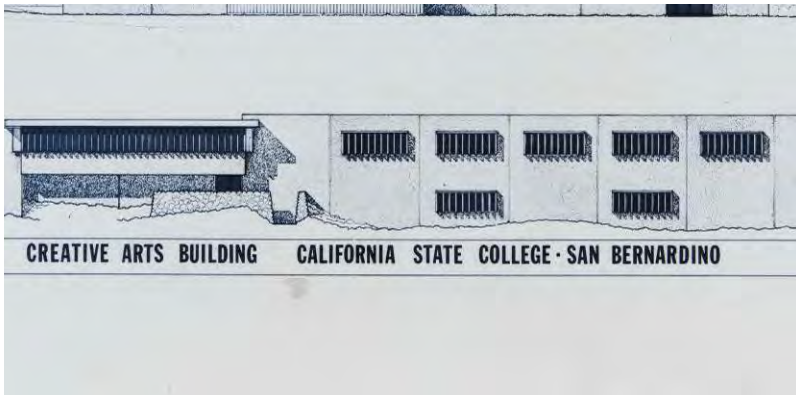
At least two exterior elements of the building were not executed as planned, and these had an effect on the level of architectural interest that results in the building. The renderings and elevations of the building show a range of textures that contrast on different volumes of the building, ranging from wood to exposed aggregate concrete to a larger-scale stone cladding. The stone cladding was not included in the building, with the result that the volumes have a sameness about them that hinders the contrasts that should be present among them. So little of the wood cladding is included that it does not provide a significant amount of contrast either. The resulting building is bland and lacks the scale and texture of the best buildings of the style and period, including most other examples of the work of Maston's office.

While Maston's concept for the building is expressive of its purpose as described and provides a distinctive profile on the main quad to identify that purpose, the execution of the building appears to have compromised the original design. Details such as the fenestration and fenestration patterns and the exterior cladding materials do not reflect what is shown on the renderings. These changes appear to be a reflection of the late date of the building, when the early building program for the campus was losing steam and the funding and institutional support necessary to create stronger buildings to serve the future of the college was running out. Flagging enrollment, as well as a drop in the level of funding to the state colleges generally, may have been to blame for the disappointing execution of what could have been an innovate and aesthetically interesting facility.

Due to the apparently watered-down execution of the original concept in combination with the compromises resulting from some alterations, the property is not significant under Criterion 3.

	**PERFORMING ARTS** Fenestration of entrance wings, east façade.
	**PERFORMING ARTS** Fenestration of entrance wings, east façade.
	**PERFORMING ARTS** East elevation, detail: Divisions in fenestration of “connectors” shown with no horizontal elements. (Carl Maston Papers, USC)

	**PERFORMING ARTS** Rendering, detail: divisions in fenestration shown with no horizontal elements. (Carl Maston Papers, USC)
	**PERFORMING ARTS** West elevation, view southeast. Glass block portion to lower left appears to be an alteration. The windows under the eaves (right) appear not to have been executed as designed (see next image).

	**PERFORMING ARTS** Rear elevation; Vertical sun shade “fins” and stone accent walls (lower left) as illustrated in original west elevation drawings; these were not executed as drawn. Compare to previous image.
	**PERFORMING ARTS** Larger-scale stone cladding appears to have been planned to anchor the corner volumes. Contrasting textures on various volumes was not executed and design of east-facing windows in courtyard was changed as well.

	**PERFORMING ARTS** Aerial view shows divergence from Maston's rendering, particularly at rear two-story mass. (Google Earth)
	**PERFORMING ARTS** The textures of exposed aggregate concrete and wood as executed show little contrast among the various volumes.

7. Impacts and Mitigation Measures

7.1 Potential Impacts to the John M. Pfau Library

The John M. Pfau Library appears eligible for the California Register of Historical Resources under Criterion 3 as discussed above in this report. The massing, size, placement, articulation, and materials of the addition that is planned will be critical to avoiding impacts to the historic building.

The area of the original five-story library building is 167,000 gross square feet. The existing addition to the building on the west side has an area of 129,000 gsf. We were further advised that the amount of area that the Master Plan proposes for addition to the building is 90,000 gsf.[67] The additions are blocked out as follows in the map that we were supplied in from Master Plan:

The diagram below, an excerpt from the Master Plan map that was supplied to ARG for this evaluation, shows the John M. Pfau library in the center of the plan. The white footprint represents the building as it exists today, and the red shapes represent the potential additions. The original portion of the building is outlined in yellow.

From this illustration of the Master Plan's intent, we concluded that the addition to the library (in red) would be comparable to or larger in footprint than the original library itself (outlined in blue), as it is depicted here. However, from additional information that we were given from University Facilities, the size of the

[67] All building area information per Hamid Azhand, AIA, CSUSB Director of Facilities, in a conference call with the project team, 6 January 2017.

addition that is proposed is in fact closer to that of the existing addition on the west side of the building.

This evaluation of the Master Plan has the advantage of taking place prior to project-level design. The massing of the proposed addition appears to be the key factor in avoiding impacts, as described below. The following review of the potential impacts of the library addition per the *Secretary of the Interior's Standards for Rehabilitation* is intended to assist with the eventual design of the building in order to avoid impacts to the historic property. The mitigation measures that follow are meant to provide a general approach to the massing of the addition and the visibility of the original building in order to maintain its significance under the California Register criteria.

To the extent that it can be determined on the basis of the information available at the Master Plan level, the proposed Project can meet *Standards 1-8* with regards to treatment of the John M. Pfau Library, as follows:

1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships.

No change in use of the Library is proposed. Adaptations for contemporary library function are expected but are unlikely to impact historic features.

2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be avoided.

Any alterations to the Library planned in conjunction with the addition should preserve its significant architectural features and character as discussed in Section 6.2.2.

3. Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.

Any alterations to the Library planned in conjunction with the addition should avoid changes to historic finishes or any additional finishes on the original building that would attempt to "enhance" its late modern character. For example, the design should avoid introducing features, finishes or materials associated with popular Mid-Century Modernism that were not historically present on the building, unless they are clearly distinguishable from original features.

4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.

This Standard is not likely to apply to the alteration of or addition to the Library. The period of significance is defined as the year the Library opened, 1971.

5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.

Any alterations to the Library planned in conjunction with the addition should preserve its significant architectural features and character as discussed in Section 6.2.2.

6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.

This Standard is not likely to apply to the alteration of or addition to the Library, but care should be taken to preserve any character-defining features or materials that may be so affected.

7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.

This Standard is not likely to apply to the alteration of or addition to the Library, but care should be taken to select and test any such chemical or physical treatments to protect character-defining features or materials of the building.

8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.

Potential impacts to archaeological resources are outside of the scope of this evaluation.

Rehabilitation Standards #9 and *#10* provide guidance for additions to historic properties.

9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work will be differentiated from the old and will be compatible with the historic materials, features, size, scale

and proportion, and massing to protect the integrity of the property and its environment.

The existing west addition meets this Standard, and as such it can serve as one example of how the new addition on the east side may be approached. As discussed above (pp. 71-72), the massing, materials and articulation of the existing west addition serve to harmonize its design with that of the original building while leaving the original massing legible. The "features, size, and scale" are compatible; they are comparable to those of the historic building while remaining distinguishable from the original, as outlined in this Standard.

10. New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

    The reversibility of the additions will be determined by the project design. The recommendation below (1.d) is aimed at ensuring that much of the east façade of the building remains intact, partially toward this end.

As noted, the Project's impact on the historic resource cannot be fully evaluated without development of the plans for the addition. Therefore, with the information given, the following impact to the historic resource may occur:

IMPACT #1: Additions proposed to the building (as depicted on the Master Plan diagram) on the west side plaza and on the east side of the building would cause a substantial adverse change in the significance of the historic resource and would render it ineligible for the California Register due to a loss of integrity of design and setting, at a minimum. Since the addition has yet to be designed, a fuller assessment of impacts cannot be made at this time.

7.2 Mitigation Measures

The existing west addition was designed in a way that maintained the design of the main library, and did not diminish the qualities that, per this analysis, made it architecturally significant. Therefore, given the similar size proposed for the next addition and the desire to maintain a physical connection between the existing building and the additional space needed, the following design guidelines will serve as Mitigation Measures to allow this aspect of the Master Plan to meet the Standards, thereby avoiding significant adverse impacts to historic resources:

MITIGATION MEASURE #1: Massing and attachment of new additions with regard to the historic building should make the following considerations:

1a. The south (front) façade will remain free of new construction so that it maintains its prominence on the main quadrangle, particularly given the importance of the view of the building as one approaches the campus from University Parkway.

1b. The north (rear) façade, which mirrors that of the south façade, will also remain free of new construction so that it maintains its visibility from the northern parts of the campus.

1c. The addition will be equal to or lower than the original building in height and smaller in footprint in order to appear subordinate to the original building.

1d. The addition will be attached only to the rear (north) portion of the east façade, so that a connection between the main building and the addition can be made on each floor, but so that much of the bulk of the addition is pulled away from the east façade to leave a significant amount of the façade – at a minimum, 50% -- physically disengaged from the addition. The east façade is defined as the outermost east wall of the building, not including the corners that are stepped back in plan.

1.d The colonnade on the east façade's ground floor should remain open and passable where it is not attached to the addition. At the connection of the addition to the original building, the ground floor should be enclosed mainly in glass, similar to the north façade of the connection between the original building and the existing west addition.

1.e The plaza to the west of the original building that is encompassed by the west wing addition (on the south side) should be maintained free of additional construction and should *not* be filled in as shown in the diagram above. This space functions to allow much of the west façade of the original building to remain visible.

1.f Respect the symmetrical massing of the original building (when viewed from the south) by maintaining a balance between the new addition and the existing west addition in their features and massing. A mirror symmetry is not expected.

1.g Refer to the National Park Service's *Preservation Brief #14, New Exterior Additions to Historic Buildings; Preservation Concerns*, for further guidance in the planning and design process (see Bibliography).

8. Conclusion

ARG has analyzed the historic and architectural contexts that produced the campus architecture, plan and landscape design of CSU San Bernardino.

ARG has determined that the remaining buildings or groupings projected for demolition and replacement or major additions in the current Master Plan are not eligible for listing in the California Register of Historical Resources. These buildings or groupings are as follows:

- Sierra Hall/Chaparral Hall/Administration Complex
- Serrano Village Housing Complex (includes Tokay, San Manuel, Joshua, Mojave, Morongo, Waterman, Badger, and Shandin Residence Halls)
- Performing Arts Center

These three properties, therefore, are not considered historic resources for purposes of CEQA.

We have determined that one building potentially impacted by the Master Plan is a historical resource under CEQA:

- John M. Pfau Library

The Library has a central position on campus and stands as its most identifiable building. It is a very good example of the architectural trends that drove the design of the campus, and it is associated with a significant local architect, William F. Cody. While some of the earliest campus buildings appear to have been designed to meet utilitarian requirements or the basic needs of the growing campus, others, as discussed above, were intended to define the image of campus through their Late Modern architecture, and commissions for the buildings were placed in the hands of more capable designers. These buildings, including the Library (as well as the Biological and Physical Sciences Buildings), have a strength of architectural design (and have maintained a level of design integrity) that effectively communicates through architecture the values of the 1960s public universities of California.

With the mitigation measures presented as design guidelines in this report, any additions to the library to serve a new generation of students can be designed effectively to maintain the property's eligibility for the California Register.

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March 14, 2017

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Transmitted via email to: Finkelstein@pbworld.com

RE: Results of a Cultural Resources Analysis for the California State University San Bernardino Campus Master Plan, San Bernardino County, California.

Dear Ms. Finkelstein:

SWCA Environmental Consultants (SWCA) was retained by Parson Brinckerhoff to perform a cultural resources analysis for the proposed California State University, San Bernardino (CSUSB) Campus Master Plan (Project) in San Bernardino, San Bernardino County, California (Figure 1). The proposed Master Plan provides for modifications of existing buildings, the construction of new buildings, and landscape improvements within the project area. The project area is defined as the boundary of planned modifications to the CSUSB main campus as provided by Parson Brinckerhoff (Figure 2).

This memorandum summarizes the results of a cultural records search and a Native American contact program, which were completed to establish the presence of any previously recorded cultural resources within the study area. All cultural resources work was conducted under the supervision of SWCA Project Manager Alyssa Newcomb, M.S., Registered Professional Archaeologist (RPA). SWCA Principal Investigator Heather Gibson, Ph.D., RPA, served as quality control officer. Ms. Newcomb and Dr. Gibson both exceed the Secretary of the Interior's Professional Qualifications Standards (PQS) in archaeology.

Pasadena Office
150 South Arroyo Parkway, 2nd Floor

Figure 1. Project vicinity map.

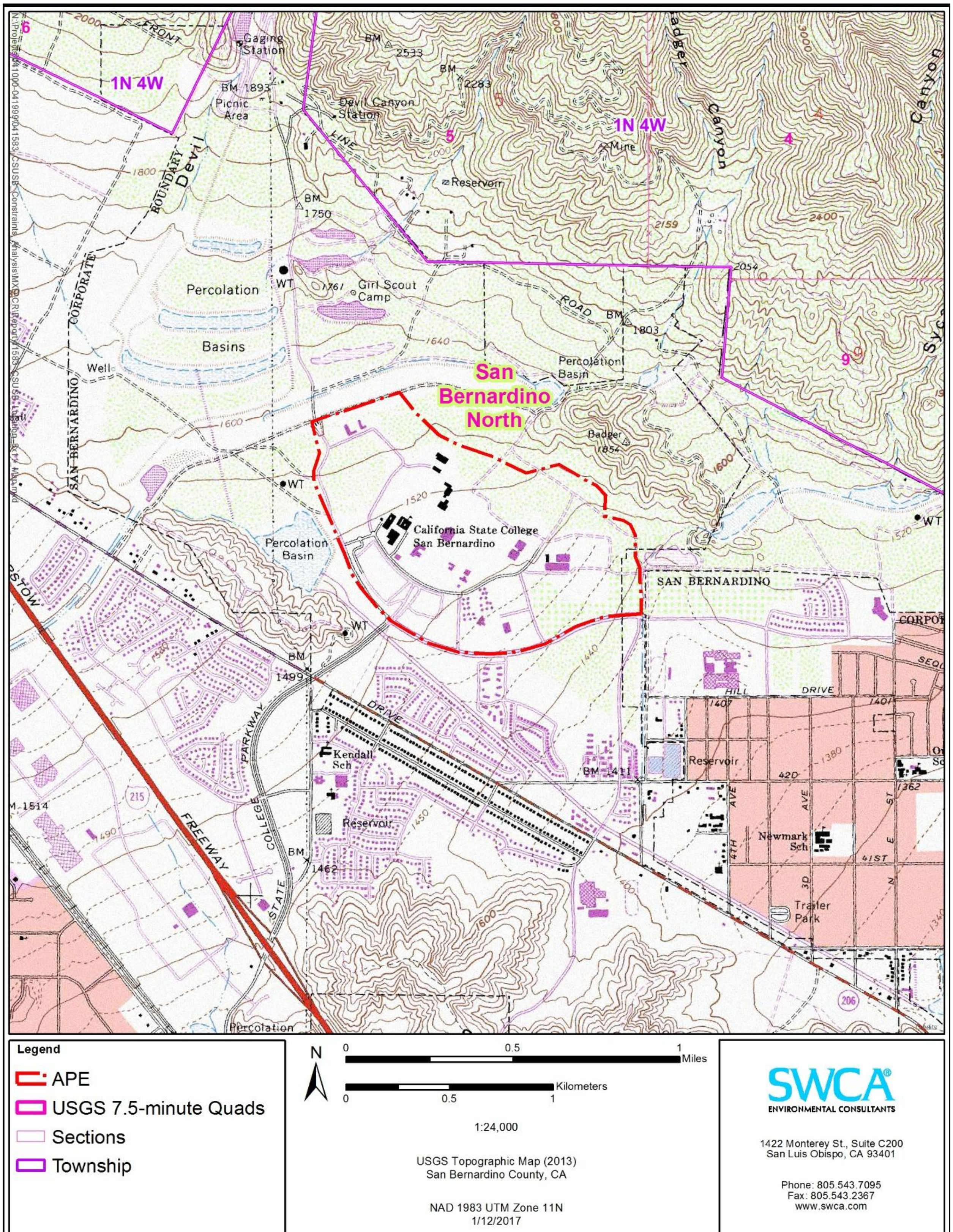

Figure 2. Project location map.

CULTURAL RESOURCES

Records Search: On January 4, 2017, SWCA archaeologist Erica Nicolay, B.A., conducted an in-house records search of the California Historical Resources Information System (CHRIS) at the South Central Coastal Information Center (SCCIC) located on the campus of California State University, Fullerton. The search included any previously recorded cultural resources and investigations within a 0.5-mile radius of the Project area. The search also involved a review of the National Register of Historic Places (NRHP), the California Register of Historical Resources (CRHR), the California Points of Historical Interest list, the California Historical Landmarks list, the Archaeological Determinations of Eligibility list, and the California State Historic Resources Inventory list. In addition, the search consisted of a review of all available historic U.S. Geologic Survey (USGS) 7.5- and 15-minute quadrangle maps.

Prior Cultural Resources Studies within 0.5-mile of the Project Area: Results of the CHRIS records search identified 25 previous cultural resources investigations have been conducted within 0.5-mile of the Project area. Of these studies, 13 occur within the project area. Details pertaining to these studies are presented below in Table 1 and Figure 3.

The project area was previously surveyed in 1996 as part of the CSUSB Master Plan EIR. At the time of that study, much of the campus had already been developed. The study stated that prehistoric sites may have existed within the master plan area that were likely destroyed during the construction of the CSUSB campus. The study found that there is a possibility of subsurface archaeological deposits along the northern portion of the campus due to alluvial soil deposits that cover the San Bernardino Valley.

Table 1. Prior Cultural Resources Studies within 0.5-mile of the Project Area

Report Number	Author	Year	Study Title	Relationship to Project Area
SB-01821	Peak & Associates, Inc.	1988	Cultural Resource Survey and Clearance for an At&T Fiberoptic Communication Cable Re-Route From San Bernardino Northwest to San Bernardino National Forest Boundary	Within
SB-01865	De Munck, Victor C.	1989	Environmental Impact Evaluation: An Archaeological Assessment of a 68.1 Acre Tract of Land Designated as Tentative Tract No. 13554 Located in the City of San Bernardino, San Bernardino County, California	Within
SB-02212	Drover, Christopher E.	1990	Environmental Impact Evaluation: An Archaeological Assessment of Paradise Hills, San Bernardino County, California	Outside (within 0.5 mile radius)
SB-02216	Carr, Peter E. and J. Stephen Alexandrowicz	1990	A Cultural Resource Assessment of the San Bernardino County Central Credit Union and San Bernardino Public Employee Association Project, City of San Bernardino, County of San Bernardino, California	Within

Table 1. Prior Cultural Resources Studies within 0.5-mile of the Project Area

Report Number	Author	Year	Study Title	Relationship to Project Area
SB-02263	Peyton, Paige Margaret	1990	Reconstructing the Fairview School	Outside (within 0.5 mile radius)
SB-02426	Parr, Robert E.	1991	A Cultural Resource Assessment of Eleven Acres of Land Southeast of Devil Canyon, San Bernardino County, California	Outside (within 0.5 mile radius)
SB-03086	Maxon, Patric O.	1996	Cultural Resources Reconnaissance and Impact Assessment of Proposed Development for the California State University, San Bernardino Master Plan	Outside (within 0.5 mile radius)
SB-03117	Love, Bruce	1996	Archaeological Record Search Results, San Bernardino Vegetation Management Project, 23PP	Within
SB-03644	Van Horn, David	1979	Archaeological Survey Report: A 165 Acre +/- Parcel Located South of Kendall Drive Near San Bernardino, CA. 5PP	Within
SB-03708	White, Robert and Laurie White	1908	An Archaeological Assessment of a 28.05 acre Parcel (TPM 15154) Adjacent to Kendall Drive at University Parkway, San Bernardino, CA.	Outside (within 0.5 mile radius)
SB-04072	Harper, Caprice D.	2004	Cultural Resource Assessment: Cingular Wireless Facility #SB 359-01, City & County of San Bernardino, CA. 8PP	Within
SB-04722	Lerch, Michael K., William E. Hayden, Kurt R. Heidelberg, And Anne Q. Stoll	2001	A Class I Cultural Resource Assessment for the FEMA/City of San Bernardino Vegetation Management Project (HMGP #1005-20), San Bernardino County, California	Within
SB-5896	McKenna, Jeanette A.	2007	North Campus Access Road, CSUSB, Archaeological Monitoring	Within
SB-06055	Bonner, Wayne H. and Marnie Aislin-Kay	2008	Cultural Resource Records Search and Site Visit Results for T-Mobile Facility Candidate IE04832D (Northpark University Park), Northpark Boulevard and University Parkway, San Bernardino, San Bernardino County, California.	Outside (within 0.5 mile radius)
SB-06291	Smith, Francesca, Caprice D. Harper, William Makeda, and John Dietler	2008	Cultural Resource Technical Report :sbx E Street Corridor BRT Project, Cities of Loma Linda and San Bernardino County, California	Within

Table 1. Prior Cultural Resources Studies within 0.5-mile of the Project Area

Report Number	Author	Year	Study Title	Relationship to Project Area
SB-06446	Chasteen, Carrie	2008	Determinations of Effect Report: sbX E Street Corridor Bus Rapid Transit (BRT) Project, Cities of Loma Linda and San Bernardino, San Bernardino County, California	Within
SB-06447	Chasteen, Carrie	2009	Addendum Cultural Resources Technical Report: sbX E Street Corridor BRT Project, Cities of Loma Linda and San Bernardino, San Bernardino County, California	Within
SB-06449	McKenna, Jeanette A.	2009	Results of a Class III (Section 106) Cultural Resources Investigation of the Proposed California State University San Bernardino Observatory and Access Road Project Area, San Bernardino, San Bernardino County, California	Outside (within 0.5 mile radius)
SB-06758	Lee, Christopher	2004	Cultural Resources Technical Report: Emergency Protection, County of San Bernardino and City of Rancho Cucamonga	Outside (within 0.5 mile radius)
SB-06810	McKenna, Jeanette A.	2010	Archaeological Monitoring for the CSUSB Observatory Project	Outside (within 0.5 mile radius)
SB-06994	Sanka, Jennifer	2011	Cultural Resources Assessment: San Bernardino Redevelopment Project Area Merger- Area B Project, City of San Bernardino, San Bernardino County, California	Outside (within 0.5 mile radius)
SB-07415	Glentis, Dionisios	2013	Cultural Resources Assessment Report for the Southern California Edison Company's Grid Reliability and Maintenance (GRM) Program Preventive Maintenance Project, Calstate 12kV Distribution Circuit, San Bernardino County, California	Outside (within 0.5 mile radius)
SB-07626	Puckett, Heather R.	2012	Berkley, Western Drive and W. Reservoir Drive, San Bernardino, California 92407	Outside (within 0.5 mile radius)
SB-07634	Tang, Bai "Tom"	2012	Subsurface Archaeological Sensitivity Assessment Water Main Project, Northpark Boulevard at University Parkway, City of San Bernardino, San Bernardino County, California	Within
SB-07636	Hamilton, M. Colleen	2011	Finding of Effect for the Palm Avenue/Burlington Northern Santa Fe Railroad Grade Separation Project	Within

Previously Recorded Cultural Resources within 0.5-mile of the Project Area: The CHRIS records search also identified six previously recorded cultural resources within a 0.5-mile radius of the project area. Of these resources, one is mapped within the project area. This resource is a historic road, Devil Canyon Toll Road/Sawpit Creek Road, which was recorded in 2007. The Devil Canyon Toll Road was built and developed as a toll lumber road during the 1860s and 1880s, which ran north out of San Bernardino to connect with a portion of the Mojave Trail. The general location of Devil Canyon Toll Road along what is now Sawpit Creek Road is also the location of the former Mojave Trail. The resource has not been evaluated for inclusion in the CRHR. Details pertaining to these resources are presented below in Table 2 and Figure 4.

Table 2. Previously Recorded Cultural Resources within 0.5 Mile of the Project Area

Primary Number (P-36-)	Trinomial (CA-SBR-)	Resource Type	Recorded by and Year Recorded	Resource Description	NRHP/CRHR Eligibility	Relationship to Project Area
002216	2216	Prehistoric Site	Cowper, D. 1972	Snaggle Tooth- Hwy 95 Cave- Rock Shelter	Not evaluated	Outside (within 0.5 mile radius)
006581	6581H	Historic Structure	Barber and Peyton 1990	Fairview School; Wiggins School	Not evaluated	Outside (within 0.5 mile radius)
008302	8302H	Historic Structure	Maxon, Patrick 1996	Rock Foundation	Not evaluated	Outside (within 0.5 mile radius)
009592	9592H	Historic Site	White 1999	Kendall-1; Water Conveyance System	Not evaluated	Outside (within 0.5 mile radius)
13421	PSBR-19H	Historic Road	Smallwood, Josh 2007	Devil Canyon Toll Road/Sawpit Creek Road	Not evaluated	Within
026215	-	-	-	-	Not evaluated	Outside (within 0.5 mile radius)

Native American Contact Program: On January 3, 2017, SWCA requested a search of the Sacred Lands Files from the Native American Heritage Commission (NAHC). SWCA received a response letter via email from the NAHC on January 5, 2017, stating that the results of the Sacred Lands File search failed to identify the presence of Native American cultural resources in the project area. The NAHC also provided a list of 24 Native American groups and individuals who may have knowledge of cultural resources in the project area. On January 6, 2017, SWCA sent letter via mail to the contacts identifying the project location and requesting input.

On January 10, 2017, Andrew Salas contacted SWCA via a phone call and stated that the project area has high sensitivity and has first-hand knowledge of cultural resources in the vicinity. Mr. Salas recommended a Native American and archaeological monitor be present during all ground disturbing activities.

By January 17, 2016, none of the other Native American groups and/or individuals had responded to the letter. Follow-up phone calls were made that day to the remaining 23 contacts provided by the NAHC.

Robert Dorame stated he did not have any knowledge of cultural resources within or near the project area and requested he be contacted in the event that any resources are identified during the project. Anthony Morales stated that he had no knowledge of cultural resources within or near the project area and requested he be contacted in the event that any resources are identified during the project.

Goldie Walker stated that she had not yet received the letter but that area was part of her traditional territory. A second follow-up phone call was made to Ms. Walker on January 18, 2017 and she stated that she was familiar with the project area. She stated if any artifacts or human remains were identified within the project area that they be assigned to her, and expressed concern for buried archaeological deposits, indicated that the project area had high sensitivity. Ms. Walker also requested a copy of the coordination letter to be resent, as she did not receive the original, and requested a copy of the report upon completion of the project. The coordination letter was re-sent that same day.

Joseph Ontiveros stated that his group had specific information regarding cultural resources within the project area and requested to communicate directly with the project's lead agency. A second follow-up phone call was made to Mr. Ontiveros on January 18, 2017, whereby Mr. Ontiveros requested to speak directly with the CSUSB Project Manager for the project.

Three of the individuals contacted requested that the information be provided via email. Follow-up emails were sent the following day, January 18, 2017, to Luther Salgado, Steven Estrada, and Michael Mirelez. Mr. Salgado and Mr. Mirelez indicated that they intended on forwarding the information to the San Manuel Band of Mission Indians. As of January 19, 2017, none of these individuals had replied to the emails.

For five of the individuals contacted, SWCA was redirected to another individual, three of which were on the contacts list provided by the NAHC. None of these individuals answered and voicemails were left providing them with overall project details and contact information should they wish to reply. On January 18, 2017, SWCA received a return call from one individual, Judy Stapp, who stated that she will not provide any comments as the project is located outside their traditional territory. Of the remaining contacts called, ten did not answer and voicemails were left providing them with overall project details and contact information should they wish to reply. Supporting documentation and details of the communication of the Native American contact program is included in Appendix A.

CONCLUSION AND RECOMMENDATIONS

The CHRIS records search results indicated that one cultural resource has previously been recorded within the project area, P-36-13421, and this resource has not been evaluated for inclusion in the CRHR. The Sacred Lands File search failed to identify the presence of Native American cultural resources in the area. The Native American contact program undertaken by SWCA resulted in three individuals indicating that the project area has a high sensitivity for cultural resources, with one individual indicating he has information about cultural resources within the project area.

The project area encompasses the existing CSUSB campus, with the planned modifications and new construction in several different locations. A review of the proposed project components, as well as historic aerial photographs, indicates that the many of the proposed modifications and new facilities will be constructed in areas with existing structures. However, some improvements are planned for portions of the campus that have historically been paved or developed only with landscaping. In these locations, there is no native ground surface visible, but it is possible that archaeological resources could preserved beneath the surface. The Master Plan includes proposed new facilities in the northwestern portion of the project area and a planned athletic field in the northeastern portion of the project area, both of which are located in currently undeveloped areas with ground visibility. Prior to development of these areas, SWCA recommends archaeological pedestrian survey to identify cultural resources. Specifically, it should be determined whether remains of P-36-13421 are present within the project area and an update the record for that resource should be prepared. Additionally, the portions of the project area which are currently undeveloped should be surveyed to identify cultural resources.

The following avoidance and mitigation measures are recommended to ensure that significant impacts to cultural resources are avoided during project implementation:

- **CUL-1: Retain a Qualified Archaeologist.** The project shall retain a qualified archaeologist, defined as an archaeologist who meets the Secretary of the Interior's Standards for professional archaeology, to carry out all mitigation measures related to cultural resources.

- **CUL-2: Survey of Undeveloped Areas Prior to Development.** Prior to development or construction of new facilities in portions of the campus which have not previously been developed (particularly the northwestern and eastern portions of campus) archaeological pedestrian survey shall be conducted to identify potentially significant archaeological resources. If a potentially significant site would be impacted by ground-disturbing activities, either the site should be avoided, or a Phase II investigation would be required to evaluate the site for eligibility for listing in the CRHR. After testing, it may be determined that data recovery will be needed.

- **CUL-3: Avoidance of Eligible or Potentially Eligible Archaeological Sites through Project Design**. The preferred mitigation under CEQA is avoidance. If direct impacts to an archaeological site, including P-36-13421, by earth-moving activities cannot be avoided, a Phase II investigation would be necessary to determine significance in accordance with the following measure.

- **CUL-4: Phase II (Evaluation) and Phase III (Data Recovery) Cultural Resources Investigations.** Ground-disturbing impacts to P-36-13421 should be avoided to the extent feasible. If avoidance of this resource, or other eligible or potentially eligible resources identified during survey is not feasible, CSUSB shall ensure that potentially impacted archaeological sites are assessed for significance, as defined by PRC Section 21083.2 or State CEQA Guidelines Section 15064.5(a), through implementation of Phase II investigations. Should such testing exhaust the data potential of these sites, impacts from the proposed project would be reduced to less than significant. Resources found to be not significant shall not require mitigation. Impacts to sites found to be significant under CRHR Criterion 4 shall be mitigated through a Phase III data recovery program. Prior to any ground-disturbing activities, a detailed archaeological treatment plan shall be prepared and implemented by a qualified archaeologist. Data recovery investigations will be conducted in accordance with the archaeological treatment plan to ensure collection of sufficient information to address archaeological and historical research questions, and results will be presented in a technical report (or reports) describing field methods, materials collected, and conclusions. Additional testing and/or data recovery phases may involve additional excavation and/or more detailed recordation of resources or more comprehensive archival research. Any cultural material collected as part of an assessment or data recovery effort should be curated at a qualified facility. Field notes and other pertinent materials should be curated along with the archaeological collection. If a resource is found to be significant under CRHR Criterion 1, 2, or 3, alternative mitigation measures may be necessary to reduce the level of impact to less than significant. These measures shall be developed by the qualified archaeologist, in consultation with CSUSB and other stakeholders, as appropriate.

- **CUL-6: Construction Monitoring for Archaeological Resources.** Prior to construction, a qualified archaeological monitor shall be retained to monitor ground-disturbing activities within portions of the campus that do not currently contain structures. These include areas that are currently paved, landscaped, or undeveloped. The duration and timing of the monitoring shall be determined by the qualified archaeologist in consultation with CSUSB. The archaeological monitor will work under the supervision of the qualified archaeologist.

- **CUL-7: Inadvertent Discoveries.** If unanticipated buried cultural deposits are encountered during any phase of project construction, all construction work within 20 m (60 feet) of the deposit shall cease and the qualified archaeologist shall be consulted to assess the find. If the resources are determined to be Native American in origin, the project archaeologist will consult with CSUSB to continue Native American consultation procedures. As part of this process, it may be determined that a Native American monitor will be required. If the discovery is determined to be not significant, work will be permitted to continue in the area. If a discovery is determined to be significant, a mitigation plan should be prepared and carried out in accordance with state guidelines. If the resource cannot be avoided, a data recovery plan should be developed to ensure collection of sufficient information to address archaeological and historical research questions, with results presented in a technical report describing field methods, materials collected, and conclusions. Any cultural material collected as part of an assessment or data recovery effort should be curated at a qualified facility. Field notes and other pertinent materials should be curated along with the archaeological collection.

- **CUL-8: Discovery of Human Remains.** If human remains are discovered, State of California Health and Safety Code Section 7050.5 stipulates that no further disturbance shall occur until the County Coroner has made a determination of origin and disposition pursuant to PRC Section 5097.98. The San Bernardino County Coroner must be notified of the find immediately. If the human remains are determined to be prehistoric, the Coroner will notify the Native American Heritage Commission, which will determine and notify a MLD. The MLD will complete the inspection of the site within 48 hours of notification and may recommend scientific removal and nondestructive analysis of human remains and items associated with Native American burials.

If you have any questions regarding this letter report, please do not hesitate to contact me at (626) 240-0587 ext. 6652, or anewcomb@swca.com.

Sincerely,

Alyssa Newcomb, M.S., RPA
Cultural Resources Project Manager

Attachment A: Native American Coordination Documentation

Attachment A.

Native American Coordination Documentation

Table 3. Native American Coordination Summary

Native American Contact	Letter Sent	Follow-Ups and Results
Jeff Grubb Chairperson Agua Caliente Band of Cahuilla Indians 5401 Dinah Shore Drive Palm Springs, CA 92264 (760) 699-6800	January 6, 2017	January 17, 2017: Follow-up phone call made. Chairperson Grubb unavailable. Was re-directed to Tribal Director of Historic Preservation, Patricia Garcia (see below).
Patricia Garcia-Plotkin Director Agua Caliente Band of Cahuilla Indians 5401 Dinah Shore Drive Palm Springs, CA 92264 (760) 699-6907 ACBCI-THPO@aguacaliente.net	January 6, 2017	January 17, 2017: Follow-up phone call made. No answer. Left voice message.
Amanda Vance Chairperson Augustine Band of Cahuilla Mission Indians P.O. Box 846 Coachella, CA 92236 (760) 398-4722	January 6, 2017	January 17, 2017: Follow-up phone call made. Chairperson Vance was unavailable. Was re-directed to David Salvidar. No answer. Left voice message.
Doug Welmas Chairperson Cabazon Band of Mission Indians 84-245 Indio Springs Parkway Indio, CA 92203 (760) 342-2593	January 6, 2017	January 17, 2017: Follow-up phone call made. Chairperson Welmas was unavailable. Was re-directed to Director of Cultural Affairs, Judy Stapp. No answer. Left voice message. January 18, 2017: Judy Stapp returned call. Stated the tribe will not provide comment; as the “project area outside of traditional territory”.
Luther Salgado Chairperson Cahuilla Band of Indians 52701 U.S. Highway 371 Anza, CA 92539 (951) 763-5549 chairmain@cahuilla.net	January 6, 2017	January 17, 2017: Follow-up phone call made. Chairperson Salgado was unavailable. Was re-directed to Cultural Director, Andreas Heredia. Mr. Heredia requested an email be sent to him with project details; he will forward details to San Manuel Band of Mission Indians. January 18, 2017: Follow-up email with requested information was sent.
Andrew Salas Chairperson Gabrieleno Band of Mission Indians – Kizh Nation P.O. Box 393 Covina, CA 91723 (626) 926-4131 gabrielenoindians@yahoo.com	January 6, 2017	January 10, 2017: Received phone call from Mr. Salas. Mr. Salas indicated that the project area has high sensitivity and has first-hand knowledge of cultural resources in the area. Mr. Salas recommended that a Native American monitor and an archaeological monitor be present for all ground disturbance activities.
Anthony Morales Chairperson Gabrieleno/Tongva San Gabriel Band of Mission Indians P.O. Box 693 San Gabriel, CA 91778 (626) 483-3564 GTTribalcouncil@aol.com	January 6, 2017	January 17, 2017: Follow-up phone call made. No answer. Left voice message. Same day: Return phone call from Mr. Morales. Mr. Morales did not have any knowledge of cultural resources within or near the project location. Mr. Morales requested to be contacted in the event that resources are identified during the project.
Sandonne Goad Chairperson Gabrielino/Tongva Nation 106 ½ Judge John Aiso St., #231 Los Angeles, CA 90012 (951) 807-0479 sgoad@gabrielino-tongva.com	January 6, 2017	January 17, 2017: Follow-up phone call made. No answer. Left voice message.

Table 3. Native American Coordination Summary

Native American Contact	Letter Sent	Follow-Ups and Results
Robert Dorame Chairperson Gabrielino Tongva Indians of California Tribal Council P.O. Box 490 Bellflower, CA 90707 (562) 761-6417 gtongval@gmail.com	January 6, 2017	January 17, 2017: Follow-up phone call made. Mr. Dorame did not have any knowledge of cultural resources within or near the project location. Mr. Dorame requested to be contacted in the event that resources are identified during the project.
Linda Candelaria Co-Chairperson Gabrielino/Tongva Tribe 1999 Avenue of the Stars, Suite 1100 Los Angeles, CA 90067 (626) 676-1184	January 6, 2017	January 17, 2017: Follow-up phone call made. No answer. Left voice message.
Shane Chapparosa Chairperson Los Coyotes Band of Mission Indians P.O. Box 189 Warner Springs, CA 92086 (760) 782-0711 Chapparosa@msn.com	January 6, 2017	January 17, 2017: Follow-up phone call made. Left message with Tribal secretary (Angelina). No return call received as of January 20, 2017.
John Perada Environmental Director Los Coyotes Band of Mission Indians P.O. Box 189 Warner Springs, CA 92086 (760) 782-0712	January 6, 2017	January 17, 2017: Follow-up phone call made. No answer. Left voice message.
Robert Martin Chairperson Morongo Band of Mission Indians 12700 Pumarra Road Banning, CA 92220 (951) 849-8807	January 6, 2017	January 17, 2017: Follow-up phone call made. Chairperson Martin was unavailable. Was re-directed to Cultural Resources Manager, Denisa Torres (see below).
Denisa Torres Cultural Resources Manager Morongo Band of Mission Indians 12700 Pumarra Road Banning, CA 92220 (951) 849-8807 dtorres@morongo-nsn.gov	January 6, 2017	January 17, 2017: Follow-up phone call made. No answer. Left voice message.
Joseph Hamilton Chairperson Ramona Band of Cahuilla Mission Indians P.O. Box 391670 Anza, CA 92539 (951) 763-4105 admin@ramnonatribe.com	January 6, 2017	January 17, 2017: Follow-up phone call made. No answer. Left voice message.
John Gomez Environmental Coordinator Ramona Band of Cahuilla Mission Indians P.O. Box 391670 Anza, CA 92539 (951) 763-4105 jgomez@ramnonatribe.com	January 6, 2017	January 17, 2017: Follow-up phone call made. No answer. Left voice message.

Table 3. Native American Coordination Summary

Native American Contact	Letter Sent	Follow-Ups and Results
John Valenzuela Chairperson San Fernando Band of Mission Indians P.O. Box 221838 Newhall, CA 91322 (760) 885-0955 tsen2u@hotmail.com	January 6, 2017	January 17, 2017: Follow-up phone call made. No answer. Left voice message.
Lee Clauss Director of Cultural Resources San Manuel Band of Mission Indians 26569 Community Center Drive Highland, CA 92346 (909) 864-8933 lclauss@sanmanuel-nsn.gov	January 6, 2017	January 17, 2017: Follow-up phone call made. No answer. Left voice message.
Steven Estrada Chairperson Santa Rosa Band of Mission Indians P.O. Box 391820 Anza, CA 92539 (951) 659-2700 sestrada@santarosacahuilla-nsn.gov	January 6, 2017	January 17, 2017: Follow-up phone call made. Was informed that Chairperson Estrada was not available by phone, only via email. January 18, 2017: Follow-up email sent with Environmental Director Gabriella Rubalcava cc'd.
Goldie Walker Chairperson Serrano Nation of Mission Indians P.O. Box 343 Patton, CA 92369 (909) 528-9027	January 6, 2017	January 17, 2017: Follow-up phone call made. Ms. Walker stated that area is part of "aboriginal homeland" but she has not yet received the coordination letter. January 18, 2017: Follow-up phone call made. Ms. Walker stated that any artifacts or human remains found need to be associated with her. She stated concern about buried cultural materials within the project area and indicated high sensitivity. She requested a copy of the letter to be re-sent and requested a copy of final report. Same day: Coordination letter re-sent via US mail.
Joseph Ontiveros Cultural Resources Department Soboba Band of Luiseno Indians P.O. Box 487 San Jacinto, CA 92583 (951) 663-5279 jontiveros@soboba-nsn.gov	January 6, 2017	January 17 and 18, 2017: Follow-up phone calls made. Mr. Ontivero stated that his group has specific information regarding cultural resources within the project area. Mr. Ontivero requested to communicate directly with the Project Manager. Follow up telephone call and e-mails on January 23 and January 25, 2017 were made by the Project Manager and were not answered.
Rosemary Morillo Chairperson Soboba Band of Luiseno Indians P.O. Box 487 San Jacinto, CA 92583 (951) 654-2765 rmorilla@soboba-nsn.gov	January 6, 2017	January 17, 2017: Follow-up phone call made. Chairperson Morillo was unavailable. Was re-directed to Cultural Resources Manager, Carrie Garcia (see below).
Carrie Garcia Cultural Resources Manager Soboba Band of Luiseno Indians P.O. Box 487 San Jacinto, CA 92583 (951) 654-2765 carrieg@soboba-nsn.gov	January 6, 2017	January 17, 2017: Follow-up phone call made. No answer. Left voice message.
Michael Mirelez Cultural Resources Coordinator Torres-Martinez Desert Cahuilla Indians P.O. Box 1160 Thermal, CA 92274 (760) 399-0022, ext. 1213 mmirelez@tmdci.org	January 6, 2017	January 17, 2017: Follow-up phone call made. Mr. Mirelez requested an email be sent to him with project details, and stated he would defer to the Serrano (i.e. San Manuel Band) representative upon receipt of email. January 18, 2017: Follow-up email sent.

Appendix C
Traffic Study

Draft CSUSB Main Campus Transportation Impact Analysis Report

Prepared for:
California State University, San Bernardino

March 2017

OC16-0470

FEHR PEERS

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1.0 EXECUTIVE SUMMARY

Fehr & Peers has completed a transportation assessment for the proposed California State University San Bernardino (CSUSB) Master Plan project in San Bernardino, California. This Transportation Impact Analysis (TIA) was developed based on the requirements within the California State University Transportation Impact Study Manual (2012), the City of San Bernardino Traffic Impact Study Guidelines (2015), and the San Bernardino County Congestion Management Program (2005).

The CSUSB Master Plan is plans for the future expansion of the campus. The proposed project includes an increase to 25,000 full time equivalent (FTE) students from the existing enrollment of,478 FTE students as of the Fall of 2015, an increase in on-campus students from 1,533 FTE in the Fall of 2015 to 4,850 FTE, and an increase in faculty and staff from 1,650 FTE in the Fall of 2015 to 2,503 FTE. The proposed project will also increase the number of parking spaces on campus from 8,054 to 11,713 spaces, add 135,000 sq. ft. of research and development space at the northwest area of the campus, and extend Campus Circle to Campus Parkway.

Future traffic forecasts were developed for each scenario identified below. The San Bernardino Transportation Analysis Model (SBTAM) was used to determine ambient growth. Additionally, school growth was estimated separately using the Campus Master Plan's full time equivalent student (FTES) assumption of 25,000. The evaluation assessed fourteen study intersections and six freeway mainline segments within the study area. Intersections were evaluated using the Synchro 9.0 level of service analysis software and is consistent with Highway Capacity Manual (HCM) 2010 methodologies, except for analysis of the proposed diverging diamond interchange across Interstate I-215 at University Parkway in which HCM 2000 methodology was required.

As part of Fehr & Peers' assessment, the following scenarios were evaluated:

- Existing (2015) Conditions
- Existing Plus Project (2015) Conditions
- Cumulative (2035) Conditions
- Cumulative Plus Project (2035) Conditions

The results of the traffic analysis indicate that eight of the study locations are forecast to be impacted by the proposed project traffic in the Existing (2015) Plus Project and Cumulative (2035) Plus Project scenarios. Feasible mitigation measures were developed for each intersection impact that would reduce the impact to a less-than-significant level and fair share contributions to the respective governing jurisdictions have been identified. However, since the university is not in control of the impacted intersection at the interchange, it cannot guarantee the implementation of the mitigation measures and, therefore, the impact at the intersection of University Parkway and the northbound I-215 ramps is considered ***significant and unavoidable.*** The results of the freeway analysis indicate that the impacts to the freeway system are considered ***significant and unavoidable.***

2.0 INTRODUCTION

2.1 PURPOSE AND OBJECTIVES

California State University, San Bernardino (CSUSB) is undertaking the development of a new activated, sustainable, and interconnected campus Master Plan. The Master Plan will guide and inform future development on campus. The purpose of the report is to summarize the findings of the transportation analyses completed for the California State University San Bernardino (CSUSB) main campus with the proposed master plan projects and future transportation and parking enhancements in place. This Transportation Impact Analysis (TIA) was developed based on the requirements within the California State University Transportation Impact Study Manual (2012), the City of San Bernardino Traffic Impact Study Guidelines (2015), and the San Bernardino County Congestion Management Program (2016).

The objectives include the following:

- Document existing traffic, bicycle, pedestrian, and transit conditions within the study area.
- Evaluate traffic conditions at Existing Year (2015) and Cumulative Year (2035)
- Determine if any transportation improvements are needed to mitigate project impacts.

2.2 BACKGROUND

Over 21,000 students, faculty, and staff attend or work at the University on a daily basis when school is in session. Many of the students, faculty, and staff commute to campus from surrounding areas. Regional access to CSUSB is provided by Interstate 215. Parking on-campus is supplied primarily by surface parking lots and two parking structures. Additional parking demand is supplied by some on-street parking and smaller faculty lots. Pedestrians are prevalent on-campus, and walking is a major form of transportation, including: walking to and from classes, parking lots, transit stops, dorms, and other on and off campus destinations.

2.3 PROJECT DESCRIPTION

The Master Plan capitalizes on the most vivid, character-defining attributes of the campus - its regal setting at the base of the San Bernardino Mountains and its extensive and well-cared-for landscape setting, and creates a long range plan for strategic infill within the existing campus to accommodate future growth. This approach avoids campus sprawl, reduces pedestrian travel distances, and creates smaller, more human open spaces all connected by a network of shaded, activated pedestrian walkways and paths.

The Master Plan also makes use of some existing surface parking lots for new building sites and proposes other building sites that are currently occupied by facilities that already have or will reach the end of their useful lives within the Master Plan's planning horizon. This new strategic infill approach provides for the use of the existing campus land to accommodate all needed facilities while preserving campus open space, and utilizes new buildings to frame smaller, more intimate courtyards and open spaces and ultimately create a denser, more walkable and collegial campus environment while at the same time reinforcing existing land uses.

To achieve this, the Master Plan incorporates a series of key features that will transform the campus in a phased manner over the next 20 years. These key features were formulated and designed in response to Master Plan objectives and specific needs identified throughout a comprehensive Master Plan development process guided by a Master Plan Steering Committee representing faculty, administration, students and staff, and by input from the campus community and stakeholders through an extensive series of Town Hall meetings.

Key components of the Master Plan are noted below:

- Expansion of the campus to 25,000 full time equivalent (FTE) students; an increase from 16,478 FTE students in the Fall of 2015
- An increase in on-campus students from 1,533 FTE in the Fall of 2015 to 4,850 FTE with buildout of the Master Plan
- An increase in faculty and staff from 1,650 FTE in the Fall of 2015 to 2,503 FTE with completion of the Master Plan
- A proposed increase in the number of parking spaces on campus from 8,054 to 11,713 spaces with completion of the Master Plan
- The addition of 135,000 sq. ft. of research and development space located at the northwest area of the campus
- The extension of Campus Circle to Campus Parkway
- Provision of parking facilities at the externalities of the campus to minimize vehicle intrusion into the campus core
- Improvements to on-site bicycle and pedestrian facilities to promote use of those modes of travel

The project location and campus parking facilities are shown on Figure 2-1.

Figure 2-1

Site Plan

2.4 STUDY AREA

2.4.1 STUDY INTERSECTIONS

The TIA focused on evaluating the potential project-related impacts at 14 study intersections surrounding the campus core. The following intersections were selected for analysis for weekday AM and PM peak hour conditions and are shown in Figure 2-2:

1. Devils Canyon Road & Campus Parkway
2. Northpark Boulevard/Devils Canyon Road & Ash Street
3. Northpark Boulevard & Sierra Drive
4. Northpark Boulevard & University Parkway
5. Serrano Village Drive & Northpark Boulevard
6. Coyote Drive & Northpark Boulevard
7. East Campus Circle & Northpark Boulevard
8. Education Lane & North Campus Circle
9. University Parkway & Kendall Drive
10. University Parkway & College Avenue
11. University Parkway & State Street
12. University Parkway & I-215 Northbound Ramps
13. University Parkway & I-215 Southbound Ramps
14. Little Mountain Drive & Kendall Drive

2.4.2 STUDY FREEWAY SEGMENTS

The following freeway mainline segments were analyzed at the University Parkway and Interstate 215 (I-215) interchange:

1. Northbound I-215 Diverge Segment
2. Northbound I-215 Basic Segment
3. Northbound I-215 Merge Segment

4. Southbound I-215 Diverge Segment
5. Southbound I-215 Basic Segment
6. Southbound I-215 Merge Segment

2.5 ANALYSIS SCENARIOS

To identify significant project impacts, the following four scenarios were evaluated. These scenarios are consistent with CEQA requirements and are consistent with the CSU TIA guidelines.

- **Existing (2015)** – Consists of existing (October 2015) traffic counts collected at the study intersections.
- **Existing Plus Project (2015)** –Consists of traffic associated with two components of the Master Plan: (1) growth in traffic associated with increased enrollment at the campus, and (2) redistribution of traffic circulation and access patterns in and around the campus associated with the relocation of on-campus parking facilities proposed in the Master Plan.
- **Cumulative (2035)** – The San Bernardino Transportation Analysis Model (SBTAM) was used to determine ambient growth in the study area.
- **Cumulative Plus Project (2035)** – Cumulative Conditions plus traffic associated with two components of the Master Plan: (1) growth in traffic associated with increased enrollment at the campus, and (2) redistribution of traffic circulation and access patterns in and around the campus associated with the relocation of on-campus parking facilities proposed in the Master Plan.

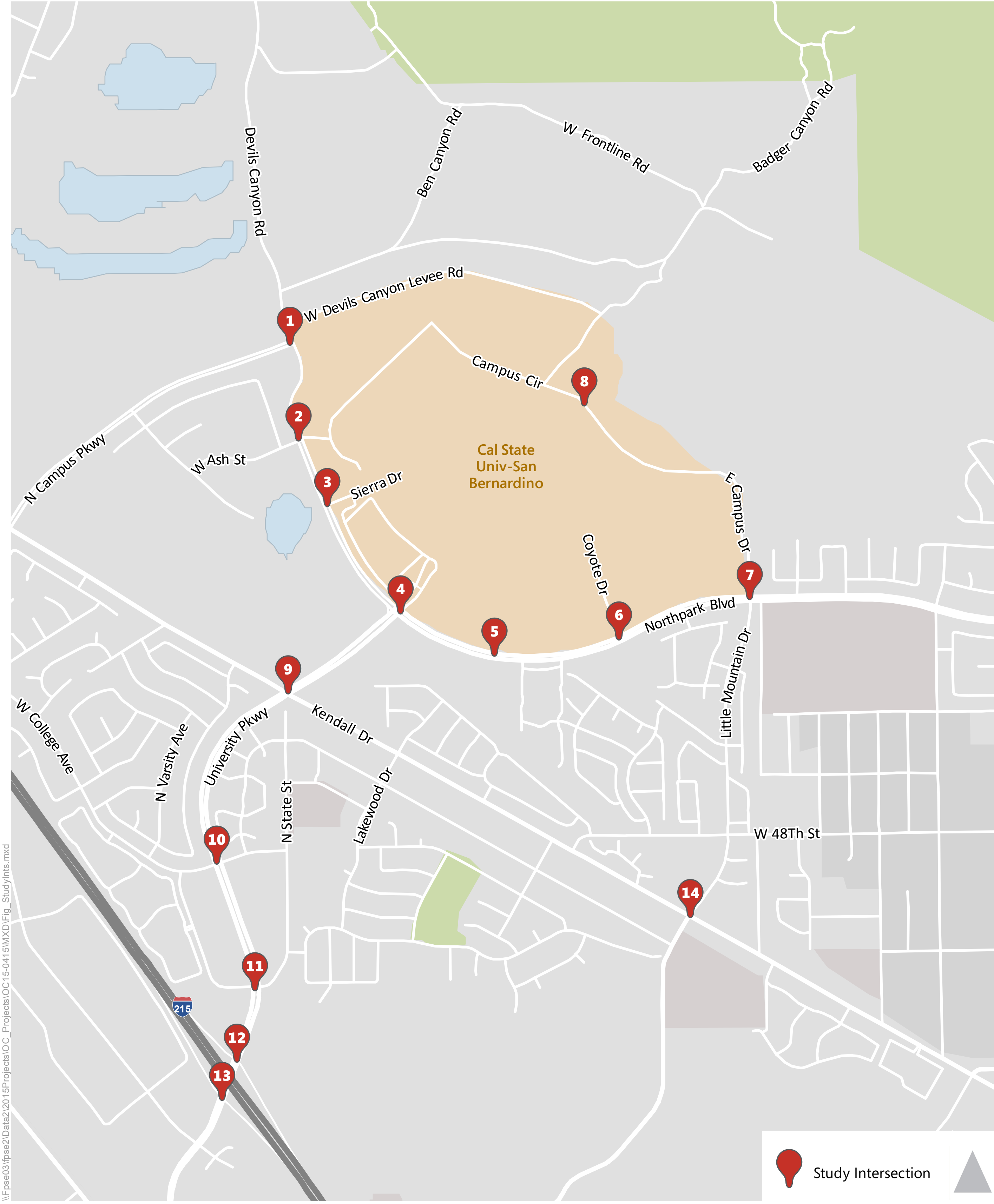

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Figure 2-2

Study Intersections

3.0 ANALYSIS METHODOLOGIES

3.1 LEVEL OF SERVICE CRITERIA

3.1.1 INTERSECTION LEVEL OF SERVICE

Fehr & Peers' analysis of intersections employs a methodology based on empirical research conducted by the Transportation Research Board (TRB) and other authorities. Signalized and unsignalized intersection operations were evaluated using methodologies provided in Highway Capacity Manual (HCM) 2010 (TRB) and are consistent with requirements in the California State University Transportation Impact Study Manual (2012), the City of San Bernardino Traffic Impact Study Guidelines (2015), and the San Bernardino County Congestion Management Program (CMP) (2005).

The HCM 2010 methodology for signalized and all-way stop-controlled intersections estimates the average control delay for the vehicle at the intersection. For side-street stop-controlled intersections, the methodology estimates the control delay for each turning movement and identifies the delay for the longest delayed approach (if there is a shared lane, delay is averaged for all turning movements from that lane). After the quantitative delay estimates are complete, the methodology assigns a qualitative letter grade that represents the operations of the intersection. These grades range from level of service (LOS) A (minimal delay) to LOS F (excessive congestion). LOS E represents at-capacity operations. Descriptions of the LOS letter grades for signalized and unsignalized intersections are provided in Table 3-1.

The Synchro 9.0 software package was used to facilitate the HCM 2010 calculations. A base saturation flow rate of 1800 pc/hr/ln was assumed per the CMP for existing condition scenarios. Peak hour factors were measured as part of the data collection process and are used in the analysis. For the cumulative assessment, a base saturation flow rate of 1900 pc/hr/ln was used, and a peak hour flow rate of 0.95 was used consistent with the CMP guidelines. Existing traffic signal timing parameters from timing sheets were used for signalized intersections.

Caltrans, SANBAG /SBCTA, and the City of San Bernardino are completing their planning work on delivering a Diverging Diamond Interchange (DDI) at the I-215/University Parkway interchange. To evaluate the DDI, Fehr & Peers utilized the Synchro 9.0 software; however, to accurately code a DDI in Synchro, five intersection "nodes" were coded and the appropriate average delays were manually added together to identify delay at the DDI intersection. Due to the custom traffic signal phasing required to code a DDI, the intersections cannot be evaluated using HCM 2010 methodologies. As such, those locations were evaluated using the HCM 2000 methodologies. The methodology is further constrained since the off-ramp movements, which function as free movements unless there is a pedestrian call, cannot be coded in such a manor. As a conservative measure, these movements have been coded as protected turns which likely overstates the delay associated with the movement.

TABLE 3-1 INTERSECTION LEVEL OF SERVICE CRITERIA

Level of Service	Description	Signalized Delay (Seconds)	Unsignalized Delay (Seconds)
A	Progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	≤ 10.0	≤ 10.0
B	Progression is good, cycle lengths are short, or both. More vehicles stop than with LOS A, causing higher levels of average delay.	> 10.0 to 20.0	> 10.0 to 15.0
C	Higher congestion may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping.	> 20.0 to 35.0	> 15.0 to 25.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	> 35.0 to 55.0	> 25.0 to 35.0
E	This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55.0 to 80.0	> 35.0 to 50.0
F	This level is considered unacceptable with oversaturation, which is when arrival flow rates exceed the capacity of the intersection. This level may also occur at high V/C ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels.	> 80.0	> 50.0

Source: *Highway Capacity Manual* (Transportation Research Board, 2010).

3.1.2 FREEWAY MAINLINE LEVEL OF SERVICE

Freeway mainline segments were analyzed utilizing the HCM 2010 methodology. LOS for each of these segments is defined on the basis of density (passenger cars/mile/lane). Table 3-2 presents the LOS criteria for basic freeway analysis.

TABLE 3-2 LOS CRITERIA FOR BASIC MAINLINE FREEWAY SEGMENTS

Level of Service	Density (Passenger Cars per Mile per Lane)
A	≤11
B	<11-18
C	<18-26
D	<26-35
E	<35-45
F	Demand exceeds capacity >45

Source: Highway Capacity Manual (Transportation Research Board, 2010).

TABLE 3-3 LOS CRITERIA FOR MERGE AND DIVERGE MAINLINE FREEWAY SEGMENTS

Level of Service	Density (pc/mi/ln)	Comments
A	<10	Unrestricted operations
B	>10-20	Merging and diverging maneuvers noticeable to drivers
C	>20-28	Influence area speeds begin to decline
D	>28-35	Influence area turbulence becomes intrusive
E	>35	Turbulence felt by virtually all drivers
F	Demand exceeds capacity	Ramp and freeway queues form

Source: Highway Capacity Manual (Transportation Research Board, 2010).

3.2 PERFORMANCE CRITERIA AND THRESHOLDS OF SIGNIFICANCE

3.2.1 CITY OF SAN BERNARDINO PERFORMANCE CRITERIA

The definition of an intersection deficiency in the City of San Bernardino is based on the City of San Bernardino General Plan Circulation Element. The City of San Bernardino General Plan states that target LOS "D" be maintained at City intersections wherever possible. Mitigation measures are required for roadway intersections where traffic conditions show an LOS worse than the minimum acceptable LOS.

3.2.2 THRESHOLDS OF SIGNIFICANCE

The California State University Transportation Impact Study Manual (2012) provides guidance on the criteria utilized to determine whether the transportation-related impacts of a proposed project would be significant within the meaning of CEQA. The following significance criteria are utilized in assessing potential impacts.

3.2.2.1 Intersection Impacts

A significant impact is said to occur when:

- An intersection operates at LOS D or better under a no project scenario and the addition of project trips causes overall traffic operations on the facility to operate at LOS E or F.
- An intersection operates at LOS E or F under a no project scenario and the project adds both 10 or more peak hour trips and 5 seconds or more of peak hour delay, during the same peak hour.
- If an intersection operates at a very poor LOS F (control delay of 120 seconds or more), the significance criterion shall be an increase in v/c ratio of 0.02 or more.
- The addition of project traffic causes an all-way stop-controlled or side street stop-controlled intersection to meet Caltrans signal warrant criteria.

3.2.2.2 Freeway Segments

A significant impact would occur at a freeway mainline segment when the project-related traffic causes:

- A freeway mainline segment to degrade from an acceptable LOS C or better to LOS D, LOS E or LOS F; or
- An increase in density for density for freeway mainline segments already operating at LOS D, LOS E, or LOS F.

3.2.2.3 Pedestrian, Bicycle, and Transit Impacts:

A significant impact is said to occur when:

- A project significantly disrupts existing or planned bicycle facilities or significantly conflicts with applicable non-automotive transportation plans, guidelines, policies, or standards.
- A project fails to provide safe pedestrian connections between campus buildings and adjacent streets and transit facilities.
- A project significantly disrupts existing or planned pedestrian facilities or significantly conflicts with applicable non-automotive transportation plans, guidelines, policies, or standards.
- A project significantly disrupts existing or planned transit facilities and services or significantly conflicts with applicable transit plans, guidelines, policies, or standards.

3.2.3 MITIGATION REQUIREMENTS

The California State University Transportation Impact Study Manual (2012) provides guidance on mitigating significant impacts. The TIA must identify both project-level impacts and cumulative impacts. For project impacts, the timing of the impact should be identified. All significant project impacts should be mitigated if feasible (right-of-way constraints, potential environmental constraints, etc.).

As the value of campus land increases and the constraints on providing more physical vehicle-carrying capacity grow, the use of travel demand management strategies to mitigate project impacts will become more and more important. The CSU Transportation Demand Management Manual should be consulted to ensure that the most appropriate measures are selected, so that mitigating project and cumulative impacts are accurately assessed.

Mitigation measures should also be analyzed for secondary significant physical impacts (e.g., widening a street to add traffic lanes would lengthen pedestrian crossing times) to ensure the proposed mitigation measures would not cause significant and unavoidable impacts. This ensures that mitigating significant physical impacts for one travel mode would not adversely impact other travel modes.

4.0 EXISTING (2015) CONDITIONS

This chapter discusses the existing transportation conditions in the project study area, including vehicular circulation on- and off-campus. This discussion addresses the roadway, transit, bicycle, and pedestrian networks. Existing intersection operations and current parking conditions are also discussed.

4.1 CAMPUS VEHICLE CIRCULATION

4.1.1 OFF-CAMPUS VEHICULAR CIRCULATION

Cal State San Bernardino's campus is served by the regional freeway system. The campus is situated off of Interstate 215. This highway connects San Bernardino's campus to the northern portion of the city. It also connects to north of the San Bernardino Mountains via Interstate 15. Highway 210 provides an east/west connection to the rest of the region, as does Interstate 10 further south. The major streets and arterials serving the study area are: Kendall Drive, Campus Parkway, and University Parkway. Detailed descriptions of the roadways are provided in Subsection 4.2.

4.1.2 ON-CAMPUS VEHICULAR CIRCULATION

Northpark Boulevard and Campus Circle provide direct access within and circulation around CSUSB's main campus.

Within the CSUSB campus, Campus Circle, Northpark Boulevard, and Coyote Drive all consist of four lanes divided by landscaped medians. There are several minor streets that also provide access within the campus including: Sierra Drive, West Ash Street, Badger Canyon Road, and Fairview Drive. These minor roadways are mostly two lane facilities.

Key access points to the University include: University Parkway at Northpark Boulevard, the Coyote Drive driveway, Campus Parkway, Devils Canyon Road, and multiple driveways along Campus Circle.

4.2 EXISTING ROADWAY FACILITIES

4.2.1.1 Regional Facilities

Interstate 215 (I-215) San Bernardino Freeway is a four lane uninterrupted highway oriented north-south and is west of the CSUSB campus. Regional access to CSUSB is provided via the I-215/University Parkway interchange. I-215 south of the project site passes through downtown San Bernardino and terminates north of Temecula. I-215 north of the project site intersects with I-15 for access through the San Bernardino Mountains.

State Route 210 (SR-210), also known as the Martin A. Matich Highway, is an east-west connector of Highland and San Dimas. Towards the west it turns into Interstate 210 and continues on towards Pasadena. The most direct route to campus is via I-215 as there is no arterial road that provides easy access to the University.

4.2.1.2 Local Facilities

Campus Parkway is oriented in the east-west direction and is located west of the CSUSB campus. Campus Parkway is 78 feet wide with a raised, landscaped median and two lanes in each direction. Access to Northpark Boulevard/Devils Canyon Road is provided by a stop controlled intersection.

Campus Circle loops around the northern half of campus, providing access to the athletic facilities on the east side, maintenance facilities on the west, and the parking structures near academic buildings in between. This 25 mph road consists of four lanes, divided by a raised, landscaped median. Important intersections include Northpark Boulevard and West Ash Street. There are also several access roads off of Campus Circle

Coyote Drive is a four lane road that stems off of Northpark Boulevard. Its primary purpose is to provide access to four major surface parking lots (Lots E, F, G, and H). Coyote Drive also connects to Coyote Court, a limited access two lane road that cuts through the middle of campus. With heavy pedestrian flows on the road, Coyote Drive has a lower speed limit of 15 mph.

Little Mountain Drive is classified as a secondary Arterial in the City of San Bernardino General Plan. Little Mountain Drive is oriented in the north-south direction and is 70 feet wide with a two-way left turn lane in the center. The roadway has two lanes in each direction and provides access to the CSUSB campus by a stop controlled intersection at Northpark Boulevard. The posted speed limit is 45 miles per hour.

Northpark Boulevard runs approximately 1.2 miles along the southern rim of campus in an east-west direction. The facility is classified as a major highway in the City of San Bernardino General Plan and is 84 feet wide. The roadway has two lanes in each direction and a raised, landscaped median. Northpark

Boulevard provides signalized and unsignalized access to the CSUSB campus, including the main entrance of the University at its intersection with University Parkway. The posted speed limit along the roadway is 40 miles per hour.

University Parkway connects the CSUSB campus with I-215 in a 1.3 mile segment running along both commercial and residential corridors. The road is six lanes, divided by a landscaped median. The speed limit is 45 mph throughout, and the majority of the parkway includes sidewalks and bike lanes on either side of the road. The parkway culminates at the entrance of the university, with a loop that redirects traffic back onto the parkway in the opposite direction. This loop is in place for students/facility/commuters to be dropped off on campus and also provides access to several of the major parking lots. The Parkway has a major intersection with Northpark Boulevard as it enters campus, but intersections with Kendall Drive, W College Avenue, North Varsity, and I-215 are also significant.

4.3 EXISTING BICYCLE, PEDESTRIAN, AND TRANSIT FACILITIES

4.3.1 EXISTING BICYCLE FACILITIES

The City of San Bernardino designates Multi-Purpose Trails and Bikeways that are available for use by bicyclists. The City designates three types of trails including Primary, Regional, and Local Multi-Purpose. Primary Multi-Purpose Trails serve an entire region, Regional Multi-Purpose Trails provide regional connections, and Local Multi-Purpose Trails provide connections within San Bernardino. The City also designates three types of Bikeways including Class I, Class II, and Class III. Additionally, Caltrans has created a fourth class of bicycle facilities (e.g. a Class IV facility), known as a separated bikeway or cycle track. Each of these facilities are described below:

Class I – Bike Path or Shared Use Path:

Class I bikeways are bikeways physically separated from any street or highway. Shared Use Paths may also be used by pedestrians, skaters, wheelchair users, joggers, and other non-motorized users.

Class II – Bike Lane:

Class II bike lanes are a portion of roadway that has been designated by striping, signaling, and pavement markings for the preferential or exclusive use of bicyclists.

Class III – Bike Route:

Class III bike routes are any road, street, path, or way that in some manner is specifically designated for bicycle travel regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes. They are a shared roadway that has been designated by signing as a preferred route for bicycle use.

Class IV – Separated Bikeway or Cycle Track:

Class IV provides delineated right-of-way assigned to bicyclists that have a physical separation between them and a vehicle. This separation can include parked vehicles, bollards, curbs, or any other physical devise that provides this separation. This "new" bicycle classification was defined in AB 1193, amended the streets and highways code to allow for this treatment, and directed Caltrans to update Chapter 1000 of the Highway Design Manual to include this facility.

Existing Class II bicycle routes are located along Campus Parkway, Northpark Boulevard, and University Parkway. According to the SANBAG Non-Motorized Transportation Plan (Revised May 2015), there are plans to add a Class I bicycle route adjacent to Campus Circle.

4.3.2 EXISTING PEDESTRIAN FACILITIES

The pedestrian network in the study area consists of sidewalks, pedestrian crosswalks, and pedestrian crossing controls.

Internal pedestrian facilities are plentiful, with walkways and sidewalks present throughout the inner core of the campus. These serve as primary walkways for student and faculty conducting general activities around campus. Crosswalks are present where vehicle and pedestrian conflicts are likely to occur, although some painted crosswalks are faded. A large number of pedestrian crossings occur at locations between major parking facilities and the inner campus core. In many instances, pedestrians will cross at desired paths instead of demarcated crossings, which can create additional pedestrian/vehicle conflicts.

External pedestrian facilities are present in some locations, but missing in others. A sidewalk is provided on the south side of Northpark Boulevard only. Crossing Northpark Boulevard can prove challenging, as there is no striped crosswalk at Ash Street or Sierra Drive along Northpark Boulevard. This could result in conflicts with crossing activity across Northpark Boulevard, especially for those students living at The Glen at University Park.

4.3.3 EXISTING TRANSIT FACILITIES

4.3.3.1 Bus Transit Facilities

Omnitrans is a public transportation agency in San Bernardino County, California, United States. It is the largest transit operator within San Bernardino County, serving the entirety of the San Bernardino Valley. Students at California State University, San Bernardino can get a free ride to class with the Go Smart program that offers them unlimited rides when they swipe their college IDs on Omnitrans buses. As shown in Figure 4-1, there are currently five lines that operate to the California State University campus bus stop.

These five routes all have a stop on University Parkway, at the entrance of the University. This area serves as the de-facto hub for transit on campus. The facility consists of a covered waiting areas, and a stacking area to accommodate several transit vehicles. Two of the lines (Routes 2 & 7) also have several stops along Northpark Boulevard.

The multiple Omintrans bus lines running in the vicinity of the project are described below:

<u>Route 2</u> – Serves Cal State San Bernardino and Loma Linda via Kendall, E Street, Hospitality and Tippecanoe/Anderson. Headways are every 30 minutes during weekdays and 20-30 minutes on Saturdays and Sundays. The route operates from 4:30 AM to 11:15 PM on Mondays-Fridays and 6:30 AM to 10:00 PM on the weekends.

<u>Route 5</u> – Serves San Bernardino, Del Rosa and Cal State San Bernardino. Popular destinations are the 4th Street Transit Center, Cajon High School, Cal State University San Bernardino, Carousel Mall, and Pacific High School. Headways are every 30 minutes during weekdays and 60 minutes on Saturdays and Sundays. The route operates from 4:45 AM to 10:40 PM on Mondays-Fridays and 6:30 AM to 9:20 PM on the weekends.

<u>Route 7</u> – Serves San Bernardino and Verdemont via Sierra Way and Electric. Headways are between 30-60 minutes during weekdays and 60 minutes on Saturdays and Sundays. This route operates on Mondays-Fridays from 6:05 AM to 7:50 PM and 7:00 AM to 6:35 PM on the weekends.

<u>Route 11</u> – Serves San Bernardino and Cal State San Bernardino via Muscoy. Headways are between 30-60 minutes during weekdays and 60 minutes on Saturdays and Sundays. This route operates on Mondays-Fridays from 5:30 AM to 10:20 PM and 6:50 AM to 7:30 PM on the weekends.

sbX Green Line – The sbX Green Line travels a 15.7 mile route along the E Street Corridor, from Cal State University San Bernardino at the north to Loma Linda University & Medical Center at the south. Service is weekdays, Monday through Friday, with service every 10 minutes during peak hours and every 15 minutes during off-peak hours. The northbound peak period is from 6:00 AM to 9:00 AM and from 3:00 PM to 6:00 PM. The Southbound peak period is from 6:00 A.M. to 9:00 AM and from 2:00 PM to 6:00 PM. Service hours are 6:00 AM to 8:00 PM for weekdays only. Portions of the route have designated lanes for the buses and center boarding stations.

4.3.3.2 Rail Transit Facilities

Metrolink, a regional transit service serving the five-county Southern California region, and Amtrak, a national rail service supplier, provide rail transit within the study area. These lines do not stop at the CSUSB campus, but rather at the downtown San Bernardino station about 11 miles south of the campus. The lines running in the vicinity of the project site are described below:

4.3.3.2.1 Metrolink

San Bernardino Line – provides weekday service (and limited weekend service) from downtown Los Angeles to San Bernardino with stops in north Pomona and Upland. The route travels parallel to Arrow Highway.

There are 12 trains in the morning and seven trains in the afternoon from San Bernardino to Los Angeles. There are five trains in the morning and 14 trains in the afternoon from Los Angeles to San Bernardino.

Inland Empire Line – provides weekday service between downtown San Bernardino and Oceanside, though a majority of the trains end service at either Riverside or Laguna Niguel/Mission Viejo.

There are three trains in the morning and one train in the afternoon from San Bernardino to the south. There are two trains in the morning and six trains in the afternoon from Laguna Niguel/Mission Viejo to San Bernardino.

4.3.3.2.2 Amtrak

Southwest Chief – Runs daily between Chicago and Los Angeles. San Bernardino is the third station after leaving Union Station in Los Angeles.

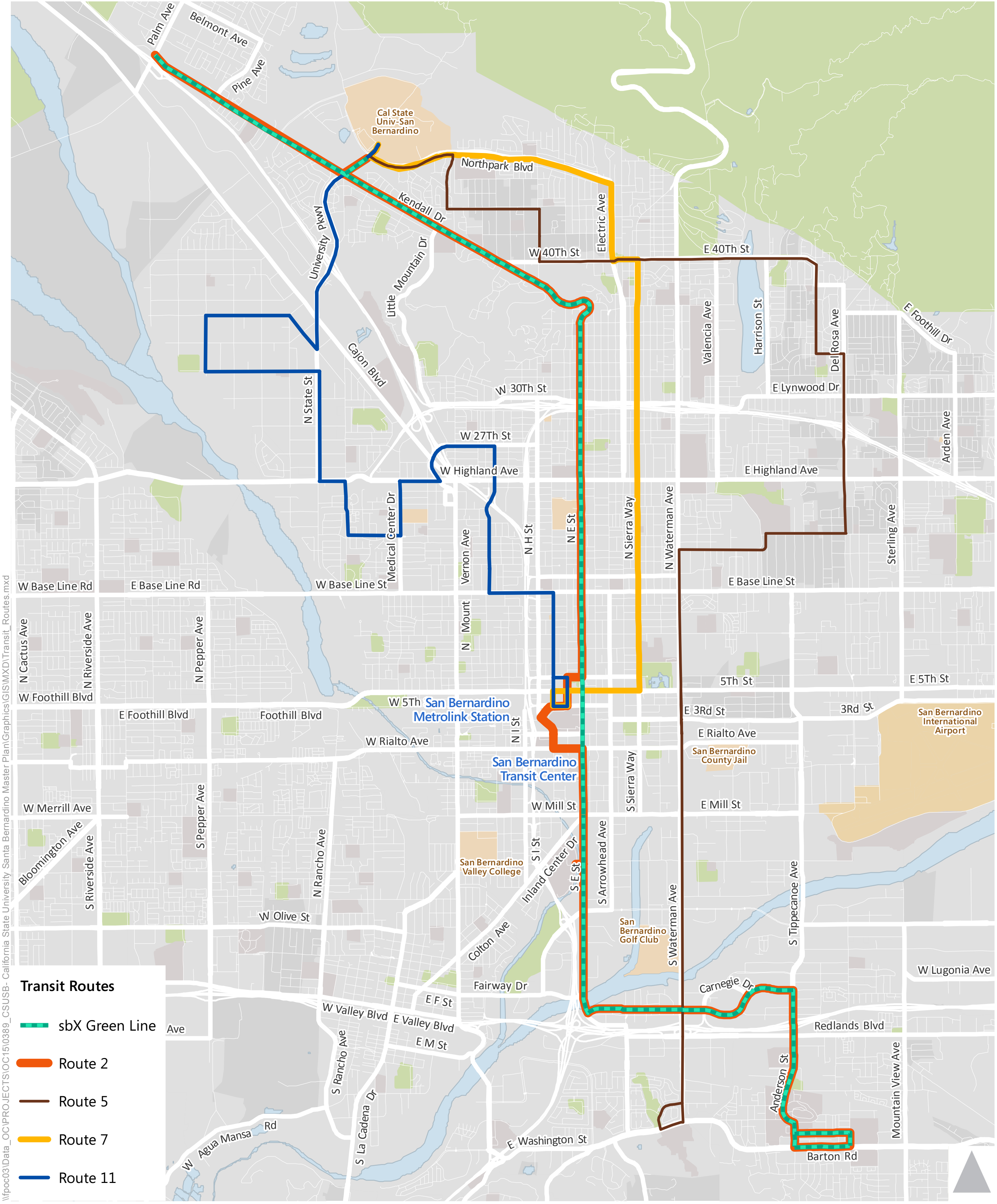

Figure 4-1

Transit Routes Serving CSUSB

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4.4 EXISTING TRAFFIC VOLUMES

Fehr & Peers collected existing turning movement counts in October 2015 at study intersections during the morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak hours. Figure 4-1 summarizes the existing intersection turning movement volumes for the AM and PM peak hour and is used to represent Existing Conditions. Existing traffic count data is provided in Appendix A.

According to staff at CSUSB, the first two weeks of a quarter traditionally experience the heaviest traffic congestion and peak parking demands. It was the intent of the University to capture the peak activity of the quarter; therefore, most of the traffic counts were taken during this peak period.

Existing freeway mainline volumes were gathered from the Caltrans PeMS database for Tuesdays, Wednesdays and Thursdays within April 2016 - May 2016. These counts were averaged together to estimate existing freeway mainline volume.

4.5 EXISTING LEVEL OF SERVICE

4.5.1 EXISTING INTERSECTION OPERATIONS

Fehr & Peers utilized the existing traffic volumes, lane configurations, and signal phasing information collected to evaluate traffic operations at the study intersections during the peak hours. The results are summarized in Table 4-1. The corresponding level of service reports are provided in Appendix B.

TABLE 4-1 INTERSECTION LEVEL OF SERVICE: EXISTING (2015) CONDITIONS

No.	Intersection	Control[1]	Peak Hour	Delay[2]	LOS[3,4]
1	Devils Canyon Road & Campus Parkway	AWSC	AM	8.2	A
			PM	9.8	A
2	Northpark Boulevard/Devils Canyon Road & Ash Street	TWSC	AM	4.2 (34.0)	A (D)
			PM	14.0 (34.3)	B (D)
3	Northpark Boulevard & Sierra Drive	AWSC	AM	9.9	A
			PM	13.8	B
4	Northpark Boulevard & University Parkway	Signal	AM	45.9	D

**TABLE 4-1 INTERSECTION LEVEL OF SERVICE:
EXISTING (2015) CONDITIONS**

No.	Intersection	Control[1]	Peak Hour	Delay[2]	LOS[3,4]
			PM	65.3	**E**
5	Serrano Village Drive & Northpark Boulevard	Signal	AM	12.0	B
			PM	17.7	B
6	Coyote Drive & Northpark Boulevard	Signal	AM	11.0	B
			PM	14.2	B
7	East Campus Circle & Northpark Boulevard	Signal	AM	16.3	B
			PM	19.9	B
8	Education Lane & North Campus Circle	TWSC	AM	1.2 (9.5)	A (A)
			PM	3.6 (15.3)	A (C)
9	University Parkway & Kendall Drive	Signal	AM	38.1	D
			PM	45.4	D
10	University Parkway & College Avenue	Signal	AM	124.8	**F**
			PM	23.7	C
11	University Parkway & State Street	Signal	AM	16.8	B
			PM	33.4	C
12	University Parkway & I-215 Northbound Ramps[5]	Signal	AM	43.7	D
			PM	111.9	**F**
13	University Parkway & I-215 Southbound Ramps	Signal	AM	23.1	C
			PM	80.8	**F**
14	Little Mountain Drive & Kendall Drive	Signal	AM	22.7	C
			PM	22.6	C

TABLE 4-1 INTERSECTION LEVEL OF SERVICE: EXISTING (2015) CONDITIONS

No.	Intersection	Control[1]	Peak Hour	Delay[2]	LOS[3,4]

Source: Fehr & Peers, 2016.
Notes:
[1] Signal = Signalized Intersection; SSSC = Side-Street Stop-Controlled Intersection; AWSC = All-Way Stop-Controlled Intersection
[2] Whole intersection weighted average control delay expressed in seconds per vehicle for signalized intersections and all-way stop-controlled intersections. Whole intersection weighted average control delay and total control delay for the worst approach (in parenthesis) are presented for side-street stop-controlled intersections. Delay indicated with ** represents oversaturated conditions and delay cannot be calculated.
[3] LOS threshold is the lowest acceptable LOS (the threshold between acceptable and unacceptable level of service). **Bold** indicates unacceptable operations by jurisdiction's level of service standard.
[4] Unless otherwise noted, intersection LOS calculations were conducted using Synchro 9.1 Build 909. LOS calculations were performed using the methods described in the Highway Capacity Manual (HCM) 2010.
[5] HCM 2010 methodology does not evaluate custom phasing; HCM 2000 methodology was used to evaluate Intersection 12: University Parkway & I-215 Northbound Ramps.

As shown in Table 4-1, the following four study intersections are operating at a deficient LOS in at least one of the analyzed peak hours under Existing Conditions:

4. Northpark Boulevard & University Parkway (LOS E – PM peak hour)
10. University Parkway & College Avenue (LOS F – AM peak hour)
12. University Parkway & I-215 Northbound Ramps (LOS F – PM peak hour)
13. University Parkway & I-215 Southbound Ramps (LOS F – PM peak hour)

Section 3.2 provides a discussion on acceptable and deficient levels of service. In this analysis, LOS D or better is considered to be acceptable. LOS E or F is considered to be deficient. For two-way stop controlled intersections, the worst case movement delay and level of service is used to determine LOS deficiency and impacts. The determination of significant impacts under Existing Conditions is identified in Section 5.2.8.

4.5.2 EXISTING FREEWAY OPERATIONS

Table 4-2 present the results of the freeway assessment for the I-215 freeway at University Parkway. Existing freeway mainline volumes were obtained from PeMS, truck percentages were taken from the 2014 Annual Average Daily Truck Traffic published by Caltrans, the terrain was assumed to be level, free-flow speed is assumed to be 65 miles per hour, and a peak hour factor of 0.95 was assumed for the segments. Freeway reports are provided in Appendix H.

TABLE 4-2 FREEWAY OPERATIONS:
EXISTING (2015) CONDITIONS

Segment	Type	AM			PM		
		Density	V/C	LOS	Density	V/C	LOS
I-215 Northbound							
University Pkwy Off-Ramp	Diverge	24.4	0.67	C	38.0	0.92	**E**
University Pkwy Off-Ramp to University Pkwy On-Ramp	Basic	19.3	0.54	C	34.6	0.87	**D**
University Pkwy On-Ramp	Merge	25.2	0.57	C	38.1	0.93	**E**
I-215 Southbound							
University Pkwy Off-Ramp	Diverge	34.9	0.84	**D**	23.6	0.55	C
University Pkwy Off-Ramp to University Pkwy On-Ramp	Basic	27.9	0.75	**D**	17.2	0.48	B
University Pkwy On-Ramp	Merge	26.1	0.71	**D**	21.1	0.58	C

Notes:
1. Calculated using methodologies consistent with the 2010 Highway Capacity Manual
2. Density reported as passenger cars per mile per lane
3. **Bold** indicates unacceptable operations

As shown in Table 4-2, the following freeway mainline segments operate unacceptably (LOS D, LOS E, or LOS F) during the AM or PM Peak Hours:

- I-215 Northbound Diverge Segment (LOS E – PM peak hour)
- I-215 Northbound Basic Segment (LOS D – PM peak hour)
- I-215 Northbound Merge Segment (LOS E – PM peak hour)
- I-215 Southbound Diverge Segment (LOS D – AM peak hour)
- I-215 Southbound Basic Segment (LOS D – AM peak hour)
- I-215 Southbound Merge Segment (LOS D – AM peak hour)

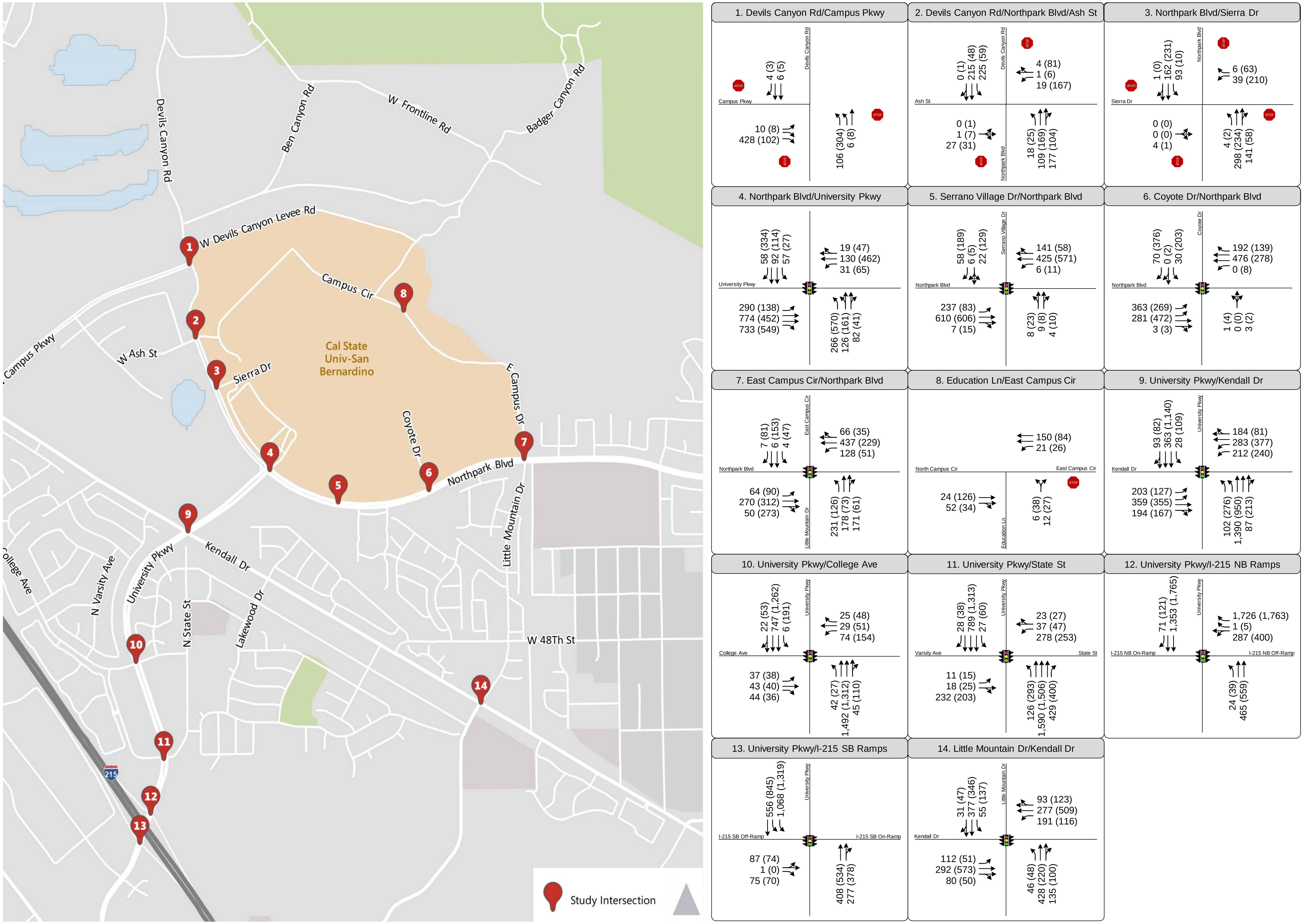


Figure 4-2
Peak Hour Traffic Volumes and Lane Configurations
Existing (2015) Conditions

5.0 EXISTING PLUS PROJECT (2015) CONDITIONS

This section identifies the methodology utilized to calculate traffic volumes within the study area for the existing plus project conditions analysis scenarios. It then provides the intersection operations for those future scenarios, signal warrant analysis, and impact assessment.

5.1 ROADWAY NETWORK IMPROVEMENTS

Part of the Master Plan is the roadway improvement to extend Campus Parkway to Campus Circle. This connectivity was assumed in the analysis and traffic was redistributed accordingly. The intersection of Campus Parkway at Devil's Canyon Road is assumed to have two lanes in each direction and is all-way stop controlled under Existing (2015) Plus Project Conditions.

5.2 PROJECT TRAFFIC

Typically, project traffic is estimated using a three step process: (1) Trip Generation, (2) Trip Distribution, and (3) Trip Assignment. In the first step, the number of trips generated by the project are estimated. In the second step, the directions those trips originate from and are destined two are estimated. Finally, those trips are assigned to the transportation system.

For this project, the traffic assignment process is different than the traditional process as the Master Plan incorporates modifications that will change how trips are assigned to the transportation network. The location and magnitude of the parking facilities on the campus site under buildout of the Master Plan will be significantly different than where they are today. To account for this, trip assignment was completed for both the existing uses on the campus and the proposed master plan. The "difference" in trip assignment was then used to represent the "project" trip assignment.

5.2.1 TRIP GENERATION

Trip generation for the project is summarized in Tables 5-1 through 5-3 for both the existing condition and future condition. Trip rates used for the assessment were derived from two sources: (1) trip survey information completed for Cal Poly Pomona (a similar CSU campus) (*DRAFT Working Paper #1: Existing Conditions Transportation Assessment Report, Fehr & Peers, August 10, 2011*) that was detailed enough to isolate trip generation characteristics by the different users that access the campus (e.g. on-campus students, off-campus (e.g. commuter) students, and faculty and staff; and (2) from cordon roadway counts placed on driveways accessing the campus.

Use of the Cal Poly Pomona trip surveys allowed different trip rates for on-campus and off-campus students and the ability to quantify the differences in trip generation associated with changing a large portion of the student body from commuter students to on-campus residents. Trip surveys for the CSUSB campus were not available and the Cal Poly Pomona surveys are the best available data source to estimate the difference in trip generation by user.

Use of the cordon counts allowed us to adjust the Cal Poly Pomona trip survey information to ensure that the trip rates were calibrated to accurately estimate trip generation on the campus. Specifically, the cordon counts indicated that the Cal Poly Pomona surveys, although accurate for Cal Poly Pomona, resulted in an underestimate in daily trips by approximately 5%, overestimated the AM peak hour trip rate by 14%, and underestimated the PM peak hour trip rate by 35%. As such, the trip rate information from the survey data was “adjusted” using the cordon count information to accurately reflect trip generation behavior that exists at the campus today for each user of the campus.

In addition to trips associated with the educational activities, described above, the master plan also incorporates research and development space at the northwest area of the campus. To estimate trip generation associated with this use, Fehr & Peers applied rates from the Institute of Transportation Engineers’ (ITE) *Trip Generation Manual* (9th Edition, 2012).

TABLE 5-1
CSUSB TRIP GENERATION RATES BY USER TYPE

User Type	Unit	Daily Rate	AM Peak Hour			PM Peak Hour		
			Rate	In	Out	Rate	In	Out
On-Campus Student	FTE	1.96	0.017	0.015	0.002	0.050	0.020	0.030
Off-Campus Student	FTE	2.07	0.189	0.163	0.026	0.181	0.072	0.109
Faculty & Staff	FTE	1.83	0.322	0.277	0.045	0.667	0.266	0.401
Research & Development (ITE Code 760)	KSF	8.11	1.220	1.013	0.207	1.070	0.161	0.910

Source: Fehr & Peers, 2016
ITE *Trip Generation Manual*, 9th Edition, 2012

TABLE 5-2
EXISTING CSUSB TRIP GENERATION ESTIMATES

User Type	Amount	Daily	AM Peak Hour			PM Peak Hour		
			Total	In	Out	Total	In	Out
On-Campus Student (FTE)	1,533	2,997	26	23	4	76	30	46
Off-Campus Student (FTE)	14,945	30,948	2,821	2,429	392	2,707	1,078	1,629
Faculty & Staff (FTE)	1,650	3,027	531	457	74	1,100	438	662
	Total	***36,971***	***3,378***	***2,909***	***470***	***3,883***	***1,547***	***2,337***

Source: Fehr & Peers, 2016

TABLE 5-3
MASTER PLAN BUILDOUT CSUSB TRIP GENERATION ESTIMATES

User Type	Amount	Daily	AM Peak Hour			PM Peak Hour		
			Total	In	Out	Total	In	Out
On-Campus Student (FTE)	4,850	9,482	83	72	12	240	95	144
Off-Campus Student (FTE)	20,150	41,726	3,804	3,275	529	3,650	1,454	2,196
Faculty & Staff (FTE)	2,503	4,592	806	694	112	1,670	665	1,005
Research & Development (ITE Code 760) (KSF)	150	1,216	183	152	31	160	24	136
Master Plan Buildout Total		***57,016***	***4,876***	***4,193***	***684***	***5,720***	***2,238***	***3,481***
Existing Total		***-36,971***	***-3,378***	***-2,909***	***-470***	***-3,883***	***-1,547***	***-2,337***
Total Net New Trips		**20,045**	**1,498**	**1,284**	**214**	**1,837**	**691**	**1,144**

Source: Fehr & Peers, 2016
ITE *Trip Generation Manual*, 9^{th} Edition, 2012

5.2.2 TRAFFIC REDISTRIBUTION

The location and quantity of parking areas will change significantly with completion of the master plan. The changes in the parking supply are noted in Table 5-4. While these changes to parking supply won't affect trip generation, they will affect where trips originate and end. Inbound and outbound trips were reassigned based on where the available parking will be provided.

TABLE 5-4
MASTER PLAN BUILDOUT
CSUSB PARKING SUPPLY

Parking Facility	Change in Parking Supply
Lot A	-368
Lot C	-1,038
Lot D	-739
Lot E	-602
Lot F	-436
Lot G	-426
Lot H	+191
Lot N	+843
Lot M	-211
PK 3	+1,324
PK 4	+822
PK 5	+1,264
PK 6	+1,135
PK 7	+908
PK N	+1,360

Source: *CSUSB Campus Master Plan, 95% Administrative Review Draft, September 2, 2016, CallisonRTKL*

5.2.3 PROJECT TRIP DISTRIBUTION

Inbound and outbound trip distribution to the campus was estimated using available zip code data of students, faculty and staff and compared against Census Longitudinal Employer-Household Dynamic (LEHD) data. Campus wide trips are regionally distributed as follows: 10% to/from Campus Parkway, 10% to/from I-215 North, 40% to/from I-215 South, 20% to/from Northpark Boulevard, 10% to/from Kendall Drive, and 10% to/from Little Mountain Drive.

5.2.4 TRAFFIC VOLUMES

Existing Plus Project (2015) traffic volumes are forecast by applying the parking facility redistributions and trip generation as described above. Figure 5-1 shows the Existing Plus Project (2015) AM and PM peak hour volumes.

5.2.5 EXISTING PLUS PROJECT INTERSECTION OPERATIONS

The results of the Existing Plus Project (2015) intersection operations are summarized in Table 5-5. The corresponding LOS reports are provided in Appendix C.

TABLE 5-5 INTERSECTIONLEVEL OF SERVICE:
EXISTING PLUS PROJECT (2015) CONDITIONS

No.	Intersection	Control[1]	Peak Hour	Delay[2]	LOS[3,4]
1	Devils Canyon Road & Campus Parkway	AWSC	AM	8.2	A
			PM	9.8	A
2	Northpark Boulevard/Devils Canyon Road & Ash Street	TWSC	AM	53.8 (>180)	**F (F)**
			PM	>180 (>180)	**F (F)**
3	Northpark Boulevard & Sierra Drive	AWSC	AM	34.9	D
			PM	88.0	**F**
4	Northpark Boulevard & University Parkway	Signal	AM	426.9	**F**
			PM	410.4	**F**
5	Serrano Village Drive & Northpark Boulevard	Signal	AM	11.6	B
			PM	16.9	B
6	Coyote Drive & Northpark Boulevard	Signal	AM	9.0	A

TABLE 5-5 INTERSECTIONLEVEL OF SERVICE: EXISTING PLUS PROJECT (2015) CONDITIONS

No.	Intersection	Control[1]	Peak Hour	Delay[2]	LOS[3,4]
			PM	12.5	B
7	East Campus Circle & Northpark Boulevard	Signal	AM	21.9	C
			PM	23.6	C
8	Education Lane & North Campus Circle	TWSC	AM	2.2 (21.4)	A (C)
			PM	>180 (>180)	**F (F)**
9	University Parkway & Kendall Drive	Signal	AM	39.0	D
			PM	58.2	**E**
10	University Parkway & College Avenue	Signal	AM	275.9	**F**
			PM	73.9	**E**
11	University Parkway & State Street	Signal	AM	28.8	C
			PM	80.3	**F**
12	University Parkway & I-215 Northbound Ramps[5]	Signal	AM	118.3	**F**
			PM	199.4	**F**
13	University Parkway & I-215 Southbound Ramps	Signal	AM	22.6	C
			PM	69.6	**E**
14	Little Mountain Drive & Kendall Drive	Signal	AM	22.8	C
			PM	25.8	C

Source: Fehr & Peers, 2016.

Notes:

[1] Signal = Signalized Intersection; SSSC = Side-Street Stop-Controlled Intersection; AWSC = All-Way Stop-Controlled Intersection

[2] Whole intersection weighted average control delay expressed in seconds per vehicle for signalized intersections and all-way stop-controlled intersections. Whole intersection weighted average control delay and total control delay for the worst approach (in parenthesis) are presented for side-street stop-controlled intersections. Delay indicated with ** represents oversaturated conditions and delay cannot be calculated.

[3] LOS threshold is the lowest acceptable LOS (the threshold between acceptable and unacceptable level of service). **Bold** indicates unacceptable operations by jurisdiction's level of service standard.

[4] Unless otherwise noted, intersection LOS calculations were conducted using Synchro 9.1 Build 909. LOS calculations were performed using the methods described in the Highway Capacity Manual (HCM) 2010.

[5] HCM 2010 methodology does not evaluate custom phasing; HCM 2000 methodology was used to evaluate Intersection 12: University Parkway & I-215 Northbound Ramps.

As shown in Table 5-5, the following intersections are operating at a deficient LOS during the peak hours for Existing (2015) Plus Project Conditions:

2. Northpark Boulevard/Devils Canyon Road & Ash Street (LOS F – AM and PM peak hour)
3. Northpark Boulevard & Sierra Drive (LOS F – PM peak hour)
4. Northpark Boulevard & University Parkway (LOS F – AM and PM peak hour)
8. Education Lane & North Campus Circle (LOS F – PM peak hour)
9. University Parkway & Kendall Drive (LOS E – PM peak hour)
10. University Parkway & College Avenue (LOS F – AM peak hour, LOS E – PM peak hour)
11. University Parkway & State Street (LOS F – PM peak hour)
12. University Parkway & I-215 Northbound Ramps (LOS F – AM and PM peak hour)
13. University Parkway & I-215 Southbound Ramps (LOS E – PM peak hour)

Section 3.2 provides a discussion on acceptable and deficient levels of service. This this analysis, LOS D or better is considered to be acceptable. LOS E or F is considered to be deficient. For two-way stop controlled intersections, the worst case approach delay and level of service is used to determine LOS deficiency and impacts. Intersections that are deficient are not necessarily considered significantly impacted. The determination of significant impacts is done in Section 5.2.8.

5.2.6 EXISTING PLUS PROJECT FREEWAY OPERATIONS

Table 5-6 present the results of the freeway assessment for the I-215 freeway at University Parkway under Existing (2015) Plus Project Conditions. Freeway reports are provided in Appendix H.

TABLE 5-6 FREEWAY OPERATIONS:
EXISTING (2015) PLUS PROJECT CONDITIONS

Segment	Type	AM			PM		
		Density	V/C	LOS	Density	V/C	LOS
I-215 Northbound							
University Pkwy Off-Ramp	Diverge	27.9	0.75	**D**	-	1.01	**F**
University Pkwy Off-Ramp to University Pkwy On-Ramp	Basic	19.3	0.54	C	40.3	0.95	**E**
University Pkwy On-Ramp	Merge	25.3	0.57	C	-	1.03	**F**
I-215 Southbound							
University Pkwy Off-Ramp	Diverge	36.2	0.88	**E**	24.4	0.56	C
University Pkwy Off-Ramp to University Pkwy On-Ramp	Basic	28.1	0.75	**D**	17.4	0.48	B
University Pkwy On-Ramp	Merge	26.6	0.72	**D**	-	0.66	**F**

Notes:

4. Calculated using methodologies consistent with the 2010 Highway Capacity Manual
5. Density reported as passenger cars per mile per lane
6. **Bold** indicates unacceptable operations

As shown in Table 5-6, the following freeway mainline segments operate unacceptably (LOS D, LOS E, or LOS F) during the AM or PM Peak Hours:

- I-215 Northbound Diverge Segment (LOS D – AM peak hour, LOS F – PM peak hour)
- I-215 Northbound Basic Segment (LOS E – PM peak hour)
- I-215 Northbound Merge Segment (LOS F – PM peak hour)
- I-215 Southbound Diverge Segment (LOS E – AM peak hour)
- I-215 Southbound Basic Segment (LOS D – AM peak hour)
- I-215 Southbound Merge Segment (LOS D – AM peak hour, LOS F – PM peak hour)

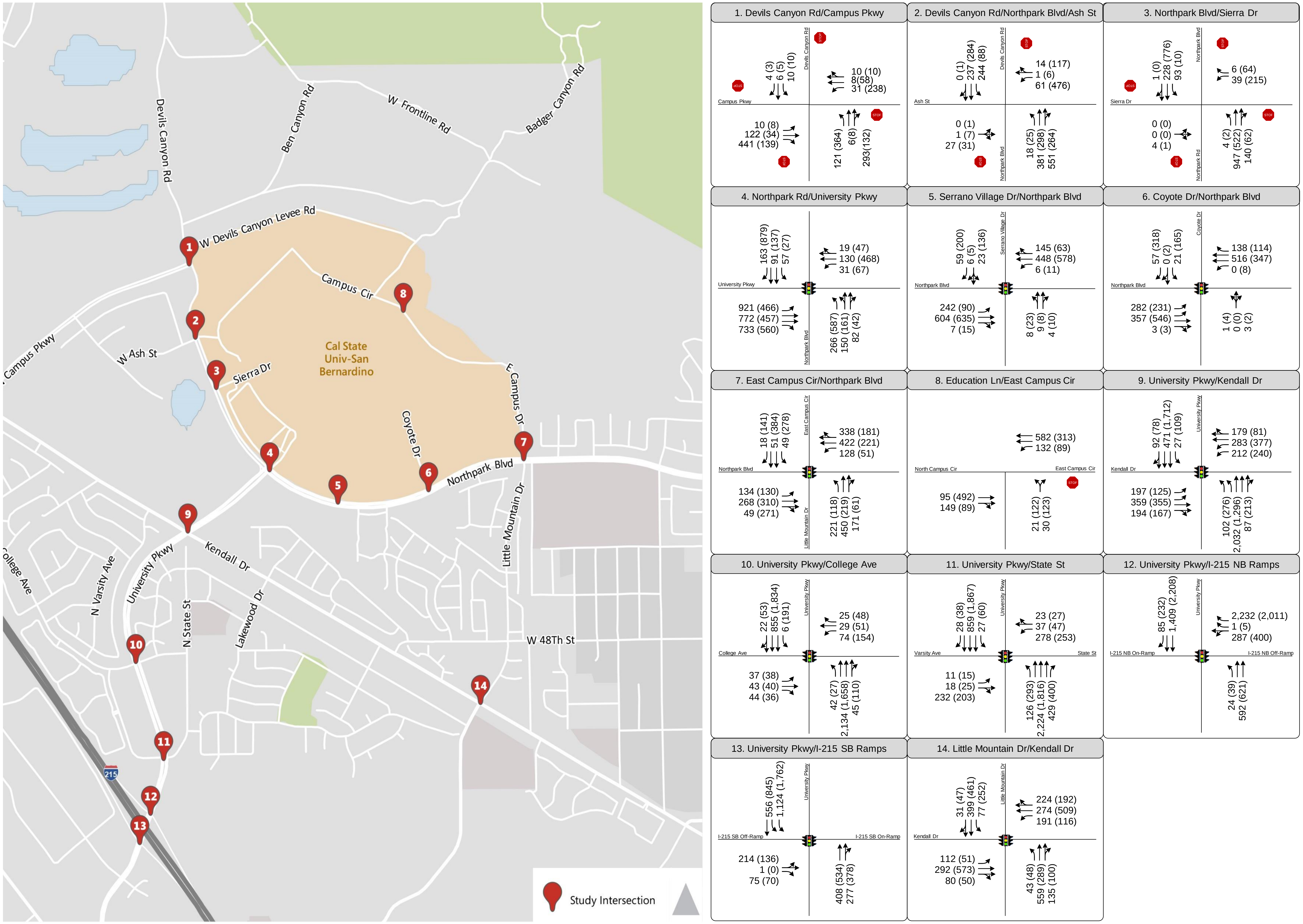


Figure 5-1
Peak Hour Traffic Volumes and Lane Configurations
Existing (2015) plus Project Conditions

5.2.7 SIGNAL WARRANT ANALYSIS

A peak hour traffic signal warrant[1] assessment was prepared for the following unsignalized intersections to identify if the intersection satisfies the peak hour volume warrant for traffic signal installation:

- Northpark Boulevard/Devils Canyon Road & Ash Street (Met under PM peak hour)
- Northpark Boulevard & Sierra Drive (Met under PM peak hour)
- Education Lane & North Campus Circle (Not met under either peak hour)

The results indicate that a peak hour traffic signal warrant is satisfied in the PM peak hour for two of the study intersections. Signal warrant reports and calculations are provided in Appendix G.

5.2.8 IMPACT ASSESSMENT

5.2.8.1 Intersection Level of Service Impacts

Table 5-6 compares the changes in delay and LOS at intersections that operate deficiently between the No Project and Plus Project scenarios to determine project impacts.

TABLE 5-6 INTERSECTION IMPACTS: EXISTING (2015) PLUS PROJECT CONDITIONS

Intersection	Traffic Control[1]	Peak Hour	Existing (2015) Conditions		Existing Plus Project (2015) Conditions		Δ Delay	Δ V/C[3]	Signal Warrant Met?	Result
			Delay	LOS	Delay	LOS				
	TWSC	AM	34.0	D	>180	F	**	-	No	**Impact**

---

[1] This analysis is intended to examine the general correlation between the planned level of future development and the need to install new traffic signals. It estimates future development-generated traffic compared against a sub-set of the standard traffic signal warrants recommended in the Federal Highway Administration Manual on Uniform Traffic Control Devices and associated State guidelines. This analysis should not serve as the only basis for deciding whether and when to install a signal. To reach such a decision, the full set of warrants should be investigated based on field-measured, rather than forecast, traffic data and a thorough study of traffic and roadway conditions by an experienced engineer. Furthermore, the decision to install a signal should not be based solely upon the warrants, since the installation of signals can lead to certain types of collisions. The City of San Bernardino and/or CSUSB should undertake regular monitoring of actual traffic conditions and accident data, and timely re-evaluation of the full set of warrants in order to prioritize and program intersections for signalization.

TABLE 5-6 INTERSECTION IMPACTS:
EXISTING (2015) PLUS PROJECT CONDITIONS

Intersection	Traffic Control[1]	Peak Hour	Existing (2015) Conditions		Existing Plus Project (2015) Conditions		Δ Delay	Δ V/C[3]	Signal Warrant Met?	Result
			Delay	LOS	Delay	LOS				
2. Northpark Boulevard/Devils Canyon Road & Ash Street		PM	34.3	D	>180	F	**	-	**Yes**	**Impact**
3. Northpark Boulevard & Sierra	AWSC	PM	13.8	B	88	F	**74.2**	-	**Yes**	**Impact**
4. Northpark Boulevard & University Parkway	Signal	AM	45.9	D	426.9	F	**381.0**	-	-	**Impact**
		PM	65.3	E	410.4	F	**345.1**	-	-	**Impact**
8. Education Lane & North Campus Circle	TWSC	PM	15.3	C	> 180	F	**	-	No	**Impact**
9. University Parkway & Kendall Drive	Signal	PM	45.4	D	58.2	E	**12.8**	**-**	**-**	**Impact**
10. University Parkway & College Avenue	Signal	AM	124.8	F	275.9	F	**151.1**	**0.19**	**-**	**Impact**
		PM	23.7	C	73.9	E	**50.2**	**-**	**-**	**Impact**
11. University Parkway & State Street	Signal	PM	33.4	C	80.3	F	**46.9**	-	-	**Impact**
12. University Parkway & I-215 Northbound Ramps	Signal	AM	43.7	D	118.3	F	**74.6**	-	-	**Impact**
		PM	111.9	F	199.4	F	**87.5**	-	-	**Impact**
13. University Parkway & I-215 Southbound Ramps	Signal	PM	80.8	F	69.6	E	-11.2	-	-	No Impact

**TABLE 5-6 INTERSECTION IMPACTS:
EXISTING (2015) PLUS PROJECT CONDITIONS**

Intersection	Traffic Control[1]	Peak Hour	Existing (2015) Conditions		Existing Plus Project (2015) Conditions		Δ Delay	Δ V/C[3]	Signal Warrant Met?	Result
			Delay	LOS	Delay	LOS				

Notes:
1- AWSC is all-way stop control; TWSC is two-way stop control.
2- Impacts are noted in bold.
3- HCM 2010 does not define V/C ratio at the intersection level. HCM 2000 is used to determine V/C ratios for impact determination purposes. ΔV/C is only provided for signalized intersections when the delay is 120 seconds or more per the impact criteria guidelines.
4- ">180" is reported for oversaturated conditions in which Synchro is no longer capable of estimating delay. ** is used to denote increases in delay in these cases.

Source: Fehr & Peers, 2016

As shown in Table 5-6, the following study intersections are forecast to result in a significant impact based on thresholds of significance for Existing (2015) Plus Project Conditions:

2. Northpark Boulevard/Devils Canyon Road & Ash Street
3. Northpark Boulevard & Sierra Drive
4. Northpark Boulevard & University Parkway
8. Education Lane & North Campus Circle
9. University Parkway & Kendall Drive
10. University Parkway & College Avenue
11. University Parkway & State Street
12. University Parkway & I-215 Northbound Ramps

5.2.8.2 Freeway Mainline Level of Service Impacts

The project adds traffic to freeway segments already operating at LOS D, LOS E or LOS F or the addition of project traffic causes the LOS to degrade to LOS D, LOS E or LOS F for all study freeway segments under at least one peak hour. The following study freeway segments are forecast to result in a significant impact based on thresholds of significance for Existing (2015) Plus Project Conditions:

- I-215 Northbound Diverge Segment
- I-215 Northbound Basic Segment
- I-215 Northbound Merge Segment
- I-215 Southbound Diverge Segment
- I-215 Southbound Basic Segment

- I-215 Southbound Merge Segment

5.2.8.3 Pedestrian, Bicycle, and Transit Impacts

The addition of traffic and redistribution of vehicle traffic associated with the parking lots is not expected to cause any pedestrian, bicycle, or transit impacts. The project does not disrupt any existing or planned bicycle, pedestrian, or transit facilities; nor does the project conflict with any plans, guidelines, policies, or standards related to the aforementioned modes.

6.0 CUMULATIVE (2035) NO PROJECT

Estimates of the Cumulative traffic without the project were developed to evaluate the potential impact of traffic generated by the proposed project on the surrounding transportation network in the buildout year 2035. Traffic conditions without the project under this scenario reflects traffic increases due to nearby approved and planned development and any roadway network changes and street improvements. These conditions are referred to as the baseline condition (i.e., "No Project" conditions). This chapter presents the results of the level of service calculations under Cumulative Conditions without the project.

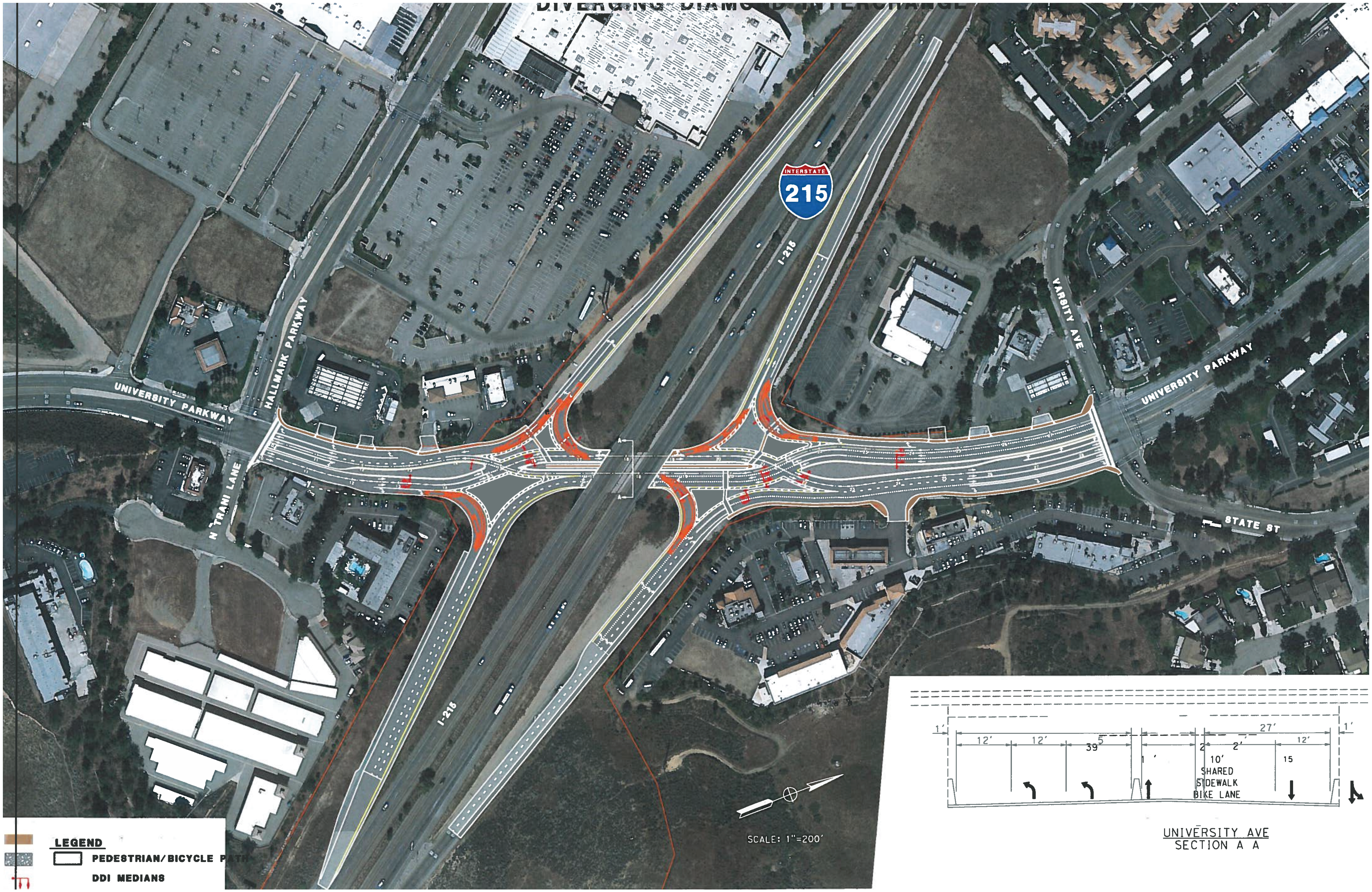
6.1 ROADWAY NETWORK IMPROVEMENTS

Details of key transportation system assumptions made for the study's Cumulative No Project Conditions are described below. These improvements, whether the result of local capital improvement programs or in connection with planned or approved projects, would result in improved traffic operations and/or capacity changes at study locations when compared to Existing Conditions. The assumed roadway network improvements are as follows:

- The interchange of University Parkway at I-215 is assumed to be improved to a Diverging Diamond Interchange (DDI). A DDI is an innovative design in which states nationwide began implementing in the past 12 years, though, there are no existing examples in California. The major design feature of a DDI is crisscrossing of arterial traffic crossing the freeway. The configuration allows traffic that would be turning left on a conventional diamond interchange to enter or exit the freeway ramps without conflicting with opposing traffic. Signalization is not required to assign right-of-way to accommodate these movements. It is assumed that the DDI will be coordinated with the closely spaced intersection of University Parkway at State Street. The proposed interchange geometrics are shown in Figure 6-1.
- A new high occupancy vehicle (HOV) lane is assumed in each direction along I-215 from I-210 to I-15. This project is listed on the Southern California Association of Governments (SCAG) Regional Transportation Plan (RTP) in the Financially-Constrained RTP Projects to be completed by 2030.

6.2 CUMULATIVE TRAFFIC

The San Bernardino Transportation Analysis Model (SBTAM) was used to determine ambient background growth of the general study area and to forecast Cumulative No Project (2035) traffic volumes. SBTAM is a TransCAD based travel demand model focused on San Bernardino County. This tool is used throughout the entire county to ensure consistency in future forecast volumes. Specifically, the daily roadway segment traffic volumes were pulled from the model and then used to calculate 2035 peak hour intersection volumes using the Furness method. The Furness method calculates the daily roadway volume growth between the base year and future year model and distributes the growth proportionally using the existing intersection turning movement counts. Overall, the growth in traffic through each study intersection is based on changes in daily traffic volumes, changes in traffic patterns identified in the model, and engineering judgment.



Source: PSR-PDS to Request Approval of a Locally Funded Project to Proceed to PA&ED Phase on I-215 between SR-210 and Palm Avenue (Tylin International, September 2016)

Figure 6-1

University Parkway and I-215 Diverging Diamond Interchange Design

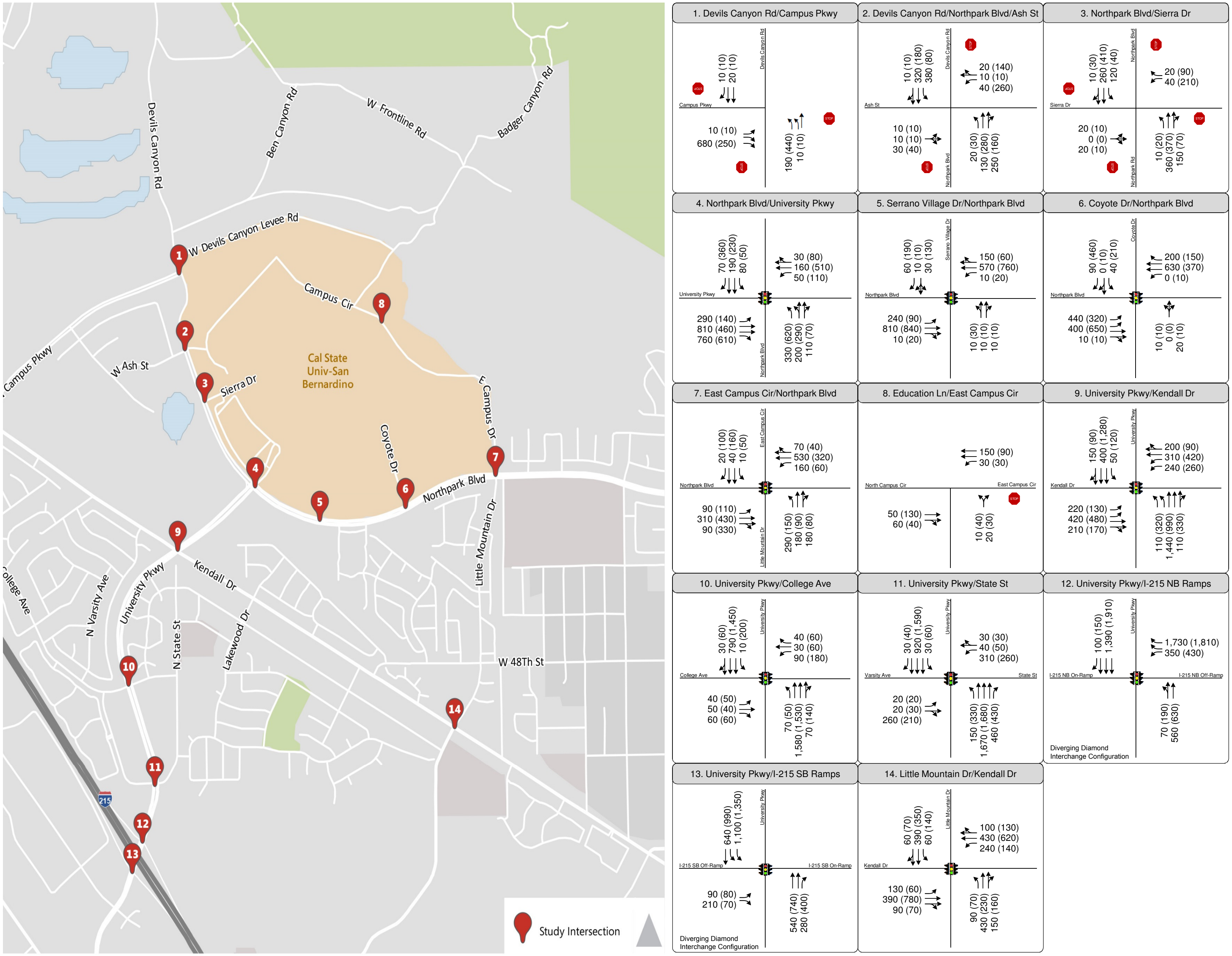


Figure 6-2
Peak Hour Traffic Volumes and Lane Configurations
Cumulative (2035) No Project

6.2.1 CUMULATIVE INTERSECTION OPERATIONS

The results of the Cumulative (2035) No Project intersection operations are summarized in Table 6-1. The corresponding LOS reports are provided in Appendix D.

TABLE 6-1 INTERSECTION LEVEL OF SERVICE: CUMULATIVE (2035) NO PROJECT CONDITIONS

No.	Intersection	Control[1]	Peak Hour	Delay[2]	LOS[3,4]
1	Devils Canyon Road & Campus Parkway	AWSC	AM	9.1	A
			PM	10.1	B
2	Northpark Boulevard/Devils Canyon Road & Ash Street	TWSC	AM	9.2 (77.5)	A**(F)**
			PM	27.1 (75.7)	D **(F)**
3	Northpark Boulevard & Sierra Drive	AWSC	AM	11.8	B
			PM	16.4	C
4	Northpark Boulevard & University Parkway	Signal	AM	30.3	C
			PM	39.9	D
5	Serrano Village Drive & Northpark Boulevard	Signal	AM	12.3	B
			PM	17.9	B
6	Coyote Drive & Northpark Boulevard	Signal	AM	16.3	B
			PM	12.0	B
7	East Campus Circle & Northpark Boulevard	Signal	AM	13.8	B
			PM	15.8	B
8	Education Lane & North Campus Circle	TWSC	AM	1.6 (9.4)	A (A)
			PM	3.2 (12.8)	A (B)
9	University Parkway & Kendall Drive	Signal	AM	46.7	D
			PM	46.8	D
10	University Parkway & College Avenue	Signal	AM	34.6	C
			PM	17.4	B
11	University Parkway &	Signal	AM	28.3	C

TABLE 6-1 INTERSECTION LEVEL OF SERVICE:
CUMULATIVE (2035) NO PROJECT CONDITIONS

No.	Intersection	Control[1]	Peak Hour	Delay[2]	LOS[3,4]
	State Street		PM	34.8	C
12	University Parkway &	Signal	AM	33.4	C
	I-215 Northbound Ramps[5]		PM	35.3	D
13	University Parkway &	Signal	AM	11	B
	I-215 Southbound Ramps		PM	22.6	C
14	Little Mountain Drive &	Signal	AM	20.1	C
	Kendall Drive		PM	20.7	C

Source: Fehr & Peers, November 2016.
Notes:
[1] Signal = Signalized Intersection; SSSC = Side-Street Stop-Controlled Intersection; AWSC = All-Way Stop-Controlled Intersection
[2] Whole intersection weighted average control delay expressed in seconds per vehicle for signalized intersections and all-way stop-controlled intersections. Whole intersection weighted average control delay and total control delay for the worst approach (in parenthesis) are presented for side-street stop-controlled intersections. Delay indicated with ** represents oversaturated conditions and delay cannot be calculated.
[3] LOS threshold is the lowest acceptable LOS (the threshold between acceptable and unacceptable level of service). **Bold** indicates unacceptable operations by jurisdiction's level of service standard.
[4] Unless otherwise noted, intersection LOS calculations were conducted using Synchro 9.1 Build 909. LOS calculations were performed using the methods described in the Highway Capacity Manual (HCM) 2010.
[5] HCM 2010 methodology does not evaluate custom phasing; HCM 2000 methodology was used to evaluate Intersection 12: University Parkway & I-215 Northbound Ramps.

As shown in Table 6-1, the following intersections are forecast to operate at a deficient LOS during the peak hours for Cumulative (2035) No Project Conditions:

- Northpark Boulevard/Devils Canyon Road & Ash Street (AM Peak Hour and PM Peak Hour)

6.2.2 CUMULATIVE FREEWAY OPERATIONS

Table 6-2 present the results of the freeway assessment for the I-215 freeway at University Parkway. Cumulative freeway mainline volumes were forecast from SBTAM model runs. Truck percentages were assumed to remain the same as existing, the terrain was assumed to be level, free-flow speed is assumed to be 65 miles per hour, and a peak hour factor of 0.95 was assumed for the segments. Freeway reports are provided in Appendix H.

TABLE 6-2 FREEWAY OPERATIONS:
CUMULATIVE (2035) NO PROJECT CONDITIONS

Segment	Type	AM			PM		
		Density	V/C	LOS	Density	V/C	LOS
I-215 Northbound							
University Pkwy Off-Ramp	Diverge	20.8	0.58	C	32.3	0.83	**D**
University Pkwy Off-Ramp to University Pkwy On-Ramp	Basic	13.6	0.38	B	26.8	0.73	**D**
University Pkwy On-Ramp	Merge	20.0	0.43	C	34.2	0.82	**D**
I-215 Southbound							
University Pkwy Off-Ramp	Diverge	26.5	0.62	C	17.2	0.37	B
University Pkwy Off-Ramp to University Pkwy On-Ramp	Basic	18.5	0.51	C	11.4	0.32	B
University Pkwy On-Ramp	Merge	20.2	0.56	C	-	0.48	**F**

Notes:
7. Calculated using methodologies consistent with the 2010 Highway Capacity Manual
8. Density reported as passenger cars per mile per lane
9. **Bold** indicates unacceptable operations

As shown in Table 6-2, the following freeway mainline segments are forecast to operate unacceptably (LOS D, LOS E, or LOS F) during the AM or PM Peak Hours:

- I-215 Northbound Diverge Segment (LOS D – PM peak hour)
- I-215 Northbound Basic Segment (LOS D – PM peak hour)
- I-215 Northbound Merge Segment (LOS D – PM peak hour)
- I-215 Southbound Basic Segment (LOS F – PM peak hour)

7.0 CUMULATIVE (2035) PLUS PROJECT

This chapter evaluates the Cumulative Plus Project Conditions (2035). This scenario analyzes the intersection conditions with the addition of traffic generated from the proposed project under the Cumulative (2035) Conditions.

7.1 ROADWAY NETWORK IMPROVEMENTS

Part of the Master Plan is the roadway improvement to extend Campus Parkway to Campus Circle. This connectivity was assumed in the analysis and traffic was redistributed accordingly. The intersection of Campus Parkway at Devil's Canyon Road is assumed to have two lanes in each direction and is all-way stop controlled under Cumulative (2035) Plus Project Conditions.

7.2 PROJECT TRAFFIC

7.2.1 PROJECT TRIP GENERATION

The same project trip generation estimates from Existing (2015) Plus Project Conditions were used for Cumulative (2035) Plus Project Conditions.

7.2.2 PROJECT TRIP DISTRIBUTION

The same project trip distribution from Existing (2015) Plus Project Conditions were used for Cumulative (2035) Plus Project Conditions with the exception of trips that were rerouted to use the proposed extension of Campus Parkway.

7.2.3 TRAFFIC VOLUMES

Cumulative (2035) Plus Project traffic volumes are forecast by assigning the project trip generation and distribution to the Cumulative (2035) No Project traffic volumes. The resulting Cumulative (2035) Plus Project traffic volumes are shown on Figure 7-1.

7.2.4 CUMULATIVE PLUS PROJECT INTERSECTION OPERATIONS

Intersection LOS results for the Cumulative Plus Project (2035) Conditions are summarized in Table 7-1. Level of service analysis sheets are provided in Appendix E.

**TABLE 7 1 INTERSECTION LEVEL OF SERVICE:
CUMULATIVE (2035) PLUS PROJECT CONDITIONS**

No.	Intersection	Control [1]	Peak Hour	Delay[2]	LOS[3,4]
1	Devils Canyon Road &	AWSC	AM	21.8	C
	Campus Parkway		PM	13.0	B
2	Northpark Boulevard/Devils Canyon Road &	TWSC	AM	41.1 (>180)	D **(F)**
	Ash Street		PM	>180 (>180)	**F (F)**
3	Northpark Boulevard &	AWSC	AM	70.2	**F**
	Sierra Drive		PM	120.4	**F**
4	Northpark Boulevard &	Signal	AM	213.3	**F**
	University Parkway		PM	62.9	**E**
5	Serrano Village Drive &	Signal	AM	12.7	B
	Northpark Boulevard		PM	18.4	B
6	Coyote Drive &	Signal	AM	11.0	B
	Northpark Boulevard		PM	11.7	B
7	East Campus Circle &	Signal	AM	17.5	B
	Northpark Boulevard		PM	17.5	B
8	Education Lane &	TWSC	AM	2.5 (16.8)	A (D)
	North Campus Circle		PM	23.2 (116.5)	C **(F)**
9	University Parkway &	Signal	AM	113.3	**F**
	Kendall Drive		PM	62.2	**E**
10	University Parkway &	Signal	AM	125.1	**F**
	College Avenue		PM	19.7	B
11	University Parkway &	Signal	AM	55.4	**E**
	State Street		PM	62.7	**E**

**TABLE 7 1 INTERSECTION LEVEL OF SERVICE:
CUMULATIVE (2035) PLUS PROJECT CONDITIONS**

No.	Intersection	Control [1]	Peak Hour	Delay[2]	LOS[3,4]
12	University Parkway & I-215 Northbound Ramps[5]	Signal	AM	76.6	**E**
			PM	55	D
13	University Parkway & I-215 Southbound Ramps	Signal	AM	13.9	B
			PM	22.1	C
14	Little Mountain Drive & Kendall Drive	Signal	AM	21.3	C
			PM	24.2	C

Source: Fehr & Peers, November 2016.
Notes:
[1] Signal = Signalized Intersection; SSSC = Side-Street Stop-Controlled Intersection; AWSC = All-Way Stop-Controlled Intersection
[2] Whole intersection weighted average control delay expressed in seconds per vehicle for signalized intersections and all-way stop-controlled intersections. Whole intersection weighted average control delay and total control delay for the worst approach (in parenthesis) are presented for side-street stop-controlled intersections. Delay indicated with ** represents oversaturated conditions and delay cannot be calculated.
[3] LOS threshold is the lowest acceptable LOS (the threshold between acceptable and unacceptable level of service). **Bold** indicates unacceptable operations by jurisdiction's level of service standard.
[4] Unless otherwise noted, intersection LOS calculations were conducted using Synchro 9.1 Build 909. LOS calculations were performed using the methods described in the Highway Capacity Manual (HCM) 2010.
[5] HCM 2010 methodology does not evaluate custom phasing; HCM 2000 methodology was used to evaluate Intersection 12: University Parkway & I-215 Northbound Ramps.

As shown in Table 7-1, the following intersections are operating at a deficient LOS during the peak hours for Cumulative (2035) Plus Project Conditions:

2. Northpark Boulevard/Devils Canyon Road & Ash Street (LOS F – AM and PM peak hour)
3. Northpark Boulevard & Sierra Drive (LOS F – AM and PM peak hour)
4. Northpark Boulevard & University Parkway (LOS F – AM, LOS E – PM peak hour)
8. Education Lane & North Campus Circle (LOS F – PM peak hour)
9. University Parkway & Kendall Drive (LOS F – AM, LOS E – PM peak hour)
10. University Parkway & College Avenue (LOS F – AM peak hour)
11. University Parkway & State Street (LOS E – AM and PM peak hour)
12. University Parkway & I-215 Northbound Ramps (LOS E – AM peak hour)

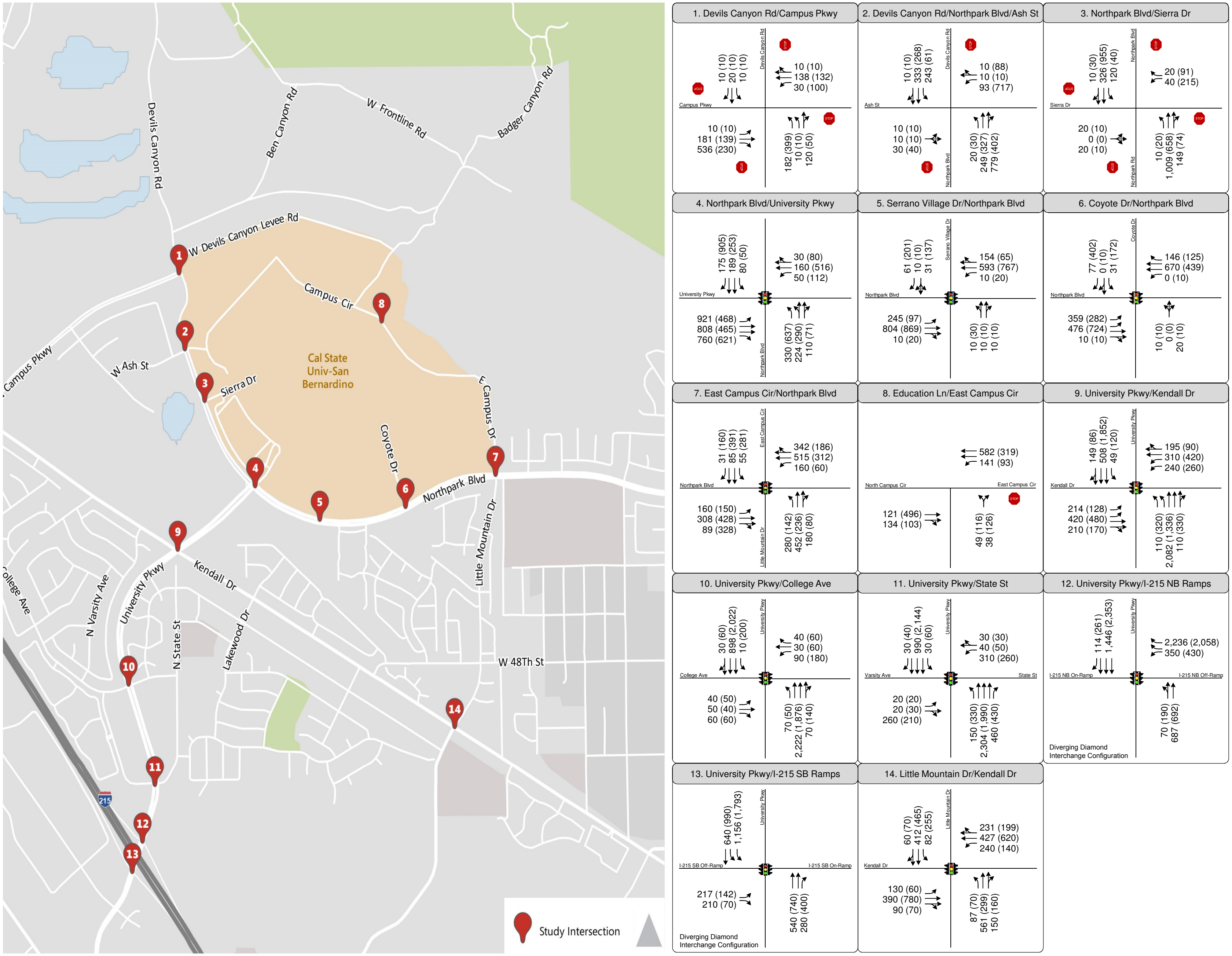


Figure 7-1
Peak Hour Traffic Volumes and Lane Configurations
Cumulative (2035) Plus Project

7.2.5 CUMULATIVE PLUS PROJECT FREEWAY OPERATIONS

Table 7-2 present the results of the freeway assessment for the I-215 freeway at University Parkway under Cumulative (2035) Plus Project Conditions. Freeway reports are provided in Appendix H.

**TABLE 7-2 FREEWAY OPERATIONS:
CUMULATIVE (2035) PLUS PROJECT CONDITIONS**

Segment	Type	AM			PM		
		Density	V/C	LOS	Density	V/C	LOS
I-215 Northbound							
University Pkwy Off-Ramp	Diverge	23.8	0.65	C	34.7	0.87	**D**
University Pkwy Off-Ramp to University Pkwy On-Ramp	Basic	13.6	0.38	B	26.8	0.73	**D**
University Pkwy On-Ramp	Merge	20.1	0.43	C	35.1	0.85	**E**
I-215 Southbound							
University Pkwy Off-Ramp	Diverge	27.7	0.65	C	18.0	0.40	B
University Pkwy Off-Ramp to University Pkwy On-Ramp	Basic	18.5	0.51	C	11.4	0.32	B
University Pkwy On-Ramp	Merge	20.5	0.57	C	-	0.55	**F**

Notes:

10. Calculated using methodologies consistent with the 2010 Highway Capacity Manual
11. Density reported as passenger cars per mile per lane
12. **Bold** indicates unacceptable operations

As shown in Table 7-2, the following freeway mainline segments operate unacceptably (LOS D, LOS E, or LOS F) during the AM or PM Peak Hours:

- I-215 Northbound Diverge Segment (LOS D –PM peak hour)
- I-215 Northbound Basic Segment (LOS D – PM peak hour)
- I-215 Northbound Merge Segment (LOS E – PM peak hour)
- I-215 Southbound Merge Segment (LOS F – PM peak hour)

7.2.6 SIGNAL WARRANT ANALYSIS

A peak hour traffic signal warrant[2] assessment was prepared for the following unsignalized intersections to identify if the intersection satisfies the peak hour volume warrant for traffic signal installation:

- Northpark Boulevard/Devils Canyon Road & Ash Street (Met under AM and PM peak hour)
- Northpark Boulevard & Sierra Drive (Met under PM peak hour)
- Education Lane & North Campus Circle (Not met under either peak hour)

The results indicate that a peak hour traffic signal warrant is satisfied in the PM peak hour for two of the study intersections. Signal warrant reports and calculations are provided in Appendix G.

7.2.7 IMPACT ASSESSMENT

7.2.7.1 Intersection Level of Service Impacts

Table 7-3 compares the changes in delay and LOS at intersections that operate deficiently between the No Project and Plus Project scenarios to determine project impacts.

[2] This analysis is intended to examine the general correlation between the planned level of future development and the need to install new traffic signals. It estimates future development-generated traffic compared against a sub-set of the standard traffic signal warrants recommended in the Federal Highway Administration Manual on Uniform Traffic Control Devices and associated State guidelines. This analysis should not serve as the only basis for deciding whether and when to install a signal. To reach such a decision, the full set of warrants should be investigated based on field-measured, rather than forecast, traffic data and a thorough study of traffic and roadway conditions by an experienced engineer. Furthermore, the decision to install a signal should not be based solely upon the warrants, since the installation of signals can lead to certain types of collisions. The City of San Bernardino and/or CSUSB should undertake regular monitoring of actual traffic conditions and accident data, and timely re-evaluation of the full set of warrants in order to prioritize and program intersections for signalization.

**TABLE 7-3 INTERSECTION IMPACTS:
CUMULATIVE (2035) PLUS PROJECT CONDITIONS**

Intersection	Traffic Control[1]	Peak Hour	Cumulative (2035) Conditions		Cumulative Plus Project (2035) Conditions		Δ Delay	Δ V/C[3]	Signal Warrant Met?	Result
			Delay	LOS	Delay	LOS				
2. Northpark Boulevard/Devils Canyon Road & Ash Street	TWSC	AM	77.5	F	>180	F	**	-	No	**Impact**
		PM	75.7	E	>180	F	**	-	**Yes**	**Impact**
3. Northpark Boulevard & Sierra	AWSC	AM	11.8	B	70.2	F	**58.4**	**-**	**Yes**	**Impact**
		PM	16.4	C	120.4	F	**104.0**	**-**	**Yes**	**Impact**
4. Northpark Boulevard & University Parkway	Signal	AM	30.3	C	213.3	F	**183.0**	-	-	**Impact**
		PM	39.9	D	62.9	E	**23.0**	-	-	**Impact**
8. Education Lane & North Campus Circle	TWSC	PM	12.8	B	116.5	F	103.7	-	No	**Impact**
9. University Parkway & Kendall Drive	Signal	AM	46.7	D	113.3	F	**66.6**	-	-	**Impact**
		PM	46.8	D	62.2	E	**15.4**	**-**	**-**	**Impact**
10. University Parkway & College Avenue	Signal	AM	34.6	C	125.1	F	**90.5**	-	**-**	**Impact**
11. University Parkway & State Street	Signal	AM	28.3	C	55.4	E	**27.1**	-	-	**Impact**
		PM	34.8	C	62.7	E	**27.9**	-	-	**Impact**
12. University Parkway & I-215 Northbound Ramps	Signal	AM	33.4	C	76.6	E	**43.2**	-	-	**Impact**

Notes:
1- AWSC is all-way stop control; TWSC is two-way stop control.
2- Impacts are noted in bold.
3- HCM 2010 does not define V/C ratio at the intersection level. HCM 2000 is used to determine V/C ratios for impact determination purposes. ΔV/C is only provided for signalized intersections when the delay is 120 seconds or more per the impact criteria guidelines.
4- ">180" is reported for oversaturated conditions in which Synchro is no longer capable of estimating delay. ** is used to denote increases in delay in these cases.

Source: Fehr & Peers, 2016

As shown in Table 7-3, the following study intersections are forecast to result in a significant impact based on thresholds of significance for Cumulative (2035) Plus Project Conditions:

2. Northpark Boulevard/Devils Canyon Road & Ash Street
3. Northpark Boulevard & Sierra Drive
4. Northpark Boulevard & University Parkway
8. Education Lane & North Campus Circle
9. University Parkway & Kendall Drive
10. University Parkway & College Avenue
11. University Parkway & State Street
12. University Parkway & I-215 Northbound Ramps

7.2.7.2 Freeway Mainline Level of Service Impacts

The project adds traffic to freeway segments already operating at LOS D, LOS E or LOS F or the addition of project traffic causes the LOS to degrade to LOS D, LOS E or LOS F for all study freeway segments under at least one peak hour. The following study freeway segments are forecast to result in a significant impact based on thresholds of significance for Cumulative (2035) Plus Project Conditions:

- I-215 Northbound Diverge Segment
- I-215 Northbound Basic Segment
- I-215 Northbound Merge Segment
- I-215 Southbound Merge Segment

7.2.7.3 Pedestrian, Bicycle, and Transit Impacts

The addition of traffic and redistribution of vehicle traffic associated with the parking lots is not expected to cause any pedestrian, bicycle, or transit impacts. The project does not disrupt any existing or planned bicycle, pedestrian, or transit facilities; nor does the project conflict with any plans, guidelines, policies, or standards related to the aforementioned modes.

8.0 MITIGATION MEASURES

This chapter provides a summary of the key findings and project impacts for each scenario analyzed, and recommended mitigation measures to mitigate these impacts.

8.1 SUMMARY OF IMPACTS

The California State University Transportation Impact Study Manual (2012) provides guidance on the criteria utilized to determine whether the transportation-related impacts of a proposed project would be significant within the meaning of CEQA. The following significance criteria are utilized in assessing potential impacts:

- A roadway segment or intersection operates at LOS D or better under a no project scenario and the addition of project trips causes overall traffic operations on the facility to operate at LOS E or F.
- A roadway segment or intersection operates at LOS E or F under a no project scenario and the project adds both 10 or more peak hour trips and 5 seconds or more of peak hour delay, during the same peak hour.
- If an intersection operates at a very poor LOS F (control delay of 120 seconds or more), the significance criterion shall be an increase in v/c ratio of 0.02 or more.
- The addition of project traffic causes an all-way stop-controlled or side street stop-controlled intersection to meet Caltrans signal warrant criteria.

Based upon the significance criteria identified, the addition of the project will significantly impact the following locations under each analyzed scenario:

8.1.1 EXISTING (2015) PLUS PROJECT CONDITIONS

<u>Intersection Impacts:</u>

2. Northpark Boulevard/Devils Canyon Road & Ash Street
3. Northpark Boulevard & Sierra Drive
4. Northpark Boulevard & University Parkway
8. Education Lane & North Campus Circle
9. University Parkway & Kendall Drive
10. University Parkway & College Avenue
11. University Parkway & State Street
12. University Parkway & I-215 Northbound Ramps

Freeway Impacts:

- I-215 Northbound Diverge Segment
- I-215 Northbound Basic Segment
- I-215 Northbound Merge Segment
- I-215 Southbound Diverge Segment
- I-215 Southbound Basic Segment
- I-215 Southbound Merge Segment

8.1.2 CUMULATIVE (2035) PLUS PROJECT CONDITIONS

Intersection Impacts:

2. Northpark Boulevard/Devils Canyon Road & Ash Street
3. Northpark Boulevard & Sierra Drive
4. Northpark Boulevard & University Parkway
8. Education Lane & North Campus Circle
9. University Parkway & Kendall Drive
10. University Parkway & College Avenue
11. University Parkway & State Street
12. University Parkway & I-215 Northbound Ramps

Freeway Impacts:

- I-215 Northbound Diverge Segment
- I-215 Northbound Basic Segment
- I-215 Northbound Merge Segment
- I-215 Southbound Merge Segment

8.2 RECOMMENDED INTERSECTION MITIGATION MEASURES

Improvement measures were developed to minimize the impact of the Project on the study intersections. Mitigation measures were developed in order to bring project operations back to acceptable or pre-project conditions. Implementing the mitigation measures described below, the “with project” scenarios would no longer result in a significant impact. A description of the recommended mitigation measures is provided below. LOS results for mitigation measures are provided in Appendix F. The fair share contributions for cumulative impacts were calculated using the following formula:

- (Project Only) / (Cumulative Plus Project – Existing Conditions Volumes)

8.2.1 EXISTING (2015) PLUS PROJECT CONDITIONS

Northpark Boulevard/Devils Canyon Road & Ash Street

The university shall make a fair share contribution to the City of San Bernardino toward the following improvements at the time conditions warrant the improvement. The intersection requires signalization with the following lane configurations:

- Eastbound: One left-turn lane, one shared through-right lane
- Westbound: One left-turn lane, one shared through-right lane
- Northbound: One left-turn lane, one through lane, one dedicated right-turn lane with an overlap phase
- Southbound: One left-turn lane, one through lane, one shared through-right lane

With implementation of the mitigation measure, the operations at the intersection would improve to LOS C in the AM peak hour, LOS D in the PM peak hour, and the impact would be reduced to ***less-than-significant.***

Northpark Boulevard & Sierra Drive

The university shall make a fair share contribution to the City of San Bernardino toward the following improvements at the time conditions warrant the improvement. The intersection requires signalization with the existing lane configurations. With implementation of the mitigation measure, the operations at the intersection would improve to LOS A in the AM and PM peak hours and the impact would be reduced to ***less-than-significant*.**

Northpark Boulevard & University Parkway

The university shall make a fair share contribution to the City of San Bernardino toward the following improvements at the time conditions warrant the improvement. The intersection requires an additional eastbound left turn lane and the right-of-way for the additional lane is available within the existing landscaped median. Since University Parkway operates an Adaptive Traffic Signal System, the entire corridor will need to be optimized. With implementation of the mitigation measure, the operations at the intersection would improve to LOS C in the AM peak hour, LOS D in the PM peak hour, and the impact would be reduced to ***less-than-significant.***

Education Lane & North Campus Circle

The university shall mitigate the project impact by modifying the intersection control from a side-street stop-controlled intersection to an all-way stop-controlled intersection. With implementation of the mitigation measure, the operations at the intersection would improve to LOS B in the PM peak hour and the impact would be reduced to ***less-than-significant.***

University Parkway & Kendall Drive

The university shall make a fair share contribution to the City of San Bernardino toward the following improvements at the time conditions warrant the improvement. The southbound approach requires modification to the shared through-right lane to one through lane and one dedicated right-turn lane. Since University Parkway operates an Adaptive Traffic Signal System, the entire corridor will need to be optimized. With implementation of the mitigation measure, the operations at the intersection would improve to LOS D in the AM and PM peak hours and the impact would be reduced to ***less-than-significant.***

University Parkway & College Avenue

The university shall make a fair share contribution to the City of San Bernardino toward the following improvements at the time conditions warrant the improvement. The intersection signal phasing requires modification to include protected phases in the east-west direction. Since University Parkway operates an Adaptive Traffic Signal System, the entire corridor will need to be optimized. With implementation of the mitigation measure, the operations at the intersection would improve to LOS C in the AM and PM peak hours and the impact would be reduced to ***less-than-significant.***

University Parkway & State Street

The university shall make a fair share contribution to the City of San Bernardino toward the following improvements at the time conditions warrant the improvement. The intersection signal timing requires optimization of the AM and PM peak hour traffic signal cycle lengths and splits within the coordinated timing plan. Since University Parkway operates an Adaptive Traffic Signal System, the entire corridor will need to be optimized. With implementation of the mitigation measure, the operations at the intersection would improve to LOS D in the PM peak hours and the impact would be reduced to ***less-than-significant.***

University Parkway & I-215 Northbound Ramps

The university shall work with Caltrans to implement the following improvements. To mitigate the project impact, implement the Caltrans improvement project at the interchange to install a diverging diamond interchange across University Parkway at I-215. The proposed project is currently going through the Project

Approval and Environmental Document (PA&ED) phase and the design is not final. Fehr & Peers recommends removing the pedestrian crossing at this intersection so that the westbound right turn is able to function as a true, free movement. The interchange will need to be coordinated with closely spaced intersections such as at State Street and therefore the entire University Avenue corridor will need to be optimized. This modification to the design improves intersection operations to LOS B in the AM and PM peak hours and the impact would be reduced to less-than-significant. However, the intersection is controlled by Caltrans; as such, the university cannot guarantee implementation of the improvement. Therefore, although the university shall work with Caltrans to implement the measure, the City of San Bernardino is ultimately responsible for implementation of the measure. Given that the university cannot guarantee implementation of the measure, this impact is considered ***significant and unavoidable.***

8.2.2 CUMULATIVE (2035) PLUS PROJECT CONDITIONS

Northpark Boulevard/Devils Canyon Road & Ash Street

The university shall make a fair share contribution to the City of San Bernardino toward the following improvements. To mitigate the cumulative impact, the intersection requires signalization with the following lane configurations:

- Eastbound: One left-turn lane, one shared through-right lane
- Westbound: Two left-turn lanes, one shared through-right lane
- Northbound: One left-turn lane, one through lane, one dedicated right-turn lane with an overlap phase
- Southbound: One left-turn lane, one through lane, one shared through-right lane

With implementation of the mitigation measure, the operations at the intersection would improve to LOS B in the AM peak hour, LOS C in the PM peak hour and the impact would be reduced to ***less-than-significant*.**

Northpark Boulevard & Sierra Drive

The university shall make a fair share contribution to the City of San Bernardino toward the following improvements. To mitigate the cumulative impact, the intersection requires signalization with same lane configurations. With implementation of the mitigation measure, the operations at the intersection would improve to LOS A in the AM and PM peak hours and the impact would be reduced to ***less-than-significant*.**

Northpark Boulevard & University Parkway

The university shall make a fair share contribution to the City of San Bernardino toward the following improvements. To mitigate the cumulative impact, the intersection requires an additional eastbound left turn lane. The right-of-way for the additional lane is available within the existing landscaped median. Since University Parkway operates an Adaptive Traffic Signal System, the entire corridor will need to be optimized. With implementation of the mitigation measure, the operations at the intersection would improve to LOS C in the AM peak hour, LOS D in the PM peak hour, and the impact would be reduced to ***less-than-significant.***

Education Lane & North Campus Circle

The university shall mitigate the project impact by modifying the intersection control from a side-street stop-controlled intersection to an all-way stop-controlled intersection. With implementation of the mitigation measure, the operations at the intersection would improve to LOS B in the PM peak hour and the impact would be reduced to ***less-than-significant.***

University Parkway & Kendall Drive

The university shall make a fair share contribution to the City of San Bernardino toward the following improvements. To mitigate the cumulative impact, the southbound approach would need to be improved by modifying the shared through-right lane to one through lane and one dedicated right-turn lane. Since University Parkway operates an Adaptive Traffic Signal System, the entire corridor will need to be optimized. With implementation of the mitigation measure, the operations at the intersection would improve to LOS D in the AM and PM peak hours and the impact would be reduced to ***less-than-significant.***

University Parkway & College Avenue

The university shall make a fair share contribution to the City of San Bernardino toward the following improvements. To mitigate the cumulative impact, the intersection signal phasing requires modification to include protected phases in the east-west direction. Since University Parkway operates an Adaptive Traffic Signal System, the entire corridor will need to be optimized. With implementation of the mitigation measure, the operations at the intersection would improve to LOS B in the AM peak hour, LOS C in the PM peak hour, and the impact would be reduced to ***less-than-significant***.

University Parkway & State Street

The university shall make a fair share contribution to the City of San Bernardino toward the following improvements. The intersection signal timing requires optimization of the AM and PM peak hour traffic signal cycle lengths and splits within the coordinated timing plan. Since University Parkway operates an Adaptive Traffic Signal System, the entire corridor will need to be optimized. With implementation of the mitigation measure, the operations at the intersection would improve to LOS C in the AM and LOS D in the PM peak hours and the impact would be reduced to ***less-than-significant.***

University Parkway & I-215 Northbound Ramps

The university shall work with Caltrans to implement the following improvements. To mitigate the cumulative impact, the Caltrans improvement project requires modification of the diverging diamond interchange by making the westbound right-turn movement a free movement. Therefore, Fehr & Peers recommends removing the pedestrian crossing at this movement so that the westbound right turn is able to function as a true, free movement. The interchange will need to be coordinated with closely spaced intersections such as at State Street and therefore the entire University Avenue corridor will need to be optimized. The proposed project is currently going through the Project Approval and Environmental Document (PA&ED) phase and the design is not final. With the implementation of this mitigation measure, the intersection operations improve to LOS B in the AM and PM peak hours and the impact would be reduced to less-than-significant. However, the intersection is controlled by Caltrans and there is no guaranteed funding to pay for the remainder of the improvement (beyond CSUSB's contribution); as such, this impact is considered ***significant and unavoidable.***

8.3 RECOMMENDED FREEWAY MITIGATION MEASURES

Mitigating the identified significant impacts to the freeway mainline segments would require a complete reconstruction of the I-215 freeway to add travel lanes and upgrade the deficient ramp locations. Since the freeways in the study area are interconnected systems, it would not be possible, nor effective, to provide isolated spot improvements of one segment of the freeway where deficient operations are observed.

HOV lanes are proposed in both directions along I-215 between I-210 and I-15 according to the SCAG Regional Transportation Plan (RTP) in the Financially-Constrained RTP Projects to be completed by 2030. These lanes are forecast to improve traffic conditions along the corridor but still result in deficient operations according to Caltrans methodology and impact thresholds. As such, this impact is considered to be ***significant and unavoidable.***

9.0 VEHICLE MILES TRAVELED ASSESSMENT

On September 27, 2013, California Governor Jerry Brown signed SB 743 into law which requires an analysis of vehicle miles traveled (VMT) to identify transportation impacts in a project's environmental impact study. The Office of Planning and Research (OPR) is working on providing guidance on a threshold for determining a VMT impact. Draft guidelines have been released for comments, however no final guidance has been adopted.

The SB743 legislation also removes LOS as a CEQA threshold. The Office of Planning and Research (OPR) has released a draft set of draft guidelines and are working on finishing the final draft guidelines for SB 743 implementation that will be submitted to the Natural Resources Agency for the formal rule making process. After the rule making process is complete, agencies will have a two year "grace" period to update their CEQA guidelines for consistency with the SB 743 requirements. As such, it will likely be 2019 or 2020 before all lead agencies will be required to utilize VMT as a CEQA metric instead of LOS.

The CSU chancellor's office has not yet adopted a new methodology and significance impact criteria as the final draft guidelines have not yet been finalized. Since initial draft guidance has been provided by OPR (and is under revision), and because the Natural Resources Agency has not completed the rule making process yet, both VMT and LOS have been included in this traffic study to comprehensively disclose the traffic impacts associated with the master plan.

Vehicle miles traveled (VMT) is measured by multiplying the number of trips generated by the project by the average trip length. For this assessment, project VMT was calculated by multiplying the number of daily trips generated by the project by the estimated average trips lengths; after accounting for the different trip lengths associated with different types of campus users (on-campus students, off-campus students, Discovery Park employees, and campus faculty and staff). This methodology is consistent with the Draft OPR guidelines. VMT used for other assessments, such as Green House Gas (GHG) assessment, is calculated differently than what is proposed in the OPR guidance as GHG accounts for all trips generated by uses; whereas the OPR guidance focusses on the commute trip VMT for employment uses.

The average trip lengths were estimated for off-campus commuter students, faculty and staff using zip code data of those users provided by the University. The average trip lengths for on-campus students and the Discovery Park were estimated from SBTAM model runs by extracting trip length data from the output skim matrices. Model skim matrices track origin and destination trip length data for each traffic analysis zone (TAZ) in the model by trip type. The home-based other production trip purpose was used to estimate the average trip length of on-campus students. The home-based work attraction trip purpose was used to estimate the average trip length of the Discovery Park employees. The existing and proposed FTE and associated average trip lengths, daily trips generated, and estimated VMT is summarized in Table 9-1.

TABLE 9-1: DAILY VMT ESTIMATES

User Type	FTE	Daily Trips	Average Trip Length[1] (miles)	Daily VMT Estimate
Existing Enrollment				
On-Campus Student	1,533	2,997	10.9	32,670
Off-Campus Student	14,945	30,948	26.4	816,968
Faculty/Staff	1,650	3,027	23.9	72,385
			Total VMT	**922,023**
			VMT Per FTE	**50.9**
Master Plan Enrollment				
On-Campus Student	4,850	9,482	10.9	103,358
Off-Campus Student	20,150	41,726	26.4	1,101,499
Faculty/Staff	2,503	4,592	23.9	109,821
Discovery Park Employees[2]	405	1,216	19.2	23,347
			Total VMT	**1,338,025**
			VMT Per FTE	**47.9**

Notes:
1- Average trip length for on-campus students and Discovery Park employees were estimated from SBATM. Average trip length for off-campus students and faculty and staff were estimated from available zip code data from CSUSB enrollment.
2- Discovery Park Employees were estimated by three employees per thousand square feet of research and development space.

Source: Fehr & Peers, 2016

As shown in Table 9-1, the resulting VMT estimates show that the VMT due to the increase in enrollment is forecast to increase by 416,003 miles on a daily basis. However, dude to the increase in the ratio of on-campus students, the VMT at the Master Plan buildout is projected to decrease on a per person basis.

APPENDIX A: EXISTING TRAFFIC COUNTS

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-001 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

AM

NS/EW Streets:	Devils Canyon Rd			Devils Canyon Rd			Campus Pkwy			Campus Pkwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	2	1	0	0	2	1	1	0	2	0	0	0	
7:00 AM	11	2	0	0	0	3	3	0	37	0	0	0	56
7:15 AM	46	3	0	0	3	0	3	0	69	0	0	0	124
7:30 AM	33	0	0	0	0	2	1	0	106	0	0	0	142
7:45 AM	12	1	0	0	1	2	5	0	179	0	0	0	200
8:00 AM	15	2	0	0	2	0	1	0	74	0	0	0	94
8:15 AM	7	2	0	0	2	1	1	0	49	0	0	0	62
8:30 AM	14	1	0	0	0	1	1	0	53	0	0	0	70
8:45 AM	15	1	0	0	2	1	3	0	56	0	0	0	78

	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	153	12	0	0	10	10	18	0	623	0	0	0	826
APPROACH %'s :	92.73%	7.27%	0.00%	0.00%	50.00%	50.00%	2.81%	0.00%	97.19%	#DIV/0!	#DIV/0!	#DIV/0!	

PEAK HR START TIME :	715 AM												TOTAL
PEAK HR VOL :	106	6	0	0	6	4	10	0	428	0	0	0	560
PEAK HR FACTOR :		0.571			0.833			0.595			0.000		0.700

CONTROL : 3-Way Stop (NB/SB/EB)

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-001 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

PM

NS/EW Streets:	Devils Canyon Rd			Devils Canyon Rd			Campus Pkwy			Campus Pkwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	2	1	0	0	2	1	1	0	2	0	0	0	
4:00 PM	88	3	0	0	1	1	0	0	17	0	0	0	110
4:15 PM	39	5	0	0	4	2	0	0	17	0	0	0	67
4:30 PM	47	0	0	1	3	3	0	0	18	0	0	0	72
4:45 PM	61	2	0	0	1	1	1	0	23	0	0	0	89
5:00 PM	66	1	0	0	0	1	2	0	15	0	0	0	85
5:15 PM	50	1	0	0	2	1	2	0	13	0	0	0	69
5:30 PM	71	4	0	0	3	0	1	0	39	0	0	0	118
5:45 PM	117	2	0	0	0	1	3	0	35	0	0	0	158

	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	539	18	0	1	14	10	9	0	177	0	0	0	768
APPROACH %'s :	96.77%	3.23%	0.00%	4.00%	56.00%	40.00%	4.84%	0.00%	95.16%	#DIV/0!	#DIV/0!	#DIV/0!	
PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	304	8	0	0	5	3	8	0	102	0	0	0	430
PEAK HR FACTOR :		0.655			0.667			0.688			0.000		0.680

CONTROL : 3-Way Stop (NB/SB/EB)

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-002 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

AM

NS/EW Streets:	Northpark Blvd			Northpark Blvd			Ash St			Ash St			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	2	0	1	2	0	0	1	0	1	0.5	0.5	
7:00 AM	4	13	14	14	23	0	0	0	13	5	0	0	86
7:15 AM	11	49	29	25	48	0	0	0	15	1	0	0	178
7:30 AM	4	31	44	45	57	0	0	1	3	3	0	3	191
7:45 AM	0	14	52	104	79	0	0	0	3	8	1	0	261
8:00 AM	3	15	52	51	31	0	0	0	6	7	0	1	166
8:15 AM	3	11	37	29	24	1	0	0	7	9	1	3	125
8:30 AM	3	10	49	32	21	0	0	5	8	5	2	2	137
8:45 AM	2	14	78	38	21	0	1	7	2	10	1	2	176
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	30	157	355	338	304	1	1	13	57	48	5	11	1320
APPROACH %'s :	5.54%	28.97%	65.50%	52.57%	47.28%	0.16%	1.41%	18.31%	80.28%	75.00%	7.81%	17.19%	

PEAK HR START TIME :	715 AM												TOTAL
PEAK HR VOL :	18	109	177	225	215	0	0	1	27	19	1	4	796
PEAK HR FACTOR :		0.854			0.601			0.467			0.667		0.762

CONTROL : 2-Way Stop (EB/WB)

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-002 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

PM

NS/EW Streets:	Northpark Blvd			Northpark Blvd			Ash St			Ash St			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	2	0	1	2	0	0	1	0	1	0.5	0.5	
4:00 PM	7	47	14	11	12	0	1	1	6	46	0	15	160
4:15 PM	5	24	12	10	9	1	0	1	1	22	1	14	100
4:30 PM	9	23	21	8	16	0	0	1	7	32	2	13	132
4:45 PM	8	35	23	17	13	0	0	1	8	44	1	17	167
5:00 PM	7	31	22	8	6	1	0	1	4	41	0	20	141
5:15 PM	5	24	21	7	6	0	0	3	9	24	2	10	111
5:30 PM	4	50	30	18	26	0	0	2	9	33	3	20	195
5:45 PM	9	64	31	26	10	0	1	1	9	69	1	31	252
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	54	298	174	105	98	2	2	11	53	311	10	140	1258
APPROACH %'s :	10.27%	56.65%	33.08%	51.22%	47.80%	0.98%	3.03%	16.67%	80.30%	67.46%	2.17%	30.37%	
PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	25	169	104	59	48	1	1	7	31	167	6	81	699
PEAK HR FACTOR :		0.716			0.614			0.813			0.629		0.693

CONTROL : 2-Way Stop (EB/WB)

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-003 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

AM

NS/EW Streets:	Northpark Blvd			Northpark Blvd			Sierra Dr			Sierra Dr			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	2	0	1	2	0	0	1	0	1	0	1	
7:00 AM	1	31	12	0	38	0	1	0	0	4	0	0	87
7:15 AM	2	87	23	8	59	0	0	0	2	9	0	0	190
7:30 AM	0	80	30	23	40	1	0	0	0	10	0	0	184
7:45 AM	2	63	38	40	37	0	0	0	0	8	0	3	191
8:00 AM	0	68	50	22	26	0	0	0	2	12	0	3	183
8:15 AM	1	50	24	12	29	0	0	0	1	5	0	1	123
8:30 AM	1	63	18	12	23	0	0	0	2	11	0	1	131
8:45 AM	0	93	24	8	26	0	0	0	1	5	0	3	160
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	7	535	219	125	278	1	1	0	8	64	0	11	1249
APPROACH %'s :	0.92%	70.30%	28.78%	30.94%	68.81%	0.25%	11.11%	0.00%	88.89%	85.33%	0.00%	14.67%	
PEAK HR START TIME :	715 AM												TOTAL
PEAK HR VOL :	4	298	141	93	162	1	0	0	4	39	0	6	748
PEAK HR FACTOR :		0.939			0.831			0.500			0.750		0.979

CONTROL : 3-Way Stop (NB/SB/WB)

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-003 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

PM

NS/EW Streets:	Northpark Blvd			Northpark Blvd			Sierra Dr			Sierra Dr			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	2	0	1	2	0	0	1	0	1	0	1	
4:00 PM	1	52	10	1	66	0	0	0	1	36	0	14	181
4:15 PM	0	34	11	1	31	0	0	0	0	18	0	6	101
4:30 PM	0	43	11	4	49	0	0	0	0	39	0	10	156
4:45 PM	1	60	9	2	63	0	0	0	0	46	0	7	188
5:00 PM	0	42	12	1	51	0	0	0	0	60	0	18	184
5:15 PM	1	41	11	0	41	0	0	0	0	40	0	9	143
5:30 PM	0	66	16	4	60	0	0	0	0	42	0	19	207
5:45 PM	1	85	19	5	79	0	0	0	1	68	0	17	275
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	4	423	99	18	440	0	0	0	2	349	0	100	1435
APPROACH %'s :	0.76%	80.42%	18.82%	3.93%	96.07%	0.00%	0.00%	0.00%	100.00%	77.73%	0.00%	22.27%	
PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	2	234	58	10	231	0	0	0	1	210	0	63	809
PEAK HR FACTOR :		0.700			0.717			0.250			0.803		0.735

CONTROL : 3-Way Stop (NB/SB/WB)

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-004 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

AM

NS/EW Streets:	Northpark Blvd			Northpark Blvd			University Pkwy			University Pkwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1.5	1.5	0	1	2	1	1	2	1	1	2	0	
7:00 AM	64	20	4	2	28	11	26	76	116	0	13	2	362
7:15 AM	78	47	4	10	44	14	57	160	196	3	23	2	638
7:30 AM	92	36	19	22	20	7	64	222	186	13	36	1	718
7:45 AM	48	21	36	19	18	15	83	218	218	8	38	6	728
8:00 AM	48	22	23	6	10	22	86	174	133	7	33	10	574
8:15 AM	44	15	11	9	12	12	55	95	78	2	16	6	355
8:30 AM	53	16	8	4	11	19	69	129	93	1	25	6	434
8:45 AM	59	17	12	6	13	13	78	147	97	5	21	19	487
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	486	194	117	78	156	113	518	1221	1117	39	205	52	4296
APPROACH %'s :	60.98%	24.34%	14.68%	22.48%	44.96%	32.56%	18.14%	42.75%	39.11%	13.18%	69.26%	17.57%	
PEAK HR START TIME :	715 AM												TOTAL
PEAK HR VOL :	266	126	82	57	92	58	290	774	733	31	130	19	2658
PEAK HR FACTOR :		0.806			0.761			0.866			0.865		0.913

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-004

Day: Tuesday

City: Muscoy

Date: 10/20/2015

PM

NS/EW Streets:	Northpark Blvd			Northpark Blvd			University Pkwy			University Pkwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1.5	1.5	0	1	2	1	1	2	1	1	2	0	
4:00 PM	122	33	12	5	27	87	32	67	94	11	90	11	591
4:15 PM	80	24	8	2	12	48	28	61	88	12	65	6	434
4:30 PM	78	26	2	4	21	65	32	77	89	6	88	7	495
4:45 PM	103	34	10	4	23	87	31	66	98	9	51	12	528
5:00 PM	109	26	6	4	28	89	34	53	90	17	98	7	561
5:15 PM	156	32	10	3	23	63	31	82	118	15	109	5	647
5:30 PM	131	42	12	12	27	62	35	154	161	10	101	16	763
5:45 PM	174	61	13	8	36	120	38	163	180	23	154	19	989
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	953	278	73	42	197	621	261	723	918	103	756	83	5008
APPROACH %'s :	73.08%	21.32%	5.60%	4.88%	22.91%	72.21%	13.72%	38.01%	48.26%	10.93%	80.25%	8.81%	
PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	570	161	41	27	114	334	138	452	549	65	462	47	2960
PEAK HR FACTOR :		0.778			0.724			0.747			0.732		0.748

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-005 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

AM

NS/EW Streets:	Serrano Village Dr			Serrano Village Dr			Northpark Blvd			Northpark Blvd			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	2	0	0.3	0.3	1.3	1	2	0	1	2	0	
7:00 AM	2	0	1	0	0	2	20	117	1	1	79	4	227
7:15 AM	2	0	0	6	0	9	40	200	2	2	153	19	433
7:30 AM	2	2	1	4	2	17	68	145	3	1	116	38	399
7:45 AM	2	1	3	7	1	19	86	162	0	3	85	65	434
8:00 AM	2	6	0	5	3	13	43	103	2	0	71	19	267
8:15 AM	2	2	1	5	1	6	13	71	0	0	62	14	177
8:30 AM	4	1	1	3	5	6	16	81	3	1	64	8	193
8:45 AM	2	2	0	3	1	8	19	92	2	1	74	8	212
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	18	14	7	33	13	80	305	971	13	9	704	175	2342
APPROACH %'s :	46.15%	35.90%	17.95%	26.19%	10.32%	63.49%	23.66%	75.33%	1.01%	1.01%	79.28%	19.71%	
PEAK HR START TIME :	715 AM												TOTAL
PEAK HR VOL :	8	9	4	22	6	58	237	610	7	6	425	141	1533
PEAK HR FACTOR :		0.656			0.796			0.861			0.822		0.883

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-005 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

PM

NS/EW Streets:	Serrano Village Dr			Serrano Village Dr			Northpark Blvd			Northpark Blvd			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	2	0	0.3	0.3	1.3	1	2	0	1	2	0	
4:00 PM	8	4	2	25	2	29	14	125	0	0	100	12	321
4:15 PM	6	1	0	15	2	24	13	95	2	2	83	7	250
4:30 PM	5	1	1	9	2	15	13	97	4	2	85	2	236
4:45 PM	7	1	2	14	0	16	15	107	6	10	132	13	323
5:00 PM	3	3	1	26	1	31	13	113	6	1	104	7	309
5:15 PM	7	1	1	24	0	46	18	135	1	5	140	11	389
5:30 PM	7	1	5	32	1	37	19	163	6	0	126	15	412
5:45 PM	6	3	3	47	3	75	33	195	2	5	201	25	598
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	49	15	15	192	11	273	138	1030	27	25	971	92	2838
APPROACH %'s :	62.03%	18.99%	18.99%	40.34%	2.31%	57.35%	11.55%	86.19%	2.26%	2.30%	89.25%	8.46%	
PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	23	8	10	129	5	189	83	606	15	11	571	58	1708
PEAK HR FACTOR :		0.788			0.646			0.765			0.693		0.714

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-006 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

AM

NS/EW Streets:	Coyote Dr			Coyote Dr			Northpark Blvd			Northpark Blvd			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	0	1	0.5	1.5	2	2	0	1	2	1	
7:00 AM	2	1	2	9	0	4	24	97	0	0	72	14	225
7:15 AM	1	0	3	4	0	9	73	134	0	0	156	17	397
7:30 AM	0	0	0	10	0	16	97	52	1	0	135	53	364
7:45 AM	0	0	0	10	0	18	121	49	1	0	119	88	406
8:00 AM	0	0	0	6	0	27	72	46	1	0	66	34	252
8:15 AM	1	0	0	6	0	15	30	46	0	0	56	19	173
8:30 AM	0	0	0	1	0	8	40	52	0	0	48	10	159
8:45 AM	0	0	0	6	0	27	45	52	1	1	71	21	224
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	4	1	5	52	0	124	502	528	4	1	723	256	2200
APPROACH %'s :	40.00%	10.00%	50.00%	29.55%	0.00%	70.45%	48.55%	51.06%	0.39%	0.10%	73.78%	26.12%	
PEAK HR START TIME :	715 AM												TOTAL
PEAK HR VOL :	1	0	3	30	0	70	363	281	3	0	476	192	1419
PEAK HR FACTOR :		0.250			0.758			0.781			0.807		0.874

CONTROL : signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-006 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

PM

NS/EW Streets:	Coyote Dr			Coyote Dr			Northpark Blvd			Northpark Blvd			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	0	1	0.5	1.5	2	2	0	1	2	1	
4:00 PM	1	0	0	52	0	66	49	102	0	0	51	19	340
4:15 PM	0	0	0	16	0	35	25	83	0	0	50	13	222
4:30 PM	1	0	0	23	0	43	29	76	0	0	41	11	224
4:45 PM	1	0	0	29	0	72	26	88	2	2	77	12	309
5:00 PM	0	0	0	39	0	77	34	87	0	2	37	24	300
5:15 PM	3	0	0	48	1	91	62	108	1	0	63	27	404
5:30 PM	0	0	0	45	0	81	72	118	0	3	80	39	438
5:45 PM	1	0	2	71	1	127	101	159	2	3	98	49	614
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	7	0	2	323	2	592	398	821	5	10	497	194	2851
APPROACH %'s :	77.78%	0.00%	22.22%	35.22%	0.22%	64.56%	32.52%	67.08%	0.41%	1.43%	70.90%	27.67%	
PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	4	0	2	203	2	376	269	472	3	8	278	139	1756
PEAK HR FACTOR :	0.500			0.730			0.710			0.708			0.715

CONTROL : signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-007 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

AM

NS/EW Streets:	East Campus Cir			East Campus Cir			Northpark Blvd			Northpark Blvd			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	2	0	1	2	1	1	2	0	1	2	0	
7:00 AM	12	8	32	0	0	0	6	91	13	29	80	4	275
7:15 AM	23	18	95	1	0	0	10	120	14	53	156	5	495
7:30 AM	86	56	31	1	2	2	24	28	11	29	111	24	405
7:45 AM	110	96	13	2	4	5	24	31	12	17	90	33	437
8:00 AM	42	39	18	3	2	1	12	29	11	13	55	14	239
8:15 AM	20	19	21	1	1	0	7	38	6	24	53	12	202
8:30 AM	17	20	26	1	1	0	13	31	11	16	51	8	195
8:45 AM	24	29	14	0	2	5	21	27	12	17	49	11	211
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	334	285	250	9	12	13	117	395	90	198	645	111	2459
APPROACH %'s :	38.43%	32.80%	28.77%	26.47%	35.29%	38.24%	19.44%	65.61%	14.95%	20.75%	67.61%	11.64%	
PEAK HR START TIME :	700 AM												TOTAL
PEAK HR VOL :	231	178	171	4	6	7	64	270	50	128	437	66	1612
PEAK HR FACTOR :		0.662			0.386			0.667			0.737		0.814

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-007 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

PM

NS/EW Streets:	East Campus Cir			East Campus Cir			Northpark Blvd			Northpark Blvd			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	2	0	1	2	1	1	2	0	1	2	0	
4:00 PM	25	11	15	11	29	15	24	81	56	18	34	5	324
4:15 PM	17	8	18	7	17	9	22	44	33	16	32	6	229
4:30 PM	10	11	13	12	22	13	20	53	22	9	32	5	222
4:45 PM	16	9	16	10	30	28	10	73	35	6	43	3	279
5:00 PM	17	7	10	14	36	11	8	72	51	5	38	6	275
5:15 PM	24	7	11	6	23	18	18	70	63	15	51	5	311
5:30 PM	41	25	24	8	30	15	31	76	55	12	73	12	402
5:45 PM	44	34	16	19	64	37	33	94	104	19	67	12	543

	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	194	112	123	87	251	146	166	563	419	100	370	54	2585
APPROACH %'s :	45.22%	26.11%	28.67%	17.98%	51.86%	30.17%	14.46%	49.04%	36.50%	19.08%	70.61%	10.31%	

PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	126	73	61	47	153	81	90	312	273	51	229	35	1531
PEAK HR FACTOR :		0.691			0.585			0.731			0.804		0.705

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-008 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

AM

NS/EW Streets:	Education Ln			Education Ln			Campus Cir			Campus Cir			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	0	0	1	0	0	2	0	1	2	0	
7:00 AM	0	0	0	0	0	0	0	1	5	0	12	0	18
7:15 AM	0	0	0	0	0	0	0	2	12	2	10	0	26
7:30 AM	0	0	2	0	0	0	0	10	12	6	39	0	69
7:45 AM	1	0	6	0	0	0	0	7	23	11	55	0	103
8:00 AM	1	0	3	0	0	0	0	6	10	2	34	0	56
8:15 AM	4	0	1	0	0	0	0	1	7	2	22	0	37
8:30 AM	1	0	2	0	0	0	0	2	9	3	21	0	38
8:45 AM	4	0	1	0	0	0	0	5	17	5	28	0	60

	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	11	0	15	0	0	0	0	34	95	31	221	0	407
APPROACH %'s :	42.31%	0.00%	57.69%	#DIV/0!	#DIV/0!	#DIV/0!	0.00%	26.36%	73.64%	12.30%	87.70%	0.00%	

PEAK HR START TIME :	730 AM												TOTAL
PEAK HR VOL :	6	0	12	0	0	0	0	24	52	21	150	0	265
PEAK HR FACTOR :		0.643			0.000			0.633			0.648		0.643

CONTROL : 2-Way Stop (NB/SB)

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-008 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

PM

NS/EW Streets:	Education Ln			Education Ln			Campus Cir			Campus Cir			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	1	0	0	1	0	0	2	0	1	2	0	
4:00 PM	7	0	5	0	0	0	0	20	9	5	17	0	63
4:15 PM	4	0	6	0	0	0	0	17	7	2	11	0	47
4:30 PM	7	0	10	0	0	0	0	12	8	5	10	0	52
4:45 PM	12	0	12	0	0	0	0	16	7	3	11	0	61
5:00 PM	10	0	8	0	0	0	0	30	5	3	13	0	69
5:15 PM	3	0	5	0	0	0	0	11	8	2	12	0	41
5:30 PM	10	0	8	0	0	0	0	22	7	10	29	0	86
5:45 PM	15	0	6	0	0	0	0	63	14	11	30	0	139
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	68	0	60	0	0	0	0	191	65	41	133	0	558
APPROACH %'s :	53.13%	0.00%	46.88%	#DIV/0!	#DIV/0!	#DIV/0!	0.00%	74.61%	25.39%	23.56%	76.44%	0.00%	
PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	38	0	27	0	0	0	0	126	34	26	84	0	335
PEAK HR FACTOR :		0.774			0.000			0.519			0.671		0.603

CONTROL : 2-Way Stop (NB/SB)

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-009 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

AM

NS/EW Streets:	University Pkwy			University Pkwy			Kendall Dr			Kendall Dr			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	2	3	0	1	3	0	2	2	0	2	2	0	
7:00 AM	20	170	36	3	55	17	58	93	55	43	57	7	614
7:15 AM	21	333	24	4	82	43	67	108	60	61	111	15	929
7:30 AM	19	384	18	8	105	27	48	111	59	73	78	49	979
7:45 AM	22	394	13	6	86	7	66	81	45	42	50	87	899
8:00 AM	40	279	32	10	90	16	22	59	30	36	44	33	691
8:15 AM	33	205	22	5	60	9	27	64	34	40	62	10	571
8:30 AM	31	240	23	7	83	7	33	77	44	39	60	18	662
8:45 AM	34	261	21	4	81	11	30	78	29	55	42	29	675
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	220	2266	189	47	642	137	351	671	356	389	504	248	6020
APPROACH %'s :	8.22%	84.71%	7.07%	5.69%	77.72%	16.59%	25.47%	48.69%	25.83%	34.09%	44.17%	21.74%	
PEAK HR START TIME :	715 AM												TOTAL
PEAK HR VOL :	102	1390	87	28	363	93	203	359	194	212	283	184	3498
PEAK HR FACTOR :		0.920			0.864			0.804			0.849		0.893

CONTROL : Signalized

UTURNS			
NB	SB	EB	WB
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	1	0	0
2	0	0	0
0	0	0	0
1	0	0	0
NB	SB	EB	WB
3	1	0	0

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-009 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

PM

NS/EW Streets:	University Pkwy			University Pkwy			Kendall Dr			Kendall Dr			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	2	3	0	1	3	0	2	2	0	2	2	0	
4:00 PM	59	144	62	28	290	16	18	66	41	59	79	14	876
4:15 PM	66	152	72	21	153	16	13	78	40	46	81	14	752
4:30 PM	46	158	45	25	198	14	27	70	28	44	83	12	750
4:45 PM	64	151	69	22	188	16	33	84	41	56	73	13	810
5:00 PM	69	136	48	29	231	20	21	71	34	52	87	16	814
5:15 PM	60	199	52	30	274	28	31	75	39	62	108	16	974
5:30 PM	68	303	42	23	263	23	37	98	49	65	89	24	1084
5:45 PM	79	312	71	27	372	11	38	111	45	61	93	25	1245
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	511	1555	461	205	1969	144	218	653	317	445	693	134	7305
APPROACH %'s :	20.22%	61.54%	18.24%	8.84%	84.94%	6.21%	18.35%	54.97%	26.68%	34.98%	54.48%	10.53%	
PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	276	950	213	109	1140	82	127	355	167	240	377	81	4117
PEAK HR FACTOR :		0.779			0.812			0.836			0.938		0.827

CONTROL : Signalized

UTURNS			
NB	SB	EB	WB
0	0	0	0
0	1	0	0
0	1	0	0
0	0	0	0
0	0	0	0
0	2	0	0
1	0	0	0
0	0	0	0
NB	SB	EB	WB
1	4	0	0

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-010 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

AM

NS/EW Streets:	University Pkwy			University Pkwy			College Ave			College Ave					UTURNS			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND								
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL		NB	SB	EB	WB
LANES:	1	3	0	1	3	0	1	1	0	1	1	0						
7:00 AM	10	246	4	3	152	0	8	7	8	23	2	2	465		0	0	0	0
7:15 AM	0	410	4	0	201	3	10	13	14	22	10	11	698		0	0	0	0
7:30 AM	12	484	10	0	225	12	10	13	14	13	11	9	813		0	0	0	0
7:45 AM	20	352	27	3	169	7	9	10	8	16	6	3	630		0	0	0	0
8:00 AM	14	237	6	2	148	9	8	5	3	9	10	7	458		1	0	0	0
8:15 AM	10	225	16	5	125	3	16	19	15	15	12	8	469		0	0	0	0
8:30 AM	10	277	10	4	156	4	12	37	9	18	29	8	574		0	0	0	0
8:45 AM	8	275	2	4	143	18	16	12	9	18	16	9	530		0	0	0	0
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL		NB	SB	EB	WB
TOTAL VOLUMES :	84	2506	79	21	1319	56	89	116	80	134	96	57	4637		1	0	0	0
APPROACH %'s :	3.15%	93.89%	2.96%	1.50%	94.48%	4.01%	31.23%	40.70%	28.07%	46.69%	33.45%	19.86%						
PEAK HR START TIME :	700 AM												TOTAL					
PEAK HR VOL :	42	1492	45	6	747	22	37	43	44	74	29	25	2606					
PEAK HR FACTOR :		0.780			0.818			0.838			0.744		0.801					

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-010 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

PM

NS/EW Streets:	University Pkwy			University Pkwy			College Ave			College Ave					UTURNS			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND								
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL		NB	SB	EB	WB
LANES:	1	3	0	1	3	0	1	1	0	1	1	0						
4:00 PM	10	343	32	34	251	13	23	11	11	25	15	14	782		2	1	0	0
4:15 PM	5	215	24	35	275	13	11	16	5	33	16	4	652		1	0	0	0
4:30 PM	7	237	18	42	220	9	8	8	11	27	16	13	616		1	0	0	0
4:45 PM	3	277	23	40	247	15	7	10	5	40	7	4	678		0	1	0	0
5:00 PM	5	296	25	42	238	10	9	14	5	33	11	6	694		0	0	0	0
5:15 PM	6	337	18	47	287	12	10	9	9	36	12	17	800		0	2	0	0
5:30 PM	7	316	30	51	371	14	9	11	8	48	12	17	894		1	2	0	0
5:45 PM	9	363	37	51	366	17	10	6	14	37	16	8	934		0	1	0	0
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL		NB	SB	EB	WB
TOTAL VOLUMES :	52	2384	207	342	2255	103	87	85	68	279	105	83	6050		5	7	0	0
APPROACH %'s :	1.97%	90.20%	7.83%	12.67%	83.52%	3.81%	36.25%	35.42%	28.33%	59.74%	22.48%	17.77%						
PEAK HR START TIME :	500 PM												TOTAL					
PEAK HR VOL :	27	1312	110	191	1262	53	38	40	36	154	51	48	3322					
PEAK HR FACTOR :		0.886			0.864			0.950			0.821		0.889					

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-011 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

AM

NS/EW Streets:	University Pkwy			University Pkwy			N State St			N State St			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	3	1	1	3	1	1	1	0	1	1	0	
7:00 AM	19	248	62	3	146	4	0	6	64	72	14	4	642
7:15 AM	30	424	81	6	223	11	3	4	70	68	12	7	939
7:30 AM	24	497	113	8	228	10	6	5	62	76	6	7	1042
7:45 AM	36	412	150	10	192	4	1	6	58	67	12	4	952
8:00 AM	36	257	85	3	146	3	1	3	42	67	7	5	655
8:15 AM	36	245	61	4	151	6	6	7	44	59	7	2	628
8:30 AM	43	306	80	10	157	5	2	7	52	68	11	2	743
8:45 AM	47	279	55	10	166	2	3	1	37	87	19	7	713
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	271	2668	687	54	1409	45	22	39	429	564	88	38	6314
APPROACH %'s :	7.47%	73.58%	18.95%	3.58%	93.44%	2.98%	4.49%	7.96%	87.55%	81.74%	12.75%	5.51%	
PEAK HR START TIME :	715 AM												TOTAL
PEAK HR VOL :	126	1590	429	27	789	28	11	18	232	278	37	23	3588
PEAK HR FACTOR :	0.846			0.858			0.847			0.949			0.861

CONTROL : Signalized

	UTURNS			
	NB	SB	EB	WB
7:00 AM	5	0	0	0
7:15 AM	11	0	0	0
7:30 AM	10	0	0	0
7:45 AM	7	0	0	0
8:00 AM	15	0	0	0
8:15 AM	12	0	0	0
8:30 AM	16	0	0	0
8:45 AM	19	0	0	0
	NB	SB	EB	WB
TOTAL VOLUMES :	95	0	0	0

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-011 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

PM

NS/EW Streets:	University Pkwy			University Pkwy			N State St			N State St			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	3	1	1	3	1	1	1	0	1	1	0	
4:00 PM	54	288	93	16	362	15	6	17	52	31	36	7	977
4:15 PM	81	319	99	16	267	4	6	9	63	52	18	4	938
4:30 PM	48	264	91	11	262	3	6	7	45	61	14	3	815
4:45 PM	61	305	94	9	258	4	4	9	58	64	12	11	889
5:00 PM	91	301	83	14	291	11	4	5	58	58	4	5	925
5:15 PM	67	341	104	18	326	10	3	10	40	65	17	7	1008
5:30 PM	58	435	107	14	358	10	5	6	51	65	10	8	1127
5:45 PM	77	429	106	14	338	7	3	4	54	65	16	7	1120
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	537	2682	777	112	2462	64	37	67	421	461	127	52	7799
APPROACH %'s :	13.44%	67.12%	19.44%	4.25%	93.33%	2.43%	7.05%	12.76%	80.19%	72.03%	19.84%	8.13%	
PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	293	1506	400	60	1313	38	15	25	203	253	47	27	4180
PEAK HR FACTOR :		0.898			0.923			0.907			0.919		0.927

CONTROL : Signalized

UTURNS				
	NB	SB	EB	WB
4:00 PM	13	0	0	0
4:15 PM	9	0	0	0
4:30 PM	8	1	0	0
4:45 PM	13	0	0	0
5:00 PM	24	0	0	0
5:15 PM	8	0	0	0
5:30 PM	14	0	0	0
5:45 PM	15	0	0	0
	NB	SB	EB	WB
TOTAL	104	1	0	0

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-012 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

AM

NS/EW Streets:	University Pkwy			University Pkwy			I-215 NB Ramps			I-215 NB Ramps			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	2	0	0	3	1	0	0	0	0.5	0.5	2	
7:00 AM	10	103	0	0	280	17	0	0	0	74	1	259	744
7:15 AM	6	116	0	0	362	20	0	0	0	85	0	438	1027
7:30 AM	5	133	0	0	356	20	0	0	0	55	0	535	1104
7:45 AM	3	113	0	0	355	14	0	0	0	73	0	494	1052
8:00 AM	11	85	0	0	250	11	0	0	0	84	2	294	737
8:15 AM	11	93	0	0	283	13	0	0	0	70	1	281	752
8:30 AM	10	107	0	0	289	18	0	0	0	56	0	322	802
8:45 AM	9	86	0	0	322	10	0	0	0	81	0	329	837
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	65	836	0	0	2497	123	0	0	0	578	4	2952	7055
APPROACH %'s :	7.21%	92.79%	0.00%	0.00%	95.31%	4.69%	#DIV/0!	#DIV/0!	#DIV/0!	16.36%	0.11%	83.53%	
PEAK HR START TIME :	700 AM												TOTAL
PEAK HR VOL :	24	465	0	0	1353	71	0	0	0	287	1	1726	3927
PEAK HR FACTOR :		0.886			0.932			0.000			0.853		0.889

CONTROL : Signalized

UTURNS			
NB	SB	EB	WB
NB	SB	EB	WB
0	0	0	0

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-012 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

PM

NS/EW Streets:	University Pkwy			University Pkwy			I-215 NB Ramps			I-215 NB Ramps			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	2	0	0	3	1	0	0	0	0.5	0.5	2	
4:00 PM	15	119	0	0	484	20	0	0	0	75	0	319	1032
4:15 PM	13	145	0	0	418	21	0	0	0	104	1	345	1047
4:30 PM	11	125	0	0	360	18	0	0	0	95	0	311	920
4:45 PM	8	157	0	0	380	21	0	0	0	110	0	330	1006
5:00 PM	13	116	0	0	395	35	0	0	0	88	0	358	1005
5:15 PM	9	126	0	0	444	30	0	0	0	101	0	429	1139
5:30 PM	8	145	0	0	465	30	0	0	0	99	1	507	1255
5:45 PM	9	172	0	0	461	26	0	0	0	112	4	469	1253
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	86	1105	0	0	3407	201	0	0	0	784	6	3068	8657
APPROACH %'s :	7.22%	92.78%	0.00%	0.00%	94.43%	5.57%	#DIV/0!	#DIV/0!	#DIV/0!	20.32%	0.16%	79.52%	
PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	39	559	0	0	1765	121	0	0	0	400	5	1763	4652
PEAK HR FACTOR :		0.826			0.953			0.000			0.893		0.927

UTURNS			
NB	SB	EB	WB
0	0	0	0

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-013 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

AM

NS/EW Streets:	University Pkwy			University Pkwy			I-215 SB Ramps			I-215 SB Ramps			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	2	0	2	1	0	0.5	0.5	1	0	0	0	
7:00 AM	0	96	73	232	122	0	20	0	20	0	0	0	563
7:15 AM	0	103	65	302	155	0	22	1	16	0	0	0	664
7:30 AM	0	113	74	263	138	0	24	0	17	0	0	0	629
7:45 AM	0	96	65	271	141	0	21	0	22	0	0	0	616
8:00 AM	0	70	62	202	147	0	17	2	9	0	0	0	509
8:15 AM	0	91	64	214	137	0	17	1	13	0	0	0	537
8:30 AM	0	109	81	224	133	0	15	0	15	0	0	0	577
8:45 AM	0	65	73	231	169	0	18	0	12	0	0	0	568
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	0	743	557	1939	1142	0	154	4	124	0	0	0	4663
APPROACH %'s :	0.00%	57.15%	42.85%	62.93%	37.07%	0.00%	54.61%	1.42%	43.97%	#DIV/0!	#DIV/0!	#DIV/0!	
PEAK HR START TIME :	700 AM												TOTAL
PEAK HR VOL :	0	408	277	1068	556	0	87	1	75	0	0	0	2472
PEAK HR FACTOR :		0.916			0.888			0.948			0.000		0.931

UTURNS			
NB	SB	EB	WB
NB	SB	EB	WB
0	0	0	0

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-013

Day: Tuesday

City: Muscoy

Date: 10/20/2015

PM

NS/EW Streets:	University Pkwy			University Pkwy			I-215 SB Ramps			I-215 SB Ramps			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	2	0	2	1	0	0.5	0.5	1	0	0	0	
4:00 PM	0	108	97	365	195	0	21	0	13	0	0	0	799
4:15 PM	0	144	123	316	213	0	16	1	15	0	0	0	828
4:30 PM	0	103	123	282	177	0	25	1	19	0	0	0	730
4:45 PM	0	135	117	262	209	0	22	0	14	0	0	0	759
5:00 PM	0	109	93	299	194	0	13	0	17	0	0	0	725
5:15 PM	0	130	91	338	204	0	13	0	22	0	0	0	798
5:30 PM	0	137	103	332	225	0	23	0	22	0	0	0	842
5:45 PM	0	158	91	350	222	0	25	0	9	0	0	0	855
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	0	1024	838	2544	1639	0	158	2	131	0	0	0	6336
APPROACH %'s :	0.00%	54.99%	45.01%	60.82%	39.18%	0.00%	54.30%	0.69%	45.02%	#DIV/0!	#DIV/0!	#DIV/0!	
PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	0	534	378	1319	845	0	74	0	70	0	0	0	3220
PEAK HR FACTOR :		0.916			0.946			0.800			0.000		0.942

CONTROL : Signalized

UTURNS			
NB	SB	EB	WB
NB	SB	EB	WB
0	0	0	0

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-014 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

AM

NS/EW Streets:	Little Mountain Dr			Little Mountain Dr			Kendall Dr			Kendall Dr			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	1	2	0	1	2	0	1	2	0	1	2	0	
7:00 AM	4	71	10	11	76	10	25	72	18	32	46	17	392
7:15 AM	14	113	59	11	137	9	28	69	35	78	80	10	643
7:30 AM	22	126	52	19	117	6	32	77	18	64	93	28	654
7:45 AM	6	118	14	14	47	6	27	74	9	17	58	38	428
8:00 AM	4	58	11	8	27	4	12	72	11	17	64	19	307
8:15 AM	7	44	11	18	39	6	13	67	10	11	70	26	322
8:30 AM	7	51	9	32	45	6	15	75	11	17	90	25	383
8:45 AM	7	47	5	33	45	7	9	88	10	10	66	22	349
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	71	628	171	146	533	54	161	594	122	246	567	185	3478
APPROACH %'s :	8.16%	72.18%	19.66%	19.92%	72.71%	7.37%	18.36%	67.73%	13.91%	24.65%	56.81%	18.54%	
PEAK HR START TIME :	700 AM												TOTAL
PEAK HR VOL :	46	428	135	55	377	31	112	292	80	191	277	93	2117
PEAK HR FACTOR :		0.761			0.737			0.917			0.758		0.809

CONTROL : Signalized

UTURNS

	NB	SB	EB	WB
7:00 AM	0	0	0	0
7:15 AM	0	0	0	0
7:30 AM	0	0	0	0
7:45 AM	0	0	0	0
8:00 AM	0	0	0	0
8:15 AM	0	0	0	0
8:30 AM	0	0	0	0
8:45 AM	1	0	0	0
	NB	SB	EB	WB
TOTAL	1	0	0	0

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-6172-014 **Day:** Tuesday

City: Muscoy **Date:** 10/20/2015

PM

NS/EW Streets:	Little Mountain Dr			Little Mountain Dr			Kendall Dr			Kendall Dr				UTURNS			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND							
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL	NB	SB	EB	WB
LANES:	1	2	0	1	2	0	1	2	0	1	2	0					
4:00 PM	15	38	25	32	82	10	8	131	12	18	109	19	499	0	0	0	0
4:15 PM	10	40	24	20	60	7	13	139	7	25	101	16	462	0	0	0	0
4:30 PM	11	36	27	27	41	4	9	129	5	22	109	25	445	0	0	0	0
4:45 PM	8	31	19	23	55	3	12	125	8	26	123	27	460	1	0	0	0
5:00 PM	12	48	16	28	82	11	8	129	13	26	107	23	503	0	0	0	0
5:15 PM	9	42	30	31	78	10	5	142	7	33	141	32	560	0	0	0	0
5:30 PM	13	65	25	40	72	6	14	140	14	27	131	29	576	0	0	0	0
5:45 PM	14	65	29	38	114	20	24	162	16	30	130	39	681	0	0	0	0
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL	NB	SB	EB	WB
TOTAL VOLUMES :	92	365	195	239	584	71	93	1097	82	207	951	210	4186	1	0	0	0
APPROACH %'s :	14.11%	55.98%	29.91%	26.73%	65.32%	7.94%	7.31%	86.24%	6.45%	15.13%	69.52%	15.35%					
PEAK HR START TIME :	500 PM												TOTAL				
PEAK HR VOL :	48	220	100	137	346	47	51	573	50	116	509	123	2320				
PEAK HR FACTOR :		0.852			0.770			0.834			0.908		0.852				

CONTROL : Signalized

APPENDIX B: EXISTING (2015) LEVEL OF SERVICE

Intersection	
Intersection Delay, s/veh	8.2
Intersection LOS	A

Movement	EBU	EBL	EBR	NBU	NBL	NBT	SBU	SBT	SBR
Lane Configurations									
Traffic Vol, veh/h	0	10	428	0	106	6	0	6	4
Future Vol, veh/h	0	10	428	0	106	6	0	6	4
Peak Hour Factor	0.92	0.70	0.70	0.92	0.70	0.70	0.92	0.70	0.70
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	14	611	0	151	9	0	9	6
Number of Lanes	0	1	2	0	2	1	0	2	1

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	3	3
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	3	3	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	3	0	3
HCM Control Delay	7.8	9.7	7.8
HCM LOS	A	A	A

Lane	NBLn1	NBLn2	NBLn3	EBLn1	EBLn2	EBLn3	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	100%	0%	100%	0%	0%	0%	0%	0%
Vol Thru, %	0%	0%	100%	0%	0%	0%	100%	100%	0%
Vol Right, %	0%	0%	0%	0%	100%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	53	53	6	10	214	214	3	3	4
LT Vol	53	53	0	10	0	0	0	0	0
Through Vol	0	0	6	0	0	0	3	3	0
RT Vol	0	0	0	0	214	214	0	0	4
Lane Flow Rate	76	76	9	14	306	306	4	4	6
Geometry Grp	8	8	8	7	7	7	8	8	8
Degree of Util (X)	0.131	0.131	0.01	0.022	0.367	0.22	0.007	0.007	0.006
Departure Headway (Hd)	6.244	6.244	3.992	5.522	4.325	2.595	6.036	6.036	3.578
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	578	578	902	651	835	1388	590	590	987
Service Time	3.944	3.944	1.692	3.232	2.035	0.305	3.806	3.806	1.347
HCM Lane V/C Ratio	0.131	0.131	0.01	0.022	0.366	0.22	0.007	0.007	0.006
HCM Control Delay	9.9	9.9	6.7	8.4	9.5	6	8.8	8.8	6.4
HCM Lane LOS	A	A	A	A	A	A	A	A	A
HCM 95th-tile Q	0.4	0.4	0	0.1	1.7	0.8	0	0	0

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	1	27	19	1	4	18	109	177	225	215	0
Future Vol, veh/h	0	1	27	19	1	4	18	109	177	225	215	0
Conflicting Peds, #/hr	12	0	7	9	0	12	7	0	9	14	0	12
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	205	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	76	76	76	76	76	76	76	76	76	76	76	76
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	1	36	25	1	5	24	143	233	296	283	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1019	1325	162	1064	1208	214	295	0	0	390	0	0
Stage 1	887	887	-	321	321	-	-	-	-	-	-	-
Stage 2	132	438	-	743	887	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	191	155	854	177	182	791	1263	-	-	1165	-	-
Stage 1	305	360	-	665	650	-	-	-	-	-	-	-
Stage 2	858	577	-	373	360	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	146	111	839	130	130	774	1254	-	-	1153	-	-
Mov Cap-2 Maneuver	146	111	-	130	130	-	-	-	-	-	-	-
Stage 1	296	265	-	645	630	-	-	-	-	-	-	-
Stage 2	826	559	-	262	265	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.6	34	0.5	4.7
HCM LOS	B	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1254	-	-	680	130	389	1153	-	-
HCM Lane V/C Ratio	0.019	-	-	0.054	0.192	0.017	0.257	-	-
HCM Control Delay (s)	7.9	-	-	10.6	39.2	14.4	9.2	-	-
HCM Lane LOS	A	-	-	B	E	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.2	0.7	0.1	1	-	-

Intersection	
Intersection Delay, s/veh	9.9
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	4	0	39	0	6	0	4	298	141
Future Vol, veh/h	0	0	0	4	0	39	0	6	0	4	298	141
Peak Hour Factor	0.92	0.98	0.98	0.98	0.92	0.98	0.98	0.98	0.92	0.98	0.98	0.98
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	4	0	40	0	6	0	4	304	144
Number of Lanes	0	0	1	0	0	1	0	1	0	1	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	3
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	3	3	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	3	2
HCM Control Delay	8.5	9.9	10.1
HCM LOS	A	A	B

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	100%	0%	100%	0%	0%
Vol Thru, %	0%	100%	41%	0%	0%	0%	0%	100%	98%
Vol Right, %	0%	0%	59%	100%	0%	100%	0%	0%	2%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	4	199	240	4	39	6	93	108	55
LT Vol	4	0	0	0	39	0	93	0	0
Through Vol	0	199	99	0	0	0	0	108	54
RT Vol	0	0	141	4	0	6	0	0	1
Lane Flow Rate	4	203	245	4	40	6	95	110	56
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.007	0.296	0.33	0.007	0.075	0.009	0.159	0.169	0.086
Departure Headway (Hd)	5.761	5.26	4.848	5.768	6.754	5.555	6.037	5.535	5.523
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	619	681	738	624	526	637	591	645	645
Service Time	3.513	3.011	2.6	3.468	4.548	3.349	3.805	3.303	3.29
HCM Lane V/C Ratio	0.006	0.298	0.332	0.006	0.076	0.009	0.161	0.171	0.087
HCM Control Delay	8.6	10.2	10	8.5	10.1	8.4	10	9.4	8.8
HCM Lane LOS	A	B	A	A	B	A	A	A	A
HCM 95th-tile Q	0	1.2	1.4	0	0.2	0	0.6	0.6	0.3

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations		↰	↑↱	
Traffic Vol, veh/h	0	93	162	1
Future Vol, veh/h	0	93	162	1
Peak Hour Factor	0.92	0.98	0.98	0.98
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	95	165	1
Number of Lanes	0	1	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	3
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	9.5
HCM LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	290	774	733	31	130	19	266	126	82	57	92	58
Future Volume (veh/h)	290	774	733	31	130	19	266	126	82	57	92	58
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.95	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1800	1765	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	319	851	207	34	143	11	322	97	63	63	101	0
Adj No. of Lanes	1	2	1	1	2	0	2	1	0	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	284	1161	504	168	871	66	983	292	190	194	387	173
Arrive On Green	0.28	0.58	0.58	0.10	0.28	0.28	0.29	0.29	0.29	0.12	0.12	0.00
Sat Flow, veh/h	1681	3353	1456	1681	3145	239	3361	1000	649	1681	3353	1500
Grp Volume(v), veh/h	319	851	207	34	75	79	322	0	160	63	101	0
Grp Sat Flow(s),veh/h/ln	1681	1676	1456	1681	1676	1707	1681	0	1649	1681	1676	1500
Q Serve(g_s), s	22.0	24.2	10.2	2.4	4.4	4.5	9.7	0.0	9.9	4.5	3.6	0.0
Cycle Q Clear(g_c), s	22.0	24.2	10.2	2.4	4.4	4.5	9.7	0.0	9.9	4.5	3.6	0.0
Prop In Lane	1.00		1.00	1.00		0.14	1.00		0.39	1.00		1.00
Lane Grp Cap(c), veh/h	284	1161	504	168	464	473	983	0	482	194	387	173
V/C Ratio(X)	1.12	0.73	0.41	0.20	0.16	0.17	0.33	0.00	0.33	0.32	0.26	0.00
Avail Cap(c_a), veh/h	284	1161	504	168	464	473	983	0	482	194	387	173
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.66	0.66	0.66	1.00	1.00	1.00	0.87	0.00	0.87	1.00	1.00	0.00
Uniform Delay (d), s/veh	46.6	23.0	20.1	53.7	35.6	35.6	36.0	0.0	36.1	52.8	52.4	0.0
Incr Delay (d2), s/veh	80.8	2.7	1.6	2.7	0.8	0.8	0.8	0.0	1.6	4.4	1.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.5	11.5	4.2	1.2	2.1	2.2	4.6	0.0	4.7	2.3	1.7	0.0
LnGrp Delay(d),s/veh	127.4	25.8	21.7	56.4	36.3	36.4	36.8	0.0	37.7	57.2	54.1	0.0
LnGrp LOS	F	C	C	E	D	D	D		D	E	D	
Approach Vol, veh/h		1377			188			482			164	
Approach Delay, s/veh		48.7			40.0			37.1			55.3	
Approach LOS		D			D			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		20.0	26.0	41.0		43.0	17.0	50.0
Change Period (Y+Rc), s		5.0	4.0	5.0		5.0	4.0	5.0
Max Green Setting (Gmax), s		15.0	22.0	36.0		38.0	13.0	45.0
Max Q Clear Time (g_c+I1), s		6.5	24.0	6.5		11.9	4.4	26.2
Green Ext Time (p_c), s		0.4	0.0	8.2		2.0	0.0	7.0

Intersection Summary	
HCM 2010 Ctrl Delay	45.9
HCM 2010 LOS	D

Notes
User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	237	610	7	6	425	141	8	9	4	22	6	58
Future Volume (veh/h)	237	610	7	6	425	141	8	9	4	22	6	58
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.98	0.95		1.00	0.95		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1800	1765	1800	1800	1765	1765
Adj Flow Rate, veh/h	269	693	8	7	483	120	9	10	0	25	7	17
Adj No. of Lanes	1	2	0	1	2	0	0	2	0	0	1	1
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	518	1570	18	392	887	219	440	526	0	430	105	415
Arrive On Green	0.14	0.46	0.46	0.01	0.33	0.33	0.29	0.29	0.00	0.29	0.29	0.29
Sat Flow, veh/h	1681	3394	39	1681	2655	655	1082	1887	0	1059	361	1426
Grp Volume(v), veh/h	269	342	359	7	304	299	11	8	0	32	0	17
Grp Sat Flow(s),veh/h/ln	1681	1676	1756	1681	1676	1633	1363	1526	0	1420	0	1426
Q Serve(g_s), s	4.9	7.3	7.3	0.1	7.8	7.9	0.0	0.2	0.0	0.2	0.0	0.5
Cycle Q Clear(g_c), s	4.9	7.3	7.3	0.1	7.8	7.9	0.7	0.2	0.0	0.7	0.0	0.5
Prop In Lane	1.00		0.02	1.00		0.40	0.82		0.00	0.78		1.00
Lane Grp Cap(c), veh/h	518	775	812	392	560	546	521	444	0	535	0	415
V/C Ratio(X)	0.52	0.44	0.44	0.02	0.54	0.55	0.02	0.02	0.00	0.06	0.00	0.04
Avail Cap(c_a), veh/h	764	954	999	855	954	929	826	781	0	846	0	730
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	8.9	9.6	9.6	11.4	14.3	14.3	13.3	13.3	0.0	13.5	0.0	13.4
Incr Delay (d2), s/veh	0.8	0.4	0.4	0.0	0.8	0.9	0.0	0.0	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	3.4	3.6	0.1	3.7	3.6	0.1	0.1	0.0	0.3	0.0	0.2
LnGrp Delay(d),s/veh	9.7	10.0	10.0	11.4	15.1	15.2	13.3	13.3	0.0	13.5	0.0	13.4
LnGrp LOS	A	A	A	B	B	B	B	B		B		B
Approach Vol, veh/h		970			610			19			49	
Approach Delay, s/veh		9.9			15.1			13.3			13.5	
Approach LOS		A			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	3.5	29.9		19.4	10.3	23.1		19.4
Change Period (Y+Rc), s	3.0	5.5		4.0	3.0	5.5		4.0
Max Green Setting (Gmax), s	15.0	30.0		27.0	15.0	30.0		27.0
Max Q Clear Time (g_c+I1), s	2.1	9.3		2.7	6.9	9.9		2.7
Green Ext Time (p_c), s	0.0	7.8		0.3	0.5	7.7		0.3

Intersection Summary			
HCM 2010 Ctrl Delay			12.0
HCM 2010 LOS			B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	363	281	3	0	476	192	1	0	3	30	0	70
Future Volume (veh/h)	363	281	3	0	476	192	1	0	3	30	0	70
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		1.00	0.98		1.00	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1765	1800	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	417	323	3	0	547	0	1	0	0	34	0	50
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	1	0	2
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	647	2039	19	4	999	447	358	0	0	366	0	965
Arrive On Green	0.20	0.60	0.60	0.00	0.30	0.00	0.13	0.00	0.00	0.13	0.00	0.13
Sat Flow, veh/h	3261	3403	32	1681	3353	1500	1323	0	0	1383	0	2831
Grp Volume(v), veh/h	417	159	167	0	547	0	1	0	0	34	0	50
Grp Sat Flow(s),veh/h/ln	1630	1676	1758	1681	1676	1500	1323	0	0	1383	0	1415
Q Serve(g_s), s	4.6	1.6	1.6	0.0	5.3	0.0	0.0	0.0	0.0	0.8	0.0	0.5
Cycle Q Clear(g_c), s	4.6	1.6	1.6	0.0	5.3	0.0	0.0	0.0	0.0	0.8	0.0	0.5
Prop In Lane	1.00		0.02	1.00		1.00	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	647	1005	1053	4	999	447	358	0	0	366	0	965
V/C Ratio(X)	0.64	0.16	0.16	0.00	0.55	0.00	0.00	0.00	0.00	0.09	0.00	0.05
Avail Cap(c_a), veh/h	1678	1005	1053	519	2156	965	1036	0	0	897	0	2052
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.3	3.4	3.4	0.0	11.4	0.0	14.7	0.0	0.0	15.1	0.0	8.9
Incr Delay (d2), s/veh	1.1	0.1	0.1	0.0	0.5	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	0.8	0.8	0.0	2.5	0.0	0.0	0.0	0.0	0.3	0.0	0.2
LnGrp Delay(d),s/veh	15.4	3.5	3.5	0.0	11.9	0.0	14.7	0.0	0.0	15.2	0.0	8.9
LnGrp LOS	B	A	A		B		B			B		A
Approach Vol, veh/h		743			547			1			84	
Approach Delay, s/veh		10.2			11.9			14.7			11.5	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	0.0	28.8		10.1	11.7	17.1		10.1
Change Period (Y+Rc), s	4.0	5.5		5.0	4.0	5.5		* 5
Max Green Setting (Gmax), s	12.0	20.0		20.0	20.0	25.0		* 25
Max Q Clear Time (g_c+I1), s	0.0	3.6		2.8	6.6	7.3		2.0
Green Ext Time (p_c), s	0.0	4.8		0.2	1.2	3.1		0.2

Intersection Summary		
HCM 2010 Ctrl Delay		11.0
HCM 2010 LOS		B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	64	270	50	128	437	66	231	178	171	4	6	7
Future Volume (veh/h)	64	270	50	128	437	66	231	178	171	4	6	7
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.97	0.99		0.98	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	79	333	43	158	540	69	285	220	21	5	7	3
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	348	828	106	470	962	122	584	900	85	266	398	318
Arrive On Green	0.05	0.28	0.28	0.10	0.32	0.32	0.18	0.29	0.29	0.00	0.12	0.12
Sat Flow, veh/h	1681	2978	381	1681	2980	379	1681	3091	292	1681	3353	1481
Grp Volume(v), veh/h	79	186	190	158	303	306	285	118	123	5	7	3
Grp Sat Flow(s),veh/h/ln	1681	1676	1682	1681	1676	1683	1681	1676	1707	1681	1676	1481
Q Serve(g_s), s	1.9	5.2	5.3	3.7	8.5	8.6	7.8	3.1	3.1	0.1	0.1	0.1
Cycle Q Clear(g_c), s	1.9	5.2	5.3	3.7	8.5	8.6	7.8	3.1	3.1	0.1	0.1	0.1
Prop In Lane	1.00		0.23	1.00		0.23	1.00		0.17	1.00		1.00
Lane Grp Cap(c), veh/h	348	466	467	470	541	543	584	488	497	266	398	318
V/C Ratio(X)	0.23	0.40	0.41	0.34	0.56	0.56	0.49	0.24	0.25	0.02	0.02	0.01
Avail Cap(c_a), veh/h	705	732	735	751	732	735	728	849	865	700	1699	893
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.9	16.8	16.8	12.4	16.0	16.0	15.5	15.5	15.5	22.1	22.3	17.7
Incr Delay (d2), s/veh	0.3	0.6	0.6	0.4	0.9	0.9	0.6	0.3	0.3	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	2.4	2.5	1.7	4.1	4.1	3.7	1.4	1.5	0.1	0.0	0.0
LnGrp Delay(d),s/veh	14.2	17.3	17.4	12.8	16.9	17.0	16.1	15.7	15.8	22.1	22.3	17.7
LnGrp LOS	B	B	B	B	B	B	B	B	B	C	C	B
Approach Vol, veh/h		455			767			526			15	
Approach Delay, s/veh		16.8			16.1			16.0			21.3	
Approach LOS		B			B			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.9	24.5	14.1	11.8	9.4	21.9	4.2	21.7
Change Period (Y+Rc), s	4.0	6.0	4.0	5.0	4.0	6.0	4.0	5.0
Max Green Setting (Gmax), s	15.0	25.0	15.0	29.0	15.0	25.0	15.0	29.0
Max Q Clear Time (g_c+I1), s	3.9	10.6	9.8	2.1	5.7	7.3	2.1	5.1
Green Ext Time (p_c), s	0.1	4.9	0.4	1.3	0.3	5.4	0.0	1.2

Intersection Summary	
HCM 2010 Ctrl Delay	16.3
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	1.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	24	52	21	150	6	12
Future Vol, veh/h	24	52	21	150	6	12
Conflicting Peds, #/hr	0	5	5	0	5	5
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	64	64	64	64	64	64
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	38	81	33	234	9	19

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	124	0	271	69
Stage 1	-	-	-	-	83	-
Stage 2	-	-	-	-	188	-
Critical Hdwy	-	-	4.14	-	7.54	6.94
Critical Hdwy Stg 1	-	-	-	-	6.54	-
Critical Hdwy Stg 2	-	-	-	-	6.54	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1461	-	660	980
Stage 1	-	-	-	-	916	-
Stage 2	-	-	-	-	796	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1455	-	644	973
Mov Cap-2 Maneuver	-	-	-	-	644	-
Stage 1	-	-	-	-	916	-
Stage 2	-	-	-	-	775	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.9	9.5
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	831	-	-	1455	-
HCM Lane V/C Ratio	0.034	-	-	0.023	-
HCM Control Delay (s)	9.5	-	-	7.5	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	203	359	194	212	283	184	102	1390	87	28	363	93
Future Volume (veh/h)	203	359	194	212	283	184	102	1390	87	28	363	93
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	228	403	147	238	318	94	115	1562	94	31	408	74
Adj No. of Lanes	2	2	0	2	2	0	2	3	0	1	3	0
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	357	521	188	289	460	134	166	2407	145	38	2017	356
Arrive On Green	0.11	0.22	0.22	0.09	0.18	0.18	0.05	0.52	0.52	0.02	0.49	0.49
Sat Flow, veh/h	3261	2412	869	3261	2559	744	3261	4640	279	1681	4112	725
Grp Volume(v), veh/h	228	279	271	238	206	206	115	1081	575	31	316	166
Grp Sat Flow(s),veh/h/ln	1630	1676	1604	1630	1676	1626	1630	1606	1708	1681	1606	1625
Q Serve(g_s), s	8.7	20.3	20.7	9.3	15.0	15.4	4.5	31.7	31.8	2.4	7.2	7.5
Cycle Q Clear(g_c), s	8.7	20.3	20.7	9.3	15.0	15.4	4.5	31.7	31.8	2.4	7.2	7.5
Prop In Lane	1.00		0.54	1.00		0.46	1.00		0.16	1.00		0.45
Lane Grp Cap(c), veh/h	357	362	347	289	301	292	166	1666	886	38	1576	797
V/C Ratio(X)	0.64	0.77	0.78	0.82	0.69	0.70	0.69	0.65	0.65	0.81	0.20	0.21
Avail Cap(c_a), veh/h	357	542	518	351	567	550	426	1666	886	220	1576	797
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.82	0.82	0.82	0.98	0.98	0.98
Uniform Delay (d), s/veh	55.4	47.9	48.1	58.2	49.9	50.1	60.7	22.7	22.7	63.2	18.7	18.8
Incr Delay (d2), s/veh	3.8	3.8	4.5	12.4	2.8	3.1	4.2	1.6	3.0	30.5	0.3	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.1	9.8	9.6	4.7	7.2	7.2	2.1	14.3	15.6	1.4	3.3	3.5
LnGrp Delay(d),s/veh	59.2	51.7	52.6	70.7	52.6	53.2	64.9	24.3	25.8	93.8	19.0	19.4
LnGrp LOS	E	D	D	E	D	D	E	C	C	F	B	B
Approach Vol, veh/h		778			650			1771			513	
Approach Delay, s/veh		54.2			59.4			27.4			23.6	
Approach LOS		D			E			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.0	73.4	15.5	34.1	10.6	69.8	20.2	29.4
Change Period (Y+Rc), s	4.0	6.0	4.0	6.0	4.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	17.0	37.0	14.0	42.0	17.0	37.0	12.0	* 44
Max Q Clear Time (g_c+I1), s	4.4	33.8	11.3	22.7	6.5	9.5	10.7	17.4
Green Ext Time (p_c), s	0.0	2.8	0.2	2.7	0.2	16.6	0.5	2.2

Intersection Summary	
HCM 2010 Ctrl Delay	38.1
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	37	43	44	74	29	25	42	1492	45	6	747	22
Future Volume (veh/h)	37	43	44	74	29	25	42	1492	45	6	747	22
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.97	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1765	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	46	54	5	92	36	6	52	1865	54	8	934	26
Adj No. of Lanes	1	1	1	1	1	1	1	3	0	1	3	0
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	307	329	271	292	329	271	65	1390	40	621	3037	84
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.01	0.10	0.10	0.37	0.63	0.63
Sat Flow, veh/h	1339	1765	1457	1320	1765	1457	1681	4812	139	1681	4818	134
Grp Volume(v), veh/h	46	54	5	92	36	6	52	1244	675	8	622	338
Grp Sat Flow(s),veh/h/ln	1339	1765	1457	1320	1765	1457	1681	1606	1740	1681	1606	1741
Q Serve(g_s), s	2.7	2.3	0.3	5.7	1.5	0.3	2.8	26.0	26.0	0.3	8.0	8.0
Cycle Q Clear(g_c), s	4.2	2.3	0.3	8.0	1.5	0.3	2.8	26.0	26.0	0.3	8.0	8.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.08	1.00		0.08
Lane Grp Cap(c), veh/h	307	329	271	292	329	271	65	928	503	621	2025	1097
V/C Ratio(X)	0.15	0.16	0.02	0.32	0.11	0.02	0.79	1.34	1.34	0.01	0.31	0.31
Avail Cap(c_a), veh/h	623	745	615	603	745	615	243	928	503	621	2025	1097
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.28	0.28	0.28	0.92	0.92	0.92
Uniform Delay (d), s/veh	32.2	30.7	29.9	34.1	30.4	29.9	44.1	40.7	40.7	18.0	7.6	7.6
Incr Delay (d2), s/veh	0.2	0.2	0.0	0.6	0.1	0.0	6.1	155.6	158.2	0.0	0.4	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	1.1	0.1	2.1	0.8	0.1	1.4	31.6	34.6	0.1	3.6	4.1
LnGrp Delay(d),s/veh	32.4	31.0	29.9	34.7	30.6	30.0	50.2	196.3	198.9	18.0	8.0	8.3
LnGrp LOS	C	C	C	C	C	C	D	F	F	B	A	A
Approach Vol, veh/h		105			134			1971			968	
Approach Delay, s/veh		31.5			33.4			193.3			8.2	
Approach LOS		C			C			F			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	38.2	31.0		20.8	7.5	61.7		20.8
Change Period (Y+Rc), s	5.0	* 5		4.0	4.0	5.0		4.0
Max Green Setting (Gmax), s	13.0	* 26		38.0	13.0	26.0		38.0
Max Q Clear Time (g_c+I1), s	2.3	28.0		6.2	4.8	10.0		10.0
Green Ext Time (p_c), s	4.2	0.0		1.0	0.0	5.2		0.9

Intersection Summary		
HCM 2010 Ctrl Delay		124.8
HCM 2010 LOS		F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	18	232	278	37	23	126	1590	429	27	789	28
Future Volume (veh/h)	11	18	232	278	37	23	126	1590	429	27	789	28
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	13	21	83	323	43	8	147	1849	180	31	917	5
Adj No. of Lanes	1	1	0	1	1	0	1	3	1	1	3	1
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	503	104	412	447	484	90	451	2395	744	40	1164	360
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.33	0.54	0.99	0.99	0.01	0.08	0.08
Sat Flow, veh/h	1346	312	1233	1283	1447	269	1681	4818	1497	1681	4818	1491
Grp Volume(v), veh/h	13	0	104	323	0	51	147	1849	180	31	917	5
Grp Sat Flow(s),veh/h/ln	1346	0	1545	1283	0	1717	1681	1606	1497	1681	1606	1491
Q Serve(g_s), s	0.6	0.0	4.3	21.6	0.0	1.8	4.4	0.8	0.1	1.7	16.8	0.3
Cycle Q Clear(g_c), s	2.4	0.0	4.3	25.9	0.0	1.8	4.4	0.8	0.1	1.7	16.8	0.3
Prop In Lane	1.00		0.80	1.00		0.16	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	503	0	516	447	0	574	451	2395	744	40	1164	360
V/C Ratio(X)	0.03	0.00	0.20	0.72	0.00	0.09	0.33	0.77	0.24	0.77	0.79	0.01
Avail Cap(c_a), veh/h	651	0	686	589	0	763	451	2395	744	205	1338	414
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.14	0.14	0.14	0.96	0.96	0.96
Uniform Delay (d), s/veh	21.4	0.0	21.4	30.6	0.0	20.5	16.3	0.1	0.1	44.4	39.2	31.5
Incr Delay (d2), s/veh	0.0	0.0	0.2	3.0	0.0	0.1	0.1	0.4	0.1	25.0	5.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	1.9	8.0	0.0	0.9	2.0	0.2	0.0	1.1	8.1	0.1
LnGrp Delay(d),s/veh	21.4	0.0	21.6	33.6	0.0	20.6	16.3	0.5	0.2	69.4	44.4	31.6
LnGrp LOS	C		C	C		C	B	A	A	E	D	C
Approach Vol, veh/h		117			374			2176			953	
Approach Delay, s/veh		21.5			31.8			1.5			45.1	
Approach LOS		C			C			A			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.2	49.7		34.1	29.2	26.7		34.1
Change Period (Y+Rc), s	4.0	5.0		4.0	5.0	* 5		4.0
Max Green Setting (Gmax), s	11.0	26.0		40.0	12.0	* 25		40.0
Max Q Clear Time (g_c+I1), s	3.7	2.8		27.9	6.4	18.8		6.3
Green Ext Time (p_c), s	0.0	15.2		1.7	0.3	2.9		2.2

Intersection Summary		
HCM 2010 Ctrl Delay		16.8
HCM 2010 LOS		B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	287	1	1726	24	465	0	0	1353	71
Future Volume (vph)	0	0	0	287	1	1726	24	465	0	0	1353	71
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)					5.5	5.5	3.5	4.5			4.5	4.5
Lane Util. Factor					1.00	0.88	1.00	0.95			0.95	1.00
Frpb, ped/bikes					1.00	1.00	1.00	1.00			1.00	0.97
Flpb, ped/bikes					1.00	1.00	1.00	1.00			1.00	1.00
Frt					1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected					0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)					1681	2640	1676	3353			3353	1449
Flt Permitted					0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (perm)					1681	2640	1676	3353			3353	1449
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	0	0	0	322	1	1939	27	522	0	0	1520	80
RTOR Reduction (vph)	0	0	0	0	0	65	0	0	0	0	0	43
Lane Group Flow (vph)	0	0	0	0	323	1874	27	522	0	0	1520	37
Confl. Peds. (#/hr)												3
Confl. Bikes (#/hr)												1
Turn Type				Perm	NA	custom	Prot	NA			NA	Perm
Protected Phases					8	8 1	5	2			6	
Permitted Phases				8								6
Actuated Green, G (s)					36.0	62.9	3.0	17.1			37.5	37.5
Effective Green, g (s)					36.0	62.9	3.0	17.1			37.5	37.5
Actuated g/C Ratio					0.40	0.70	0.03	0.19			0.42	0.42
Clearance Time (s)					5.5		3.5	4.5			4.5	4.5
Vehicle Extension (s)					3.5		2.0	2.0			2.0	2.0
Lane Grp Cap (vph)					672	1845	55	637			1397	603
v/s Ratio Prot						c0.71	0.02	c0.16			c0.45	
v/s Ratio Perm					0.19							0.03
v/c Ratio					0.48	1.02	0.49	0.82			1.09	0.06
Uniform Delay, d1					20.1	13.6	42.7	35.0			26.2	15.7
Progression Factor					1.00	1.00	0.77	0.57			0.48	0.21
Incremental Delay, d2					0.6	24.9	2.2	9.9			49.7	0.2
Delay (s)					20.7	38.4	34.9	30.0			62.2	3.5
Level of Service					C	D	C	C			E	A
Approach Delay (s)		0.0			35.9			30.2			59.3	
Approach LOS		A			D			C			E	

Intersection Summary			
HCM 2000 Control Delay	43.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.5
Intersection Capacity Utilization	85.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	87	1	75	0	0	0	0	408	277	1068	556	0
Future Volume (veh/h)	87	1	75	0	0	0	0	408	277	1068	556	0
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98				1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1765				0	1765	1800	1765	1765	0
Adj Flow Rate, veh/h	94	1	4				0	439	183	1148	598	0
Adj No. of Lanes	0	1	1				0	2	0	2	1	0
Peak Hour Factor	0.93	0.93	0.93				0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	132	1	117				0	448	185	1843	1429	0
Arrive On Green	0.08	0.08	0.08				0.00	0.19	0.19	0.94	1.00	0.00
Sat Flow, veh/h	1664	18	1472				0	2392	951	3261	1765	0
Grp Volume(v), veh/h	95	0	4				0	318	304	1148	598	0
Grp Sat Flow(s),veh/h/ln	1682	0	1472				0	1676	1579	1630	1765	0
Q Serve(g_s), s	5.0	0.0	0.2				0.0	17.0	17.3	4.3	0.0	0.0
Cycle Q Clear(g_c), s	5.0	0.0	0.2				0.0	17.0	17.3	4.3	0.0	0.0
Prop In Lane	0.99		1.00				0.00		0.60	1.00		0.00
Lane Grp Cap(c), veh/h	133	0	117				0	326	307	1843	1429	0
V/C Ratio(X)	0.71	0.00	0.03				0.00	0.98	0.99	0.62	0.42	0.00
Avail Cap(c_a), veh/h	392	0	343				0	326	307	1843	1429	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.67	1.67	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.09	0.09	0.00
Uniform Delay (d), s/veh	40.4	0.0	38.3				0.0	36.0	36.2	1.2	0.0	0.0
Incr Delay (d2), s/veh	2.6	0.0	0.0				0.0	44.2	48.9	0.0	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	0.0	0.1				0.0	11.9	11.7	1.6	0.0	0.0
LnGrp Delay(d),s/veh	43.1	0.0	38.3				0.0	80.2	85.0	1.3	0.1	0.0
LnGrp LOS	D		D					F	F	A	A	
Approach Vol, veh/h		99						622			1746	
Approach Delay, s/veh		42.9						82.6			0.9	
Approach LOS		D						F			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	55.4	22.0		12.6		77.4		
Change Period (Y+Rc), s	4.5	* 4.5		5.5		4.5		
Max Green Setting (Gmax), s	38.0	* 18		21.0		16.0		
Max Q Clear Time (g_c+I1), s	6.3	19.3		7.0		2.0		
Green Ext Time (p_c), s	3.9	0.0		0.2		4.9		

Intersection Summary	
HCM 2010 Ctrl Delay	23.1
HCM 2010 LOS	C

Notes
User approved pedestrian interval to be less than phase max green.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	112	292	80	191	277	93	46	428	135	55	377	31
Future Volume (veh/h)	112	292	80	191	277	93	46	428	135	55	377	31
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.99	0.98		0.95	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1872	1765	1765	1800	1765	1765	1872	1765	1765	1872
Adj Flow Rate, veh/h	138	360	68	236	342	78	57	528	121	68	465	29
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	556	1104	206	554	1076	242	262	864	197	199	1030	64
Arrive On Green	0.11	0.39	0.39	0.11	0.40	0.40	0.32	0.32	0.32	0.32	0.32	0.32
Sat Flow, veh/h	1681	2811	525	1681	2717	612	885	2682	611	770	3197	199
Grp Volume(v), veh/h	138	213	215	236	209	211	57	329	320	68	243	251
Grp Sat Flow(s),veh/h/ln	1681	1676	1660	1681	1676	1652	885	1676	1616	770	1676	1720
Q Serve(g_s), s	4.0	8.0	8.1	7.3	7.8	7.9	4.9	14.9	15.1	7.4	10.3	10.4
Cycle Q Clear(g_c), s	4.0	8.0	8.1	7.3	7.8	7.9	15.3	14.9	15.1	22.4	10.3	10.4
Prop In Lane	1.00		0.32	1.00		0.37	1.00		0.38	1.00		0.12
Lane Grp Cap(c), veh/h	556	658	652	554	664	654	262	540	520	199	540	554
V/C Ratio(X)	0.25	0.32	0.33	0.43	0.32	0.32	0.22	0.61	0.61	0.34	0.45	0.45
Avail Cap(c_a), veh/h	656	658	652	598	664	654	292	596	575	225	596	611
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	12.6	19.0	19.1	13.4	18.8	18.8	30.3	25.7	25.8	35.3	24.2	24.2
Incr Delay (d2), s/veh	0.2	1.3	1.4	0.5	1.2	1.3	0.4	1.5	1.7	1.0	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	3.9	3.9	3.4	3.8	3.9	1.2	7.1	6.9	1.6	4.9	5.0
LnGrp Delay(d),s/veh	12.9	20.3	20.4	13.9	20.0	20.1	30.7	27.3	27.5	36.3	24.8	24.8
LnGrp LOS	B	C	C	B	C	C	C	C	C	D	C	C
Approach Vol, veh/h		566			656			706			562	
Approach Delay, s/veh		18.5			17.9			27.6			26.2	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.7	41.6		34.7	14.0	41.3		34.7
Change Period (Y+Rc), s	4.0	6.0		5.7	4.0	6.0		5.7
Max Green Setting (Gmax), s	15.0	27.3		32.0	12.3	30.0		32.0
Max Q Clear Time (g_c+I1), s	6.0	9.9		24.4	9.3	10.1		17.3
Green Ext Time (p_c), s	0.2	5.1		4.5	0.2	5.4		7.2

Intersection Summary		
HCM 2010 Ctrl Delay		22.7
HCM 2010 LOS		C

Intersection	
Intersection Delay, s/veh	9.8
Intersection LOS	A

Movement	EBU	EBL	EBR	NBU	NBL	NBT	SBU	SBT	SBR
Lane Configurations									
Traffic Vol, veh/h	0	8	102	0	304	8	0	5	3
Future Vol, veh/h	0	8	102	0	304	8	0	5	3
Peak Hour Factor	0.92	0.68	0.68	0.92	0.68	0.68	0.92	0.68	0.68
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	12	150	0	447	12	0	7	4
Number of Lanes	0	1	2	0	2	1	0	2	1

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	3	3
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	3	3	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	3	0	3
HCM Control Delay	7.3	10.8	7.7
HCM LOS	A	B	A

Lane	NBLn1	NBLn2	NBLn3	EBLn1	EBLn2	EBLn3	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	100%	0%	100%	0%	0%	0%	0%	0%
Vol Thru, %	0%	0%	100%	0%	0%	0%	100%	100%	0%
Vol Right, %	0%	0%	0%	0%	100%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	152	152	8	8	51	51	3	3	3
LT Vol	152	152	0	8	0	0	0	0	0
Through Vol	0	0	8	0	0	0	3	3	0
RT Vol	0	0	0	0	51	51	0	0	3
Lane Flow Rate	224	224	12	12	75	75	4	4	4
Geometry Grp	8	8	8	7	7	7	8	8	8
Degree of Util (X)	0.339	0.339	0.01	0.02	0.103	0.067	0.006	0.006	0.004
Departure Headway (Hd)	5.453	5.453	3.2	6.142	4.949	3.224	5.816	5.816	3.372
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	664	664	1121	584	725	1111	614	614	1052
Service Time	3.153	3.153	0.913	3.863	2.669	0.945	3.568	3.568	1.122
HCM Lane V/C Ratio	0.337	0.337	0.011	0.021	0.103	0.068	0.007	0.007	0.004
HCM Control Delay	10.9	10.9	5.9	9	8.2	6.2	8.6	8.6	6.1
HCM Lane LOS	B	B	A	A	A	A	A	A	A
HCM 95th-tile Q	1.5	1.5	0	0.1	0.3	0.2	0	0	0

Intersection	
Int Delay, s/veh	14

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	7	31	167	6	81	25	169	104	59	48	1
Future Vol, veh/h	1	7	31	167	6	81	25	169	104	59	48	1
Conflicting Peds, #/hr	3	0	4	10	0	3	4	0	10	9	0	3
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	205	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	69	69	69	69	69	69	69	69	69	69	69	69
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	10	45	242	9	117	36	245	151	86	70	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	447	723	50	624	649	211	75	0	0	406	0	0
Stage 1	245	245	-	403	403	-	-	-	-	-	-	-
Stage 2	202	478	-	221	246	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	495	351	1008	370	387	794	1522	-	-	1149	-	-
Stage 1	737	702	-	595	598	-	-	-	-	-	-	-
Stage 2	781	554	-	761	701	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	380	313	996	314	345	785	1509	-	-	1146	-	-
Mov Cap-2 Maneuver	380	313	-	314	345	-	-	-	-	-	-	-
Stage 1	717	647	-	576	579	-	-	-	-	-	-	-
Stage 2	637	536	-	656	646	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.6	34.3	0.6	4.6
HCM LOS	B	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1509	-	-	695	314	722	1146	-	-
HCM Lane V/C Ratio	0.024	-	-	0.081	0.771	0.175	0.075	-	-
HCM Control Delay (s)	7.4	-	-	10.6	46.4	11	8.4	-	-
HCM Lane LOS	A	-	-	B	E	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.3	6	0.6	0.2	-	-

Intersection	
Intersection Delay, s/veh	13.8
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations			✥			↰		↱		↰	↑↱	
Traffic Vol, veh/h	0	0	0	1	0	210	0	63	0	2	234	58
Future Vol, veh/h	0	0	0	1	0	210	0	63	0	2	234	58
Peak Hour Factor	0.92	0.73	0.73	0.73	0.92	0.73	0.73	0.73	0.92	0.73	0.73	0.73
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	1	0	288	0	86	0	3	321	79
Number of Lanes	0	0	1	0	0	1	0	1	0	1	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	3
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	3	3	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	3	2
HCM Control Delay	9.8	16.9	13.1
HCM LOS	A	C	B

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	100%	0%	100%	0%	0%
Vol Thru, %	0%	100%	57%	0%	0%	0%	0%	100%	100%
Vol Right, %	0%	0%	43%	100%	0%	100%	0%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	2	156	136	1	210	63	10	116	116
LT Vol	2	0	0	0	210	0	10	0	0
Through Vol	0	156	78	0	0	0	0	116	116
RT Vol	0	0	58	1	0	63	0	0	0
Lane Flow Rate	3	214	186	1	288	86	14	158	158
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.005	0.397	0.331	0.003	0.57	0.142	0.028	0.304	0.226
Departure Headway (Hd)	7.204	6.695	6.391	7.101	7.139	5.939	7.424	6.914	5.146
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	494	534	559	507	503	601	480	517	691
Service Time	4.981	4.472	4.167	4.801	4.909	3.708	5.206	4.696	2.926
HCM Lane V/C Ratio	0.006	0.401	0.333	0.002	0.573	0.143	0.029	0.306	0.229
HCM Control Delay	10	13.9	12.3	9.8	19	9.7	10.4	12.7	9.4
HCM Lane LOS	A	B	B	A	C	A	B	B	A
HCM 95th-tile Q	0	1.9	1.4	0	3.5	0.5	0.1	1.3	0.9

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations		↰	↑↱	
Traffic Vol, veh/h	0	10	231	0
Future Vol, veh/h	0	10	231	0
Peak Hour Factor	0.92	0.73	0.73	0.73
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	14	316	0
Number of Lanes	0	1	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	3
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	11
HCM LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↱		↰	↰↑↱		↰	↑↑	↱
Traffic Volume (veh/h)	138	452	549	65	462	47	570	161	41	27	114	334
Future Volume (veh/h)	138	452	549	65	462	47	570	161	41	27	114	334
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95	1.00		0.91	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1800	1765	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	184	603	17	87	616	55	760	215	48	36	152	0
Adj No. of Lanes	1	2	1	1	2	0	2	1	0	1	2	1
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	116	1006	426	90	878	78	983	407	91	349	696	312
Arrive On Green	0.12	0.50	0.50	0.05	0.28	0.28	0.29	0.29	0.29	0.21	0.21	0.00
Sat Flow, veh/h	1681	3353	1419	1681	3084	275	3361	1392	311	1681	3353	1500
Grp Volume(v), veh/h	184	603	17	87	334	337	760	0	263	36	152	0
Grp Sat Flow(s),veh/h/ln	1681	1676	1419	1681	1676	1682	1681	0	1703	1681	1676	1500
Q Serve(g_s), s	9.0	16.7	0.8	6.7	23.2	23.3	26.9	0.0	16.8	2.3	4.9	0.0
Cycle Q Clear(g_c), s	9.0	16.7	0.8	6.7	23.2	23.3	26.9	0.0	16.8	2.3	4.9	0.0
Prop In Lane	1.00		1.00	1.00		0.16	1.00		0.18	1.00		1.00
Lane Grp Cap(c), veh/h	116	1006	426	90	477	479	983	0	498	349	696	312
V/C Ratio(X)	1.58	0.60	0.04	0.96	0.70	0.70	0.77	0.00	0.53	0.10	0.22	0.00
Avail Cap(c_a), veh/h	116	1006	426	90	477	479	983	0	498	349	696	312
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.62	0.62	0.62	1.00	1.00	1.00	0.72	0.00	0.72	1.00	1.00	0.00
Uniform Delay (d), s/veh	57.5	26.9	22.9	61.4	41.5	41.6	42.1	0.0	38.5	41.7	42.7	0.0
Incr Delay (d2), s/veh	285.5	1.6	0.1	84.5	8.3	8.4	4.3	0.0	2.9	0.6	0.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	18.4	7.9	0.3	5.2	11.8	12.0	13.0	0.0	8.3	1.1	2.3	0.0
LnGrp Delay(d),s/veh	343.0	28.5	23.0	145.8	49.8	50.0	46.4	0.0	41.4	42.3	43.5	0.0
LnGrp LOS	F	C	C	F	D	D	D		D	D	D	
Approach Vol, veh/h		804			758			1023			188	
Approach Delay, s/veh		100.4			60.9			45.1			43.2	
Approach LOS		F			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		32.0	13.0	42.0		43.0	11.0	44.0
Change Period (Y+Rc), s		5.0	4.0	5.0		5.0	4.0	5.0
Max Green Setting (Gmax), s		27.0	9.0	37.0		38.0	7.0	39.0
Max Q Clear Time (g_c+I1), s		6.9	11.0	25.3		28.9	8.7	18.7
Green Ext Time (p_c), s		0.9	0.0	6.2		3.1	0.0	8.5

Intersection Summary	
HCM 2010 Ctrl Delay	65.3
HCM 2010 LOS	E

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	83	606	15	11	571	58	23	8	10	129	5	189
Future Volume (veh/h)	83	606	15	11	571	58	23	8	10	129	5	189
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.99	0.93		1.00	0.91		0.89
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1800	1765	1800	1800	1765	1765
Adj Flow Rate, veh/h	117	854	18	15	804	71	32	11	0	182	7	51
Adj No. of Lanes	1	2	0	1	2	0	0	2	0	0	1	1
Peak Hour Factor	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	314	1405	30	277	1156	102	438	576	0	566	20	506
Arrive On Green	0.07	0.42	0.42	0.02	0.37	0.37	0.38	0.38	0.00	0.38	0.38	0.38
Sat Flow, veh/h	1681	3355	71	1681	3114	275	877	1606	0	1221	52	1340
Grp Volume(v), veh/h	117	427	445	15	433	442	32	11	0	189	0	51
Grp Sat Flow(s),veh/h/ln	1681	1676	1749	1681	1676	1713	877	1526	0	1274	0	1340
Q Serve(g_s), s	2.7	13.4	13.4	0.4	14.7	14.7	1.3	0.3	0.0	7.2	0.0	1.7
Cycle Q Clear(g_c), s	2.7	13.4	13.4	0.4	14.7	14.7	8.8	0.3	0.0	7.5	0.0	1.7
Prop In Lane	1.00		0.04	1.00		0.16	1.00		0.00	0.96		1.00
Lane Grp Cap(c), veh/h	314	702	733	277	622	636	438	576	0	586	0	506
V/C Ratio(X)	0.37	0.61	0.61	0.05	0.70	0.70	0.07	0.02	0.00	0.32	0.00	0.10
Avail Cap(c_a), veh/h	577	747	779	620	747	763	467	612	0	616	0	537
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.8	15.3	15.3	13.5	18.0	18.0	18.6	13.1	0.0	15.5	0.0	13.6
Incr Delay (d2), s/veh	0.7	1.3	1.2	0.1	2.2	2.2	0.1	0.0	0.0	0.3	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	6.4	6.7	0.2	7.1	7.3	0.5	0.1	0.0	2.6	0.0	0.6
LnGrp Delay(d),s/veh	13.6	16.5	16.5	13.5	20.2	20.1	18.7	13.2	0.0	15.8	0.0	13.7
LnGrp LOS	B	B	B	B	C	C	B	B		B		B
Approach Vol, veh/h		989			890			43			240	
Approach Delay, s/veh		16.2			20.0			17.3			15.3	
Approach LOS		B			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	4.2	33.7		29.4	7.4	30.5		29.4
Change Period (Y+Rc), s	3.0	5.5		4.0	3.0	5.5		4.0
Max Green Setting (Gmax), s	15.0	30.0		27.0	15.0	30.0		27.0
Max Q Clear Time (g_c+I1), s	2.4	15.4		9.5	4.7	16.7		10.8
Green Ext Time (p_c), s	0.0	8.8		1.5	0.2	8.2		1.5

Intersection Summary	
HCM 2010 Ctrl Delay	17.7
HCM 2010 LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	269	472	3	8	278	139	4	0	2	203	2	376
Future Volume (veh/h)	269	472	3	8	278	139	4	0	2	203	2	376
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		1.00	0.99		1.00	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1765	1800	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	379	665	3	11	392	0	6	0	0	286	0	331
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	1	0	2
Peak Hour Factor	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	559	1451	7	14	874	391	425	0	0	519	0	1271
Arrive On Green	0.17	0.42	0.42	0.01	0.26	0.00	0.27	0.00	0.00	0.27	0.00	0.27
Sat Flow, veh/h	3261	3422	15	1681	3353	1500	1030	0	0	1380	0	2826
Grp Volume(v), veh/h	379	326	342	11	392	0	6	0	0	286	0	331
Grp Sat Flow(s),veh/h/ln	1630	1676	1761	1681	1676	1500	1030	0	0	1380	0	1413
Q Serve(g_s), s	5.3	6.7	6.7	0.3	4.7	0.0	0.2	0.0	0.0	9.0	0.0	3.6
Cycle Q Clear(g_c), s	5.3	6.7	6.7	0.3	4.7	0.0	0.2	0.0	0.0	9.2	0.0	3.6
Prop In Lane	1.00		0.01	1.00		1.00	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	559	711	747	14	874	391	425	0	0	519	0	1271
V/C Ratio(X)	0.68	0.46	0.46	0.77	0.45	0.00	0.01	0.00	0.00	0.55	0.00	0.26
Avail Cap(c_a), veh/h	1350	711	747	417	1735	776	682	0	0	721	0	1684
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.8	10.0	10.0	23.9	15.0	0.0	13.0	0.0	0.0	16.3	0.0	8.6
Incr Delay (d2), s/veh	1.4	0.5	0.4	57.8	0.4	0.0	0.0	0.0	0.0	0.9	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.5	3.2	3.3	0.4	2.2	0.0	0.1	0.0	0.0	3.6	0.0	1.4
LnGrp Delay(d),s/veh	20.2	10.4	10.4	81.7	15.3	0.0	13.1	0.0	0.0	17.2	0.0	8.7
LnGrp LOS	C	B	B	F	B		B			B		A
Approach Vol, veh/h		1047			403			6			617	
Approach Delay, s/veh		14.0			17.1			13.1			12.7	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	4.4	26.0		17.9	12.3	18.1		17.9
Change Period (Y+Rc), s	4.0	5.5		5.0	4.0	5.5		* 5
Max Green Setting (Gmax), s	12.0	20.0		20.0	20.0	25.0		* 25
Max Q Clear Time (g_c+I1), s	2.3	8.7		11.2	7.3	6.7		2.2
Green Ext Time (p_c), s	0.0	4.7		1.7	1.1	5.2		2.4

Intersection Summary	
HCM 2010 Ctrl Delay	14.2
HCM 2010 LOS	B

Notes
User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	312	273	51	229	35	126	73	61	47	153	81
Future Volume (veh/h)	90	312	273	51	229	35	126	73	61	47	153	81
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	1.00		0.97	0.98		0.96	0.96		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	129	446	190	73	327	33	180	104	16	67	219	10
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	410	661	279	275	789	79	534	988	148	521	943	474
Arrive On Green	0.08	0.29	0.29	0.05	0.26	0.26	0.10	0.34	0.34	0.04	0.28	0.28
Sat Flow, veh/h	1681	2279	961	1681	3069	307	1681	2909	437	1681	3353	1436
Grp Volume(v), veh/h	129	327	309	73	177	183	180	59	61	67	219	10
Grp Sat Flow(s),veh/h/ln	1681	1676	1564	1681	1676	1700	1681	1676	1669	1681	1676	1436
Q Serve(g_s), s	3.7	11.6	11.8	2.1	5.9	6.0	4.8	1.6	1.7	1.9	3.4	0.3
Cycle Q Clear(g_c), s	3.7	11.6	11.8	2.1	5.9	6.0	4.8	1.6	1.7	1.9	3.4	0.3
Prop In Lane	1.00		0.61	1.00		0.18	1.00		0.26	1.00		1.00
Lane Grp Cap(c), veh/h	410	486	454	275	431	437	534	570	567	521	943	474
V/C Ratio(X)	0.31	0.67	0.68	0.26	0.41	0.42	0.34	0.10	0.11	0.13	0.23	0.02
Avail Cap(c_a), veh/h	649	620	579	570	620	629	738	720	716	823	1439	686
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.3	21.1	21.2	17.9	20.8	20.9	13.4	15.3	15.3	16.1	18.7	15.4
Incr Delay (d2), s/veh	0.4	1.9	2.3	0.5	0.6	0.6	0.4	0.1	0.1	0.1	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	5.6	5.4	1.0	2.8	2.9	2.2	0.8	0.8	0.9	1.6	0.1
LnGrp Delay(d),s/veh	16.7	23.1	23.5	18.4	21.5	21.5	13.7	15.3	15.4	16.2	18.8	15.4
LnGrp LOS	B	C	C	B	C	C	B	B	B	B	B	B
Approach Vol, veh/h		765			433			300			296	
Approach Delay, s/veh		22.2			21.0			14.4			18.1	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.4	23.4	10.8	24.0	7.2	25.6	6.9	28.0
Change Period (Y+Rc), s	4.0	6.0	4.0	5.0	4.0	6.0	4.0	5.0
Max Green Setting (Gmax), s	15.0	25.0	15.0	29.0	15.0	25.0	15.0	29.0
Max Q Clear Time (g_c+I1), s	5.7	8.0	6.8	5.4	4.1	13.8	3.9	3.7
Green Ext Time (p_c), s	0.2	5.4	0.3	2.1	0.1	4.4	0.1	2.1

Intersection Summary	
HCM 2010 Ctrl Delay	19.9
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	3.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	126	34	26	84	38	27
Future Vol, veh/h	126	34	26	84	38	27
Conflicting Peds, #/hr	0	88	49	0	88	49
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	60	60	60	60	60	60
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	210	57	43	140	63	45

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	355	0	571	270
Stage 1	-	-	-	-	326	-
Stage 2	-	-	-	-	245	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1200	-	451	728
Stage 1	-	-	-	-	704	-
Stage 2	-	-	-	-	773	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1155	-	378	654
Mov Cap-2 Maneuver	-	-	-	-	378	-
Stage 1	-	-	-	-	657	-
Stage 2	-	-	-	-	694	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.9	15.3
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	458	-	-	1155	-
HCM Lane V/C Ratio	0.237	-	-	0.038	-
HCM Control Delay (s)	15.3	-	-	8.2	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0.9	-	-	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	127	355	167	240	377	81	276	950	213	109	1140	82
Future Volume (veh/h)	127	355	167	240	377	81	276	950	213	109	1140	82
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	153	428	143	289	454	76	333	1145	228	131	1373	92
Adj No. of Lanes	2	2	0	2	2	0	2	3	0	1	3	0
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	322	571	189	341	637	106	376	1678	334	155	1819	122
Arrive On Green	0.10	0.23	0.23	0.10	0.22	0.22	0.12	0.42	0.42	0.09	0.39	0.39
Sat Flow, veh/h	3261	2466	815	3261	2869	477	3261	4011	799	1681	4608	309
Grp Volume(v), veh/h	153	290	281	289	264	266	333	917	456	131	957	508
Grp Sat Flow(s),veh/h/ln	1630	1676	1605	1630	1676	1670	1630	1606	1598	1681	1606	1705
Q Serve(g_s), s	5.8	20.9	21.3	11.3	18.9	19.2	13.1	30.2	30.2	10.0	33.4	33.4
Cycle Q Clear(g_c), s	5.8	20.9	21.3	11.3	18.9	19.2	13.1	30.2	30.2	10.0	33.4	33.4
Prop In Lane	1.00		0.51	1.00		0.29	1.00		0.50	1.00		0.18
Lane Grp Cap(c), veh/h	322	388	372	341	372	371	376	1343	668	155	1268	673
V/C Ratio(X)	0.48	0.75	0.76	0.85	0.71	0.72	0.89	0.68	0.68	0.85	0.75	0.75
Avail Cap(c_a), veh/h	322	542	518	401	632	629	376	1343	668	194	1268	673
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.73	0.73	0.73	0.74	0.74	0.74
Uniform Delay (d), s/veh	55.4	46.4	46.6	57.2	46.7	46.8	56.7	30.8	30.8	58.1	33.9	33.9
Incr Delay (d2), s/veh	1.1	3.6	4.1	13.8	2.5	2.6	16.7	2.1	4.1	18.5	3.1	5.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	10.0	9.9	5.8	9.0	9.1	6.7	13.8	14.1	5.4	15.3	16.7
LnGrp Delay(d),s/veh	56.5	50.0	50.7	71.0	49.2	49.4	73.4	32.9	34.9	76.6	37.0	39.7
LnGrp LOS	E	D	D	E	D	D	E	C	C	E	D	D
Approach Vol, veh/h		724			819			1706			1596	
Approach Delay, s/veh		51.6			57.0			41.3			41.1	
Approach LOS		D			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.0	60.4	17.6	36.1	19.0	57.3	18.8	34.9
Change Period (Y+Rc), s	4.0	6.0	4.0	6.0	4.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	15.0	37.0	16.0	42.0	15.0	37.0	9.0	* 49
Max Q Clear Time (g_c+I1), s	12.0	32.2	13.3	23.3	15.1	35.4	7.8	21.2
Green Ext Time (p_c), s	0.1	4.5	0.3	2.7	0.0	1.5	0.5	2.9

Intersection Summary	
HCM 2010 Ctrl Delay	45.4
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	40	36	154	51	48	27	1312	110	191	1262	53
Future Volume (veh/h)	38	40	36	154	51	48	27	1312	110	191	1262	53
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.99	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1765	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	43	45	4	173	57	6	30	1474	116	215	1418	57
Adj No. of Lanes	1	1	1	1	1	1	1	3	0	1	3	0
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	328	389	322	339	389	326	520	2289	180	245	1566	63
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.62	1.00	1.00	0.15	0.33	0.33
Sat Flow, veh/h	1318	1765	1459	1334	1765	1480	1681	4545	358	1681	4745	191
Grp Volume(v), veh/h	43	45	4	173	57	6	30	1042	548	215	960	515
Grp Sat Flow(s),veh/h/ln	1318	1765	1459	1334	1765	1480	1681	1606	1691	1681	1606	1724
Q Serve(g_s), s	2.7	2.0	0.2	11.9	2.6	0.3	0.7	0.0	0.0	12.5	28.6	28.6
Cycle Q Clear(g_c), s	5.3	2.0	0.2	14.0	2.6	0.3	0.7	0.0	0.0	12.5	28.6	28.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.21	1.00		0.11
Lane Grp Cap(c), veh/h	328	389	322	339	389	326	520	1618	851	245	1060	569
V/C Ratio(X)	0.13	0.12	0.01	0.51	0.15	0.02	0.06	0.64	0.64	0.88	0.91	0.91
Avail Cap(c_a), veh/h	539	671	554	552	671	562	520	1618	851	269	1060	569
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.62	0.62	0.62	0.49	0.49	0.49
Uniform Delay (d), s/veh	33.5	31.2	30.5	36.8	31.4	30.5	13.3	0.0	0.0	41.8	32.0	32.0
Incr Delay (d2), s/veh	0.2	0.1	0.0	1.2	0.2	0.0	0.0	1.2	2.3	14.1	6.9	11.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	1.0	0.1	4.5	1.3	0.1	0.3	0.3	0.6	6.8	13.7	15.4
LnGrp Delay(d),s/veh	33.7	31.3	30.5	37.9	31.6	30.5	13.3	1.2	2.3	56.0	38.9	43.7
LnGrp LOS	C	C	C	D	C	C	B	A	A	E	D	D
Approach Vol, veh/h		92			236			1620			1690	
Approach Delay, s/veh		32.4			36.2			1.8			42.5	
Approach LOS		C			D			A			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	18.6	55.4		26.1	35.9	38.0		26.1
Change Period (Y+Rc), s	4.0	5.0		4.0	5.0	* 5		4.0
Max Green Setting (Gmax), s	16.0	33.0		38.0	16.0	* 33		38.0
Max Q Clear Time (g_c+I1), s	14.5	2.0		7.3	2.7	30.6		16.0
Green Ext Time (p_c), s	0.1	13.0		1.3	8.1	1.8		1.2

Intersection Summary	
HCM 2010 Ctrl Delay	23.7
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	25	203	253	47	27	293	1506	400	60	1313	38
Future Volume (veh/h)	15	25	203	253	47	27	293	1506	400	60	1313	38
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	16	27	62	272	51	9	315	1619	182	65	1412	13
Adj No. of Lanes	1	1	0	1	1	0	1	3	1	1	3	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	435	142	325	404	436	77	409	2513	782	83	1532	473
Arrive On Green	0.30	0.30	0.30	0.30	0.30	0.30	0.24	0.52	0.52	0.02	0.10	0.10
Sat Flow, veh/h	1328	474	1088	1294	1459	258	1681	4818	1499	1681	4818	1488
Grp Volume(v), veh/h	16	0	89	272	0	60	315	1619	182	65	1412	13
Grp Sat Flow(s),veh/h/ln	1328	0	1562	1294	0	1717	1681	1606	1499	1681	1606	1488
Q Serve(g_s), s	0.9	0.0	4.2	19.8	0.0	2.5	17.5	24.2	6.6	3.9	29.0	0.8
Cycle Q Clear(g_c), s	3.4	0.0	4.2	24.0	0.0	2.5	17.5	24.2	6.6	3.9	29.0	0.8
Prop In Lane	1.00		0.70	1.00		0.15	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	435	0	467	404	0	513	409	2513	782	83	1532	473
V/C Ratio(X)	0.04	0.00	0.19	0.67	0.00	0.12	0.77	0.64	0.23	0.78	0.92	0.03
Avail Cap(c_a), veh/h	556	0	609	522	0	670	409	2513	782	269	1542	476
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.11	0.11	0.11	0.83	0.83	0.83
Uniform Delay (d), s/veh	26.7	0.0	26.1	35.0	0.0	25.5	35.2	17.2	13.0	48.6	43.5	30.9
Incr Delay (d2), s/veh	0.0	0.0	0.2	2.3	0.0	0.1	1.1	0.1	0.1	12.3	9.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	1.9	7.3	0.0	1.2	8.2	10.7	2.7	2.1	14.3	0.3
LnGrp Delay(d),s/veh	26.8	0.0	26.3	37.3	0.0	25.6	36.3	17.4	13.1	60.9	52.7	31.0
LnGrp LOS	C		C	D		C	D	B	B	E	D	C
Approach Vol, veh/h		105			332			2116			1490	
Approach Delay, s/veh		26.3			35.2			19.8			52.8	
Approach LOS		C			D			B			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.0	57.2		33.9	29.3	36.8		33.9
Change Period (Y+Rc), s	4.0	5.0		4.0	5.0	* 5		4.0
Max Green Setting (Gmax), s	16.0	32.0		39.0	16.0	* 32		39.0
Max Q Clear Time (g_c+I1), s	5.9	26.2		26.0	19.5	31.0		6.2
Green Ext Time (p_c), s	0.1	4.7		1.5	0.0	0.7		1.9

Intersection Summary		
HCM 2010 Ctrl Delay		33.4
HCM 2010 LOS		C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	400	5	1763	39	559	0	0	1765	121
Future Volume (vph)	0	0	0	400	5	1763	39	559	0	0	1765	121
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)					5.5	5.5	3.5	4.5			4.5	4.5
Lane Util. Factor					1.00	0.88	1.00	0.95			0.95	1.00
Frpb, ped/bikes					1.00	1.00	1.00	1.00			1.00	0.91
Flpb, ped/bikes					1.00	1.00	1.00	1.00			1.00	1.00
Frt					1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected					0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)					1682	2640	1676	3353			3353	1372
Flt Permitted					0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (perm)					1682	2640	1676	3353			3353	1372
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	0	0	0	430	5	1896	42	601	0	0	1898	130
RTOR Reduction (vph)	0	0	0	0	0	79	0	0	0	0	0	51
Lane Group Flow (vph)	0	0	0	0	435	1817	42	601	0	0	1898	79
Confl. Peds. (#/hr)												13
Confl. Bikes (#/hr)												2
Turn Type				Perm	NA	custom	Prot	NA			NA	Perm
Protected Phases					8	8 1	5	2			6	
Permitted Phases				8								6
Actuated Green, G (s)					40.5	63.7	4.9	26.3			41.1	41.1
Effective Green, g (s)					40.5	63.7	4.9	26.3			41.1	41.1
Actuated g/C Ratio					0.40	0.64	0.05	0.26			0.41	0.41
Clearance Time (s)					5.5		3.5	4.5			4.5	4.5
Vehicle Extension (s)					3.5		2.0	2.0			2.0	2.0
Lane Grp Cap (vph)					681	1681	82	881			1378	563
v/s Ratio Prot						c0.69	0.03	0.18			c0.57	
v/s Ratio Perm					0.26							0.06
v/c Ratio					0.64	1.08	0.51	0.68			1.38	0.14
Uniform Delay, d1					23.9	18.1	46.4	33.1			29.4	18.4
Progression Factor					1.00	1.00	1.36	0.89			1.26	1.34
Incremental Delay, d2					2.1	47.4	1.6	3.0			173.1	0.4
Delay (s)					25.9	65.5	64.6	32.5			210.1	25.1
Level of Service					C	E	E	C			F	C
Approach Delay (s)		0.0			58.1			34.6			198.2	
Approach LOS		A			E			C			F	

Intersection Summary			
HCM 2000 Control Delay	111.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.5
Intersection Capacity Utilization	157.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	74	0	70	0	0	0	0	534	378	1319	845	0
Future Volume (veh/h)	74	0	70	0	0	0	0	534	378	1319	845	0
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1765				0	1765	1800	1765	1765	0
Adj Flow Rate, veh/h	79	0	4				0	568	296	1403	899	0
Adj No. of Lanes	0	1	1				0	2	0	2	1	0
Peak Hour Factor	0.94	0.94	0.94				0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	104	0	93				0	370	193	2016	1479	0
Arrive On Green	0.06	0.00	0.06				0.00	0.17	0.17	1.00	1.00	0.00
Sat Flow, veh/h	1681	0	1500				0	2205	1102	3261	1765	0
Grp Volume(v), veh/h	79	0	4				0	450	414	1403	899	0
Grp Sat Flow(s),veh/h/ln	1681	0	1500				0	1676	1542	1630	1765	0
Q Serve(g_s), s	4.6	0.0	0.3				0.0	17.5	17.5	0.0	0.0	0.0
Cycle Q Clear(g_c), s	4.6	0.0	0.3				0.0	17.5	17.5	0.0	0.0	0.0
Prop In Lane	1.00		1.00				0.00		0.71	1.00		0.00
Lane Grp Cap(c), veh/h	104	0	93				0	293	270	2016	1479	0
V/C Ratio(X)	0.76	0.00	0.04				0.00	1.53	1.54	0.70	0.61	0.00
Avail Cap(c_a), veh/h	487	0	435				0	293	270	2016	1479	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.67	1.67	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.09	0.09	0.00
Uniform Delay (d), s/veh	46.2	0.0	44.1				0.0	41.3	41.3	0.0	0.0	0.0
Incr Delay (d2), s/veh	4.3	0.0	0.1				0.0	256.3	258.6	0.1	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.3	0.0	0.1				0.0	29.0	26.8	0.0	0.1	0.0
LnGrp Delay(d),s/veh	50.5	0.0	44.2				0.0	297.5	299.9	0.1	0.2	0.0
LnGrp LOS	D		D					F	F	A	A	
Approach Vol, veh/h		83						864			2302	
Approach Delay, s/veh		50.2						298.7			0.1	
Approach LOS		D						F			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	66.3	22.0		11.7		88.3		
Change Period (Y+Rc), s	4.5	* 4.5		5.5		4.5		
Max Green Setting (Gmax), s	40.0	* 18		29.0		16.0		
Max Q Clear Time (g_c+I1), s	2.0	19.5		6.6		2.0		
Green Ext Time (p_c), s	6.2	0.0		0.2		7.3		

Intersection Summary		
HCM 2010 Ctrl Delay		80.8
HCM 2010 LOS		F

Notes

User approved pedestrian interval to be less than phase max green.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	51	573	50	116	509	123	48	220	100	137	346	47
Future Volume (veh/h)	51	573	50	116	509	123	48	220	100	137	346	47
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	0.99		0.96	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1872	1765	1765	1800	1765	1765	1872	1765	1765	1872
Adj Flow Rate, veh/h	60	674	52	136	599	123	56	259	39	161	407	40
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	438	1341	103	455	1234	253	251	852	126	316	899	88
Arrive On Green	0.09	0.43	0.43	0.11	0.45	0.45	0.29	0.29	0.29	0.29	0.29	0.29
Sat Flow, veh/h	1681	3150	243	1681	2762	566	930	2913	432	1062	3074	300
Grp Volume(v), veh/h	60	358	368	136	363	359	56	147	151	161	221	226
Grp Sat Flow(s),veh/h/ln	1681	1676	1716	1681	1676	1651	930	1676	1669	1062	1676	1698
Q Serve(g_s), s	1.6	14.1	14.1	3.7	13.8	13.8	4.7	6.1	6.3	12.5	9.7	9.8
Cycle Q Clear(g_c), s	1.6	14.1	14.1	3.7	13.8	13.8	14.5	6.1	6.3	18.8	9.7	9.8
Prop In Lane	1.00		0.14	1.00		0.34	1.00		0.26	1.00		0.18
Lane Grp Cap(c), veh/h	438	714	731	455	749	738	251	490	488	316	490	496
V/C Ratio(X)	0.14	0.50	0.50	0.30	0.48	0.49	0.22	0.30	0.31	0.51	0.45	0.46
Avail Cap(c_a), veh/h	517	714	731	467	749	738	299	577	575	371	577	585
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	12.0	18.9	18.9	12.0	17.6	17.6	31.9	24.7	24.8	32.1	26.0	26.0
Incr Delay (d2), s/veh	0.1	2.5	2.5	0.4	2.2	2.3	0.4	0.3	0.4	1.3	0.6	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	7.0	7.1	1.7	6.8	6.8	1.2	2.9	2.9	3.8	4.6	4.7
LnGrp Delay(d),s/veh	12.1	21.4	21.4	12.4	19.8	19.9	32.4	25.0	25.1	33.4	26.6	26.6
LnGrp LOS	B	C	C	B	B	B	C	C	C	C	C	C
Approach Vol, veh/h		786			858			354			608	
Approach Delay, s/veh		20.7			18.7			26.2			28.4	
Approach LOS		C			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.8	46.2		32.0	13.7	44.3		32.0
Change Period (Y+Rc), s	4.0	6.0		5.7	4.0	6.0		5.7
Max Green Setting (Gmax), s	12.0	31.3		31.0	10.3	33.0		31.0
Max Q Clear Time (g_c+I1), s	3.6	15.8		20.8	5.7	16.1		16.5
Green Ext Time (p_c), s	0.1	8.5		4.1	0.1	9.0		5.1

Intersection Summary	
HCM 2010 Ctrl Delay	22.6
HCM 2010 LOS	C

APPENDIX C: EXISTING PLUS PROJECT (2015) LEVEL OF SERVICE

Intersection	
Intersection Delay, s/veh	31.2
Intersection LOS	D

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	10	122	441	0	31	8	10	0	121	6	273
Future Vol, veh/h	0	10	122	441	0	31	8	10	0	121	6	273
Peak Hour Factor	0.92	0.70	0.92	0.70	0.92	0.92	0.92	0.92	0.92	0.70	0.70	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	14	133	630	0	34	9	11	0	173	9	297
Number of Lanes	0	1	1	1	0	1	2	0	0	2	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	3	3	3
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	3	3	3
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	3	3
HCM Control Delay	43.7	11	14.2
HCM LOS	E	B	B

Lane	NBLn1	NBLn2	NBLn3	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	WBLn3	SBLn1	SBLn2
Vol Left, %	100%	100%	0%	100%	0%	0%	100%	0%	0%	100%	0%
Vol Thru, %	0%	0%	2%	0%	100%	0%	0%	100%	21%	0%	100%
Vol Right, %	0%	0%	98%	0%	0%	100%	0%	0%	79%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	61	61	279	10	122	441	31	5	13	10	6
LT Vol	61	61	0	10	0	0	31	0	0	10	0
Through Vol	0	0	6	0	122	0	0	5	3	0	6
RT Vol	0	0	273	0	0	441	0	0	10	0	0
Lane Flow Rate	86	86	305	14	133	630	34	6	14	11	9
Geometry Grp	8	8	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.177	0.177	0.524	0.027	0.23	0.97	0.076	0.012	0.027	0.025	0.019
Departure Headway (Hd)	7.368	7.368	6.183	6.742	6.242	5.542	8.087	7.587	7.034	8.329	7.829
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	486	486	580	530	574	655	441	469	506	428	455
Service Time	5.129	5.129	3.944	4.496	3.996	3.296	5.876	5.376	4.823	6.122	5.622
HCM Lane V/C Ratio	0.177	0.177	0.526	0.026	0.232	0.962	0.077	0.013	0.028	0.026	0.02
HCM Control Delay	11.7	11.7	15.6	9.7	10.9	51.4	11.5	10.5	10	11.3	10.8
HCM Lane LOS	B	B	C	A	B	F	B	B	A	B	B
HCM 95th-tile Q	0.6	0.6	3	0.1	0.9	14.1	0.2	0	0.1	0.1	0.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations		↰	↑	↱
Traffic Vol, veh/h	0	10	6	4
Future Vol, veh/h	0	10	6	4
Peak Hour Factor	0.92	0.92	0.70	0.70
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	11	9	6
Number of Lanes	0	1	1	1

Approach	SB
Opposing Approach	NB
Opposing Lanes	3
Conflicting Approach Left	WB
Conflicting Lanes Left	3
Conflicting Approach Right	EB
Conflicting Lanes Right	3
HCM Control Delay	10.8
HCM LOS	B

Intersection	
Int Delay, s/veh	53.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	1	27	61	1	14	18	381	551	244	237	0
Future Vol, veh/h	0	1	27	61	1	14	18	381	551	244	237	0
Conflicting Peds, #/hr	12	0	7	9	0	12	7	0	9	14	0	12
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	205	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	76	76	76	76	76	76	76	76	76	76	76	76
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	1	36	80	1	18	24	501	725	321	312	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1277	2254	177	1733	1891	639	324	0	0	1240	0	0
Stage 1	966	966	-	925	925	-	-	-	-	-	-	-
Stage 2	311	1288	-	808	966	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	123	41	835	~ 56	69	419	1233	-	-	557	-	-
Stage 1	273	331	-	290	346	-	-	-	-	-	-	-
Stage 2	674	233	-	341	331	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	59	16	820	~ 26	28	410	1224	-	-	551	-	-
Mov Cap-2 Maneuver	59	16	-	~ 26	28	-	-	-	-	-	-	-
Stage 1	265	137	-	281	335	-	-	-	-	-	-	-
Stage 2	622	226	-	134	137	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	19	$ 1012.4	0.2	10.3
HCM LOS	C	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1224	-	-	293	26	215	551	-	-
HCM Lane V/C Ratio	0.019	-	-	0.126	3.087	0.092	0.583	-	-
HCM Control Delay (s)	8	-	-	19	$ 1255.6	23.4	20.3	-	-
HCM Lane LOS	A	-	-	C	F	C	C	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.4	9.8	0.3	3.7	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Intersection Delay, s/veh	34.9
Intersection LOS	D

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	4	0	39	0	6	0	4	947	140
Future Vol, veh/h	0	0	0	4	0	39	0	6	0	4	947	140
Peak Hour Factor	0.92	0.98	0.98	0.98	0.92	0.98	0.98	0.98	0.92	0.98	0.98	0.98
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	4	0	40	0	6	0	4	966	143
Number of Lanes	0	0	1	0	0	1	0	1	0	1	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	3
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	3	3	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	3	2
HCM Control Delay	10.1	11.7	42.8
HCM LOS	B	B	E

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	100%	0%	100%	0%	0%
Vol Thru, %	0%	100%	69%	0%	0%	0%	0%	100%	99%
Vol Right, %	0%	0%	31%	100%	0%	100%	0%	0%	1%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	4	631	456	4	39	6	93	152	77
LT Vol	4	0	0	0	39	0	93	0	0
Through Vol	0	631	316	0	0	0	0	152	76
RT Vol	0	0	140	4	0	6	0	0	1
Lane Flow Rate	4	644	465	4	40	6	95	155	79
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.007	1.004	0.697	0.008	0.093	0.012	0.192	0.292	0.148
Departure Headway (Hd)	6.113	5.611	5.395	7.319	8.379	7.174	7.288	6.786	6.777
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	587	651	670	488	428	498	493	530	530
Service Time	3.838	3.336	3.12	5.074	6.129	4.923	5.025	4.522	4.513
HCM Lane V/C Ratio	0.007	0.989	0.694	0.008	0.093	0.012	0.193	0.292	0.149
HCM Control Delay	8.9	59.7	19.6	10.1	12	10	11.8	12.3	10.7
HCM Lane LOS	A	F	C	B	B	A	B	B	B
HCM 95th-tile Q	0	15.7	5.6	0	0.3	0	0.7	1.2	0.5

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations		↰	↑↱	
Traffic Vol, veh/h	0	93	228	1
Future Vol, veh/h	0	93	228	1
Peak Hour Factor	0.92	0.98	0.98	0.98
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	95	233	1
Number of Lanes	0	1	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	3
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	11.8
HCM LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	921	772	733	31	130	19	266	150	82	57	91	163
Future Volume (veh/h)	921	772	733	31	130	19	266	150	82	57	91	163
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.95	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1800	1765	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	1012	848	234	34	143	11	174	330	66	63	100	0
Adj No. of Lanes	1	2	1	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	284	1186	515	168	895	68	504	859	170	207	413	173
Arrive On Green	0.23	0.47	0.47	0.10	0.28	0.28	0.30	0.30	0.29	0.12	0.12	0.00
Sat Flow, veh/h	1681	3353	1457	1681	3145	239	1681	2863	566	1681	3353	1500
Grp Volume(v), veh/h	1012	848	234	34	75	79	174	202	194	63	100	0
Grp Sat Flow(s),veh/h/ln	1681	1676	1457	1681	1676	1707	1681	1765	1664	1681	1676	1500
Q Serve(g_s), s	22.0	26.2	14.1	2.4	4.4	4.5	10.5	11.7	12.1	4.4	3.5	0.0
Cycle Q Clear(g_c), s	22.0	26.2	14.1	2.4	4.4	4.5	10.5	11.7	12.1	4.4	3.5	0.0
Prop In Lane	1.00		1.00	1.00		0.14	1.00		0.34	1.00		1.00
Lane Grp Cap(c), veh/h	284	1186	515	168	477	486	504	529	499	207	413	173
V/C Ratio(X)	3.56	0.71	0.45	0.20	0.16	0.16	0.35	0.38	0.39	0.30	0.24	0.00
Avail Cap(c_a), veh/h	284	1186	515	168	477	486	504	529	499	207	413	173
HCM Platoon Ratio	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.20	0.20	0.20	1.00	1.00	1.00	0.88	0.88	0.88	1.00	1.00	0.00
Uniform Delay (d), s/veh	50.4	29.2	26.0	53.7	34.8	34.9	35.5	36.0	36.2	51.9	51.5	0.0
Incr Delay (d2), s/veh	1152.9	0.8	0.6	2.7	0.7	0.7	1.7	1.8	2.0	3.8	1.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	101.3	12.1	5.7	1.2	2.1	2.2	5.1	6.0	5.8	2.3	1.7	0.0
LnGrp Delay(d),s/veh	1203.3	29.9	26.5	56.4	35.5	35.6	37.2	37.8	38.2	55.7	52.9	0.0
LnGrp LOS	F	C	C	E	D	D	D	D	D	E	D	
Approach Vol, veh/h		2094			188			570			163	
Approach Delay, s/veh		596.6			39.4			37.8			54.0	
Approach LOS		F			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		20.0	26.0	41.0		43.0	17.0	50.0
Change Period (Y+Rc), s		5.0	4.0	5.0		5.0	4.0	5.0
Max Green Setting (Gmax), s		15.0	22.0	36.0		38.0	13.0	45.0
Max Q Clear Time (g_c+I1), s		6.4	24.0	6.5		14.1	4.4	28.2
Green Ext Time (p_c), s		0.4	0.0	8.3		2.7	0.0	6.7

Intersection Summary	
HCM 2010 Ctrl Delay	426.9
HCM 2010 LOS	F

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	242	604	7	6	448	145	8	9	4	23	6	59
Future Volume (veh/h)	242	604	7	6	448	145	8	9	4	23	6	59
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.98	0.95		1.00	0.95		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1800	1765	1800	1800	1765	1765
Adj Flow Rate, veh/h	275	686	7	7	509	128	9	10	0	26	7	18
Adj No. of Lanes	1	2	0	1	2	0	0	2	0	0	1	1
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	474	1697	17	372	962	241	433	520	0	427	101	411
Arrive On Green	0.13	0.50	0.47	0.00	0.36	0.34	0.29	0.29	0.00	0.29	0.29	0.29
Sat Flow, veh/h	1681	3399	35	1681	2647	662	1079	1882	0	1068	348	1425
Grp Volume(v), veh/h	275	338	355	7	321	316	11	8	0	33	0	18
Grp Sat Flow(s),veh/h/ln	1681	1676	1757	1681	1676	1632	1355	1526	0	1416	0	1425
Q Serve(g_s), s	5.5	6.9	6.9	0.1	8.2	8.4	0.0	0.2	0.0	0.2	0.0	0.5
Cycle Q Clear(g_c), s	5.5	6.9	6.9	0.1	8.2	8.4	0.8	0.2	0.0	0.8	0.0	0.5
Prop In Lane	1.00		0.02	1.00		0.41	0.83		0.00	0.79		1.00
Lane Grp Cap(c), veh/h	474	837	877	372	609	593	512	440	0	528	0	411
V/C Ratio(X)	0.58	0.40	0.40	0.02	0.53	0.53	0.02	0.02	0.00	0.06	0.00	0.04
Avail Cap(c_a), veh/h	696	975	1022	804	975	949	801	760	0	822	0	710
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.3	8.5	8.5	12.6	13.6	13.9	13.8	13.8	0.0	14.0	0.0	13.9
Incr Delay (d2), s/veh	1.1	0.3	0.3	0.0	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	3.2	3.3	0.0	3.9	3.8	0.1	0.1	0.0	0.4	0.0	0.2
LnGrp Delay(d),s/veh	11.4	8.8	8.8	12.7	14.3	14.6	13.8	13.8	0.0	14.0	0.0	13.9
LnGrp LOS	B	A	A	B	B	B	B	B		B		B
Approach Vol, veh/h		968			644			19			51	
Approach Delay, s/veh		9.6			14.4			13.8			14.0	
Approach LOS		A			B			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	3.5	31.0		19.6	10.8	23.7		19.6				
Change Period (Y+Rc), s	3.0	5.5		4.0	3.0	5.5		4.0				
Max Green Setting (Gmax), s	15.0	30.0		27.0	15.0	30.0		27.0				
Max Q Clear Time (g_c+I1), s	[illegible]	8.9		2.8	7.5	10.4		2.8				
Green Ext Time (p_c), s	0.0	8.1		0.3	0.5	7.8		0.3				

Intersection Summary

HCM 2010 Ctrl Delay		11.6
HCM 2010 LOS		B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑↱		↰	↑↑	↱		✣		↰	↱	↱
Traffic Volume (veh/h)	282	357	3	0	516	138	1	0	3	21	0	57
Future Volume (veh/h)	282	357	3	0	516	138	1	0	3	21	0	57
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		1.00	0.98		0.97	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1765	1800	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	324	410	3	0	593	0	1	0	1	24	0	41
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	1	0	2
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	537	2177	16	4	1230	490	199	34	89	398	0	839
Arrive On Green	0.16	0.64	0.60	0.00	0.37	0.00	0.12	0.00	0.12	0.15	0.00	0.12
Sat Flow, veh/h	3261	3411	25	1681	3353	1500	452	277	730	1385	0	2833
Grp Volume(v), veh/h	324	201	212	0	593	0	2	0	0	24	0	41
Grp Sat Flow(s),veh/h/ln	1630	1676	1759	1681	1676	1500	1459	0	0	1385	0	1416
Q Serve(g_s), s	3.5	1.9	1.9	0.0	5.1	0.0	0.0	0.0	0.0	0.5	0.0	0.4
Cycle Q Clear(g_c), s	3.5	1.9	1.9	0.0	5.1	0.0	0.0	0.0	0.0	0.6	0.0	0.4
Prop In Lane	1.00		0.01	1.00		1.00	0.50		0.50	1.00		1.00
Lane Grp Cap(c), veh/h	537	1070	1123	4	1230	490	322	0	0	398	0	839
V/C Ratio(X)	0.60	0.19	0.19	0.00	0.48	0.00	0.01	0.00	0.00	0.06	0.00	0.05
Avail Cap(c_a), veh/h	1739	1070	1123	538	2369	1000	1078	0	0	968	0	2005
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.5	2.8	2.8	0.0	9.1	0.0	14.5	0.0	0.0	13.8	0.0	9.7
Incr Delay (d2), s/veh	1.1	0.1	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.9	0.9	0.0	2.4	0.0	0.0	0.0	0.0	0.2	0.0	0.2
LnGrp Delay(d),s/veh	15.6	2.9	2.9	0.0	9.4	0.0	14.5	0.0	0.0	13.9	0.0	9.7
LnGrp LOS	B	A	A		A		B			B		A
Approach Vol, veh/h		737			593			2			65	
Approach Delay, s/veh		8.5			9.4			14.5			11.3	
Approach LOS		A			A			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	0.0	27.9		9.6	10.2	17.8		9.6
Change Period (Y+Rc), s	4.0	5.5		5.0	4.0	5.5		* 5
Max Green Setting (Gmax), s	12.0	20.0		20.0	20.0	25.0		* 25
Max Q Clear Time (g_c+I1), s	0.0	3.9		2.6	5.5	7.1		2.0
Green Ext Time (p_c), s	0.0	5.5		0.2	0.9	4.1		0.2

Intersection Summary	
HCM 2010 Ctrl Delay	9.0
HCM 2010 LOS	A

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	134	268	49	128	422	338	221	450	171	49	51	18
Future Volume (veh/h)	134	268	49	128	422	338	221	450	171	49	51	18
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	0.99		0.97	0.99		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	165	331	44	158	521	257	273	556	165	60	63	3
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	324	1022	134	482	735	361	571	770	228	235	629	392
Arrive On Green	0.09	0.34	0.32	0.09	0.34	0.31	0.16	0.30	0.29	0.04	0.19	0.17
Sat Flow, veh/h	1681	2967	390	1681	2154	1058	1681	2541	751	1681	3353	1487
Grp Volume(v), veh/h	165	186	189	158	405	373	273	366	355	60	63	3
Grp Sat Flow(s),veh/h/ln	1681	1676	1681	1681	1676	1535	1681	1676	1616	1681	1676	1487
Q Serve(g_s), s	4.6	5.9	6.0	4.5	15.1	15.3	8.9	14.0	14.1	2.1	1.1	0.1
Cycle Q Clear(g_c), s	4.6	5.9	6.0	4.5	15.1	15.3	8.9	14.0	14.1	2.1	1.1	0.1
Prop In Lane	1.00		0.23	1.00		0.69	1.00		0.46	1.00		1.00
Lane Grp Cap(c), veh/h	324	577	579	482	572	524	571	508	490	235	629	392
V/C Ratio(X)	0.51	0.32	0.33	0.33	0.71	0.71	0.48	0.72	0.72	0.25	0.10	0.01
Avail Cap(c_a), veh/h	520	630	632	683	630	577	660	701	675	519	1401	734
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.2	17.3	17.6	14.4	20.5	21.2	17.8	22.3	22.6	23.3	24.1	19.5
Incr Delay (d2), s/veh	1.2	0.3	0.3	0.4	3.3	3.7	0.6	2.3	2.4	0.6	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.2	2.7	2.9	2.1	7.5	7.0	4.2	6.7	6.6	1.0	0.5	0.0
LnGrp Delay(d),s/veh	17.4	17.7	17.9	14.8	23.8	24.9	18.4	24.6	25.0	23.8	24.2	19.6
LnGrp LOS	B	B	B	B	C	C	B	C	C	C	C	B
Approach Vol, veh/h		540			936			994			126	
Approach Delay, s/veh		17.7			22.7			23.0			23.9	
Approach LOS		B			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.6	28.5	15.2	17.5	10.4	28.7	6.9	25.8
Change Period (Y+Rc), s	4.0	6.0	4.0	5.0	4.0	6.0	4.0	5.0
Max Green Setting (Gmax), s	15.0	25.0	15.0	29.0	15.0	25.0	15.0	29.0
Max Q Clear Time (g_c+I1), s	6.6	17.3	10.9	3.1	6.5	8.0	4.1	16.1
Green Ext Time (p_c), s	0.3	4.0	0.3	4.8	0.2	6.5	0.1	3.7

Intersection Summary	
HCM 2010 Ctrl Delay	21.9
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	2.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	95	149	132	582	21	30
Future Vol, veh/h	95	149	132	582	21	30
Conflicting Peds, #/hr	0	5	5	0	5	5
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	64	64	64	64	64	64
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	148	233	206	909	33	47

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	386	0	1142	201
Stage 1	-	-	-	-	270	-
Stage 2	-	-	-	-	872	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1169	-	194	806
Stage 1	-	-	-	-	751	-
Stage 2	-	-	-	-	369	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1165	-	158	800
Mov Cap-2 Maneuver	-	-	-	-	158	-
Stage 1	-	-	-	-	748	-
Stage 2	-	-	-	-	303	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.6	21.4
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	299	-	-	1165	-
HCM Lane V/C Ratio	0.267	-	-	0.177	-
HCM Control Delay (s)	21.4	-	-	8.8	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	1.1	-	-	0.6	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	197	359	194	212	283	179	102	2032	87	27	471	92
Future Volume (veh/h)	197	359	194	212	283	179	102	2032	87	27	471	92
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	221	403	147	238	318	94	115	2283	95	30	529	83
Adj No. of Lanes	2	2	0	2	2	0	2	3	0	1	3	0
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	356	554	200	289	496	144	166	2543	105	37	2134	329
Arrive On Green	0.11	0.23	0.21	0.09	0.19	0.18	0.05	0.54	0.52	0.02	0.51	0.49
Sat Flow, veh/h	3261	2411	869	3261	2559	744	3261	4740	196	1681	4204	648
Grp Volume(v), veh/h	221	279	271	238	206	206	115	1542	836	30	402	210
Grp Sat Flow(s),veh/h/ln	1630	1676	1604	1630	1676	1626	1630	1606	1725	1681	1606	1640
Q Serve(g_s), s	8.4	20.0	20.5	9.3	14.7	15.2	4.5	55.7	56.7	2.3	9.2	9.5
Cycle Q Clear(g_c), s	8.4	20.0	20.5	9.3	14.7	15.2	4.5	55.7	56.7	2.3	9.2	9.5
Prop In Lane	1.00		0.54	1.00		0.46	1.00		0.11	1.00		0.39
Lane Grp Cap(c), veh/h	356	385	369	289	325	315	166	1723	925	37	1630	832
V/C Ratio(X)	0.62	0.72	0.74	0.82	0.64	0.65	0.69	0.90	0.90	0.81	0.25	0.25
Avail Cap(c_a), veh/h	356	567	543	351	593	575	426	1723	925	220	1630	832
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.56	0.56	0.56	0.98	0.98	0.98
Uniform Delay (d), s/veh	55.3	46.2	46.9	58.2	48.2	48.8	60.7	26.9	27.2	63.3	18.0	18.3
Incr Delay (d2), s/veh	3.3	2.6	2.9	12.4	2.1	2.3	2.9	4.6	8.5	31.8	0.4	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.0	9.5	9.4	4.7	7.0	7.0	2.1	25.7	29.1	1.4	4.2	4.5
LnGrp Delay(d),s/veh	58.6	48.8	49.8	70.7	50.3	51.1	63.6	31.4	35.8	95.1	18.4	19.0
LnGrp LOS	E	D	D	E	D	D	E	C	D	F	B	B
Approach Vol, veh/h		771			650			2493			642	
Approach Delay, s/veh		52.0			58.0			34.4			22.2	
Approach LOS		D			E			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	6.9	73.7	15.5	33.9	10.6	70.0	20.2	29.2				
Change Period (Y+Rc), s	4.0	6.0	4.0	6.0	4.0	6.0	6.0	* 6				
Max Green Setting (Gmax), s	17.0	37.0	14.0	42.0	17.0	37.0	12.0	* 44				
Max Q Clear Time (g_c+I1), s	4.3	58.7	11.3	22.5	6.5	11.5	10.4	17.2				
Green Ext Time (p_c), s	0.0	0.0	0.2	2.7	0.2	21.6	0.7	2.2				
Intersection Summary												
HCM 2010 Ctrl Delay			39.0									
HCM 2010 LOS			D									

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	37	43	44	74	29	25	42	2134	45	6	855	22
Future Volume (veh/h)	37	43	44	74	29	25	42	2134	45	6	855	22
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.97	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1765	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	46	54	5	92	36	6	52	2668	55	8	1069	27
Adj No. of Lanes	1	1	1	1	1	1	1	3	0	1	3	0
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	307	329	271	292	329	271	65	1458	30	621	3100	78
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.03	0.20	0.19	0.37	0.64	0.63
Sat Flow, veh/h	1339	1765	1457	1320	1765	1457	1681	4859	100	1681	4832	122
Grp Volume(v), veh/h	46	54	5	92	36	6	52	1759	964	8	710	386
Grp Sat Flow(s),veh/h/ln	1339	1765	1457	1320	1765	1457	1681	1606	1747	1681	1606	1743
Q Serve(g_s), s	2.7	2.3	0.3	5.7	1.5	0.3	2.8	27.0	27.0	0.3	9.2	9.2
Cycle Q Clear(g_c), s	4.2	2.3	0.3	8.0	1.5	0.3	2.8	27.0	27.0	0.3	9.2	9.2
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.06	1.00		0.07
Lane Grp Cap(c), veh/h	307	329	271	292	329	271	65	964	524	621	2061	1118
V/C Ratio(X)	0.15	0.16	0.02	0.32	0.11	0.02	0.80	1.83	1.84	0.01	0.34	0.34
Avail Cap(c_a), veh/h	623	745	615	603	745	615	243	964	524	621	2061	1118
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.09	0.09	0.09	0.92	0.92	0.92
Uniform Delay (d), s/veh	32.2	30.7	29.9	34.1	30.4	29.9	43.5	36.0	36.0	18.0	7.4	7.4
Incr Delay (d2), s/veh	0.2	0.2	0.0	0.6	0.1	0.0	2.0	371.9	378.5	0.0	0.4	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	1.1	0.1	2.1	0.8	0.1	1.3	61.7	68.1	0.1	4.2	4.6
LnGrp Delay(d),s/veh	32.4	31.0	29.9	34.7	30.6	30.0	45.5	407.8	414.5	18.0	7.8	8.2
LnGrp LOS	C	C	C	C	C	C	D	F	F	B	A	A
Approach Vol, veh/h		105			134			2775			1104	
Approach Delay, s/veh		31.5			33.4			403.4			8.0	
Approach LOS		C			C			F			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	38.2	31.0		20.8	7.5	61.7		20.8
Change Period (Y+Rc), s	5.0	* 5		4.0	4.0	5.0		4.0
Max Green Setting (Gmax), s	13.0	* 26		38.0	13.0	26.0		38.0
Max Q Clear Time (g_c+I1), s	2.3	29.0		6.2	4.8	11.2		10.0
Green Ext Time (p_c), s	4.8	0.0		1.0	0.0	5.8		0.9

Intersection Summary	
HCM 2010 Ctrl Delay	275.9
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	18	232	278	37	23	126	2224	429	27	859	28
Future Volume (veh/h)	11	18	232	278	37	23	126	2224	429	27	859	28
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	13	21	83	323	43	8	147	2586	272	31	999	5
Adj No. of Lanes	1	1	0	1	1	0	1	3	1	1	3	1
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	503	104	412	447	484	90	431	2449	761	40	1275	395
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.33	0.51	1.00	1.00	0.01	0.09	0.09
Sat Flow, veh/h	1346	312	1233	1283	1447	269	1681	4818	1497	1681	4818	1491
Grp Volume(v), veh/h	13	0	104	323	0	51	147	2586	272	31	999	5
Grp Sat Flow(s),veh/h/ln	1346	0	1545	1283	0	1717	1681	1606	1497	1681	1606	1491
Q Serve(g_s), s	0.6	0.0	4.3	21.6	0.0	1.8	4.6	45.7	0.0	1.7	18.3	0.3
Cycle Q Clear(g_c), s	2.4	0.0	4.3	25.9	0.0	1.8	4.6	45.7	0.0	1.7	18.3	0.3
Prop In Lane	1.00		0.80	1.00		0.16	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	503	0	516	447	0	574	431	2449	761	40	1275	395
V/C Ratio(X)	0.03	0.00	0.20	0.72	0.00	0.09	0.34	1.06	0.36	0.77	0.78	0.01
Avail Cap(c_a), veh/h	651	0	686	589	0	763	431	2449	761	205	1392	431
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.09	0.09	0.09	0.95	0.95	0.95
Uniform Delay (d), s/veh	21.4	0.0	21.4	30.6	0.0	20.5	17.4	0.0	0.0	44.4	38.5	30.3
Incr Delay (d2), s/veh	0.0	0.0	0.2	3.0	0.0	0.1	0.0	26.4	0.1	24.8	4.6	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	1.9	8.0	0.0	0.9	2.1	6.0	0.0	1.0	8.7	0.1
LnGrp Delay(d),s/veh	21.4	0.0	21.6	33.6	0.0	20.6	17.5	26.4	0.1	69.2	43.2	30.4
LnGrp LOS	C		C	C		C	B	F	A	E	D	C
Approach Vol, veh/h		117			374			3005			1035	
Approach Delay, s/veh		21.5			31.8			23.6			43.9	
Approach LOS		C			C			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.2	49.7		34.1	28.1	27.8		34.1
Change Period (Y+Rc), s	4.0	5.0		4.0	5.0	* 5		4.0
Max Green Setting (Gmax), s	11.0	26.0		40.0	12.0	* 25		40.0
Max Q Clear Time (g_c+I1), s	3.7	47.7		27.9	6.6	20.3		6.3
Green Ext Time (p_c), s	0.0	0.0		1.7	0.2	2.5		2.2

Intersection Summary		
HCM 2010 Ctrl Delay		28.8
HCM 2010 LOS		C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	287	1	2232	24	592	0	0	1409	85
Future Volume (vph)	0	0	0	287	1	2232	24	592	0	0	1409	85
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)					4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor					1.00	0.88	1.00	0.95			0.95	1.00
Frpb, ped/bikes					1.00	1.00	1.00	1.00			1.00	0.97
Flpb, ped/bikes					1.00	1.00	1.00	1.00			1.00	1.00
Frt					1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected					0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)					1681	2640	1676	3353			3353	1449
Flt Permitted					0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (perm)					1681	2640	1676	3353			3353	1449
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	0	0	0	322	1	2508	27	665	0	0	1583	96
RTOR Reduction (vph)	0	0	0	0	0	39	0	0	0	0	0	46
Lane Group Flow (vph)	0	0	0	0	323	2469	27	665	0	0	1583	50
Confl. Peds. (#/hr)												3
Confl. Bikes (#/hr)												1
Turn Type				Perm	NA	custom	Prot	NA			NA	Perm
Protected Phases					8	8 1	5	2			6	
Permitted Phases				8								6
Actuated Green, G (s)					36.0	59.6	3.0	20.4			37.5	37.5
Effective Green, g (s)					37.5	61.1	2.5	20.9			38.0	38.0
Actuated g/C Ratio					0.42	0.68	0.03	0.23			0.42	0.42
Clearance Time (s)					5.5		3.5	4.5			4.5	4.5
Vehicle Extension (s)					3.5		2.0	2.0			2.0	2.0
Lane Grp Cap (vph)					700	1792	46	778			1415	611
v/s Ratio Prot						c0.94	0.02	c0.20			c0.47	
v/s Ratio Perm					0.19							0.03
v/c Ratio					0.46	1.38	0.59	0.85			1.12	0.08
Uniform Delay, d1					19.0	14.4	43.2	33.1			26.0	15.6
Progression Factor					1.00	1.00	0.87	0.60			0.47	0.19
Incremental Delay, d2					0.6	173.5	8.8	8.9			61.5	0.2
Delay (s)					19.5	188.0	46.4	28.8			73.9	3.1
Level of Service					B	F	D	C			E	A
Approach Delay (s)		0.0			168.8			29.5			69.8	
Approach LOS		A			F			C			E	

Intersection Summary			
HCM 2000 Control Delay	118.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.35		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	106.4%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	214	1	75	0	0	0	0	408	277	1124	556	0
Future Volume (veh/h)	214	1	75	0	0	0	0	408	277	1124	556	0
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99				1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1765				0	1765	1800	1765	1765	0
Adj Flow Rate, veh/h	230	1	11				0	439	168	1209	598	0
Adj No. of Lanes	0	1	1				0	2	0	2	1	0
Peak Hour Factor	0.93	0.93	0.93				0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	298	1	265				0	474	179	1557	1294	0
Arrive On Green	0.18	0.18	0.18				0.00	0.20	0.19	0.80	1.00	0.00
Sat Flow, veh/h	1674	7	1487				0	2456	897	3261	1765	0
Grp Volume(v), veh/h	231	0	11				0	309	298	1209	598	0
Grp Sat Flow(s),veh/h/ln	1681	0	1487				0	1676	1589	1630	1765	0
Q Serve(g_s), s	11.8	0.0	0.6				0.0	16.3	16.6	17.7	0.0	0.0
Cycle Q Clear(g_c), s	11.8	0.0	0.6				0.0	16.3	16.6	17.7	0.0	0.0
Prop In Lane	1.00		1.00				0.00		0.56	1.00		0.00
Lane Grp Cap(c), veh/h	299	0	265				0	335	318	1557	1294	0
V/C Ratio(X)	0.77	0.00	0.04				0.00	0.92	0.94	0.78	0.46	0.00
Avail Cap(c_a), veh/h	420	0	372				0	335	318	1557	1294	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.67	1.67	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.09	0.09	0.00
Uniform Delay (d), s/veh	35.3	0.0	30.6				0.0	35.3	35.6	6.5	0.0	0.0
Incr Delay (d2), s/veh	3.4	0.0	0.0				0.0	33.0	36.6	0.2	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	0.0	0.2				0.0	10.6	10.5	7.6	0.0	0.0
LnGrp Delay(d),s/veh	38.7	0.0	30.7				0.0	68.3	72.1	6.8	0.1	0.0
LnGrp LOS	D		C					E	E	A	A	
Approach Vol, veh/h		242						607			1807	
Approach Delay, s/veh		38.3						70.2			4.6	
Approach LOS		D						E			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	48.0	22.0		20.0		70.0		
Change Period (Y+Rc), s	4.5	* 4.5		5.5		4.5		
Max Green Setting (Gmax), s	38.0	* 18		21.0		16.0		
Max Q Clear Time (g_c+I1), s	19.7	18.6		13.8		2.0		
Green Ext Time (p_c), s	3.7	0.0		0.5		5.1		

Intersection Summary		
HCM 2010 Ctrl Delay		22.6
HCM 2010 LOS		C

Notes

User approved pedestrian interval to be less than phase max green.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	112	292	80	191	274	224	43	559	135	77	399	31
Future Volume (veh/h)	112	292	80	191	274	224	43	559	135	77	399	31
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.99	0.99		0.95	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1872	1765	1765	1800	1765	1765	1872	1765	1765	1872
Adj Flow Rate, veh/h	138	360	66	236	338	118	53	690	137	95	493	31
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	503	1078	195	521	941	323	304	1035	205	188	1197	75
Arrive On Green	0.11	0.38	0.36	0.11	0.38	0.36	0.37	0.37	0.36	0.37	0.37	0.36
Sat Flow, veh/h	1681	2826	512	1681	2446	839	864	2763	548	656	3196	200
Grp Volume(v), veh/h	138	212	214	236	230	226	53	418	409	95	258	266
Grp Sat Flow(s),veh/h/ln	1681	1676	1662	1681	1676	1609	864	1676	1634	656	1676	1720
Q Serve(g_s), s	4.3	8.1	8.3	7.8	8.8	9.2	4.4	18.7	18.8	12.7	10.2	10.3
Cycle Q Clear(g_c), s	4.3	8.1	8.3	7.8	8.8	9.2	14.7	18.7	18.8	31.6	10.2	10.3
Prop In Lane	1.00		0.31	1.00		0.52	1.00		0.34	1.00		0.12
Lane Grp Cap(c), veh/h	503	639	634	521	645	619	304	628	612	188	628	644
V/C Ratio(X)	0.27	0.33	0.34	0.45	0.36	0.37	0.17	0.67	0.67	0.50	0.41	0.41
Avail Cap(c_a), veh/h	602	639	634	564	645	619	304	628	612	188	628	644
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	14.5	19.7	20.0	15.2	19.7	20.2	26.3	23.5	23.7	36.7	20.8	20.9
Incr Delay (d2), s/veh	0.3	1.4	1.4	0.6	1.5	1.7	0.3	2.7	2.8	2.2	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	4.0	4.0	3.6	4.4	4.4	1.1	9.1	8.9	2.4	4.8	5.0
LnGrp Delay(d),s/veh	14.7	21.1	21.4	15.8	21.3	21.9	26.5	26.2	26.5	38.8	21.2	21.3
LnGrp LOS	B	C	C	B	C	C	C	C	C	D	C	C
Approach Vol, veh/h		564			692			880			619	
Approach Delay, s/veh		19.7			19.6			26.3			24.0	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.7	38.6		37.7	14.0	38.3		37.7
Change Period (Y+Rc), s	4.0	6.0		5.7	4.0	6.0		5.7
Max Green Setting (Gmax), s	15.0	27.3		32.0	12.3	30.0		32.0
Max Q Clear Time (g_c+I1), s	6.3	11.2		33.6	9.8	10.3		20.8
Green Ext Time (p_c), s	0.2	5.2		0.0	0.2	5.7		7.1

Intersection Summary		
HCM 2010 Ctrl Delay		22.8
HCM 2010 LOS		C

Intersection	
Intersection Delay, s/veh	15.8
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	8	34	139	0	238	58	10	0	364	8	132
Future Vol, veh/h	0	8	34	139	0	238	58	10	0	364	8	132
Peak Hour Factor	0.92	0.68	0.92	0.68	0.92	0.92	0.92	0.92	0.92	0.68	0.68	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	12	37	204	0	259	63	11	0	535	12	143
Number of Lanes	0	1	1	1	0	1	2	0	0	2	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	3	3	3
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	3	3	3
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	3	3
HCM Control Delay	13.2	17.6	16.1
HCM LOS	B	C	C

Lane	NBLn1	NBLn2	NBLn3	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	WBLn3	SBLn1	SBLn2
Vol Left, %	100%	100%	0%	100%	0%	0%	100%	0%	0%	100%	0%
Vol Thru, %	0%	0%	6%	0%	100%	0%	0%	100%	66%	0%	100%
Vol Right, %	0%	0%	94%	0%	0%	100%	0%	0%	34%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	182	182	140	8	34	139	238	39	29	10	5
LT Vol	182	182	0	8	0	0	238	0	0	10	0
Through Vol	0	0	8	0	34	0	0	39	19	0	5
RT Vol	0	0	132	0	0	139	0	0	10	0	0
Lane Flow Rate	268	268	155	12	37	204	259	42	32	11	7
Geometry Grp	8	8	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.527	0.527	0.256	0.026	0.076	0.383	0.552	0.084	0.062	0.026	0.017
Departure Headway (Hd)	7.088	7.088	5.928	7.949	7.449	6.749	7.687	7.187	6.948	8.657	8.157
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	506	506	602	448	478	529	468	496	512	416	441
Service Time	4.86	4.86	3.7	5.741	5.241	4.541	5.471	4.971	4.733	6.357	5.857
HCM Lane V/C Ratio	0.53	0.53	0.257	0.027	0.077	0.386	0.553	0.085	0.063	0.026	0.016
HCM Control Delay	17.6	17.6	10.8	11	10.9	13.7	19.6	10.6	10.2	11.6	11
HCM Lane LOS	C	C	B	B	B	B	C	B	B	B	B
HCM 95th-tile Q	3	3	1	0.1	0.2	1.8	3.3	0.3	0.2	0.1	0.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations		↰	↑	↱
Traffic Vol, veh/h	0	10	5	3
Future Vol, veh/h	0	10	5	3
Peak Hour Factor	0.92	0.92	0.68	0.68
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	11	7	4
Number of Lanes	0	1	1	1

Approach	SB
Opposing Approach	NB
Opposing Lanes	3
Conflicting Approach Left	WB
Conflicting Lanes Left	3
Conflicting Approach Right	EB
Conflicting Lanes Right	3
HCM Control Delay	11.1
HCM LOS	B

Intersection	
Int Delay, s/veh	772.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	7	31	476	6	117	25	298	264	88	284	1
Future Vol, veh/h	1	7	31	476	6	117	25	298	264	88	284	1
Conflicting Peds, #/hr	3	0	4	10	0	3	4	0	10	9	0	3
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	205	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	69	69	69	69	69	69	69	69	69	69	69	69
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	10	45	690	9	170	36	432	383	128	412	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	967	1568	221	1182	1378	420	417	0	0	824	0	0
Stage 1	671	671	-	706	706	-	-	-	-	-	-	-
Stage 2	296	897	-	476	672	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	209	110	783	~ 145	144	582	1138	-	-	802	-	-
Stage 1	412	453	-	~ 393	437	-	-	-	-	-	-	-
Stage 2	688	357	-	~ 539	453	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	119	88	774	~ 105	116	576	1129	-	-	800	-	-
Mov Cap-2 Maneuver	119	88	-	~ 105	116	-	-	-	-	-	-	-
Stage 1	398	379	-	~ 377	420	-	-	-	-	-	-	-
Stage 2	459	343	-	~ 412	379	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	19.5	$ 2058.1	0.4	2.4
HCM LOS	C	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1129	-	-	305	105	483	800	-	-
HCM Lane V/C Ratio	0.032	-	-	0.185	6.57	0.369	0.159	-	-
HCM Control Delay (s)	8.3	-	-	19.5	$ 2585.6	16.7	10.4	-	-
HCM Lane LOS	A	-	-	C	F	C	B	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.7	76.5	1.7	0.6	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Intersection Delay, s/veh	88
Intersection LOS	F

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	1	0	215	0	64	0	2	522	62
Future Vol, veh/h	0	0	0	1	0	215	0	64	0	2	522	62
Peak Hour Factor	0.92	0.73	0.73	0.73	0.92	0.73	0.73	0.73	0.92	0.73	0.73	0.73
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	1	0	295	0	88	0	3	715	85
Number of Lanes	0	0	1	0	0	1	0	1	0	1	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	3
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	3	3	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	3	2
HCM Control Delay	13.7	38.5	84.5
HCM LOS	B	E	F

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	100%	0%	100%	0%	0%
Vol Thru, %	0%	100%	74%	0%	0%	0%	0%	100%	100%
Vol Right, %	0%	0%	26%	100%	0%	100%	0%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	2	348	236	1	215	64	10	388	388
LT Vol	2	0	0	0	215	0	10	0	0
Through Vol	0	348	174	0	0	0	0	388	388
RT Vol	0	0	62	1	0	64	0	0	0
Lane Flow Rate	3	477	323	1	295	88	14	532	532
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.007	1.143	0.758	0.004	0.813	0.213	0.034	1.246	0.99
Departure Headway (Hd)	9.49	8.973	8.783	10.957	10.389	9.167	9.254	8.736	6.942
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	379	410	414	329	350	394	389	420	526
Service Time	7.19	6.673	6.483	8.657	8.089	6.867	6.954	6.436	4.642
HCM Lane V/C Ratio	0.008	1.163	0.78	0.003	0.843	0.223	0.036	1.267	1.011
HCM Control Delay	12.3	119	34.2	13.7	45.7	14.3	12.3	156	63
HCM Lane LOS	B	F	D	B	E	B	B	F	F
HCM 95th-tile Q	0	17.2	6.2	0	7	0.8	0.1	21.6	13.6

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations		↰	↑↱	
Traffic Vol, veh/h	0	10	776	0
Future Vol, veh/h	0	10	776	0
Peak Hour Factor	0.92	0.73	0.73	0.73
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	14	1063	0
Number of Lanes	0	1	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	3
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	108.3
HCM LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	466	457	560	67	468	47	587	161	42	27	137	879
Future Volume (veh/h)	466	457	560	67	468	47	587	161	42	27	137	879
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95	1.00		0.91	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1800	1765	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	621	609	79	89	624	55	783	215	49	36	183	0
Adj No. of Lanes	1	2	1	1	2	0	2	1	0	1	2	1
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	116	1032	437	90	903	79	1008	416	95	362	722	312
Arrive On Green	0.12	0.51	0.51	0.05	0.29	0.28	0.30	0.30	0.29	0.22	0.22	0.00
Sat Flow, veh/h	1681	3353	1421	1681	3088	272	3361	1386	316	1681	3353	1500
Grp Volume(v), veh/h	621	609	79	89	338	341	783	0	264	36	183	0
Grp Sat Flow(s),veh/h/ln	1681	1676	1421	1681	1676	1683	1681	0	1702	1681	1676	1500
Q Serve(g_s), s	9.0	16.5	3.9	6.9	23.2	23.4	27.6	0.0	16.7	2.2	5.9	0.0
Cycle Q Clear(g_c), s	9.0	16.5	3.9	6.9	23.2	23.4	27.6	0.0	16.7	2.2	5.9	0.0
Prop In Lane	1.00		1.00	1.00		0.16	1.00		0.19	1.00		1.00
Lane Grp Cap(c), veh/h	116	1032	437	90	490	492	1008	0	510	362	722	312
V/C Ratio(X)	5.34	0.59	0.18	0.98	0.69	0.69	0.78	0.00	0.52	0.10	0.25	0.00
Avail Cap(c_a), veh/h	116	1032	437	90	490	492	1008	0	510	362	722	312
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.31	0.31	0.31	1.00	1.00	1.00	0.75	0.00	0.75	1.00	1.00	0.00
Uniform Delay (d), s/veh	57.5	25.9	22.8	61.4	40.8	40.9	41.5	0.0	37.8	40.9	42.3	0.0
Incr Delay (d2), s/veh	1957.6	0.8	0.3	90.2	7.7	7.8	4.4	0.0	2.8	0.5	0.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	67.4	7.7	1.5	5.5	11.8	12.0	13.5	0.0	8.2	1.1	2.8	0.0
LnGrp Delay(d),s/veh	2015.1	26.7	23.1	151.6	48.5	48.7	45.9	0.0	40.6	41.4	43.2	0.0
LnGrp LOS	F	C	C	F	D	D	D		D	D	D	
Approach Vol, veh/h		1309			768			1047			219	
Approach Delay, s/veh		969.8			60.5			44.6			42.9	
Approach LOS		F			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		32.0	13.0	42.0		43.0	11.0	44.0
Change Period (Y+Rc), s		5.0	4.0	5.0		5.0	4.0	5.0
Max Green Setting (Gmax), s		27.0	9.0	37.0		38.0	7.0	39.0
Max Q Clear Time (g_c+I1), s		7.9	11.0	25.4		29.6	8.9	18.5
Green Ext Time (p_c), s		1.0	0.0	6.4		3.0	0.0	8.9

Intersection Summary	
HCM 2010 Ctrl Delay	410.4
HCM 2010 LOS	F

Notes
User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	635	15	11	578	63	23	8	10	136	5	200
Future Volume (veh/h)	90	635	15	11	578	63	23	8	10	136	5	200
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.99	0.93		1.00	0.91		0.89
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1800	1765	1800	1800	1765	1765
Adj Flow Rate, veh/h	127	894	20	15	814	76	32	11	0	192	7	57
Adj No. of Lanes	1	2	0	1	2	0	0	2	0	0	1	1
Peak Hour Factor	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	287	1492	33	237	1217	114	423	572	0	562	19	502
Arrive On Green	0.06	0.45	0.42	0.00	0.39	0.37	0.37	0.37	0.00	0.37	0.37	0.37
Sat Flow, veh/h	1681	3350	75	1681	3097	289	845	1606	0	1222	50	1339
Grp Volume(v), veh/h	127	447	467	15	441	449	32	11	0	199	0	57
Grp Sat Flow(s),veh/h/ln	1681	1676	1748	1681	1676	1710	845	1526	0	1272	0	1339
Q Serve(g_s), s	3.1	13.7	13.8	0.2	14.7	14.8	1.3	0.3	0.0	7.8	0.0	1.9
Cycle Q Clear(g_c), s	3.1	13.7	13.8	0.2	14.7	14.8	9.4	0.3	0.0	8.1	0.0	1.9
Prop In Lane	1.00		0.04	1.00		0.17	1.00		0.00	0.96		1.00
Lane Grp Cap(c), veh/h	287	747	779	237	659	672	423	572	0	581	0	502
V/C Ratio(X)	0.44	0.60	0.60	0.06	0.67	0.67	0.08	0.02	0.00	0.34	0.00	0.11
Avail Cap(c_a), veh/h	538	775	808	577	775	791	449	605	0	608	0	531
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.1	14.3	14.3	17.6	17.0	17.1	19.3	13.4	0.0	15.9	0.0	13.9
Incr Delay (d2), s/veh	1.1	1.2	1.2	0.1	1.8	1.7	0.1	0.0	0.0	0.3	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	6.6	6.9	0.1	7.1	7.2	0.5	0.1	0.0	2.8	0.0	0.7
LnGrp Delay(d),s/veh	15.2	15.5	15.5	17.7	18.8	18.9	19.4	13.4	0.0	16.3	0.0	14.0
LnGrp LOS	B	B	B	B	B	B	B	B		B		B
Approach Vol, veh/h		1041			905			43			256	
Approach Delay, s/veh		15.4			18.8			17.9			15.8	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	4.2	34.3		29.5	7.8	30.8		29.5
Change Period (Y+Rc), s	3.0	5.5		4.0	3.0	5.5		4.0
Max Green Setting (Gmax), s	15.0	30.0		27.0	15.0	30.0		27.0
Max Q Clear Time (g_c+I1), s	2.2	15.8		10.1	5.1	16.8		11.4
Green Ext Time (p_c), s	0.0	8.9		1.6	0.2	8.5		1.5

Intersection Summary	
HCM 2010 Ctrl Delay	16.9
HCM 2010 LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	231	546	3	8	347	114	4	0	2	165	2	318
Future Volume (veh/h)	231	546	3	8	347	114	4	0	2	165	2	318
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		1.00	0.98		0.96	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1765	1800	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	325	769	4	11	489	0	6	0	2	232	0	275
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	1	0	2
Peak Hour Factor	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	504	1645	9	14	1123	454	322	18	68	501	0	1105
Arrive On Green	0.15	0.48	0.45	0.01	0.34	0.00	0.23	0.00	0.23	0.25	0.00	0.23
Sat Flow, veh/h	3261	3420	18	1681	3353	1500	810	79	296	1376	0	2807
Grp Volume(v), veh/h	325	377	396	11	489	0	8	0	0	232	0	275
Grp Sat Flow(s),veh/h/ln	1630	1676	1761	1681	1676	1500	1185	0	0	1376	0	1403
Q Serve(g_s), s	4.3	6.9	6.9	0.3	5.2	0.0	0.0	0.0	0.0	6.8	0.0	3.1
Cycle Q Clear(g_c), s	4.3	6.9	6.9	0.3	5.2	0.0	0.2	0.0	0.0	7.0	0.0	3.1
Prop In Lane	1.00		0.01	1.00		1.00	0.75		0.25	1.00		1.00
Lane Grp Cap(c), veh/h	504	806	847	14	1123	454	407	0	0	501	0	1105
V/C Ratio(X)	0.64	0.47	0.47	0.77	0.44	0.00	0.02	0.00	0.00	0.46	0.00	0.25
Avail Cap(c_a), veh/h	1414	806	847	437	1927	813	769	0	0	784	0	1681
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.3	8.0	8.0	22.8	11.9	0.0	13.8	0.0	0.0	15.6	0.0	9.7
Incr Delay (d2), s/veh	1.4	0.4	0.4	57.3	0.3	0.0	0.0	0.0	0.0	0.7	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	3.2	3.4	0.4	2.4	0.0	0.1	0.0	0.0	2.7	0.0	1.2
LnGrp Delay(d),s/veh	19.7	8.4	8.4	80.1	12.2	0.0	13.8	0.0	0.0	16.2	0.0	9.8
LnGrp LOS	B	A	A	F	B		B			B		A
Approach Vol, veh/h		1098			500			8			507	
Approach Delay, s/veh		11.8			13.7			13.8			12.8	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	4.4	26.2		15.5	11.1	19.4		15.5
Change Period (Y+Rc), s	4.0	5.5		5.0	4.0	5.5		* 5
Max Green Setting (Gmax), s	12.0	20.0		20.0	20.0	25.0		* 25
Max Q Clear Time (g_c+I1), s	2.3	8.9		9.0	6.3	7.2		2.2
Green Ext Time (p_c), s	0.0	5.6		1.6	0.9	6.2		2.0

Intersection Summary	
HCM 2010 Ctrl Delay	12.5
HCM 2010 LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↑↱		↰	↑↑	↱
Traffic Volume (veh/h)	130	310	271	51	221	181	118	219	61	278	384	141
Future Volume (veh/h)	130	310	271	51	221	181	118	219	61	278	384	141
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.97	0.98		0.96	0.98		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	186	443	183	73	316	50	169	313	50	397	549	37
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	383	678	277	245	680	106	437	819	129	573	1238	590
Arrive On Green	0.11	0.29	0.27	0.05	0.23	0.21	0.10	0.28	0.27	0.18	0.37	0.36
Sat Flow, veh/h	1681	2302	941	1681	2893	452	1681	2882	454	1681	3353	1450
Grp Volume(v), veh/h	186	321	305	73	181	185	169	180	183	397	549	37
Grp Sat Flow(s),veh/h/ln	1681	1676	1567	1681	1676	1668	1681	1676	1660	1681	1676	1450
Q Serve(g_s), s	6.8	13.9	14.3	2.8	7.7	7.9	5.9	7.2	7.4	13.4	10.2	1.3
Cycle Q Clear(g_c), s	6.8	13.9	14.3	2.8	7.7	7.9	5.9	7.2	7.4	13.4	10.2	1.3
Prop In Lane	1.00		0.60	1.00		0.27	1.00		0.27	1.00		1.00
Lane Grp Cap(c), veh/h	383	494	461	245	394	392	437	477	472	573	1238	590
V/C Ratio(X)	0.49	0.65	0.66	0.30	0.46	0.47	0.39	0.38	0.39	0.69	0.44	0.06
Avail Cap(c_a), veh/h	506	545	510	469	545	543	580	606	600	573	1238	590
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.9	25.6	26.2	24.4	27.2	27.6	18.5	23.8	24.0	15.7	19.7	15.1
Incr Delay (d2), s/veh	1.0	2.4	2.8	0.7	0.8	0.9	0.6	0.5	0.5	3.6	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.2	6.8	6.5	1.3	3.7	3.8	2.7	3.4	3.4	6.7	4.8	0.5
LnGrp Delay(d),s/veh	21.9	27.9	29.0	25.1	28.1	28.4	19.1	24.3	24.5	19.3	20.0	15.1
LnGrp LOS	C	C	C	C	C	C	B	C	C	B	B	B
Approach Vol, veh/h		812			439			532			983	
Approach Delay, s/veh		26.9			27.7			22.7			19.5	
Approach LOS		C			C			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.9	23.5	11.9	34.7	8.0	28.4	19.0	27.6
Change Period (Y+Rc), s	4.0	6.0	4.0	5.0	4.0	6.0	4.0	5.0
Max Green Setting (Gmax), s	15.0	25.0	15.0	29.0	15.0	25.0	15.0	29.0
Max Q Clear Time (g_c+I1), s	8.8	9.9	7.9	12.2	4.8	16.3	15.4	9.4
Green Ext Time (p_c), s	0.2	5.1	0.2	5.6	0.1	3.7	0.0	4.9

Intersection Summary		
HCM 2010 Ctrl Delay		23.6
HCM 2010 LOS		C

Intersection	
Int Delay, s/veh	270.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	492	89	89	313	122	123
Future Vol, veh/h	492	89	89	313	122	123
Conflicting Peds, #/hr	0	88	49	0	88	49
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	60	60	60	60	60	60
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	820	148	148	522	203	205

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1056	0	1628	621
Stage 1	-	-	-	-	982	-
Stage 2	-	-	-	-	646	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	655	-	~ 93	430
Stage 1	-	-	-	-	323	-
Stage 2	-	-	-	-	484	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	630	-	~ 62	386
Mov Cap-2 Maneuver	-	-	-	-	~ 62	-
Stage 1	-	-	-	-	301	-
Stage 2	-	-	-	-	345	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.8	$ 1350
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	107	-	-	630	-
HCM Lane V/C Ratio	3.816	-	-	0.235	-
HCM Control Delay (s)	$ 1350	-	-	12.5	-
HCM Lane LOS	F	-	-	B	-
HCM 95th %tile Q(veh)	41.4	-	-	0.9	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	125	355	167	240	377	81	276	1296	213	109	1712	78
Future Volume (veh/h)	125	355	167	240	377	81	276	1296	213	109	1712	78
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	151	428	142	289	454	76	333	1561	239	131	2063	90
Adj No. of Lanes	2	2	0	2	2	0	2	3	0	1	3	0
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	321	605	199	341	676	112	376	1830	279	155	1949	85
Arrive On Green	0.10	0.25	0.23	0.10	0.24	0.22	0.12	0.44	0.42	0.09	0.41	0.40
Sat Flow, veh/h	3261	2471	811	3261	2869	477	3261	4201	641	1681	4731	206
Grp Volume(v), veh/h	151	289	281	289	264	266	333	1192	608	131	1398	755
Grp Sat Flow(s),veh/h/ln	1630	1676	1605	1630	1676	1670	1630	1606	1631	1681	1606	1725
Q Serve(g_s), s	5.7	20.4	20.9	11.3	18.6	18.9	13.1	43.3	43.7	10.0	53.6	53.6
Cycle Q Clear(g_c), s	5.7	20.4	20.9	11.3	18.6	18.9	13.1	43.3	43.7	10.0	53.6	53.6
Prop In Lane	1.00		0.51	1.00		0.29	1.00		0.39	1.00		0.12
Lane Grp Cap(c), veh/h	321	411	393	341	395	394	376	1399	710	155	1323	711
V/C Ratio(X)	0.47	0.70	0.71	0.85	0.67	0.68	0.89	0.85	0.86	0.85	1.06	1.06
Avail Cap(c_a), veh/h	321	567	543	401	658	655	376	1399	710	194	1323	711
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.54	0.54	0.54	0.54	0.54	0.54
Uniform Delay (d), s/veh	55.4	44.8	45.4	57.2	45.1	45.4	56.7	32.9	33.4	58.1	38.2	38.3
Incr Delay (d2), s/veh	1.1	2.4	2.7	13.8	2.0	2.0	13.0	3.8	7.3	14.3	35.4	43.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	9.7	9.5	5.8	8.8	9.0	6.6	19.9	21.1	5.2	30.2	34.0
LnGrp Delay(d),s/veh	56.5	47.1	48.1	71.0	47.0	47.5	69.7	36.7	40.7	72.4	73.6	81.5
LnGrp LOS	E	D	D	E	D	D	E	D	D	E	F	F
Approach Vol, veh/h		721			819			2133			2284	
Approach Delay, s/veh		49.5			55.6			43.0			76.1	
Approach LOS		D			E			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.0	60.6	17.6	35.9	19.0	57.6	18.8	34.6
Change Period (Y+Rc), s	4.0	6.0	4.0	6.0	4.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	15.0	37.0	16.0	42.0	15.0	37.0	9.0	* 49
Max Q Clear Time (g_c+I1), s	12.0	45.7	13.3	22.9	15.1	55.6	7.7	20.9
Green Ext Time (p_c), s	0.1	0.0	0.3	2.7	0.0	0.0	0.5	2.9

Intersection Summary	
HCM 2010 Ctrl Delay	58.2
HCM 2010 LOS	E

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	40	36	154	51	48	27	1658	110	191	1834	53
Future Volume (veh/h)	38	40	36	154	51	48	27	1658	110	191	1834	53
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.99	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1765	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	43	45	4	173	57	6	30	1863	118	215	2061	58
Adj No. of Lanes	1	1	1	1	1	1	1	3	0	1	3	0
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	328	389	322	339	389	326	520	2375	150	245	1636	46
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.62	1.00	1.00	0.15	0.34	0.33
Sat Flow, veh/h	1318	1765	1459	1334	1765	1480	1681	4624	292	1681	4813	135
Grp Volume(v), veh/h	43	45	4	173	57	6	30	1292	689	215	1374	745
Grp Sat Flow(s),veh/h/ln	1318	1765	1459	1334	1765	1480	1681	1606	1704	1681	1606	1736
Q Serve(g_s), s	2.7	2.0	0.2	11.9	2.6	0.3	0.7	0.0	0.0	12.5	34.0	34.0
Cycle Q Clear(g_c), s	5.3	2.0	0.2	14.0	2.6	0.3	0.7	0.0	0.0	12.5	34.0	34.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.17	1.00		0.08
Lane Grp Cap(c), veh/h	328	389	322	339	389	326	520	1650	875	245	1092	590
V/C Ratio(X)	0.13	0.12	0.01	0.51	0.15	0.02	0.06	0.78	0.79	0.88	1.26	1.26
Avail Cap(c_a), veh/h	539	671	554	552	671	562	520	1650	875	269	1092	590
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.41	0.41	0.41	0.09	0.09	0.09
Uniform Delay (d), s/veh	33.5	31.2	30.5	36.8	31.4	30.5	13.3	0.0	0.0	41.8	33.0	33.0
Incr Delay (d2), s/veh	0.2	0.1	0.0	1.2	0.2	0.0	0.0	1.6	3.0	3.1	116.9	119.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	1.0	0.1	4.5	1.3	0.1	0.3	0.4	0.7	6.0	32.7	35.8
LnGrp Delay(d),s/veh	33.7	31.3	30.5	37.9	31.6	30.5	13.3	1.6	3.0	44.9	149.9	152.4
LnGrp LOS	C	C	C	D	C	C	B	A	A	D	F	F
Approach Vol, veh/h		92			236			2011			2334	
Approach Delay, s/veh		32.4			36.2			2.2			141.0	
Approach LOS		C			D			A			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	18.6	55.4		26.1	35.9	38.0		26.1
Change Period (Y+Rc), s	4.0	5.0		4.0	5.0	* 5		4.0
Max Green Setting (Gmax), s	16.0	33.0		38.0	16.0	* 33		38.0
Max Q Clear Time (g_c+I1), s	14.5	2.0		7.3	2.7	36.0		16.0
Green Ext Time (p_c), s	0.1	17.5		1.3	9.8	0.0		1.2

Intersection Summary		
HCM 2010 Ctrl Delay	73.9	
HCM 2010 LOS	E	

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	25	203	253	47	27	293	1816	400	60	1867	38
Future Volume (veh/h)	15	25	203	253	47	27	293	1816	400	60	1867	38
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	16	27	62	272	51	9	315	1953	225	65	2008	13
Adj No. of Lanes	1	1	0	1	1	0	1	3	1	1	3	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	435	142	325	404	436	77	405	2562	797	83	1590	491
Arrive On Green	0.30	0.30	0.30	0.30	0.30	0.30	0.24	0.53	0.53	0.02	0.11	0.11
Sat Flow, veh/h	1328	474	1088	1294	1459	258	1681	4818	1499	1681	4818	1489
Grp Volume(v), veh/h	16	0	89	272	0	60	315	1953	225	65	2008	13
Grp Sat Flow(s),veh/h/ln	1328	0	1562	1294	0	1717	1681	1606	1499	1681	1606	1489
Q Serve(g_s), s	0.9	0.0	4.2	19.8	0.0	2.5	17.5	31.9	8.3	3.9	33.0	0.8
Cycle Q Clear(g_c), s	3.4	0.0	4.2	24.0	0.0	2.5	17.5	31.9	8.3	3.9	33.0	0.8
Prop In Lane	1.00		0.70	1.00		0.15	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	435	0	467	404	0	513	405	2562	797	83	1590	491
V/C Ratio(X)	0.04	0.00	0.19	0.67	0.00	0.12	0.78	0.76	0.28	0.78	1.26	0.03
Avail Cap(c_a), veh/h	556	0	609	522	0	670	405	2562	797	269	1590	491
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.09	0.09	0.09	0.61	0.61	0.61
Uniform Delay (d), s/veh	26.7	0.0	26.1	35.0	0.0	25.5	35.4	18.4	12.9	48.6	44.6	30.2
Incr Delay (d2), s/veh	0.0	0.0	0.2	2.3	0.0	0.1	0.9	0.2	0.1	9.2	121.6	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	1.9	7.3	0.0	1.2	8.2	14.2	3.5	2.0	32.6	0.3
LnGrp Delay(d),s/veh	26.8	0.0	26.3	37.3	0.0	25.6	36.3	18.6	13.0	57.9	166.1	30.3
LnGrp LOS	C		C	D		C	D	B	B	E	F	C
Approach Vol, veh/h		105			332			2493			2086	
Approach Delay, s/veh		26.3			35.2			20.4			161.9	
Approach LOS		C			D			C			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.0	57.2		33.9	29.1	37.0		33.9
Change Period (Y+Rc), s	4.0	5.0		4.0	5.0	* 5		4.0
Max Green Setting (Gmax), s	16.0	32.0		39.0	16.0	* 32		39.0
Max Q Clear Time (g_c+I1), s	5.9	33.9		26.0	19.5	35.0		6.2
Green Ext Time (p_c), s	0.1	0.0		1.5	0.0	0.0		1.9

Intersection Summary	
HCM 2010 Ctrl Delay	80.3
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	400	5	2011	39	621	0	0	2208	232
Future Volume (vph)	0	0	0	400	5	2011	39	621	0	0	2208	232
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)					4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor					1.00	0.88	1.00	0.95			0.95	1.00
Frpb, ped/bikes					1.00	1.00	1.00	1.00			1.00	0.91
Flpb, ped/bikes					1.00	1.00	1.00	1.00			1.00	1.00
Frt					1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected					0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)					1682	2640	1676	3353			3353	1372
Flt Permitted					0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (perm)					1682	2640	1676	3353			3353	1372
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	0	0	0	430	5	2162	42	668	0	0	2374	249
RTOR Reduction (vph)	0	0	0	0	0	65	0	0	0	0	0	73
Lane Group Flow (vph)	0	0	0	0	435	2097	42	668	0	0	2374	176
Confl. Peds. (#/hr)												13
Confl. Bikes (#/hr)												2
Turn Type				Perm	NA	custom	Prot	NA			NA	Perm
Protected Phases					8	8 1	5	2			6	
Permitted Phases				8								6
Actuated Green, G (s)					40.5	61.6	4.9	28.4			41.1	41.1
Effective Green, g (s)					42.0	63.1	4.4	28.9			41.6	41.6
Actuated g/C Ratio					0.42	0.63	0.04	0.29			0.42	0.42
Clearance Time (s)					5.5		3.5	4.5			4.5	4.5
Vehicle Extension (s)					3.5		2.0	2.0			2.0	2.0
Lane Grp Cap (vph)					706	1665	73	969			1394	570
v/s Ratio Prot						c0.79	0.03	0.20			c0.71	
v/s Ratio Perm					0.26							0.13
v/c Ratio					0.62	1.26	0.58	0.69			1.70	0.31
Uniform Delay, d1					22.7	18.4	46.9	31.6			29.2	19.6
Progression Factor					1.00	1.00	1.37	0.94			1.21	1.29
Incremental Delay, d2					1.7	121.9	4.3	2.6			317.4	0.5
Delay (s)					24.4	140.3	68.6	32.2			352.8	25.7
Level of Service					C	F	E	C			F	C
Approach Delay (s)		0.0			120.9			34.4			321.7	
Approach LOS		A			F			C			F	

Intersection Summary			
HCM 2000 Control Delay	199.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.56		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	177.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	136	0	70	0	0	0	0	534	378	1762	845	0
Future Volume (veh/h)	136	0	70	0	0	0	0	534	378	1762	845	0
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1765				0	1765	1800	1765	1765	0
Adj Flow Rate, veh/h	145	0	8				0	568	289	1874	899	0
Adj No. of Lanes	0	1	1				0	2	0	2	1	0
Peak Hour Factor	0.94	0.94	0.94				0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2				0	2	2	2	2	0
Cap, veh/h	204	0	182				0	385	195	1855	1410	0
Arrive On Green	0.12	0.00	0.12				0.00	0.18	0.17	0.95	1.00	0.00
Sat Flow, veh/h	1681	0	1500				0	2225	1086	3261	1765	0
Grp Volume(v), veh/h	145	0	8				0	446	411	1874	899	0
Grp Sat Flow(s),veh/h/ln	1681	0	1500				0	1676	1545	1630	1765	0
Q Serve(g_s), s	8.3	0.0	0.5				0.0	18.0	18.0	56.9	0.0	0.0
Cycle Q Clear(g_c), s	8.3	0.0	0.5				0.0	18.0	18.0	56.9	0.0	0.0
Prop In Lane	1.00		1.00				0.00		0.70	1.00		0.00
Lane Grp Cap(c), veh/h	204	0	182				0	302	278	1855	1410	0
V/C Ratio(X)	0.71	0.00	0.04				0.00	1.48	1.48	1.01	0.64	0.00
Avail Cap(c_a), veh/h	513	0	458				0	302	278	1855	1410	0
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.67	1.67	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	1.00	0.09	0.09	0.00
Uniform Delay (d), s/veh	42.3	0.0	38.8				0.0	41.0	41.2	2.5	0.0	0.0
Incr Delay (d2), s/veh	1.7	0.0	0.0				0.0	231.5	234.0	9.0	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.0	0.0	0.2				0.0	27.7	25.7	19.9	0.1	0.0
LnGrp Delay(d),s/veh	44.0	0.0	38.9				0.0	272.5	275.2	11.5	0.2	0.0
LnGrp LOS	D		D					F	F	F	A	
Approach Vol, veh/h		153						857			2773	
Approach Delay, s/veh		43.7						273.8			7.9	
Approach LOS		D						F			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	61.9	22.0		16.1		83.9		
Change Period (Y+Rc), s	4.5	* 4.5		5.5		4.5		
Max Green Setting (Gmax), s	40.0	* 18		29.0		16.0		
Max Q Clear Time (g_c+I1), s	58.9	20.0		10.3		2.0		
Green Ext Time (p_c), s	0.0	0.0		0.5		8.7		

Intersection Summary		
HCM 2010 Ctrl Delay		69.6
HCM 2010 LOS		E

Notes

User approved pedestrian interval to be less than phase max green.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	51	573	50	116	509	192	48	289	100	252	461	47
Future Volume (veh/h)	51	573	50	116	509	192	48	289	100	252	461	47
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	0.99		0.97	0.99		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1872	1765	1765	1800	1765	1765	1872	1765	1765	1872
Adj Flow Rate, veh/h	60	674	51	136	599	179	56	340	73	296	542	46
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	371	1249	94	412	1056	315	267	994	210	340	1134	96
Arrive On Green	0.09	0.40	0.37	0.11	0.42	0.39	0.36	0.36	0.34	0.36	0.36	0.34
Sat Flow, veh/h	1681	3154	238	1681	2533	755	820	2736	579	961	3120	264
Grp Volume(v), veh/h	60	358	367	136	396	382	56	206	207	296	291	297
Grp Sat Flow(s),veh/h/ln	1681	1676	1716	1681	1676	1612	820	1676	1639	961	1676	1707
Q Serve(g_s), s	1.8	14.8	14.8	4.1	16.2	16.5	5.1	8.0	8.3	24.4	12.0	12.1
Cycle Q Clear(g_c), s	1.8	14.8	14.8	4.1	16.2	16.5	17.2	8.0	8.3	32.7	12.0	12.1
Prop In Lane	1.00		0.14	1.00		0.47	1.00		0.35	1.00		0.15
Lane Grp Cap(c), veh/h	371	664	680	412	699	672	267	609	595	340	609	620
V/C Ratio(X)	0.16	0.54	0.54	0.33	0.57	0.57	0.21	0.34	0.35	0.87	0.48	0.48
Avail Cap(c_a), veh/h	450	664	680	424	699	672	267	609	595	340	609	620
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	14.9	20.9	21.0	14.7	20.0	20.5	28.7	20.8	21.1	34.3	22.1	22.2
Incr Delay (d2), s/veh	0.2	3.1	3.1	0.5	3.3	3.5	0.4	0.3	0.3	20.9	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	7.3	7.5	1.9	8.1	7.9	1.2	3.8	3.8	9.3	5.7	5.8
LnGrp Delay(d),s/veh	15.1	24.0	24.1	15.2	23.3	23.9	29.1	21.1	21.5	55.1	22.6	22.8
LnGrp LOS	B	C	C	B	C	C	C	C	C	E	C	C
Approach Vol, veh/h		785			914			469			884	
Approach Delay, s/veh		23.4			22.4			22.2			33.6	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.8	41.5		36.7	13.7	39.6		36.7
Change Period (Y+Rc), s	4.0	6.0		5.7	4.0	6.0		5.7
Max Green Setting (Gmax), s	12.0	31.3		31.0	10.3	33.0		31.0
Max Q Clear Time (g_c+I1), s	13.8	18.5		34.7	6.1	16.8		19.2
Green Ext Time (p_c), s	0.1	7.8		0.0	0.1	9.1		6.4

Intersection Summary			
HCM 2010 Ctrl Delay			25.8
HCM 2010 LOS			C

APPENDIX D: CUMULATIVE (2035) LEVEL OF SERVICE

Intersection	
Intersection Delay, s/veh	9.1
Intersection LOS	A

Movement	EBU	EBL	EBR	NBU	NBL	NBT	SBU	SBT	SBR
Lane Configurations									
Traffic Vol, veh/h	0	10	680	0	190	10	0	20	10
Future Vol, veh/h	0	10	680	0	190	10	0	20	10
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	11	716	0	200	11	0	21	11
Number of Lanes	0	1	2	0	2	1	0	2	1

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	3	3
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	3	3	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	3	0	3
HCM Control Delay	8.7	10.5	8.5
HCM LOS	A	B	A

Lane	NBLn1	NBLn2	NBLn3	EBLn1	EBLn2	EBLn3	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	100%	0%	100%	0%	0%	0%	0%	0%
Vol Thru, %	0%	0%	100%	0%	0%	0%	100%	100%	0%
Vol Right, %	0%	0%	0%	0%	100%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	95	95	10	10	340	340	10	10	10
LT Vol	95	95	0	10	0	0	0	0	0
Through Vol	0	0	10	0	0	0	10	10	0
RT Vol	0	0	0	0	340	340	0	0	10
Lane Flow Rate	100	100	11	11	358	358	11	11	11
Geometry Grp	8	8	8	7	7	7	8	8	8
Degree of Util (X)	0.181	0.181	0.012	0.017	0.45	0.278	0.019	0.019	0.012
Departure Headway (Hd)	6.518	6.518	4.262	5.718	4.522	2.793	6.462	6.462	3.996
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	554	554	845	627	798	1281	556	556	897
Service Time	4.219	4.219	1.963	3.443	2.247	0.519	4.178	4.178	1.712
HCM Lane V/C Ratio	0.181	0.181	0.013	0.018	0.449	0.279	0.02	0.02	0.012
HCM Control Delay	10.7	10.7	7	8.5	10.9	6.6	9.3	9.3	6.8
HCM Lane LOS	B	B	A	A	B	A	A	A	A
HCM 95th-tile Q	0.7	0.7	0	0.1	2.4	1.1	0.1	0.1	0

Intersection	
Int Delay, s/veh	9.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	10	30	40	10	20	20	130	250	380	320	10
Future Vol, veh/h	10	10	30	40	10	20	20	130	250	380	320	10
Conflicting Peds, #/hr	12	0	7	9	0	12	7	0	9	14	0	12
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	205	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	11	32	42	11	21	21	137	263	400	337	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1282	1610	195	1308	1484	226	359	0	0	414	0	0
Stage 1	1154	1154	-	325	325	-	-	-	-	-	-	-
Stage 2	128	456	-	983	1159	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	122	104	814	117	124	777	1196	-	-	1141	-	-
Stage 1	210	270	-	661	648	-	-	-	-	-	-	-
Stage 2	862	567	-	267	268	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	75	65	800	70	77	760	1187	-	-	1130	-	-
Mov Cap-2 Maneuver	75	65	-	70	77	-	-	-	-	-	-	-
Stage 1	204	173	-	642	629	-	-	-	-	-	-	-
Stage 2	801	550	-	154	171	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	40.1	77.5	0.4	5.3
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1187	-	-	154	70	192	1130	-	-
HCM Lane V/C Ratio	0.018	-	-	0.342	0.602	0.164	0.354	-	-
HCM Control Delay (s)	8.1	-	-	40.1	115	27.4	9.9	-	-
HCM Lane LOS	A	-	-	E	F	D	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	1.4	2.6	0.6	1.6	-	-

Intersection	
Intersection Delay, s/veh	11.8
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	20	0	20	0	40	0	20	0	10	360	150
Future Vol, veh/h	0	20	0	20	0	40	0	20	0	10	360	150
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	21	0	21	0	42	0	21	0	11	379	158
Number of Lanes	0	0	1	0	0	1	0	1	0	1	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	3
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	3	3	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	3	2
HCM Control Delay	10.5	10.6	12.6
HCM LOS	B	B	B

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	50%	100%	0%	100%	0%	0%
Vol Thru, %	0%	100%	44%	0%	0%	0%	0%	100%	90%
Vol Right, %	0%	0%	56%	50%	0%	100%	0%	0%	10%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	10	240	270	40	40	20	120	173	97
LT Vol	10	0	0	20	40	0	120	0	0
Through Vol	0	240	120	0	0	0	0	173	87
RT Vol	0	0	150	20	0	20	0	0	10
Lane Flow Rate	11	253	284	42	42	21	126	182	102
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.019	0.415	0.436	0.083	0.09	0.038	0.232	0.31	0.171
Departure Headway (Hd)	6.414	5.91	5.519	7.124	7.681	6.476	6.617	6.114	6.041
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	558	609	654	502	466	552	543	588	593
Service Time	4.148	3.645	3.254	4.882	5.437	4.231	4.355	3.852	3.779
HCM Lane V/C Ratio	0.02	0.415	0.434	0.084	0.09	0.038	0.232	0.31	0.172
HCM Control Delay	9.3	12.8	12.5	10.5	11.2	9.5	11.4	11.6	10
HCM Lane LOS	A	B	B	B	B	A	B	B	A
HCM 95th-tile Q	0.1	2	2.2	0.3	0.3	0.1	0.9	1.3	0.6

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	120	260	10
Future Vol, veh/h	0	120	260	10
Peak Hour Factor	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	126	274	11
Number of Lanes	0	1	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	3
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	11.1
HCM LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	290	810	760	50	160	30	330	200	110	80	190	70
Future Volume (veh/h)	290	810	760	50	160	30	330	200	110	80	190	70
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.93	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	305	853	295	53	168	16	212	400	78	84	200	0
Adj No. of Lanes	1	2	1	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	403	1416	617	97	709	66	581	993	192	129	257	101
Arrive On Green	0.38	0.67	0.67	0.05	0.22	0.21	0.33	0.33	0.32	0.07	0.07	0.00
Sat Flow, veh/h	1774	3539	1543	1774	3248	305	1774	3035	587	1774	3539	1583
Grp Volume(v), veh/h	305	853	295	53	90	94	212	244	234	84	200	0
Grp Sat Flow(s),veh/h/ln	1774	1770	1543	1774	1770	1783	1774	1863	1759	1774	1770	1583
Q Serve(g_s), s	16.5	14.7	10.3	3.2	4.6	4.8	10.0	11.2	11.4	5.1	6.1	0.0
Cycle Q Clear(g_c), s	16.5	14.7	10.3	3.2	4.6	4.8	10.0	11.2	11.4	5.1	6.1	0.0
Prop In Lane	1.00		1.00	1.00		0.17	1.00		0.33	1.00		1.00
Lane Grp Cap(c), veh/h	403	1416	617	97	386	389	581	610	576	129	257	101
V/C Ratio(X)	0.76	0.60	0.48	0.55	0.23	0.24	0.37	0.40	0.41	0.65	0.78	0.00
Avail Cap(c_a), veh/h	403	1416	617	97	483	486	581	610	576	129	257	101
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.70	0.70	0.70	1.00	1.00	1.00	0.87	0.87	0.87	1.00	1.00	0.00
Uniform Delay (d), s/veh	31.5	13.4	12.7	50.7	35.4	35.6	28.3	28.6	28.9	49.6	50.1	0.0
Incr Delay (d2), s/veh	9.0	1.3	1.9	20.5	1.4	1.5	1.5	1.7	1.9	22.7	20.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.0	7.4	4.5	2.1	2.4	2.5	5.1	6.1	5.8	3.3	3.7	0.0
LnGrp Delay(d),s/veh	40.4	14.7	14.5	71.1	36.8	37.0	29.8	30.4	30.7	72.4	70.4	0.0
LnGrp LOS	D	B	B	E	D	D	C	C	C	E	E	
Approach Vol, veh/h		1453			237			690			284	
Approach Delay, s/veh		20.1			44.6			30.3			71.0	
Approach LOS		C			D			C			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		12.0	30.0	28.0		40.0	10.0	48.0
Change Period (Y+Rc), s		5.0	5.0	* 5		5.0	4.0	5.0
Max Green Setting (Gmax), s		7.0	20.0	* 29		35.0	6.0	43.0
Max Q Clear Time (g_c+I1), s		8.1	18.5	6.8		13.4	5.2	16.7
Green Ext Time (p_c), s		0.0	1.1	1.0		3.3	0.0	8.3

Intersection Summary		
HCM 2010 Ctrl Delay		30.3
HCM 2010 LOS		C

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	240	810	10	10	570	150	10	10	10	30	10	60
Future Volume (veh/h)	240	810	10	10	570	150	10	10	10	30	10	60
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.98	0.96		0.94	0.95		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1900	1863	1900	1900	1863	1863
Adj Flow Rate, veh/h	253	853	10	11	600	129	11	11	6	32	11	19
Adj No. of Lanes	1	2	0	1	2	0	0	2	0	0	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	426	1633	19	300	976	209	417	392	223	439	133	460
Arrive On Green	0.11	0.46	0.43	0.00	0.34	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Sat Flow, veh/h	1774	3581	42	1774	2888	619	957	1285	732	1017	435	1509
Grp Volume(v), veh/h	253	421	442	11	367	362	16	0	12	43	0	19
Grp Sat Flow(s),veh/h/ln	1774	1770	1854	1774	1770	1738	1463	0	1511	1452	0	1509
Q Serve(g_s), s	4.6	8.3	8.3	0.1	8.5	8.6	0.0	0.0	0.3	0.2	0.0	0.4
Cycle Q Clear(g_c), s	4.6	8.3	8.3	0.1	8.5	8.6	0.3	0.0	0.3	0.8	0.0	0.4
Prop In Lane	1.00		0.02	1.00		0.36	0.70		0.48	0.74		1.00
Lane Grp Cap(c), veh/h	426	807	845	300	598	588	572	0	461	571	0	460
V/C Ratio(X)	0.59	0.52	0.52	0.04	0.61	0.62	0.03	0.00	0.03	0.08	0.00	0.04
Avail Cap(c_a), veh/h	481	807	845	441	687	675	926	0	833	924	0	832
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.7	9.5	9.5	13.6	13.5	13.8	11.9	0.0	11.9	12.1	0.0	12.0
Incr Delay (d2), s/veh	1.6	0.6	0.6	0.0	1.3	1.3	0.0	0.0	0.0	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.3	4.1	4.3	0.1	4.3	4.3	0.2	0.0	0.1	0.4	0.0	0.2
LnGrp Delay(d),s/veh	12.3	10.1	10.1	13.6	14.8	15.1	11.9	0.0	11.9	12.2	0.0	12.0
LnGrp LOS	B	B	B	B	B	B	B		B	B		B
Approach Vol, veh/h		1116			740			28			62	
Approach Delay, s/veh		10.6			14.9			11.9			12.1	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	3.7	26.3		18.9	9.5	20.5		18.9
Change Period (Y+Rc), s	3.0	5.5		4.0	3.0	5.5		4.0
Max Green Setting (Gmax), s	5.0	20.5		27.0	8.0	17.5		27.0
Max Q Clear Time (g_c+I1), s	2.1	10.3		2.8	6.6	10.6		2.3
Green Ext Time (p_c), s	0.0	6.3		0.4	0.1	4.3		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	12.3
HCM 2010 LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	440	400	10	0	630	200	10	0	20	40	0	90
Future Volume (veh/h)	440	400	10	0	630	200	10	0	20	40	0	90
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		1.00	0.98		0.97	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	463	421	9	0	663	0	11	0	10	42	0	56
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	1	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	503	2291	49	4	1428	581	204	34	95	397	0	863
Arrive On Green	0.15	0.65	0.61	0.00	0.40	0.00	0.13	0.00	0.13	0.16	0.00	0.13
Sat Flow, veh/h	3442	3541	76	1774	3539	1583	526	255	710	1376	0	2991
Grp Volume(v), veh/h	463	210	220	0	663	0	21	0	0	42	0	56
Grp Sat Flow(s),veh/h/ln	1721	1770	1846	1774	1770	1583	1491	0	0	1376	0	1495
Q Serve(g_s), s	5.4	2.0	2.0	0.0	5.6	0.0	0.0	0.0	0.0	0.5	0.0	0.6
Cycle Q Clear(g_c), s	5.4	2.0	2.0	0.0	5.6	0.0	0.4	0.0	0.0	1.0	0.0	0.6
Prop In Lane	1.00		0.04	1.00		1.00	0.52		0.48	1.00		1.00
Lane Grp Cap(c), veh/h	503	1145	1195	4	1428	581	333	0	0	397	0	863
V/C Ratio(X)	0.92	0.18	0.18	0.00	0.46	0.00	0.06	0.00	0.00	0.11	0.00	0.06
Avail Cap(c_a), veh/h	503	1293	1349	130	2328	983	1003	0	0	397	0	863
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	17.3	2.9	2.9	0.0	9.0	0.0	15.6	0.0	0.0	14.9	0.0	10.8
Incr Delay (d2), s/veh	22.3	0.1	0.1	0.0	0.2	0.0	0.1	0.0	0.0	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.1	1.0	1.0	0.0	2.7	0.0	0.2	0.0	0.0	0.4	0.0	0.2
LnGrp Delay(d),s/veh	39.6	3.0	3.0	0.0	9.2	0.0	15.7	0.0	0.0	15.0	0.0	10.9
LnGrp LOS	D	A	A		A		B			B		B
Approach Vol, veh/h		893			663			21			98	
Approach Delay, s/veh		22.0			9.2			15.7			12.7	
Approach LOS		C			A			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	0.0	30.6		10.5	10.0	20.6		10.5
Change Period (Y+Rc), s	4.0	5.5		5.0	4.0	5.5		* 5
Max Green Setting (Gmax), s	3.0	28.5		5.0	6.0	25.5		* 25
Max Q Clear Time (g_c+I1), s	0.0	4.0		3.0	7.4	7.6		2.4
Green Ext Time (p_c), s	0.0	7.2		0.1	0.0	6.4		0.1

Intersection Summary		
HCM 2010 Ctrl Delay		16.3
HCM 2010 LOS		B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	310	90	160	530	70	290	180	180	10	40	20
Future Volume (veh/h)	90	310	90	160	530	70	290	180	180	10	40	20
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.97	0.99		0.98	0.99		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	95	326	60	168	558	60	305	189	42	11	42	2
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	419	1121	204	516	1239	133	435	612	133	320	558	314
Arrive On Green	0.05	0.38	0.33	0.06	0.39	0.34	0.06	0.21	0.19	0.01	0.16	0.14
Sat Flow, veh/h	1774	2977	541	1774	3214	345	1774	2882	625	1774	3539	1566
Grp Volume(v), veh/h	95	192	194	168	307	311	305	114	117	11	42	2
Grp Sat Flow(s),veh/h/ln	1774	1770	1748	1774	1770	1789	1774	1770	1737	1774	1770	1566
Q Serve(g_s), s	1.6	3.6	3.7	3.0	6.1	6.2	3.0	2.6	2.7	0.3	0.5	0.0
Cycle Q Clear(g_c), s	1.6	3.6	3.7	3.0	6.1	6.2	3.0	2.6	2.7	0.3	0.5	0.0
Prop In Lane	1.00		0.31	1.00		0.19	1.00		0.36	1.00		1.00
Lane Grp Cap(c), veh/h	419	667	658	516	682	689	435	376	369	320	558	314
V/C Ratio(X)	0.23	0.29	0.29	0.33	0.45	0.45	0.70	0.30	0.32	0.03	0.08	0.01
Avail Cap(c_a), veh/h	434	1049	1036	516	1049	1060	435	1124	1103	418	2248	1062
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	9.7	10.3	10.6	9.6	10.8	11.0	18.8	15.7	15.9	17.4	17.0	15.1
Incr Delay (d2), s/veh	0.3	0.2	0.2	0.4	0.5	0.5	5.0	0.5	0.5	0.0	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	1.8	1.9	1.5	3.0	3.1	3.8	1.3	1.3	0.1	0.2	0.0
LnGrp Delay(d),s/veh	10.0	10.5	10.8	10.0	11.3	11.4	23.8	16.1	16.3	17.4	17.0	15.1
LnGrp LOS	A	B	B	B	B	B	C	B	B	B	B	B
Approach Vol, veh/h		481			786			536			55	
Approach Delay, s/veh		10.5			11.1			20.5			17.0	
Approach LOS		B			B			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.6	22.2	7.0	11.4	7.0	21.8	4.4	14.0
Change Period (Y+Rc), s	4.0	6.0	4.0	5.0	4.0	6.0	4.0	5.0
Max Green Setting (Gmax), s	3.0	26.0	3.0	29.0	3.0	26.0	3.0	29.0
Max Q Clear Time (g_c+I1), s	3.6	8.2	5.0	2.5	5.0	5.7	2.3	4.7
Green Ext Time (p_c), s	0.0	5.5	0.0	1.5	0.0	5.8	0.0	1.4

Intersection Summary	
HCM 2010 Ctrl Delay	13.8
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	1.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	50	60	30	150	10	20
Future Vol, veh/h	50	60	30	150	10	20
Conflicting Peds, #/hr	0	5	5	0	5	5
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	53	63	32	158	11	21

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	121	0	236	68
Stage 1	-	-	-	-	89	-
Stage 2	-	-	-	-	147	-
Critical Hdwy	-	-	4.14	-	7.54	6.94
Critical Hdwy Stg 1	-	-	-	-	6.54	-
Critical Hdwy Stg 2	-	-	-	-	6.54	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1464	-	699	981
Stage 1	-	-	-	-	908	-
Stage 2	-	-	-	-	841	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1458	-	682	974
Mov Cap-2 Maneuver	-	-	-	-	682	-
Stage 1	-	-	-	-	908	-
Stage 2	-	-	-	-	819	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.3	9.4
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	852	-	-	1458	-
HCM Lane V/C Ratio	0.037	-	-	0.022	-
HCM Control Delay (s)	9.4	-	-	7.5	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	220	420	210	240	310	200	110	1440	110	50	400	150
Future Volume (veh/h)	220	420	210	240	310	200	110	1440	110	50	400	150
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.97	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	232	442	148	253	326	130	116	1516	110	53	421	105
Adj No. of Lanes	2	2	0	2	2	0	2	3	0	1	3	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	339	645	214	282	528	206	651	1624	118	335	1372	330
Arrive On Green	0.10	0.25	0.23	0.08	0.21	0.19	0.19	0.34	0.32	0.19	0.34	0.32
Sat Flow, veh/h	3442	2608	865	3442	2482	970	3442	4828	350	1774	4080	982
Grp Volume(v), veh/h	232	299	291	253	231	225	116	1064	562	53	347	179
Grp Sat Flow(s),veh/h/ln	1721	1770	1703	1721	1770	1683	1721	1695	1788	1774	1695	1672
Q Serve(g_s), s	7.2	16.8	17.2	8.0	13.0	13.5	3.1	33.4	33.4	2.7	8.3	8.8
Cycle Q Clear(g_c), s	7.2	16.8	17.2	8.0	13.0	13.5	3.1	33.4	33.4	2.7	8.3	8.8
Prop In Lane	1.00		0.51	1.00		0.58	1.00		0.20	1.00		0.59
Lane Grp Cap(c), veh/h	339	438	421	282	376	358	651	1140	601	335	1140	563
V/C Ratio(X)	0.69	0.68	0.69	0.90	0.61	0.63	0.18	0.93	0.93	0.16	0.30	0.32
Avail Cap(c_a), veh/h	339	708	681	282	708	673	651	1140	601	335	1140	563
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.89	0.89	0.89	0.96	0.96	0.96
Uniform Delay (d), s/veh	47.9	37.5	38.1	50.0	39.2	39.9	37.4	35.3	35.5	37.3	27.0	27.6
Incr Delay (d2), s/veh	5.6	1.9	2.0	29.1	1.6	1.8	0.1	13.5	21.7	0.2	0.7	1.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	8.4	8.3	4.9	6.5	6.5	1.5	17.7	20.0	1.4	4.0	4.3
LnGrp Delay(d),s/veh	53.6	39.4	40.1	79.1	40.8	41.8	37.5	48.8	57.2	37.5	27.7	29.0
LnGrp LOS	D	D	D	E	D	D	D	D	E	D	C	C
Approach Vol, veh/h		822			709			1742			579	
Approach Delay, s/veh		43.6			54.8			50.8			29.0	
Approach LOS		D			D			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	24.8	41.0	13.0	31.2	24.8	41.0	16.8	27.4
Change Period (Y+Rc), s	4.0	6.0	4.0	6.0	4.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	4.0	35.0	9.0	42.0	4.0	35.0	9.0	* 42
Max Q Clear Time (g_c+I1), s	4.7	35.4	10.0	19.2	5.1	10.8	9.2	15.5
Green Ext Time (p_c), s	0.0	0.0	0.0	3.3	0.0	3.1	0.0	2.4

Intersection Summary	
HCM 2010 Ctrl Delay	46.7
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	50	60	90	30	40	70	1580	70	10	790	30
Future Volume (veh/h)	40	50	60	90	30	40	70	1580	70	10	790	30
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.97	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	42	53	8	95	32	5	74	1663	71	11	832	29
Adj No. of Lanes	1	1	1	1	1	1	1	3	0	1	3	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	330	359	296	313	359	296	590	1688	72	568	1640	57
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.44	0.45	0.43	0.32	0.32	0.31
Sat Flow, veh/h	1346	1863	1538	1318	1863	1538	1774	5001	213	1774	5045	176
Grp Volume(v), veh/h	42	53	8	95	32	5	74	1127	607	11	559	302
Grp Sat Flow(s),veh/h/ln	1346	1863	1538	1318	1863	1538	1774	1695	1824	1774	1695	1830
Q Serve(g_s), s	2.1	1.9	0.3	5.2	1.1	0.2	2.0	26.3	26.3	0.3	10.7	10.7
Cycle Q Clear(g_c), s	3.2	1.9	0.3	7.1	1.1	0.2	2.0	26.3	26.3	0.3	10.7	10.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.12	1.00		0.10
Lane Grp Cap(c), veh/h	330	359	296	313	359	296	590	1144	616	568	1102	595
V/C Ratio(X)	0.13	0.15	0.03	0.30	0.09	0.02	0.13	0.99	0.99	0.02	0.51	0.51
Avail Cap(c_a), veh/h	693	862	711	668	862	711	590	1144	616	568	1102	595
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.60	0.60	0.60	0.89	0.89	0.89
Uniform Delay (d), s/veh	27.9	26.8	26.2	29.8	26.5	26.2	15.4	21.8	21.9	18.6	21.8	21.9
Incr Delay (d2), s/veh	0.2	0.2	0.0	0.5	0.1	0.0	0.1	17.3	24.8	0.0	1.5	2.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	1.0	0.1	1.9	0.6	0.1	1.0	14.9	17.3	0.2	5.2	5.8
LnGrp Delay(d),s/veh	28.0	27.0	26.3	30.3	26.6	26.2	15.5	39.1	46.7	18.6	23.3	24.6
LnGrp LOS	C	C	C	C	C	C	B	D	D	B	C	C
Approach Vol, veh/h		103			132			1808			872	
Approach Delay, s/veh		27.4			29.3			40.7			23.7	
Approach LOS		C			C			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	29.6	31.0		19.4	30.6	30.0		19.4
Change Period (Y+Rc), s	4.0	5.0		4.0	4.0	5.0		4.0
Max Green Setting (Gmax), s	4.0	26.0		37.0	5.0	25.0		37.0
Max Q Clear Time (g_c+I1), s	2.3	28.3		5.2	4.0	12.7		9.1
Green Ext Time (p_c), s	0.0	0.0		0.9	0.0	4.1		0.9

Intersection Summary			
HCM 2010 Ctrl Delay			34.6
HCM 2010 LOS			C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	20	260	310	40	30	150	1670	460	30	920	30
Future Volume (veh/h)	20	20	260	310	40	30	150	1670	460	30	920	30
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	21	21	159	326	42	12	158	1758	195	32	968	11
Adj No. of Lanes	1	1	0	1	1	0	1	3	1	1	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	588	73	554	465	543	155	155	2212	687	45	1896	588
Arrive On Green	0.39	0.39	0.39	0.39	0.39	0.39	0.09	0.43	0.43	0.01	0.12	0.12
Sat Flow, veh/h	1343	188	1422	1198	1394	398	1774	5085	1580	1774	5085	1577
Grp Volume(v), veh/h	21	0	180	326	0	54	158	1758	195	32	968	11
Grp Sat Flow(s),veh/h/ln	1343	0	1609	1198	0	1792	1774	1695	1580	1774	1695	1577
Q Serve(g_s), s	0.8	0.0	6.1	20.6	0.0	1.5	7.0	23.9	6.4	1.4	14.2	0.5
Cycle Q Clear(g_c), s	2.3	0.0	6.1	26.7	0.0	1.5	7.0	23.9	6.4	1.4	14.2	0.5
Prop In Lane	1.00		0.88	1.00		0.22	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	588	0	627	465	0	698	155	2212	687	45	1896	588
V/C Ratio(X)	0.04	0.00	0.29	0.70	0.00	0.08	1.02	0.79	0.28	0.71	0.51	0.02
Avail Cap(c_a), veh/h	719	0	785	582	0	873	155	2212	687	89	1896	588
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	16.1	0.0	16.8	26.0	0.0	15.4	36.5	19.5	14.6	39.4	28.2	22.2
Incr Delay (d2), s/veh	0.0	0.0	0.2	2.8	0.0	0.0	77.0	3.1	1.0	18.0	1.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	2.7	7.1	0.0	0.8	6.7	11.7	3.0	0.9	6.9	0.2
LnGrp Delay(d),s/veh	16.1	0.0	17.0	28.7	0.0	15.4	113.7	22.6	15.6	57.3	29.2	22.3
LnGrp LOS	B		B	C		B	F	C	B	E	C	C
Approach Vol, veh/h		201			380			2111			1011	
Approach Delay, s/veh		16.9			26.8			28.7			30.0	
Approach LOS		B			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.0	38.8		35.2	11.0	33.8		35.2
Change Period (Y+Rc), s	4.0	5.0		4.0	4.0	5.0		4.0
Max Green Setting (Gmax), s	4.0	24.0		39.0	7.0	21.0		39.0
Max Q Clear Time (g_c+I1), s	3.4	25.9		28.7	9.0	16.2		8.1
Green Ext Time (p_c), s	0.0	0.0		2.1	0.0	4.5		3.0

Intersection Summary		
HCM 2010 Ctrl Delay		28.3
HCM 2010 LOS		C

I-215/University Parkway Interchange
Diverging Diamond Alternative
Cumulative AM Peak Hour

Intersection	Control	Delay	LOS
12. University Parkway/I 215 Northbound Ramps	Signal	33.4	C
13. University Parkway/I 215 Southbound Ramps	Signal	11.0	B

	Delay					
University Parkway/I 215 NB Ramps Intersection	**WBL**	**WBR**	**SBT**	**SBR**	**NBL**	**NBT**
12. University Parkway/I 215 Northbound Ramps		55.3	11.1	8.2		22.3
23. University Parkway SB Approach Merge	42.7		0.5			
Combined Delay	42.7	55.3	11.6	8.2	0	22.3
Volume	350	1730	1390	100	70	560
Approach Delay	53.2		11.4		19.8	
Approach Volume	2080		1490		630	

	Delay					
University Parkway/I 215 SB Ramps Intersection	**EBL**	**EBR**	**SBL**	**SBT**	**NBT**	**NBR**
13. University Parkway/I 215 Southbound Ramps		13.9		20.6	25.5	
33. University Parkway NB Approach Merge	12.5				0.9	
Combined Delay	12.5	13.9	0	20.6	26.4	0
Volume	90	210	1100	640	540	280
Approach Delay	13.5		7.6		17.4	
Approach Volume	300		1740		820	

Movement	WBR	NBT	SBL	SBR
Lane Configurations				
Traffic Volume (vph)	1730	560	1390	100
Future Volume (vph)	1730	560	1390	100
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	8.0	8.0
Lane Util. Factor	0.88	0.95	0.94	1.00
Frt	0.85	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00
Satd. Flow (prot)	2656	3374	4757	1509
Flt Permitted	1.00	1.00	0.95	1.00
Satd. Flow (perm)	2656	3374	4757	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1821	589	1463	105
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	1821	589	1463	105
Turn Type	Prot	NA	Prot	Prot
Protected Phases	2	4	6	6
Permitted Phases				
Actuated Green, G (s)	65.0	25.0	61.0	61.0
Effective Green, g (s)	65.0	25.0	61.0	61.0
Actuated g/C Ratio	0.65	0.25	0.61	0.61
Clearance Time (s)	4.0	6.0	8.0	8.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1726	843	2901	920
v/s Ratio Prot	c0.69	c0.17	0.31	0.07
v/s Ratio Perm				
v/c Ratio	1.06	0.70	0.50	0.11
Uniform Delay, d1	17.5	34.1	11.0	8.2
Progression Factor	1.00	0.52	1.00	1.00
Incremental Delay, d2	37.8	4.5	0.1	0.1
Delay (s)	55.3	22.3	11.1	8.2
Level of Service	E	C	B	A
Approach Delay (s)		22.3		
Approach LOS		C		

Intersection Summary			
HCM 2000 Control Delay	32.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	84.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR2	SER	SWL
Lane Configurations				
Traffic Volume (vph)	540	280	210	640
Future Volume (vph)	540	280	210	640
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	8.0	4.0	4.0	6.0
Lane Util. Factor	0.95	1.00	1.00	1.00
Frt	1.00	0.85	0.86	1.00
Flt Protected	1.00	1.00	1.00	0.95
Satd. Flow (prot)	3374	1509	1536	1687
Flt Permitted	1.00	1.00	1.00	0.95
Satd. Flow (perm)	3374	1509	1536	1687
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	568	295	221	674
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	568	295	221	674
Turn Type	NA	Free	Perm	Prot
Protected Phases	6			8
Permitted Phases		Free	4	
Actuated Green, G (s)	36.5	100.0	51.5	49.5
Effective Green, g (s)	36.5	100.0	51.5	49.5
Actuated g/C Ratio	0.36	1.00	0.52	0.50
Clearance Time (s)	8.0		4.0	6.0
Vehicle Extension (s)	3.0		3.0	3.0
Lane Grp Cap (vph)	1231	1509	791	835
v/s Ratio Prot	c0.17			c0.40
v/s Ratio Perm		0.20	0.14	
v/c Ratio	0.46	0.20	0.28	0.81
Uniform Delay, d1	24.2	0.0	13.7	21.2
Progression Factor	1.00	1.00	1.00	0.75
Incremental Delay, d2	1.2	0.3	0.2	4.6
Delay (s)	25.5	0.3	13.9	20.6
Level of Service	C	A	B	C
Approach Delay (s)	16.9			20.6
Approach LOS	B			C

Intersection Summary			
HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	62.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Volume (vph)	350	0	0	0	0	1390
Future Volume (vph)	350	0	0	0	0	1390
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0					4.0
Lane Util. Factor	1.00					0.91
Frt	1.00					1.00
Flt Protected	0.95					1.00
Satd. Flow (prot)	1687					4848
Flt Permitted	0.95					1.00
Satd. Flow (perm)	1687					4848
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	368	0	0	0	0	1463
RTOR Reduction (vph)	39	0	0	0	0	0
Lane Group Flow (vph)	329	0	0	0	0	1463
Turn Type	Prot					NA
Protected Phases	8					2
Permitted Phases						
Actuated Green, G (s)	27.0					65.0
Effective Green, g (s)	27.0					65.0
Actuated g/C Ratio	0.27					0.65
Clearance Time (s)	4.0					4.0
Vehicle Extension (s)	3.0					3.0
Lane Grp Cap (vph)	455					3151
v/s Ratio Prot	c0.20					c0.30
v/s Ratio Perm						
v/c Ratio	0.72					0.46
Uniform Delay, d1	33.1					8.8
Progression Factor	1.00					0.04
Incremental Delay, d2	9.6					0.1
Delay (s)	42.7					0.5
Level of Service	D					A
Approach Delay (s)	42.7		0.0			0.5
Approach LOS	D		A			A

Intersection Summary			
HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	90	0	0	540	0	0
Future Volume (vph)	90	0	0	540	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	1687			3374		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	1687			3374		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	95	0	0	568	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	95	0	0	568	0	0
Turn Type	Prot			NA		
Protected Phases	4			2		
Permitted Phases			2			
Actuated Green, G (s)	51.5			40.5		
Effective Green, g (s)	51.5			40.5		
Actuated g/C Ratio	0.52			0.40		
Clearance Time (s)	4.0			4.0		
Vehicle Extension (s)	3.0			3.0		
Lane Grp Cap (vph)	868			1366		
v/s Ratio Prot	c0.06			c0.17		
v/s Ratio Perm						
v/c Ratio	0.11			0.42		
Uniform Delay, d1	12.5			21.3		
Progression Factor	1.00			0.00		
Incremental Delay, d2	0.1			0.8		
Delay (s)	12.5			0.9		
Level of Service	B			A		
Approach Delay (s)	12.5			0.9	0.0	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	2.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	26.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	130	390	90	240	430	100	90	430	150	60	390	60
Future Volume (veh/h)	130	390	90	240	430	100	90	430	150	60	390	60
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.99	0.98		0.95	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1976	1863	1863	1900	1863	1863	1976	1863	1863	1976
Adj Flow Rate, veh/h	137	411	73	253	453	83	95	453	110	63	411	46
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	523	1208	213	549	1217	222	304	947	228	258	1082	120
Arrive On Green	0.11	0.40	0.38	0.12	0.41	0.38	0.34	0.34	0.32	0.34	0.34	0.32
Sat Flow, veh/h	1774	2999	528	1774	2988	544	914	2796	672	832	3196	355
Grp Volume(v), veh/h	137	241	243	253	267	269	95	285	278	63	226	231
Grp Sat Flow(s),veh/h/ln	1774	1770	1757	1774	1770	1762	914	1770	1699	832	1770	1782
Q Serve(g_s), s	3.6	8.0	8.2	7.1	9.0	9.2	7.5	10.8	11.1	5.5	8.2	8.4
Cycle Q Clear(g_c), s	3.6	8.0	8.2	7.1	9.0	9.2	15.9	10.8	11.1	16.6	8.2	8.4
Prop In Lane	1.00		0.30	1.00		0.31	1.00		0.40	1.00		0.20
Lane Grp Cap(c), veh/h	523	713	708	549	721	718	304	599	575	258	599	603
V/C Ratio(X)	0.26	0.34	0.34	0.46	0.37	0.37	0.31	0.48	0.48	0.24	0.38	0.38
Avail Cap(c_a), veh/h	532	713	708	549	721	718	325	639	614	277	639	644
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	12.4	17.5	17.8	13.1	17.6	17.9	27.4	22.2	22.5	28.8	21.3	21.5
Incr Delay (d2), s/veh	0.3	1.3	1.3	0.6	1.5	1.5	0.6	0.6	0.6	0.5	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	4.1	4.2	3.5	4.7	4.7	1.9	5.3	5.3	1.3	4.1	4.2
LnGrp Delay(d),s/veh	12.7	18.8	19.1	13.7	19.1	19.4	28.0	22.7	23.2	29.3	21.7	21.9
LnGrp LOS	B	B	B	B	B	B	C	C	C	C	C	C
Approach Vol, veh/h		621			789			658			520	
Approach Delay, s/veh		17.6			17.4			23.7			22.7	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.6	38.6		32.8	14.0	38.2		32.8
Change Period (Y+Rc), s	4.0	6.0		5.7	4.0	6.0		5.7
Max Green Setting (Gmax), s	10.0	30.3		29.0	10.0	30.3		29.0
Max Q Clear Time (g_c+I1), s	5.6	11.2		18.6	9.1	10.2		17.9
Green Ext Time (p_c), s	0.1	6.6		5.3	0.1	6.7		5.6

Intersection Summary	
HCM 2010 Ctrl Delay	20.1
HCM 2010 LOS	C

Intersection	
Intersection Delay, s/veh	10.1
Intersection LOS	B

Movement	EBU	EBL	EBR	NBU	NBL	NBT	SBU	SBT	SBR
Lane Configurations									
Traffic Vol, veh/h	0	10	250	0	440	10	0	10	10
Future Vol, veh/h	0	10	250	0	440	10	0	10	10
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	11	263	0	463	11	0	11	11
Number of Lanes	0	1	2	0	2	1	0	2	1

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	3	3
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	3	3	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	3	0	3
HCM Control Delay	7.8	11.6	7.8
HCM LOS	A	B	A

Lane	NBLn1	NBLn2	NBLn3	EBLn1	EBLn2	EBLn3	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	100%	0%	100%	0%	0%	0%	0%	0%
Vol Thru, %	0%	0%	100%	0%	0%	0%	100%	100%	0%
Vol Right, %	0%	0%	0%	0%	100%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	220	220	10	10	125	125	5	5	10
LT Vol	220	220	0	10	0	0	0	0	0
Through Vol	0	0	10	0	0	0	5	5	0
RT Vol	0	0	0	0	125	125	0	0	10
Lane Flow Rate	232	232	11	11	132	132	5	5	11
Geometry Grp	8	8	8	7	7	7	8	8	8
Degree of Util (X)	0.369	0.369	0.01	0.018	0.184	0.121	0.009	0.009	0.011
Departure Headway (Hd)	5.734	5.734	3.49	6.23	5.036	3.312	6.111	6.111	3.659
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	632	632	1032	575	712	1076	580	580	960
Service Time	3.434	3.434	1.19	3.966	2.773	1.049	3.905	3.905	1.452
HCM Lane V/C Ratio	0.367	0.367	0.011	0.019	0.185	0.123	0.009	0.009	0.011
HCM Control Delay	11.7	11.7	6.2	9.1	8.9	6.5	9	9	6.5
HCM Lane LOS	B	B	A	A	A	A	A	A	A
HCM 95th-tile Q	1.7	1.7	0	0.1	0.7	0.4	0	0	0

Intersection	
Int Delay, s/veh	27.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	10	40	260	10	140	30	280	160	80	180	10
Future Vol, veh/h	10	10	40	260	10	140	30	280	160	80	180	10
Conflicting Peds, #/hr	3	0	4	10	0	3	4	0	10	9	0	3
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	205	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	11	42	274	11	147	32	295	168	84	189	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	586	903	114	730	824	245	204	0	0	473	0	0
Stage 1	367	367	-	452	452	-	-	-	-	-	-	-
Stage 2	219	536	-	278	372	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	394	276	917	310	307	755	1365	-	-	1085	-	-
Stage 1	625	621	-	557	569	-	-	-	-	-	-	-
Stage 2	763	522	-	705	617	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	282	246	906	~ 260	273	747	1354	-	-	1082	-	-
Mov Cap-2 Maneuver	282	246	-	~ 260	273	-	-	-	-	-	-	-
Stage 1	608	571	-	539	551	-	-	-	-	-	-	-
Stage 2	585	505	-	604	567	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.3	75.7	0.5	2.6
HCM LOS	B	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1354	-	-	499	260	670	1082	-	-
HCM Lane V/C Ratio	0.023	-	-	0.127	1.053	0.236	0.078	-	-
HCM Control Delay (s)	7.7	-	-	13.3	112.5	12	8.6	-	-
HCM Lane LOS	A	-	-	B	F	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.4	11	0.9	0.3	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Intersection Delay, s/veh	16.4
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	10	0	10	0	210	0	90	0	20	370	70
Future Vol, veh/h	0	10	0	10	0	210	0	90	0	20	370	70
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	11	0	11	0	221	0	95	0	21	389	74
Number of Lanes	0	0	1	0	0	1	0	1	0	1	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	3
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	3	3	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	3	2
HCM Control Delay	11.8	16.6	16.1
HCM LOS	B	C	C

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	50%	100%	0%	100%	0%	0%
Vol Thru, %	0%	100%	64%	0%	0%	0%	0%	100%	82%
Vol Right, %	0%	0%	36%	50%	0%	100%	0%	0%	18%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	20	247	193	20	210	90	40	273	167
LT Vol	20	0	0	10	210	0	40	0	0
Through Vol	0	247	123	0	0	0	0	273	137
RT Vol	0	0	70	10	0	90	0	0	30
Lane Flow Rate	21	260	204	21	221	95	42	288	175
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.046	0.527	0.398	0.05	0.502	0.183	0.091	0.58	0.347
Departure Headway (Hd)	7.819	7.308	7.049	8.585	8.172	6.964	7.767	7.256	7.127
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	458	493	511	417	442	515	462	498	505
Service Time	5.562	5.051	4.791	6.348	5.917	4.708	5.508	4.996	4.868
HCM Lane V/C Ratio	0.046	0.527	0.399	0.05	0.5	0.184	0.091	0.578	0.347
HCM Control Delay	10.9	17.9	14.4	11.8	18.9	11.3	11.3	19.6	13.6
HCM Lane LOS	B	C	B	B	C	B	B	C	B
HCM 95th-tile Q	0.1	3	1.9	0.2	2.7	0.7	0.3	3.6	1.5

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	40	410	30
Future Vol, veh/h	0	40	410	30
Peak Hour Factor	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	42	432	32
Number of Lanes	0	1	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	3
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	16.8
HCM LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	460	610	110	510	80	620	290	70	50	230	360
Future Volume (veh/h)	140	460	610	110	510	80	620	290	70	50	230	360
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95	1.00		0.89	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	147	484	203	116	537	73	672	278	67	53	242	0
Adj No. of Lanes	1	2	1	1	2	0	2	1	0	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	376	1239	529	207	759	103	1064	433	104	177	354	145
Arrive On Green	0.35	0.58	0.58	0.12	0.25	0.24	0.30	0.30	0.29	0.10	0.10	0.00
Sat Flow, veh/h	1774	3539	1510	1774	3081	416	3548	1445	348	1774	3539	1583
Grp Volume(v), veh/h	147	484	203	116	307	303	672	0	345	53	242	0
Grp Sat Flow(s),veh/h/ln	1774	1770	1510	1774	1770	1728	1774	0	1793	1774	1770	1583
Q Serve(g_s), s	7.5	8.8	8.6	7.4	19.0	19.2	19.6	0.0	20.0	3.3	7.9	0.0
Cycle Q Clear(g_c), s	7.5	8.8	8.6	7.4	19.0	19.2	19.6	0.0	20.0	3.3	7.9	0.0
Prop In Lane	1.00		1.00	1.00		0.24	1.00		0.19	1.00		1.00
Lane Grp Cap(c), veh/h	376	1239	529	207	436	426	1064	0	538	177	354	145
V/C Ratio(X)	0.39	0.39	0.38	0.56	0.70	0.71	0.63	0.00	0.64	0.30	0.68	0.00
Avail Cap(c_a), veh/h	376	1239	529	207	560	547	1064	0	538	177	354	145
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.72	0.72	0.72	1.00	1.00	1.00	0.85	0.00	0.85	1.00	1.00	0.00
Uniform Delay (d), s/veh	32.9	18.0	18.0	50.1	41.3	41.5	36.3	0.0	36.5	50.1	52.2	0.0
Incr Delay (d2), s/veh	2.2	0.7	1.5	10.5	9.2	9.7	2.4	0.0	4.9	4.3	10.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.8	4.4	3.8	4.2	10.4	10.3	10.0	0.0	10.6	1.8	4.4	0.0
LnGrp Delay(d),s/veh	35.1	18.7	19.5	60.6	50.5	51.2	38.7	0.0	41.4	54.4	62.4	0.0
LnGrp LOS	D	B	B	E	D	D	D		D	D	E	
Approach Vol, veh/h		834			726			1017			295	
Approach Delay, s/veh		21.8			52.4			39.6			61.0	
Approach LOS		C			D			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		16.0	30.5	33.5		40.0	18.0	46.0
Change Period (Y+Rc), s		5.0	5.0	* 5		5.0	4.0	5.0
Max Green Setting (Gmax), s		11.0	18.0	* 37		35.0	14.0	41.0
Max Q Clear Time (g_c+I1), s		9.9	9.5	21.2		22.0	9.4	10.8
Green Ext Time (p_c), s		0.2	2.7	3.6		3.8	0.1	4.3

Intersection Summary	
HCM 2010 Ctrl Delay	39.9
HCM 2010 LOS	D

Notes
User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	840	20	20	760	60	30	10	10	130	10	190
Future Volume (veh/h)	90	840	20	20	760	60	30	10	10	130	10	190
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.99	0.93		0.90	0.92		0.90
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1900	1863	1900	1900	1863	1863
Adj Flow Rate, veh/h	95	884	19	21	800	56	32	11	3	137	11	66
Adj No. of Lanes	1	2	0	1	2	0	0	2	0	0	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	264	1337	29	214	1126	79	533	515	141	610	45	588
Arrive On Green	0.05	0.38	0.35	0.01	0.34	0.31	0.41	0.41	0.41	0.41	0.41	0.41
Sat Flow, veh/h	1774	3539	76	1774	3353	235	998	1251	341	1196	108	1427
Grp Volume(v), veh/h	95	442	461	21	422	434	32	0	14	148	0	66
Grp Sat Flow(s),veh/h/ln	1774	1770	1845	1774	1770	1818	998	0	1592	1305	0	1427
Q Serve(g_s), s	2.2	12.3	12.3	0.5	12.4	12.4	1.1	0.0	0.3	4.2	0.0	1.7
Cycle Q Clear(g_c), s	2.2	12.3	12.3	0.5	12.4	12.4	5.6	0.0	0.3	4.5	0.0	1.7
Prop In Lane	1.00		0.04	1.00		0.13	1.00		0.21	0.93		1.00
Lane Grp Cap(c), veh/h	264	669	697	214	594	611	533	0	656	654	0	588
V/C Ratio(X)	0.36	0.66	0.66	0.10	0.71	0.71	0.06	0.00	0.02	0.23	0.00	0.11
Avail Cap(c_a), veh/h	295	669	697	319	656	674	585	0	724	710	0	649
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.8	15.3	15.3	16.0	17.2	17.3	13.5	0.0	10.3	11.6	0.0	10.8
Incr Delay (d2), s/veh	0.8	2.4	2.3	0.2	3.2	3.1	0.0	0.0	0.0	0.2	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	6.3	6.6	0.1	6.5	6.7	0.4	0.0	0.1	1.6	0.0	0.7
LnGrp Delay(d),s/veh	15.6	17.7	17.7	16.2	20.4	20.4	13.5	0.0	10.4	11.8	0.0	10.8
LnGrp LOS	B	B	B	B	C	C	B		B	B		B
Approach Vol, veh/h		998			877			46			214	
Approach Delay, s/veh		17.5			20.3			12.5			11.5	
Approach LOS		B			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	4.5	26.4		28.5	7.0	23.9		28.5
Change Period (Y+Rc), s	3.0	5.5		4.0	3.0	5.5		4.0
Max Green Setting (Gmax), s	5.0	20.5		27.0	5.0	20.5		27.0
Max Q Clear Time (g_c+I1), s	2.5	14.3		6.5	4.2	14.4		7.6
Green Ext Time (p_c), s	0.0	4.6		1.4	0.0	4.1		1.4

Intersection Summary		
HCM 2010 Ctrl Delay		17.9
HCM 2010 LOS		B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	320	650	10	10	370	150	10	0	10	210	10	460
Future Volume (veh/h)	320	650	10	10	370	150	10	0	10	210	10	460
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		1.00	0.98		0.96	0.98		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	337	684	10	11	389	0	11	0	9	221	0	324
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	1	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	485	1665	24	15	1183	473	252	35	127	504	0	1092
Arrive On Green	0.14	0.47	0.43	0.01	0.33	0.00	0.22	0.00	0.22	0.24	0.00	0.22
Sat Flow, veh/h	3442	3569	52	1774	3539	1583	550	160	581	1367	0	2956
Grp Volume(v), veh/h	337	339	355	11	389	0	20	0	0	221	0	324
Grp Sat Flow(s),veh/h/ln	1721	1770	1852	1774	1770	1583	1291	0	0	1367	0	1478
Q Serve(g_s), s	4.0	5.4	5.4	0.3	3.5	0.0	0.0	0.0	0.0	5.7	0.0	3.3
Cycle Q Clear(g_c), s	4.0	5.4	5.4	0.3	3.5	0.0	0.4	0.0	0.0	6.1	0.0	3.3
Prop In Lane	1.00		0.03	1.00		1.00	0.55		0.45	1.00		1.00
Lane Grp Cap(c), veh/h	485	826	864	15	1183	473	413	0	0	504	0	1092
V/C Ratio(X)	0.69	0.41	0.41	0.72	0.33	0.00	0.05	0.00	0.00	0.44	0.00	0.30
Avail Cap(c_a), veh/h	568	1335	1397	125	2336	989	861	0	0	624	0	1352
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	17.4	7.5	7.5	21.0	10.6	0.0	13.1	0.0	0.0	14.4	0.0	9.8
Incr Delay (d2), s/veh	3.0	0.3	0.3	47.8	0.2	0.0	0.0	0.0	0.0	0.6	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	2.6	2.7	0.3	1.7	0.0	0.2	0.0	0.0	2.4	0.0	1.4
LnGrp Delay(d),s/veh	20.3	7.8	7.8	68.8	10.7	0.0	13.2	0.0	0.0	15.0	0.0	9.9
LnGrp LOS	C	A	A	E	B		B			B		A
Approach Vol, veh/h		1031			400			20			545	
Approach Delay, s/veh		11.9			12.3			13.2			12.0	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	4.4	23.8		14.3	10.0	18.2		14.3
Change Period (Y+Rc), s	4.0	5.5		5.0	4.0	5.5		* 5
Max Green Setting (Gmax), s	3.0	30.5		13.0	7.0	26.5		* 25
Max Q Clear Time (g_c+I1), s	2.3	7.4		8.1	6.0	5.5		2.4
Green Ext Time (p_c), s	0.0	6.8		1.1	0.1	6.6		2.3

Intersection Summary	
HCM 2010 Ctrl Delay	12.0
HCM 2010 LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	430	330	60	320	40	150	90	80	50	160	100
Future Volume (veh/h)	110	430	330	60	320	40	150	90	80	50	160	100
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	1.00		0.97	0.97		0.96	0.96		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	116	453	181	63	337	30	158	95	18	53	168	23
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	422	824	326	304	1058	94	505	964	177	528	1084	499
Arrive On Green	0.05	0.34	0.30	0.04	0.32	0.29	0.05	0.33	0.31	0.03	0.31	0.29
Sat Flow, veh/h	1774	2458	973	1774	3282	290	1774	2966	545	1774	3539	1518
Grp Volume(v), veh/h	116	325	309	63	181	186	158	55	58	53	168	23
Grp Sat Flow(s),veh/h/ln	1774	1770	1661	1774	1770	1803	1774	1770	1741	1774	1770	1518
Q Serve(g_s), s	2.7	8.9	9.1	1.5	4.6	4.7	3.0	1.3	1.4	1.2	2.0	0.6
Cycle Q Clear(g_c), s	2.7	8.9	9.1	1.5	4.6	4.7	3.0	1.3	1.4	1.2	2.0	0.6
Prop In Lane	1.00		0.59	1.00		0.16	1.00		0.31	1.00		1.00
Lane Grp Cap(c), veh/h	422	593	557	304	570	581	505	575	566	528	1084	499
V/C Ratio(X)	0.27	0.55	0.56	0.21	0.32	0.32	0.31	0.10	0.10	0.10	0.15	0.05
Avail Cap(c_a), veh/h	422	837	785	327	837	852	505	896	882	562	1793	803
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	14.0	16.0	16.6	14.6	15.1	15.3	14.6	13.9	14.1	14.1	15.0	13.6
Incr Delay (d2), s/veh	0.3	0.8	0.9	0.3	0.3	0.3	0.4	0.1	0.1	0.1	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	4.5	4.3	0.7	2.3	2.3	1.8	0.6	0.7	0.6	1.0	0.3
LnGrp Delay(d),s/veh	14.4	16.8	17.5	14.9	15.5	15.6	14.9	14.0	14.1	14.1	15.0	13.7
LnGrp LOS	B	B	B	B	B	B	B	B	B	B	B	B
Approach Vol, veh/h		750			430			271			244	
Approach Delay, s/veh		16.7			15.4			14.6			14.7	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.0	23.1	7.0	22.1	6.2	23.9	5.9	23.3
Change Period (Y+Rc), s	4.0	6.0	4.0	5.0	4.0	6.0	4.0	5.0
Max Green Setting (Gmax), s	3.0	26.0	3.0	29.0	3.0	26.0	3.0	29.0
Max Q Clear Time (g_c+I1), s	4.7	6.7	5.0	4.0	3.5	11.1	3.2	3.4
Green Ext Time (p_c), s	0.0	5.7	0.0	1.8	0.0	5.1	0.0	1.8

Intersection Summary	
HCM 2010 Ctrl Delay	15.8
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	3.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	130	40	30	90	40	30
Future Vol, veh/h	130	40	30	90	40	30
Conflicting Peds, #/hr	0	88	49	0	88	49
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	137	42	32	95	42	32

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	267	0	445	226
Stage 1	-	-	-	-	246	-
Stage 2	-	-	-	-	199	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1294	-	542	777
Stage 1	-	-	-	-	772	-
Stage 2	-	-	-	-	815	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1246	-	459	698
Mov Cap-2 Maneuver	-	-	-	-	459	-
Stage 1	-	-	-	-	720	-
Stage 2	-	-	-	-	741	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2	12.8
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	538	-	-	1246	-
HCM Lane V/C Ratio	0.137	-	-	0.025	-
HCM Control Delay (s)	12.8	-	-	8	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.5	-	-	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	130	480	170	260	420	90	320	990	330	120	1280	90
Future Volume (veh/h)	130	480	170	260	420	90	320	990	330	120	1280	90
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	137	505	143	274	442	76	337	1042	302	126	1347	89
Adj No. of Lanes	2	2	0	2	2	0	2	3	0	1	3	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	333	717	202	287	705	120	344	1230	356	330	2042	135
Arrive On Green	0.10	0.26	0.25	0.08	0.23	0.22	0.10	0.32	0.30	0.19	0.42	0.40
Sat Flow, veh/h	3442	2717	765	3442	3015	515	3442	3885	1125	1774	4869	322
Grp Volume(v), veh/h	137	328	320	274	258	260	337	909	435	126	938	498
Grp Sat Flow(s),veh/h/ln	1721	1770	1713	1721	1770	1760	1721	1695	1619	1774	1695	1800
Q Serve(g_s), s	4.5	20.1	20.4	9.5	15.7	16.0	11.7	30.1	30.2	7.5	26.7	26.7
Cycle Q Clear(g_c), s	4.5	20.1	20.4	9.5	15.7	16.0	11.7	30.1	30.2	7.5	26.7	26.7
Prop In Lane	1.00		0.45	1.00		0.29	1.00		0.69	1.00		0.18
Lane Grp Cap(c), veh/h	333	467	452	287	414	411	344	1074	513	330	1422	755
V/C Ratio(X)	0.41	0.70	0.71	0.96	0.62	0.63	0.98	0.85	0.85	0.38	0.66	0.66
Avail Cap(c_a), veh/h	333	649	628	287	664	660	344	1074	513	330	1422	755
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.73	0.73	0.73	0.86	0.86	0.86
Uniform Delay (d), s/veh	51.0	39.9	40.4	54.8	41.2	41.6	53.9	38.3	39.0	42.8	28.0	28.1
Incr Delay (d2), s/veh	0.8	2.0	2.2	41.0	1.5	1.6	36.1	6.3	12.2	0.6	2.1	3.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.2	10.1	9.9	6.2	7.9	7.9	7.3	15.0	15.2	3.7	12.8	14.1
LnGrp Delay(d),s/veh	51.8	41.9	42.6	95.8	42.8	43.2	89.9	44.5	51.2	43.4	30.0	32.0
LnGrp LOS	D	D	D	F	D	D	F	D	D	D	C	C
Approach Vol, veh/h		785			792			1681			1562	
Approach Delay, s/veh		43.9			61.3			55.4			31.7	
Approach LOS		D			E			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	28.3	42.0	14.0	35.7	16.0	54.3	17.6	32.1
Change Period (Y+Rc), s	6.0	* 6	4.0	6.0	4.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	12.0	* 36	10.0	42.0	12.0	36.0	9.0	* 43
Max Q Clear Time (g_c+I1), s	9.5	32.2	11.5	22.4	13.7	28.7	6.5	18.0
Green Ext Time (p_c), s	0.8	2.6	0.0	3.3	0.0	4.8	1.0	2.7

Intersection Summary	
HCM 2010 Ctrl Delay	46.8
HCM 2010 LOS	D

Notes
* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	40	60	180	60	60	50	1530	140	200	1450	60
Future Volume (veh/h)	50	40	60	180	60	60	50	1530	140	200	1450	60
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.99	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	53	42	10	189	63	10	53	1611	139	211	1526	60
Adj No. of Lanes	1	1	1	1	1	1	1	3	0	1	3	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	335	425	352	352	425	357	358	2452	211	242	2206	87
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.40	1.00	1.00	0.14	0.44	0.43
Sat Flow, veh/h	1307	1863	1541	1331	1863	1563	1774	4758	410	1774	5015	197
Grp Volume(v), veh/h	53	42	10	189	63	10	53	1147	603	211	1032	554
Grp Sat Flow(s),veh/h/ln	1307	1863	1541	1331	1863	1563	1774	1695	1778	1774	1695	1822
Q Serve(g_s), s	3.4	1.8	0.5	13.1	2.7	0.5	1.9	0.0	0.0	11.7	24.5	24.5
Cycle Q Clear(g_c), s	6.1	1.8	0.5	14.8	2.7	0.5	1.9	0.0	0.0	11.7	24.5	24.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.23	1.00		0.11
Lane Grp Cap(c), veh/h	335	425	352	352	425	357	358	1747	916	242	1492	802
V/C Ratio(X)	0.16	0.10	0.03	0.54	0.15	0.03	0.15	0.66	0.66	0.87	0.69	0.69
Avail Cap(c_a), veh/h	520	689	570	541	689	578	358	1747	916	248	1492	802
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.68	0.68	0.68	0.60	0.60	0.60
Uniform Delay (d), s/veh	33.3	30.5	30.0	36.3	30.8	30.0	24.4	0.0	0.0	42.3	22.5	22.6
Incr Delay (d2), s/veh	0.2	0.1	0.0	1.3	0.2	0.0	0.1	1.3	2.5	17.8	1.6	3.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.9	0.2	4.9	1.4	0.2	0.9	0.3	0.6	6.9	11.8	13.0
LnGrp Delay(d),s/veh	33.5	30.6	30.0	37.6	31.0	30.0	24.5	1.3	2.5	60.2	24.2	25.6
LnGrp LOS	C	C	C	D	C	C	C	A	A	E	C	C
Approach Vol, veh/h		105			262			1803			1797	
Approach Delay, s/veh		32.0			35.7			2.4			28.8	
Approach LOS		C			D			A			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	17.6	55.5		26.8	25.2	48.0		26.8
Change Period (Y+Rc), s	4.0	5.0		4.0	5.0	* 5		4.0
Max Green Setting (Gmax), s	14.0	36.0		37.0	7.0	* 43		37.0
Max Q Clear Time (g_c+I1), s	13.7	2.0		8.1	3.9	26.5		16.8
Green Ext Time (p_c), s	0.0	15.6		1.4	2.6	9.2		1.3

Intersection Summary	
HCM 2010 Ctrl Delay	17.4
HCM 2010 LOS	B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	30	210	260	50	30	330	1680	430	60	1590	40
Future Volume (veh/h)	20	30	210	260	50	30	330	1680	430	60	1590	40
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	21	32	65	274	53	10	347	1768	215	63	1674	15
Adj No. of Lanes	1	1	0	1	1	0	1	3	1	1	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	439	165	336	405	460	87	319	2090	650	278	2022	626
Arrive On Green	0.30	0.30	0.30	0.30	0.30	0.30	0.18	0.41	0.41	0.21	0.53	0.53
Sat Flow, veh/h	1324	546	1110	1285	1522	287	1774	5085	1581	1774	5085	1573
Grp Volume(v), veh/h	21	0	97	274	0	63	347	1768	215	63	1674	15
Grp Sat Flow(s),veh/h/ln	1324	0	1656	1285	0	1809	1774	1695	1581	1774	1695	1573
Q Serve(g_s), s	1.2	0.0	4.3	20.1	0.0	2.5	18.0	31.4	9.3	3.0	27.6	0.5
Cycle Q Clear(g_c), s	3.7	0.0	4.3	24.4	0.0	2.5	18.0	31.4	9.3	3.0	27.6	0.5
Prop In Lane	1.00		0.67	1.00		0.16	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	439	0	501	405	0	547	319	2090	650	278	2022	626
V/C Ratio(X)	0.05	0.00	0.19	0.68	0.00	0.12	1.09	0.85	0.33	0.23	0.83	0.02
Avail Cap(c_a), veh/h	555	0	646	517	0	706	319	2187	680	278	2022	626
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.85	0.85	0.85
Uniform Delay (d), s/veh	26.5	0.0	25.8	34.9	0.0	25.2	41.0	26.6	20.1	34.6	20.7	14.3
Incr Delay (d2), s/veh	0.0	0.0	0.2	2.4	0.0	0.1	75.5	4.4	1.4	0.3	3.5	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	2.0	7.3	0.0	1.3	15.5	15.4	4.3	1.5	13.5	0.2
LnGrp Delay(d),s/veh	26.6	0.0	26.0	37.3	0.0	25.3	116.5	31.0	21.4	34.9	24.2	14.4
LnGrp LOS	C		C	D		C	F	C	C	C	C	B
Approach Vol, veh/h		118			337			2330			1752	
Approach Delay, s/veh		26.1			35.1			42.9			24.5	
Approach LOS		C			D			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	20.7	45.1		34.2	22.0	43.8		34.2
Change Period (Y+Rc), s	5.0	* 5		4.0	4.0	5.0		4.0
Max Green Setting (Gmax), s	6.0	* 42		39.0	18.0	30.0		39.0
Max Q Clear Time (g_c+I1), s	15.0	33.4		26.4	20.0	29.6		6.3
Green Ext Time (p_c), s	0.9	6.7		1.6	0.0	0.4		2.0

Intersection Summary	
HCM 2010 Ctrl Delay	34.8
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

I-215/University Parkway Interchange
Diverging Diamond Alternative
Cumulative PM Peak Hour

Intersection	Control	Delay	LOS
12. University Parkway/I 215 Northbound Ramps	Signal	35.3	D
13. University Parkway/I 215 Southbound Ramps	Signal	22.6	C

	Delay					
University Parkway/I 215 NB Ramps Intersection	**WBL**	**WBR**	**SBT**	**SBR**	**NBL**	**NBT**
12. University Parkway/I 215 Northbound Ramps		54	12.5	7.8		20.8
23. University Parkway SB Approach Merge	101.8		0.6			
Combined Delay	101.8	54	13.1	7.8	0	20.8
Volume	430	1810	1910	150	190	630
Approach Delay	63.2		12.7		16	
Approach Volume	2240		2060		820	

	Delay					
University Parkway/I 215 SB Ramps Intersection	**EBL**	**EBR**	**SBL**	**SBT**	**NBT**	**NBR**
13. University Parkway/I 215 Southbound Ramps		7.3		32.3	60.5	
33. University Parkway NB Approach Merge	7.3				5.7	
Combined Delay	7.3	7.3	0	32.3	66.2	0
Volume	80	70	1350	990	740	400
Approach Delay	7.3		13.7		43	
Approach Volume	150		2340		1140	

Movement	WBR	NBT	SBL	SBR
Lane Configurations				
Traffic Volume (vph)	1810	630	1910	150
Future Volume (vph)	1810	630	1910	150
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	8.0	8.0
Lane Util. Factor	0.88	0.95	0.94	1.00
Frt	0.85	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00
Satd. Flow (prot)	2656	3374	4757	1509
Flt Permitted	1.00	1.00	0.95	1.00
Satd. Flow (perm)	2656	3374	4757	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1905	663	2011	158
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	1905	663	2011	158
Turn Type	Prot	NA	Prot	Prot
Protected Phases	2	4	6	6
Permitted Phases				
Actuated Green, G (s)	75.0	25.0	71.0	71.0
Effective Green, g (s)	75.0	25.0	71.0	71.0
Actuated g/C Ratio	0.68	0.23	0.65	0.65
Clearance Time (s)	4.0	6.0	8.0	8.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1810	766	3070	973
v/s Ratio Prot	c0.72	c0.20	0.42	0.10
v/s Ratio Perm				
v/c Ratio	1.05	0.87	0.66	0.16
Uniform Delay, d1	17.5	40.9	12.0	7.7
Progression Factor	1.00	0.29	1.00	1.00
Incremental Delay, d2	36.5	8.8	0.5	0.1
Delay (s)	54.0	20.8	12.5	7.8
Level of Service	D	C	B	A
Approach Delay (s)		20.8		
Approach LOS		C		

Intersection Summary			
HCM 2000 Control Delay	30.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	89.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR2	SER	SWL
Lane Configurations				
Traffic Volume (vph)	740	400	70	990
Future Volume (vph)	740	400	70	990
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	8.0	4.0	4.0	6.0
Lane Util. Factor	0.95	1.00	1.00	1.00
Frt	1.00	0.85	0.86	1.00
Flt Protected	1.00	1.00	1.00	0.95
Satd. Flow (prot)	3374	1509	1536	1687
Flt Permitted	1.00	1.00	1.00	0.95
Satd. Flow (perm)	3374	1509	1536	1687
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	779	421	74	1042
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	779	421	74	1042
Turn Type	NA	Free	Perm	Prot
Protected Phases	6			8
Permitted Phases		Free	4	
Actuated Green, G (s)	27.0	110.0	71.0	69.0
Effective Green, g (s)	27.0	110.0	71.0	69.0
Actuated g/C Ratio	0.25	1.00	0.65	0.63
Clearance Time (s)	8.0		4.0	6.0
Vehicle Extension (s)	3.0		3.0	3.0
Lane Grp Cap (vph)	828	1509	991	1058
v/s Ratio Prot	c0.23			c0.62
v/s Ratio Perm		0.28	0.05	
v/c Ratio	0.94	0.28	0.07	0.98
Uniform Delay, d1	40.7	0.0	7.3	20.0
Progression Factor	1.00	1.00	1.00	0.75
Incremental Delay, d2	19.8	0.5	0.0	17.3
Delay (s)	60.5	0.5	7.3	32.3
Level of Service	E	A	A	C
Approach Delay (s)	39.5			32.3
Approach LOS	D			C

Intersection Summary			
HCM 2000 Control Delay	35.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Volume (vph)	430	0	0	0	0	1910
Future Volume (vph)	430	0	0	0	0	1910
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0					4.0
Lane Util. Factor	1.00					0.91
Frt	1.00					1.00
Flt Protected	0.95					1.00
Satd. Flow (prot)	1687					4848
Flt Permitted	0.95					1.00
Satd. Flow (perm)	1687					4848
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	453	0	0	0	0	2011
RTOR Reduction (vph)	15	0	0	0	0	0
Lane Group Flow (vph)	438	0	0	0	0	2011
Turn Type	Prot					NA
Protected Phases	8					2
Permitted Phases						
Actuated Green, G (s)	27.0					75.0
Effective Green, g (s)	27.0					75.0
Actuated g/C Ratio	0.25					0.68
Clearance Time (s)	4.0					4.0
Vehicle Extension (s)	3.0					3.0
Lane Grp Cap (vph)	414					3305
v/s Ratio Prot	c0.26					c0.41
v/s Ratio Perm						
v/c Ratio	1.06					0.61
Uniform Delay, d1	41.5					9.5
Progression Factor	1.00					0.04
Incremental Delay, d2	60.3					0.2
Delay (s)	101.8					0.6
Level of Service	F					A
Approach Delay (s)	101.8		0.0			0.6
Approach LOS	F		A			A

Intersection Summary			
HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	80	0	0	740	0	0
Future Volume (vph)	80	0	0	740	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	1687			3374		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	1687			3374		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	84	0	0	779	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	84	0	0	779	0	0
Turn Type	Prot			NA		
Protected Phases	4			2		
Permitted Phases			2			
Actuated Green, G (s)	71.0			31.0		
Effective Green, g (s)	71.0			31.0		
Actuated g/C Ratio	0.65			0.28		
Clearance Time (s)	4.0			4.0		
Vehicle Extension (s)	3.0			3.0		
Lane Grp Cap (vph)	1088			950		
v/s Ratio Prot	c0.05			c0.23		
v/s Ratio Perm						
v/c Ratio	0.08			0.82		
Uniform Delay, d1	7.3			36.9		
Progression Factor	1.00			0.08		
Incremental Delay, d2	0.0			2.9		
Delay (s)	7.3			5.7		
Level of Service	A			A		
Approach Delay (s)	7.3			5.7	0.0	
Approach LOS	A			A	A	

Intersection Summary			
HCM 2000 Control Delay	5.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	31.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	780	70	140	620	130	70	230	160	140	350	70
Future Volume (veh/h)	60	780	70	140	620	130	70	230	160	140	350	70
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	0.99		0.96	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1976	1863	1863	1900	1863	1863	1976	1863	1863	1976
Adj Flow Rate, veh/h	63	821	67	147	653	119	74	242	41	147	368	51
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	444	1449	118	429	1374	250	287	926	154	348	954	131
Arrive On Green	0.09	0.44	0.41	0.11	0.46	0.44	0.31	0.31	0.29	0.31	0.31	0.29
Sat Flow, veh/h	1774	3308	270	1774	2981	542	953	3018	502	1077	3110	427
Grp Volume(v), veh/h	63	439	449	147	387	385	74	140	143	147	208	211
Grp Sat Flow(s),veh/h/ln	1774	1770	1808	1774	1770	1753	953	1770	1751	1077	1770	1768
Q Serve(g_s), s	1.5	15.8	15.8	3.6	12.8	13.0	5.6	5.1	5.3	10.1	7.8	8.0
Cycle Q Clear(g_c), s	1.5	15.8	15.8	3.6	12.8	13.0	13.7	5.1	5.3	15.4	7.8	8.0
Prop In Lane	1.00		0.15	1.00		0.31	1.00		0.29	1.00		0.24
Lane Grp Cap(c), veh/h	444	775	792	429	816	808	287	543	537	348	543	542
V/C Ratio(X)	0.14	0.57	0.57	0.34	0.47	0.48	0.26	0.26	0.27	0.42	0.38	0.39
Avail Cap(c_a), veh/h	491	775	792	436	816	808	339	639	632	407	639	638
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	11.6	17.9	18.0	12.2	15.8	16.1	28.6	22.2	22.4	28.1	23.1	23.4
Incr Delay (d2), s/veh	0.1	3.0	2.9	0.5	2.0	2.0	0.5	0.2	0.3	0.8	0.4	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	8.3	8.5	1.8	6.7	6.7	1.5	2.5	2.6	3.1	3.9	4.0
LnGrp Delay(d),s/veh	11.7	20.8	20.9	12.7	17.8	18.1	29.1	22.4	22.7	28.9	23.6	23.8
LnGrp LOS	B	C	C	B	B	B	C	C	C	C	C	C
Approach Vol, veh/h		951			919			357			566	
Approach Delay, s/veh		20.3			17.1			23.9			25.0	
Approach LOS		C			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.7	43.2		30.1	13.7	41.2		30.1
Change Period (Y+Rc), s	4.0	6.0		5.7	4.0	6.0		5.7
Max Green Setting (Gmax), s	10.0	30.3		29.0	10.0	30.3		29.0
Max Q Clear Time (g_c+I1), s	3.5	15.0		17.4	5.6	17.8		15.7
Green Ext Time (p_c), s	0.1	9.6		4.3	0.1	8.3		4.6

Intersection Summary		
HCM 2010 Ctrl Delay		20.7
HCM 2010 LOS		C

APPENDIX E: CUMULATIVE PLUS PROJECT (2035) LEVEL OF SERVICE

Intersection	
Intersection Delay, s/veh	21.8
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	10	181	536	0	30	138	10	0	182	10	120
Future Vol, veh/h	0	10	181	536	0	30	138	10	0	182	10	120
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	11	191	564	0	32	145	11	0	192	11	126
Number of Lanes	0	1	1	1	0	1	2	0	0	2	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	3	3	3
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	3	3	3
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	3	3
HCM Control Delay	29.2	11.5	12
HCM LOS	D	B	B

Lane	NBLn1	NBLn2	NBLn3	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	WBLn3	SBLn1	SBLn2
Vol Left, %	100%	100%	0%	100%	0%	0%	100%	0%	0%	100%	0%
Vol Thru, %	0%	0%	8%	0%	100%	0%	0%	100%	82%	0%	100%
Vol Right, %	0%	0%	92%	0%	0%	100%	0%	0%	18%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	91	91	130	10	181	536	30	92	56	10	20
LT Vol	91	91	0	10	0	0	30	0	0	10	0
Through Vol	0	0	10	0	181	0	0	92	46	0	20
RT Vol	0	0	120	0	0	536	0	0	10	0	0
Lane Flow Rate	96	96	137	11	191	564	32	97	59	11	21
Geometry Grp	8	8	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.204	0.204	0.248	0.02	0.333	0.876	0.068	0.196	0.117	0.025	0.047
Departure Headway (Hd)	7.672	7.672	6.526	6.79	6.29	5.59	7.781	7.281	7.156	8.478	7.978
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	466	466	547	525	570	643	458	490	498	425	452
Service Time	5.451	5.451	4.305	4.554	4.054	3.354	5.57	5.07	4.945	6.178	5.678
HCM Lane V/C Ratio	0.206	0.206	0.25	0.021	0.335	0.877	0.07	0.198	0.118	0.026	0.046
HCM Control Delay	12.4	12.4	11.5	9.7	12.2	35.3	11.1	11.9	10.9	11.4	11.1
HCM Lane LOS	B	B	B	A	B	E	B	B	B	B	B
HCM 95th-tile Q	0.8	0.8	1	0.1	1.5	10.3	0.2	0.7	0.4	0.1	0.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations		↰	↑	↱
Traffic Vol, veh/h	0	10	20	10
Future Vol, veh/h	0	10	20	10
Peak Hour Factor	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	11	21	11
Number of Lanes	0	1	1	1

Approach	SB
Opposing Approach	NB
Opposing Lanes	3
Conflicting Approach Left	WB
Conflicting Lanes Left	3
Conflicting Approach Right	EB
Conflicting Lanes Right	3
HCM Control Delay	10.9
HCM LOS	B

Intersection	
Int Delay, s/veh	41.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	10	30	93	10	10	20	249	779	243	333	10
Future Vol, veh/h	10	10	30	93	10	10	20	249	779	243	333	10
Conflicting Peds, #/hr	12	0	7	9	0	12	7	0	9	14	0	12
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	205	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	11	32	98	11	11	21	262	820	256	351	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1069	2017	202	1429	1613	567	373	0	0	1096	0	0
Stage 1	879	879	-	728	728	-	-	-	-	-	-	-
Stage 2	190	1138	-	701	885	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	176	58	805	~ 95	103	467	1182	-	-	633	-	-
Stage 1	309	363	-	381	427	-	-	-	-	-	-	-
Stage 2	794	275	-	395	361	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	99	33	791	~ 46	59	457	1173	-	-	627	-	-
Mov Cap-2 Maneuver	99	33	-	~ 46	59	-	-	-	-	-	-	-
Stage 1	300	213	-	370	414	-	-	-	-	-	-	-
Stage 2	735	267	-	212	211	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	62	$ 593.1	0.2	6.1
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1173	-	-	113	46	105	627	-	-
HCM Lane V/C Ratio	0.018	-	-	0.466	2.128	0.201	0.408	-	-
HCM Control Delay (s)	8.1	-	-	62	$ 710.4	47.7	14.6	-	-
HCM Lane LOS	A	-	-	F	F	E	B	-	-
HCM 95th %tile Q(veh)	0.1	-	-	2.1	10.1	0.7	2	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Intersection Delay, s/veh	70.2
Intersection LOS	F

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	20	0	20	0	40	0	20	0	10	1009	149
Future Vol, veh/h	0	20	0	20	0	40	0	20	0	10	1009	149
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	21	0	21	0	42	0	21	0	11	1062	157
Number of Lanes	0	0	1	0	0	1	0	1	0	1	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	3
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	3	3	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	3	2
HCM Control Delay	12.5	12.6	96.9
HCM LOS	B	B	F

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	50%	100%	0%	100%	0%	0%
Vol Thru, %	0%	100%	69%	0%	0%	0%	0%	100%	92%
Vol Right, %	0%	0%	31%	50%	0%	100%	0%	0%	8%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	10	673	485	40	40	20	120	217	119
LT Vol	10	0	0	20	40	0	120	0	0
Through Vol	0	673	336	0	0	0	0	217	109
RT Vol	0	0	149	20	0	20	0	0	10
Lane Flow Rate	11	708	511	42	42	21	126	229	125
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.02	1.238	0.862	0.1	0.106	0.046	0.269	0.455	0.246
Departure Headway (Hd)	6.796	6.292	6.076	8.847	9.418	8.202	7.961	7.456	7.397
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	527	581	598	408	383	439	453	487	488
Service Time	4.535	4.031	3.814	6.547	7.118	5.902	5.661	5.156	5.097
HCM Lane V/C Ratio	0.021	1.219	0.855	0.103	0.11	0.048	0.278	0.47	0.256
HCM Control Delay	9.7	142.5	35.5	12.5	13.2	11.3	13.6	16.2	12.5
HCM Lane LOS	A	F	E	B	B	B	B	C	B
HCM 95th-tile Q	0.1	26.8	9.6	0.3	0.4	0.1	1.1	2.3	1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations		↰	↑↱	
Traffic Vol, veh/h	0	120	326	10
Future Vol, veh/h	0	120	326	10
Peak Hour Factor	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	126	343	11
Number of Lanes	0	1	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	3
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	14.6
HCM LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	921	808	760	50	160	30	330	224	110	80	189	175
Future Volume (veh/h)	921	808	760	50	160	30	330	224	110	80	189	175
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.93	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	969	851	295	53	168	16	223	409	87	84	199	0
Adj No. of Lanes	1	2	1	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	403	1416	617	97	709	66	581	977	206	129	257	101
Arrive On Green	0.38	0.67	0.67	0.05	0.22	0.21	0.33	0.33	0.32	0.07	0.07	0.00
Sat Flow, veh/h	1774	3539	1543	1774	3248	305	1774	2985	629	1774	3539	1583
Grp Volume(v), veh/h	969	851	295	53	90	94	223	254	242	84	199	0
Grp Sat Flow(s),veh/h/ln	1774	1770	1543	1774	1770	1783	1774	1863	1751	1774	1770	1583
Q Serve(g_s), s	25.0	14.7	10.3	3.2	4.6	4.8	10.6	11.7	11.9	5.1	6.1	0.0
Cycle Q Clear(g_c), s	25.0	14.7	10.3	3.2	4.6	4.8	10.6	11.7	11.9	5.1	6.1	0.0
Prop In Lane	1.00		1.00	1.00		0.17	1.00		0.36	1.00		1.00
Lane Grp Cap(c), veh/h	403	1416	617	97	386	389	581	610	573	129	257	101
V/C Ratio(X)	2.40	0.60	0.48	0.55	0.23	0.24	0.38	0.42	0.42	0.65	0.77	0.00
Avail Cap(c_a), veh/h	403	1416	617	97	483	486	581	610	573	129	257	101
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.28	0.28	0.28	1.00	1.00	1.00	0.86	0.86	0.86	1.00	1.00	0.00
Uniform Delay (d), s/veh	34.1	13.4	12.7	50.7	35.4	35.6	28.5	28.8	29.0	49.6	50.1	0.0
Incr Delay (d2), s/veh	633.4	0.5	0.8	20.5	1.4	1.5	1.6	1.8	2.0	22.7	19.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	83.1	7.2	4.4	2.1	2.4	2.5	5.5	6.3	6.0	3.3	3.7	0.0
LnGrp Delay(d),s/veh	667.6	13.9	13.4	71.1	36.8	37.0	30.1	30.6	31.0	72.4	70.0	0.0
LnGrp LOS	F	B	B	E	D	D	C	C	C	E	E	
Approach Vol, veh/h		2115			237			719			283	
Approach Delay, s/veh		313.3			44.6			30.6			70.7	
Approach LOS		F			D			C			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		12.0	30.0	28.0		40.0	10.0	48.0
Change Period (Y+Rc), s		5.0	5.0	* 5		5.0	4.0	5.0
Max Green Setting (Gmax), s		7.0	20.0	* 29		35.0	6.0	43.0
Max Q Clear Time (g_c+I1), s		8.1	27.0	6.8		13.9	5.2	16.7
Green Ext Time (p_c), s		0.0	0.0	1.0		3.4	0.0	12.7

Intersection Summary	
HCM 2010 Ctrl Delay	213.3
HCM 2010 LOS	F

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	245	804	10	10	593	154	10	10	10	31	10	61
Future Volume (veh/h)	245	804	10	10	593	154	10	10	10	31	10	61
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.98	0.96		0.94	0.95		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1900	1863	1900	1900	1863	1863
Adj Flow Rate, veh/h	258	846	10	11	624	134	11	11	6	33	11	20
Adj No. of Lanes	1	2	0	1	2	0	0	2	0	0	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	420	1637	19	303	975	209	416	391	223	441	129	460
Arrive On Green	0.11	0.46	0.43	0.00	0.34	0.31	0.30	0.30	0.30	0.30	0.30	0.30
Sat Flow, veh/h	1774	3581	42	1774	2889	619	955	1283	731	1025	424	1509
Grp Volume(v), veh/h	258	418	438	11	382	376	16	0	12	44	0	20
Grp Sat Flow(s),veh/h/ln	1774	1770	1854	1774	1770	1738	1457	0	1511	1449	0	1509
Q Serve(g_s), s	4.7	8.3	8.3	0.1	9.0	9.1	0.0	0.0	0.3	0.2	0.0	0.5
Cycle Q Clear(g_c), s	4.7	8.3	8.3	0.1	9.0	9.1	0.9	0.0	0.3	0.9	0.0	0.5
Prop In Lane	1.00		0.02	1.00		0.36	0.71		0.48	0.75		1.00
Lane Grp Cap(c), veh/h	420	809	848	303	597	587	569	0	461	570	0	460
V/C Ratio(X)	0.61	0.52	0.52	0.04	0.64	0.64	0.03	0.00	0.03	0.08	0.00	0.04
Avail Cap(c_a), veh/h	471	809	848	443	684	671	920	0	829	919	0	828
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.9	9.5	9.5	13.6	13.8	14.0	12.0	0.0	12.0	12.2	0.0	12.0
Incr Delay (d2), s/veh	2.0	0.6	0.5	0.0	1.6	1.7	0.0	0.0	0.0	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.5	4.1	4.3	0.1	4.6	4.6	0.2	0.0	0.1	0.4	0.0	0.2
LnGrp Delay(d),s/veh	12.9	10.1	10.1	13.6	15.4	15.7	12.0	0.0	12.0	12.2	0.0	12.1
LnGrp LOS	B	B	B	B	B	B	B		B	B		B
Approach Vol, veh/h		1114			769			28			64	
Approach Delay, s/veh		10.7			15.5			12.0			12.2	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	3.7	26.5		19.0	9.6	20.6		19.0
Change Period (Y+Rc), s	3.0	5.5		4.0	3.0	5.5		4.0
Max Green Setting (Gmax), s	5.0	20.5		27.0	8.0	17.5		27.0
Max Q Clear Time (g_c+I1), s	2.1	10.3		2.9	6.7	11.1		2.9
Green Ext Time (p_c), s	0.0	6.4		0.4	0.1	3.9		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	12.7
HCM 2010 LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	359	476	10	0	670	146	10	0	20	31	0	77
Future Volume (veh/h)	359	476	10	0	670	146	10	0	20	31	0	77
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		1.00	0.98		0.97	0.98		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	378	501	10	0	705	0	11	0	10	33	0	47
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	1	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	492	2331	46	4	1483	607	198	33	91	385	0	835
Arrive On Green	0.14	0.66	0.62	0.00	0.42	0.00	0.13	0.00	0.13	0.15	0.00	0.13
Sat Flow, veh/h	3442	3546	71	1774	3539	1583	525	258	712	1375	0	2986
Grp Volume(v), veh/h	378	250	261	0	705	0	21	0	0	33	0	47
Grp Sat Flow(s),veh/h/ln	1721	1770	1848	1774	1770	1583	1495	0	0	1375	0	1493
Q Serve(g_s), s	4.4	2.4	2.4	0.0	6.1	0.0	0.0	0.0	0.0	0.3	0.0	0.5
Cycle Q Clear(g_c), s	4.4	2.4	2.4	0.0	6.1	0.0	0.5	0.0	0.0	0.7	0.0	0.5
Prop In Lane	1.00		0.04	1.00		1.00	0.52		0.48	1.00		1.00
Lane Grp Cap(c), veh/h	492	1163	1215	4	1483	607	322	0	0	385	0	835
V/C Ratio(X)	0.77	0.21	0.22	0.00	0.48	0.00	0.07	0.00	0.00	0.09	0.00	0.06
Avail Cap(c_a), veh/h	492	1265	1321	127	2277	962	984	0	0	385	0	835
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	17.3	2.9	2.9	0.0	8.8	0.0	16.1	0.0	0.0	15.4	0.0	11.3
Incr Delay (d2), s/veh	7.2	0.1	0.1	0.0	0.2	0.0	0.1	0.0	0.0	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	1.1	1.2	0.0	3.0	0.0	0.2	0.0	0.0	0.3	0.0	0.2
LnGrp Delay(d),s/veh	24.5	3.0	3.0	0.0	9.1	0.0	16.2	0.0	0.0	15.5	0.0	11.4
LnGrp LOS	C	A	A		A		B			B		B
Approach Vol, veh/h		889			705			21			80	
Approach Delay, s/veh		12.1			9.1			16.2			13.1	
Approach LOS		B			A			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	0.0	31.6		10.4	10.0	21.6		10.4
Change Period (Y+Rc), s	4.0	5.5		5.0	4.0	5.5		* 5
Max Green Setting (Gmax), s	3.0	28.5		5.0	6.0	25.5		* 25
Max Q Clear Time (g_c+I1), s	0.0	4.4		2.7	6.4	8.1		2.5
Green Ext Time (p_c), s	0.0	8.1		0.1	0.0	7.1		0.1

Intersection Summary		
HCM 2010 Ctrl Delay		11.0
HCM 2010 LOS		B

Notes
User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	160	308	89	160	515	342	280	452	180	55	85	31
Future Volume (veh/h)	160	308	89	160	515	342	280	452	180	55	85	31
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	0.99		0.97	0.99		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	168	324	60	168	542	216	295	476	127	58	89	8
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	314	1097	200	460	904	359	506	778	206	274	950	475
Arrive On Green	0.05	0.37	0.34	0.05	0.37	0.34	0.05	0.28	0.27	0.04	0.27	0.25
Sat Flow, veh/h	1774	2974	543	1774	2450	973	1774	2757	730	1774	3539	1574
Grp Volume(v), veh/h	168	191	193	168	391	367	295	304	299	58	89	8
Grp Sat Flow(s),veh/h/ln	1774	1770	1748	1774	1770	1653	1774	1770	1718	1774	1770	1574
Q Serve(g_s), s	3.0	4.6	4.8	3.0	10.8	11.1	3.0	9.0	9.2	1.5	1.1	0.2
Cycle Q Clear(g_c), s	3.0	4.6	4.8	3.0	10.8	11.1	3.0	9.0	9.2	1.5	1.1	0.2
Prop In Lane	1.00		0.31	1.00		0.59	1.00		0.43	1.00		1.00
Lane Grp Cap(c), veh/h	314	653	645	460	653	610	506	499	485	274	950	475
V/C Ratio(X)	0.54	0.29	0.30	0.37	0.60	0.60	0.58	0.61	0.62	0.21	0.09	0.02
Avail Cap(c_a), veh/h	314	817	807	460	817	763	506	875	850	299	1750	831
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.2	13.5	13.8	13.8	15.5	16.1	19.0	18.9	19.1	16.5	16.7	14.9
Incr Delay (d2), s/veh	1.8	0.2	0.3	0.5	0.9	1.0	1.7	1.2	1.3	0.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	2.3	2.3	0.8	5.4	5.2	3.2	4.6	4.5	0.7	0.6	0.1
LnGrp Delay(d),s/veh	18.0	13.8	14.1	14.3	16.4	17.0	20.8	20.1	20.4	16.9	16.7	14.9
LnGrp LOS	B	B	B	B	B	B	C	C	C	B	B	B
Approach Vol, veh/h		552			926			898			155	
Approach Delay, s/veh		15.2			16.2			20.4			16.7	
Approach LOS		B			B			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.0	26.4	7.0	20.3	7.0	26.4	6.2	21.1
Change Period (Y+Rc), s	4.0	6.0	4.0	5.0	4.0	6.0	4.0	5.0
Max Green Setting (Gmax), s	3.0	26.0	3.0	29.0	3.0	26.0	3.0	29.0
Max Q Clear Time (g_c+I1), s	5.0	13.1	5.0	3.1	5.0	6.8	3.5	11.2
Green Ext Time (p_c), s	0.0	5.5	0.0	4.2	0.0	6.7	0.0	3.8

Intersection Summary		
HCM 2010 Ctrl Delay		17.5
HCM 2010 LOS		B

Intersection	
Int Delay, s/veh	2.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↱		↰	↑↑	Y	
Traffic Vol, veh/h	121	134	141	582	49	38
Future Vol, veh/h	121	134	141	582	49	38
Conflicting Peds, #/hr	0	5	5	0	5	5
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	127	141	148	613	52	40

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	273	0	811	144
Stage 1	-	-	-	-	203	-
Stage 2	-	-	-	-	608	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1287	-	317	877
Stage 1	-	-	-	-	811	-
Stage 2	-	-	-	-	506	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1282	-	278	870
Mov Cap-2 Maneuver	-	-	-	-	278	-
Stage 1	-	-	-	-	808	-
Stage 2	-	-	-	-	446	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.6	16.8
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	396	-	-	1282	-
HCM Lane V/C Ratio	0.231	-	-	0.116	-
HCM Control Delay (s)	16.8	-	-	8.2	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0.9	-	-	0.4	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	214	420	210	240	310	195	110	2082	110	49	508	149
Future Volume (veh/h)	214	420	210	240	310	195	110	2082	110	49	508	149
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.97	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	225	442	148	253	326	125	116	2192	112	52	535	116
Adj No. of Lanes	2	2	0	2	2	0	2	3	0	1	3	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	343	644	214	282	530	199	652	1664	84	336	1410	299
Arrive On Green	0.10	0.25	0.23	0.08	0.21	0.19	0.19	0.34	0.32	0.19	0.34	0.32
Sat Flow, veh/h	3442	2608	865	3442	2512	945	3442	4948	251	1774	4193	888
Grp Volume(v), veh/h	225	299	291	253	228	223	116	1497	807	52	430	221
Grp Sat Flow(s),veh/h/ln	1721	1770	1703	1721	1770	1687	1721	1695	1809	1774	1695	1691
Q Serve(g_s), s	6.9	16.8	17.2	8.0	12.8	13.3	3.1	37.0	37.0	2.7	10.6	11.1
Cycle Q Clear(g_c), s	6.9	16.8	17.2	8.0	12.8	13.3	3.1	37.0	37.0	2.7	10.6	11.1
Prop In Lane	1.00		0.51	1.00		0.56	1.00		0.14	1.00		0.53
Lane Grp Cap(c), veh/h	343	437	421	282	373	356	652	1140	609	336	1140	569
V/C Ratio(X)	0.66	0.68	0.69	0.90	0.61	0.63	0.18	1.31	1.33	0.15	0.38	0.39
Avail Cap(c_a), veh/h	343	708	681	282	708	675	652	1140	609	336	1140	569
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.72	0.72	0.72	0.97	0.97	0.97
Uniform Delay (d), s/veh	47.7	37.5	38.1	50.0	39.3	40.0	37.4	36.5	36.6	37.2	27.7	28.3
Incr Delay (d2), s/veh	4.5	1.9	2.1	29.1	1.6	1.8	0.1	145.5	154.8	0.2	0.9	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	8.4	8.3	4.9	6.4	6.4	1.5	40.3	44.6	1.3	5.1	5.4
LnGrp Delay(d),s/veh	52.2	39.4	40.2	79.1	40.9	41.8	37.5	182.0	191.5	37.4	28.7	30.2
LnGrp LOS	D	D	D	E	D	D	D	F	F	D	C	C
Approach Vol, veh/h		815			704			2420			703	
Approach Delay, s/veh		43.2			54.9			178.2			29.8	
Approach LOS		D			D			F			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	24.8	41.0	13.0	31.2	24.8	41.0	16.9	27.2
Change Period (Y+Rc), s	4.0	6.0	4.0	6.0	4.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	4.0	35.0	9.0	42.0	4.0	35.0	9.0	* 42
Max Q Clear Time (g_c+I1), s	4.7	39.0	10.0	19.2	5.1	13.1	8.9	15.3
Green Ext Time (p_c), s	0.0	0.0	0.0	3.3	0.0	3.8	0.0	2.4

Intersection Summary	
HCM 2010 Ctrl Delay	113.3
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	50	60	90	30	40	70	2222	70	10	898	30
Future Volume (veh/h)	40	50	60	90	30	40	70	2222	70	10	898	30
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.97	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	42	53	8	95	32	5	74	2339	72	11	945	29
Adj No. of Lanes	1	1	1	1	1	1	1	3	0	1	3	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	330	359	296	313	359	296	590	1711	52	568	1647	50
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.66	0.68	0.65	0.32	0.32	0.31
Sat Flow, veh/h	1346	1863	1538	1318	1863	1538	1774	5070	155	1774	5069	155
Grp Volume(v), veh/h	42	53	8	95	32	5	74	1561	850	11	632	342
Grp Sat Flow(s),veh/h/ln	1346	1863	1538	1318	1863	1538	1774	1695	1835	1774	1695	1834
Q Serve(g_s), s	2.1	1.9	0.3	5.2	1.1	0.2	1.2	27.0	27.0	0.3	12.4	12.4
Cycle Q Clear(g_c), s	3.2	1.9	0.3	7.1	1.1	0.2	1.2	27.0	27.0	0.3	12.4	12.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.08	1.00		0.08
Lane Grp Cap(c), veh/h	330	359	296	313	359	296	590	1144	619	568	1102	596
V/C Ratio(X)	0.13	0.15	0.03	0.30	0.09	0.02	0.13	1.36	1.37	0.02	0.57	0.57
Avail Cap(c_a), veh/h	693	862	711	668	862	711	590	1144	619	568	1102	596
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.09	0.09	0.09	0.89	0.89	0.89
Uniform Delay (d), s/veh	27.9	26.8	26.2	29.8	26.5	26.2	9.2	13.0	13.1	18.6	22.4	22.4
Incr Delay (d2), s/veh	0.2	0.2	0.0	0.5	0.1	0.0	0.0	164.4	168.8	0.0	1.9	3.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	1.0	0.1	1.9	0.6	0.1	0.6	37.9	41.8	0.2	6.1	6.9
LnGrp Delay(d),s/veh	28.0	27.0	26.3	30.3	26.6	26.2	9.2	177.4	181.9	18.6	24.3	26.0
LnGrp LOS	C	C	C	C	C	C	A	F	F	B	C	C
Approach Vol, veh/h		103			132			2485			985	
Approach Delay, s/veh		27.4			29.3			173.9			24.8	
Approach LOS		C			C			F			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	29.6	31.0		19.4	30.6	30.0		19.4
Change Period (Y+Rc), s	4.0	5.0		4.0	4.0	5.0		4.0
Max Green Setting (Gmax), s	4.0	26.0		37.0	5.0	25.0		37.0
Max Q Clear Time (g_c+I1), s	2.3	29.0		5.2	3.2	14.4		9.1
Green Ext Time (p_c), s	0.0	0.0		0.9	0.0	4.2		0.9

Intersection Summary			
HCM 2010 Ctrl Delay			125.1
HCM 2010 LOS			F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	20	260	310	40	30	150	2304	460	30	990	30
Future Volume (veh/h)	20	20	260	310	40	30	150	2304	460	30	990	30
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	21	21	160	326	42	12	158	2425	250	32	1042	11
Adj No. of Lanes	1	1	0	1	1	0	1	3	1	1	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	588	73	555	465	544	155	155	2209	686	45	1893	587
Arrive On Green	0.39	0.39	0.39	0.39	0.39	0.39	0.09	0.43	0.43	0.01	0.12	0.12
Sat Flow, veh/h	1343	187	1422	1197	1394	398	1774	5085	1580	1774	5085	1577
Grp Volume(v), veh/h	21	0	181	326	0	54	158	2425	250	32	1042	11
Grp Sat Flow(s),veh/h/ln	1343	0	1609	1197	0	1792	1774	1695	1580	1774	1695	1577
Q Serve(g_s), s	0.8	0.0	6.2	20.6	0.0	1.5	7.0	34.7	8.5	1.4	15.4	0.5
Cycle Q Clear(g_c), s	2.3	0.0	6.2	26.8	0.0	1.5	7.0	34.7	8.5	1.4	15.4	0.5
Prop In Lane	1.00		0.88	1.00		0.22	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	588	0	628	465	0	699	155	2209	686	45	1893	587
V/C Ratio(X)	0.04	0.00	0.29	0.70	0.00	0.08	1.02	1.10	0.36	0.71	0.55	0.02
Avail Cap(c_a), veh/h	719	0	784	581	0	873	155	2209	686	89	1893	587
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	16.1	0.0	16.8	26.0	0.0	15.3	36.5	22.6	15.2	39.4	28.8	22.2
Incr Delay (d2), s/veh	0.0	0.0	0.3	2.8	0.0	0.0	77.0	51.8	1.5	17.8	1.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	2.8	7.2	0.0	0.8	6.7	26.8	4.0	0.9	7.4	0.2
LnGrp Delay(d),s/veh	16.1	0.0	17.0	28.7	0.0	15.4	113.7	74.4	16.7	57.2	29.9	22.3
LnGrp LOS	B		B	C		B	F	F	B	E	C	C
Approach Vol, veh/h		202			380			2833			1085	
Approach Delay, s/veh		16.9			26.8			71.5			30.6	
Approach LOS		B			C			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.0	38.7		35.2	11.0	33.8		35.2
Change Period (Y+Rc), s	4.0	5.0		4.0	4.0	5.0		4.0
Max Green Setting (Gmax), s	4.0	24.0		39.0	7.0	21.0		39.0
Max Q Clear Time (g_c+I1), s	3.4	36.7		28.8	9.0	17.4		8.2
Green Ext Time (p_c), s	0.0	0.0		2.1	0.0	3.5		3.0

Intersection Summary		
HCM 2010 Ctrl Delay		55.4
HCM 2010 LOS		E

I-215/University Parkway Interchange
Diverging Diamond Alternative
Cumulative plus Project AM Peak Hour

Intersection	Control	Delay	LOS
12. University Parkway/I 215 Northbound Ramps	Signal	76.6	**E**
13. University Parkway/I 215 Southbound Ramps	Signal	13.9	B

	Delay					
University Parkway/I 215 NB Ramps Intersection	**WBL**	**WBR**	**SBT**	**SBR**	**NBL**	**NBT**
12. University Parkway/I 215 Northbound Ramps		113.8	9.2	6.7		111
23. University Parkway SB Approach Merge	86.1		0.4			
Combined Delay	86.1	113.8	9.6	6.7	0	111
Volume	350	2236	1446	114	70	687
Approach Delay	110.1		9.4		100.7	
Approach Volume	2586		1560		757	

	Delay					
University Parkway/I 215 SB Ramps Intersection	**EBL**	**EBR**	**SBL**	**SBT**	**NBT**	**NBR**
13. University Parkway/I 215 Southbound Ramps		19.9		23.5	34.1	
33. University Parkway NB Approach Merge	19.7				0.8	
Combined Delay	19.7	19.9	0	23.5	34.9	0
Volume	217	210	1156	640	540	280
Approach Delay	19.8		8.4		23	
Approach Volume	427		1796		820	

Movement	WBR	NBT	SBL	SBR
Lane Configurations				
Traffic Volume (vph)	2236	687	1446	114
Future Volume (vph)	2236	687	1446	114
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	8.0	8.0
Lane Util. Factor	0.88	0.95	0.94	1.00
Frt	0.85	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00
Satd. Flow (prot)	2656	3374	4757	1509
Flt Permitted	1.00	1.00	0.95	1.00
Satd. Flow (perm)	2656	3374	4757	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	2354	723	1522	120
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	2354	723	1522	120
Turn Type	Prot	NA	Prot	Prot
Protected Phases	2	4	6	6
Permitted Phases				
Actuated Green, G (s)	111.0	29.0	107.0	107.0
Effective Green, g (s)	111.0	29.0	107.0	107.0
Actuated g/C Ratio	0.74	0.19	0.71	0.71
Clearance Time (s)	4.0	6.0	8.0	8.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1965	652	3393	1076
v/s Ratio Prot	c0.89	c0.21	0.32	0.08
v/s Ratio Perm				
v/c Ratio	1.20	1.11	0.45	0.11
Uniform Delay, d1	19.5	60.5	9.1	6.7
Progression Factor	1.00	0.71	1.00	1.00
Incremental Delay, d2	94.3	68.3	0.1	0.0
Delay (s)	113.8	111.0	9.2	6.7
Level of Service	F	F	A	A
Approach Delay (s)		111.0		
Approach LOS		F		

Intersection Summary			
HCM 2000 Control Delay	76.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	105.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR2	SER	SWL
Lane Configurations	↑↑	↱	↱	↰
Traffic Volume (vph)	540	280	210	640
Future Volume (vph)	540	280	210	640
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	8.0	4.0	4.0	6.0
Lane Util. Factor	0.95	1.00	1.00	1.00
Frt	1.00	0.85	0.86	1.00
Flt Protected	1.00	1.00	1.00	0.95
Satd. Flow (prot)	3374	1509	1536	1687
Flt Permitted	1.00	1.00	1.00	0.95
Satd. Flow (perm)	3374	1509	1536	1687
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	568	295	221	674
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	568	295	221	674
Turn Type	NA	Free	Perm	Prot
Protected Phases	6			8
Permitted Phases		Free	4	
Actuated Green, G (s)	59.2	150.0	78.8	76.8
Effective Green, g (s)	59.2	150.0	78.8	76.8
Actuated g/C Ratio	0.39	1.00	0.53	0.51
Clearance Time (s)	8.0		4.0	6.0
Vehicle Extension (s)	3.0		3.0	3.0
Lane Grp Cap (vph)	1331	1509	806	863
v/s Ratio Prot	c0.17			c0.40
v/s Ratio Perm		0.20	0.14	
v/c Ratio	0.43	0.20	0.27	0.78
Uniform Delay, d1	33.0	0.0	19.7	29.8
Progression Factor	1.00	1.00	1.00	0.68
Incremental Delay, d2	1.0	0.3	0.2	3.3
Delay (s)	34.1	0.3	19.9	23.5
Level of Service	C	A	B	C
Approach Delay (s)	22.5			23.5
Approach LOS	C			C

Intersection Summary			
HCM 2000 Control Delay	22.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	62.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Volume (vph)	350	0	0	0	0	1446
Future Volume (vph)	350	0	0	0	0	1446
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0					4.0
Lane Util. Factor	1.00					0.91
Frt	1.00					1.00
Flt Protected	0.95					1.00
Satd. Flow (prot)	1687					4848
Flt Permitted	0.95					1.00
Satd. Flow (perm)	1687					4848
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	368	0	0	0	0	1522
RTOR Reduction (vph)	56	0	0	0	0	0
Lane Group Flow (vph)	312	0	0	0	0	1522
Turn Type	Prot					NA
Protected Phases	8					2
Permitted Phases						
Actuated Green, G (s)	31.0					111.0
Effective Green, g (s)	31.0					111.0
Actuated g/C Ratio	0.21					0.74
Clearance Time (s)	4.0					4.0
Vehicle Extension (s)	3.0					3.0
Lane Grp Cap (vph)	348					3587
v/s Ratio Prot	c0.19					c0.31
v/s Ratio Perm						
v/c Ratio	0.90					0.42
Uniform Delay, d1	58.0					7.4
Progression Factor	1.00					0.04
Incremental Delay, d2	28.2					0.1
Delay (s)	86.1					0.4
Level of Service	F					A
Approach Delay (s)	86.1		0.0			0.4
Approach LOS	F		A			A

Intersection Summary			
HCM 2000 Control Delay	17.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	54.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	217	0	0	540	0	0
Future Volume (vph)	217	0	0	540	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	1687			3374		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	1687			3374		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	228	0	0	568	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	228	0	0	568	0	0
Turn Type	Prot			NA		
Protected Phases	4			2		
Permitted Phases			2			
Actuated Green, G (s)	78.8			63.2		
Effective Green, g (s)	78.8			63.2		
Actuated g/C Ratio	0.53			0.42		
Clearance Time (s)	4.0			4.0		
Vehicle Extension (s)	3.0			3.0		
Lane Grp Cap (vph)	886			1421		
v/s Ratio Prot	c0.14			c0.17		
v/s Ratio Perm						
v/c Ratio	0.26			0.40		
Uniform Delay, d1	19.5			30.2		
Progression Factor	1.00			0.00		
Incremental Delay, d2	0.2			0.8		
Delay (s)	19.7			0.8		
Level of Service	B			A		
Approach Delay (s)	19.7			0.8	0.0	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	6.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	33.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	130	390	90	240	427	231	87	561	150	82	412	60
Future Volume (veh/h)	130	390	90	240	427	231	87	561	150	82	412	60
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.99	0.98		0.95	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1976	1863	1863	1900	1863	1863	1976	1863	1863	1976
Adj Flow Rate, veh/h	137	411	72	253	449	161	92	591	126	86	434	48
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	478	1174	204	536	1009	359	307	1008	214	216	1123	123
Arrive On Green	0.11	0.39	0.37	0.12	0.39	0.37	0.35	0.35	0.33	0.35	0.35	0.33
Sat Flow, veh/h	1774	3006	522	1774	2556	908	895	2874	611	724	3201	352
Grp Volume(v), veh/h	137	241	242	253	310	300	92	363	354	86	239	243
Grp Sat Flow(s),veh/h/ln	1774	1770	1758	1774	1770	1695	895	1770	1715	724	1770	1783
Q Serve(g_s), s	3.7	8.1	8.4	7.3	10.9	11.2	7.3	14.2	14.4	9.4	8.6	8.8
Cycle Q Clear(g_c), s	3.7	8.1	8.4	7.3	10.9	11.2	16.1	14.2	14.4	23.8	8.6	8.8
Prop In Lane	1.00		0.30	1.00		0.54	1.00		0.36	1.00		0.20
Lane Grp Cap(c), veh/h	478	691	687	536	699	669	307	621	602	216	621	626
V/C Ratio(X)	0.29	0.35	0.35	0.47	0.44	0.45	0.30	0.58	0.59	0.40	0.38	0.39
Avail Cap(c_a), veh/h	486	691	687	537	699	669	316	639	620	223	639	644
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.3	18.3	18.5	13.7	18.9	19.4	26.8	22.5	22.8	32.3	20.7	20.9
Incr Delay (d2), s/veh	0.3	1.4	1.4	0.6	2.0	2.2	0.5	1.3	1.4	1.2	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	4.2	4.3	3.6	5.7	5.6	1.9	7.2	7.0	1.9	4.2	4.3
LnGrp Delay(d),s/veh	13.6	19.6	20.0	14.4	20.9	21.5	27.3	23.8	24.2	33.5	21.1	21.3
LnGrp LOS	B	B	B	B	C	C	C	C	C	C	C	C
Approach Vol, veh/h		620			863			809			568	
Approach Delay, s/veh		18.4			19.2			24.4			23.1	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.6	37.6		33.8	14.0	37.2		33.8
Change Period (Y+Rc), s	4.0	6.0		5.7	4.0	6.0		5.7
Max Green Setting (Gmax), s	10.0	30.3		29.0	10.0	30.3		29.0
Max Q Clear Time (g_c+I1), s	5.7	13.2		25.8	9.3	10.4		18.1
Green Ext Time (p_c), s	0.1	6.8		2.3	0.1	7.3		6.4

Intersection Summary		
HCM 2010 Ctrl Delay		21.3
HCM 2010 LOS		C

Intersection	
Intersection Delay, s/veh	13
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	10	139	230	0	100	132	10	0	399	10	50
Future Vol, veh/h	0	10	139	230	0	100	132	10	0	399	10	50
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	11	146	242	0	105	139	11	0	420	11	53
Number of Lanes	0	1	1	1	0	1	2	0	0	2	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	3	3	3
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	3	3	3
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	3	3
HCM Control Delay	12.7	11.6	14.1
HCM LOS	B	B	B

Lane	NBLn1	NBLn2	NBLn3	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	WBLn3	SBLn1	SBLn2
Vol Left, %	100%	100%	0%	100%	0%	0%	100%	0%	0%	100%	0%
Vol Thru, %	0%	0%	17%	0%	100%	0%	0%	100%	81%	0%	100%
Vol Right, %	0%	0%	83%	0%	0%	100%	0%	0%	19%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	200	200	60	10	139	230	100	88	54	10	10
LT Vol	200	200	0	10	0	0	100	0	0	10	0
Through Vol	0	0	10	0	139	0	0	88	44	0	10
RT Vol	0	0	50	0	0	230	0	0	10	0	0
Lane Flow Rate	210	210	63	11	146	242	105	93	57	11	11
Geometry Grp	8	8	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.414	0.414	0.105	0.021	0.276	0.41	0.22	0.181	0.109	0.024	0.022
Departure Headway (Hd)	7.094	7.094	6.011	7.3	6.8	6.1	7.535	7.035	6.906	8.154	7.654
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	506	506	594	489	527	588	475	508	517	437	465
Service Time	4.856	4.856	3.773	5.069	4.569	3.869	5.311	4.811	4.681	5.95	5.45
HCM Lane V/C Ratio	0.415	0.415	0.106	0.022	0.277	0.412	0.221	0.183	0.11	0.025	0.024
HCM Control Delay	14.8	14.8	9.5	10.2	12.2	13.1	12.4	11.4	10.5	11.2	10.6
HCM Lane LOS	B	B	A	B	B	B	B	B	B	B	B
HCM 95th-tile Q	2	2	0.4	0.1	1.1	2	0.8	0.7	0.4	0.1	0.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations		↰	↑	↱
Traffic Vol, veh/h	0	10	10	10
Future Vol, veh/h	0	10	10	10
Peak Hour Factor	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	11	11	11
Number of Lanes	0	1	1	1

Approach	SB
Opposing Approach	NB
Opposing Lanes	3
Conflicting Approach Left	WB
Conflicting Lanes Left	3
Conflicting Approach Right	EB
Conflicting Lanes Right	3
HCM Control Delay	10.6
HCM LOS	B

Intersection	
Int Delay, s/veh	519.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	10	40	717	10	88	30	327	402	61	268	10
Future Vol, veh/h	10	10	40	717	10	88	30	327	402	61	268	10
Conflicting Peds, #/hr	3	0	4	10	0	3	4	0	10	9	0	3
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	205	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	11	42	755	11	93	32	344	423	64	282	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	664	1261	160	914	1054	397	297	0	0	777	0	0
Stage 1	420	420	-	629	629	-	-	-	-	-	-	-
Stage 2	244	841	-	285	425	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	346	169	857	~ 228	225	602	1261	-	-	835	-	-
Stage 1	581	588	-	~ 437	474	-	-	-	-	-	-	-
Stage 2	738	379	-	~ 698	585	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	257	150	847	~ 186	200	595	1250	-	-	833	-	-
Mov Cap-2 Maneuver	257	150	-	~ 186	200	-	-	-	-	-	-	-
Stage 1	564	541	-	~ 422	458	-	-	-	-	-	-	-
Stage 2	592	366	-	~ 595	538	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	15.9	$ 1255.9	0.3	1.7
HCM LOS	C	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1250	-	-	393	186	495	833	-	-
HCM Lane V/C Ratio	0.025	-	-	0.161	4.058	0.208	0.077	-	-
HCM Control Delay (s)	8	-	-	15.9	$ 1425.6	14.2	9.7	-	-
HCM Lane LOS	A	-	-	C	F	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.6	74.9	0.8	0.2	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s   +: Computation Not Defined   *: All major volume in platoon

Intersection	
Intersection Delay, s/veh	120.4
Intersection LOS	F

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	10	0	10	0	215	0	91	0	20	658	74
Future Vol, veh/h	0	10	0	10	0	215	0	91	0	20	658	74
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	11	0	11	0	226	0	96	0	21	693	78
Number of Lanes	0	0	1	0	0	1	0	1	0	1	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	1	3
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	3	3	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	3	3	2
HCM Control Delay	15.1	26	70.1
HCM LOS	C	D	F

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	50%	100%	0%	100%	0%	0%
Vol Thru, %	0%	100%	75%	0%	0%	0%	0%	100%	91%
Vol Right, %	0%	0%	25%	50%	0%	100%	0%	0%	9%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	20	439	293	20	215	91	40	637	348
LT Vol	20	0	0	10	215	0	40	0	0
Through Vol	0	439	219	0	0	0	0	637	318
RT Vol	0	0	74	10	0	91	0	0	30
Lane Flow Rate	21	462	309	21	226	96	42	670	367
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.052	1.082	0.708	0.063	0.632	0.236	0.103	1.544	0.839
Departure Headway (Hd)	9.578	9.062	8.88	11.598	10.866	9.639	9.04	8.525	8.462
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	376	406	411	311	335	375	399	436	433
Service Time	7.278	6.762	6.58	9.298	8.566	7.339	6.74	6.225	6.162
HCM Lane V/C Ratio	0.056	1.138	0.752	0.068	0.675	0.256	0.105	1.537	0.848
HCM Control Delay	12.8	99.2	30.4	15.1	30.5	15.3	12.8	278.2	42.1
HCM Lane LOS	B	F	D	C	D	C	B	F	E
HCM 95th-tile Q	0.2	14.9	5.3	0.2	4.1	0.9	0.3	35.6	8.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations		↰	↑↱	
Traffic Vol, veh/h	0	40	955	30
Future Vol, veh/h	0	40	955	30
Peak Hour Factor	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	42	1005	32
Number of Lanes	0	1	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	3
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	187.6
HCM LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	468	465	621	112	516	80	637	290	71	50	253	905
Future Volume (veh/h)	468	465	621	112	516	80	637	290	71	50	253	905
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95	1.00		0.89	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	493	489	207	118	543	73	682	289	68	53	266	0
Adj No. of Lanes	1	2	1	1	2	0	2	1	0	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	376	1239	529	207	761	102	1064	436	103	177	354	145
Arrive On Green	0.35	0.58	0.58	0.12	0.25	0.24	0.30	0.30	0.29	0.10	0.10	0.00
Sat Flow, veh/h	1774	3539	1510	1774	3087	413	3548	1453	342	1774	3539	1583
Grp Volume(v), veh/h	493	489	207	118	310	306	682	0	357	53	266	0
Grp Sat Flow(s),veh/h/ln	1774	1770	1510	1774	1770	1730	1774	0	1794	1774	1770	1583
Q Serve(g_s), s	25.4	9.0	8.9	7.6	19.2	19.5	20.0	0.0	20.9	3.3	8.8	0.0
Cycle Q Clear(g_c), s	25.4	9.0	8.9	7.6	19.2	19.5	20.0	0.0	20.9	3.3	8.8	0.0
Prop In Lane	1.00		1.00	1.00		0.24	1.00		0.19	1.00		1.00
Lane Grp Cap(c), veh/h	376	1239	529	207	436	426	1064	0	538	177	354	145
V/C Ratio(X)	1.31	0.39	0.39	0.57	0.71	0.72	0.64	0.00	0.66	0.30	0.75	0.00
Avail Cap(c_a), veh/h	376	1239	529	207	560	548	1064	0	538	177	354	145
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.47	0.47	0.47	1.00	1.00	1.00	0.82	0.00	0.82	1.00	1.00	0.00
Uniform Delay (d), s/veh	38.8	18.1	18.0	50.2	41.3	41.5	36.4	0.0	36.8	50.1	52.5	0.0
Incr Delay (d2), s/veh	149.1	0.4	1.0	10.9	9.5	10.0	2.4	0.0	5.2	4.3	13.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	27.9	4.4	3.8	4.3	10.5	10.5	10.1	0.0	11.1	1.8	5.0	0.0
LnGrp Delay(d),s/veh	187.8	18.5	19.1	61.1	50.8	51.5	38.8	0.0	42.0	54.4	66.3	0.0
LnGrp LOS	F	B	B	E	D	D	D		D	D	E	
Approach Vol, veh/h		1189			734			1039			319	
Approach Delay, s/veh		88.8			52.7			39.9			64.3	
Approach LOS		F			D			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		16.0	30.4	33.6		40.0	18.0	46.0
Change Period (Y+Rc), s		5.0	5.0	* 5		5.0	4.0	5.0
Max Green Setting (Gmax), s		11.0	18.0	* 37		35.0	14.0	41.0
Max Q Clear Time (g_c+I1), s		10.8	27.4	21.5		22.9	9.6	11.0
Green Ext Time (p_c), s		0.0	0.0	3.6		3.8	0.1	5.8

Intersection Summary	
HCM 2010 Ctrl Delay	62.9
HCM 2010 LOS	E

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	97	869	20	20	767	65	30	10	10	137	10	201
Future Volume (veh/h)	97	869	20	20	767	65	30	10	10	137	10	201
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.99	0.93		0.90	0.92		0.90
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1900	1863	1900	1900	1863	1863
Adj Flow Rate, veh/h	102	915	19	21	807	60	32	11	3	144	11	70
Adj No. of Lanes	1	2	0	1	2	0	0	2	0	0	1	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	264	1342	28	206	1118	83	525	515	140	611	43	588
Arrive On Green	0.05	0.38	0.35	0.01	0.34	0.31	0.41	0.41	0.41	0.41	0.41	0.41
Sat Flow, veh/h	1774	3542	74	1774	3337	248	982	1251	341	1199	103	1427
Grp Volume(v), veh/h	102	457	477	21	428	439	32	0	14	155	0	70
Grp Sat Flow(s),veh/h/ln	1774	1770	1846	1774	1770	1815	982	0	1592	1302	0	1427
Q Serve(g_s), s	2.3	12.9	12.9	0.5	12.6	12.7	1.1	0.0	0.3	4.5	0.0	1.8
Cycle Q Clear(g_c), s	2.3	12.9	12.9	0.5	12.6	12.7	5.9	0.0	0.3	4.8	0.0	1.8
Prop In Lane	1.00		0.04	1.00		0.14	1.00		0.21	0.93		1.00
Lane Grp Cap(c), veh/h	264	670	699	206	593	608	525	0	656	653	0	588
V/C Ratio(X)	0.39	0.68	0.68	0.10	0.72	0.72	0.06	0.00	0.02	0.24	0.00	0.12
Avail Cap(c_a), veh/h	291	670	699	312	654	671	576	0	722	707	0	647
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.9	15.5	15.5	16.1	17.4	17.5	13.7	0.0	10.4	11.7	0.0	10.8
Incr Delay (d2), s/veh	0.9	2.8	2.7	0.2	3.5	3.4	0.0	0.0	0.0	0.2	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	6.7	7.0	0.1	6.8	6.9	0.4	0.0	0.1	1.7	0.0	0.7
LnGrp Delay(d),s/veh	15.8	18.3	18.2	16.3	20.9	20.9	13.7	0.0	10.4	11.9	0.0	10.9
LnGrp LOS	B	B	B	B	C	C	B		B	B		B
Approach Vol, veh/h		1036			888			46			225	
Approach Delay, s/veh		18.0			20.8			12.7			11.6	
Approach LOS		B			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	4.5	26.6		28.5	7.1	24.0		28.5
Change Period (Y+Rc), s	3.0	5.5		4.0	3.0	5.5		4.0
Max Green Setting (Gmax), s	5.0	20.5		27.0	5.0	20.5		27.0
Max Q Clear Time (g_c+I1), s	2.5	14.9		6.8	4.3	14.7		7.9
Green Ext Time (p_c), s	0.0	4.2		1.5	0.0	3.8		1.4

Intersection Summary		
HCM 2010 Ctrl Delay		18.4
HCM 2010 LOS		B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	282	724	10	10	439	125	10	0	10	172	10	402
Future Volume (veh/h)	282	724	10	10	439	125	10	0	10	172	10	402
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		1.00	0.98		0.96	0.98		0.93
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	297	762	10	11	462	0	11	0	6	181	0	282
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	1	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	440	1718	23	15	1278	517	282	28	95	492	0	1038
Arrive On Green	0.13	0.48	0.45	0.01	0.36	0.00	0.21	0.00	0.21	0.24	0.00	0.21
Sat Flow, veh/h	3442	3576	47	1774	3539	1583	685	129	444	1369	0	2953
Grp Volume(v), veh/h	297	377	395	11	462	0	17	0	0	181	0	282
Grp Sat Flow(s),veh/h/ln	1721	1770	1853	1774	1770	1583	1257	0	0	1369	0	1477
Q Serve(g_s), s	3.6	6.2	6.2	0.3	4.2	0.0	0.0	0.0	0.0	4.6	0.0	3.0
Cycle Q Clear(g_c), s	3.6	6.2	6.2	0.3	4.2	0.0	0.3	0.0	0.0	5.0	0.0	3.0
Prop In Lane	1.00		0.03	1.00		1.00	0.65		0.35	1.00		1.00
Lane Grp Cap(c), veh/h	440	850	890	15	1278	517	405	0	0	492	0	1038
V/C Ratio(X)	0.67	0.44	0.44	0.72	0.36	0.00	0.04	0.00	0.00	0.37	0.00	0.27
Avail Cap(c_a), veh/h	550	1293	1353	121	2262	958	831	0	0	605	0	1282
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.2	7.5	7.5	21.7	10.3	0.0	13.7	0.0	0.0	14.6	0.0	10.5
Incr Delay (d2), s/veh	2.3	0.4	0.3	48.1	0.2	0.0	0.0	0.0	0.0	0.5	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	3.0	3.2	0.3	2.1	0.0	0.2	0.0	0.0	2.0	0.0	1.2
LnGrp Delay(d),s/veh	20.6	7.9	7.9	69.7	10.5	0.0	13.7	0.0	0.0	15.1	0.0	10.6
LnGrp LOS	C	A	A	E	B		B			B		B
Approach Vol, veh/h		1069			473			17			463	
Approach Delay, s/veh		11.4			11.8			13.7			12.4	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	4.4	25.0		14.4	9.6	19.8		14.4
Change Period (Y+Rc), s	4.0	5.5		5.0	4.0	5.5		* 5
Max Green Setting (Gmax), s	3.0	30.5		13.0	7.0	26.5		* 25
Max Q Clear Time (g_c+I1), s	2.3	8.2		7.0	5.6	6.2		2.3
Green Ext Time (p_c), s	0.0	7.9		1.1	0.2	7.6		1.9

Intersection Summary	
HCM 2010 Ctrl Delay	11.7
HCM 2010 LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	150	428	328	60	312	186	142	236	80	281	391	160
Future Volume (veh/h)	150	428	328	60	312	186	142	236	80	281	391	160
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	1.00		0.97	0.98		0.96	0.98		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	158	451	168	63	328	78	149	248	35	296	412	52
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	379	807	298	290	883	207	415	1063	148	483	1212	558
Arrive On Green	0.05	0.32	0.29	0.04	0.31	0.28	0.05	0.34	0.33	0.05	0.34	0.33
Sat Flow, veh/h	1774	2512	927	1774	2832	663	1774	3105	432	1774	3539	1525
Grp Volume(v), veh/h	158	316	303	63	203	203	149	140	143	296	412	52
Grp Sat Flow(s),veh/h/ln	1774	1770	1670	1774	1770	1725	1774	1770	1767	1774	1770	1525
Q Serve(g_s), s	3.0	9.4	9.7	1.6	5.7	5.9	3.0	3.6	3.7	3.0	5.5	1.4
Cycle Q Clear(g_c), s	3.0	9.4	9.7	1.6	5.7	5.9	3.0	3.6	3.7	3.0	5.5	1.4
Prop In Lane	1.00		0.56	1.00		0.38	1.00		0.24	1.00		1.00
Lane Grp Cap(c), veh/h	379	568	536	290	552	538	415	606	605	483	1212	558
V/C Ratio(X)	0.42	0.56	0.56	0.22	0.37	0.38	0.36	0.23	0.24	0.61	0.34	0.09
Avail Cap(c_a), veh/h	379	778	734	306	778	759	415	834	833	483	1668	755
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.6	17.9	18.4	16.0	17.0	17.4	14.7	14.9	15.1	18.0	15.6	13.3
Incr Delay (d2), s/veh	0.7	0.9	0.9	0.4	0.4	0.4	0.5	0.2	0.2	2.3	0.2	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	4.7	4.6	0.8	2.8	2.9	0.6	1.8	1.8	3.5	2.7	0.6
LnGrp Delay(d),s/veh	18.3	18.7	19.4	16.4	17.4	17.8	15.2	15.1	15.3	20.3	15.7	13.4
LnGrp LOS	B	B	B	B	B	B	B	B	B	C	B	B
Approach Vol, veh/h		777			469			432			760	
Approach Delay, s/veh		18.9			17.5			15.2			17.4	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.0	23.9	7.0	25.8	6.4	24.4	7.0	25.8
Change Period (Y+Rc), s	4.0	6.0	4.0	5.0	4.0	6.0	4.0	5.0
Max Green Setting (Gmax), s	3.0	26.0	3.0	29.0	3.0	26.0	3.0	29.0
Max Q Clear Time (g_c+I1), s	5.0	7.9	5.0	7.5	3.6	11.7	5.0	5.7
Green Ext Time (p_c), s	0.0	5.7	0.0	4.6	0.0	5.2	0.0	4.7

Intersection Summary			
HCM 2010 Ctrl Delay			17.5
HCM 2010 LOS			B

Intersection	
Int Delay, s/veh	23.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	496	103	93	319	116	126
Future Vol, veh/h	496	103	93	319	116	126
Conflicting Peds, #/hr	0	88	49	0	88	49
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	522	108	98	336	122	133

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	719	0	1116	452
Stage 1	-	-	-	-	664	-
Stage 2	-	-	-	-	452	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	878	-	202	555
Stage 1	-	-	-	-	474	-
Stage 2	-	-	-	-	608	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	845	-	155	498
Mov Cap-2 Maneuver	-	-	-	-	155	-
Stage 1	-	-	-	-	442	-
Stage 2	-	-	-	-	501	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.2	116.5
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	242	-	-	845	-
HCM Lane V/C Ratio	1.053	-	-	0.116	-
HCM Control Delay (s)	116.5	-	-	9.8	-
HCM Lane LOS	F	-	-	A	-
HCM 95th %tile Q(veh)	10.6	-	-	0.4	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	128	480	170	260	420	90	320	1336	330	120	1852	86
Future Volume (veh/h)	128	480	170	260	420	90	320	1336	330	120	1852	86
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	135	505	143	274	442	76	337	1406	315	126	1949	87
Adj No. of Lanes	2	2	0	2	2	0	2	3	0	1	3	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	333	717	202	287	705	120	344	1308	292	330	2092	93
Arrive On Green	0.10	0.26	0.25	0.08	0.23	0.22	0.10	0.32	0.30	0.19	0.42	0.40
Sat Flow, veh/h	3442	2717	765	3442	3015	515	3442	4131	923	1774	4988	222
Grp Volume(v), veh/h	135	328	320	274	258	260	337	1153	568	126	1323	713
Grp Sat Flow(s),veh/h/ln	1721	1770	1713	1721	1770	1760	1721	1695	1663	1774	1695	1820
Q Serve(g_s), s	4.4	20.1	20.4	9.5	15.7	16.0	11.7	38.0	38.0	7.5	44.6	44.9
Cycle Q Clear(g_c), s	4.4	20.1	20.4	9.5	15.7	16.0	11.7	38.0	38.0	7.5	44.6	44.9
Prop In Lane	1.00		0.45	1.00		0.29	1.00		0.55	1.00		0.12
Lane Grp Cap(c), veh/h	333	467	452	287	414	411	344	1074	527	330	1422	763
V/C Ratio(X)	0.40	0.70	0.71	0.96	0.62	0.63	0.98	1.07	1.08	0.38	0.93	0.93
Avail Cap(c_a), veh/h	333	649	628	287	664	660	344	1074	527	330	1422	763
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.56	0.56	0.56	0.76	0.76	0.76
Uniform Delay (d), s/veh	50.9	39.9	40.4	54.8	41.2	41.6	53.9	41.0	41.6	42.8	33.2	33.4
Incr Delay (d2), s/veh	0.8	2.0	2.2	41.0	1.5	1.6	30.9	43.7	52.6	0.6	9.8	16.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	10.1	9.9	6.2	7.9	7.9	7.0	24.3	25.1	3.7	22.7	25.8
LnGrp Delay(d),s/veh	51.7	41.9	42.6	95.8	42.8	43.2	84.7	84.7	94.2	43.3	43.0	49.7
LnGrp LOS	D	D	D	F	D	D	F	F	F	D	D	D
Approach Vol, veh/h		783			792			2058			2162	
Approach Delay, s/veh		43.9			61.3			87.3			45.2	
Approach LOS		D			E			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	28.3	42.0	14.0	35.7	16.0	54.3	17.6	32.1
Change Period (Y+Rc), s	6.0	* 6	4.0	6.0	4.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	12.0	* 36	10.0	42.0	12.0	36.0	9.0	* 43
Max Q Clear Time (g_c+I1), s	9.5	40.0	11.5	22.4	13.7	46.9	6.4	18.0
Green Ext Time (p_c), s	0.8	0.0	0.0	3.3	0.0	0.0	1.1	2.7

Intersection Summary	
HCM 2010 Ctrl Delay	62.2
HCM 2010 LOS	E

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	40	60	180	60	60	50	1876	140	200	2022	60
Future Volume (veh/h)	50	40	60	180	60	60	50	1876	140	200	2022	60
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.99	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	53	42	10	189	63	10	53	1975	141	211	2128	61
Adj No. of Lanes	1	1	1	1	1	1	1	3	0	1	3	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	335	425	352	352	425	357	358	2494	177	242	2234	64
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.40	1.00	1.00	0.14	0.44	0.43
Sat Flow, veh/h	1307	1863	1541	1331	1863	1563	1774	4838	344	1774	5078	145
Grp Volume(v), veh/h	53	42	10	189	63	10	53	1381	735	211	1419	770
Grp Sat Flow(s),veh/h/ln	1307	1863	1541	1331	1863	1563	1774	1695	1792	1774	1695	1832
Q Serve(g_s), s	3.4	1.8	0.5	13.1	2.7	0.5	1.9	0.0	0.0	11.7	40.3	40.6
Cycle Q Clear(g_c), s	6.1	1.8	0.5	14.8	2.7	0.5	1.9	0.0	0.0	11.7	40.3	40.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.19	1.00		0.08
Lane Grp Cap(c), veh/h	335	425	352	352	425	357	358	1747	923	242	1492	806
V/C Ratio(X)	0.16	0.10	0.03	0.54	0.15	0.03	0.15	0.79	0.80	0.87	0.95	0.96
Avail Cap(c_a), veh/h	520	689	570	541	689	578	358	1747	923	248	1492	806
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.50	0.50	0.50	0.15	0.15	0.15
Uniform Delay (d), s/veh	33.3	30.5	30.0	36.3	30.8	30.0	24.4	0.0	0.0	42.3	27.0	27.1
Incr Delay (d2), s/veh	0.2	0.1	0.0	1.3	0.2	0.0	0.1	1.9	3.7	5.4	3.2	5.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.9	0.2	4.9	1.4	0.2	0.9	0.5	0.9	6.0	19.4	21.6
LnGrp Delay(d),s/veh	33.5	30.6	30.0	37.6	31.0	30.0	24.5	1.9	3.7	47.7	30.1	32.8
LnGrp LOS	C	C	C	D	C	C	C	A	A	D	C	C
Approach Vol, veh/h		105			262			2169			2400	
Approach Delay, s/veh		32.0			35.7			3.0			32.5	
Approach LOS		C			D			A			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	17.6	55.5		26.8	25.2	48.0		26.8
Change Period (Y+Rc), s	4.0	5.0		4.0	5.0	* 5		4.0
Max Green Setting (Gmax), s	14.0	36.0		37.0	7.0	* 43		37.0
Max Q Clear Time (g_c+I1), s	13.7	2.0		8.1	3.9	42.6		16.8
Green Ext Time (p_c), s	0.0	20.3		1.4	2.8	0.4		1.3

Intersection Summary		
HCM 2010 Ctrl Delay		19.7
HCM 2010 LOS		B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	30	210	260	50	30	330	1990	430	60	2144	40
Future Volume (veh/h)	20	30	210	260	50	30	330	1990	430	60	2144	40
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	21	32	65	274	53	10	347	2095	238	63	2257	15
Adj No. of Lanes	1	1	0	1	1	0	1	3	1	1	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	439	165	336	405	460	87	319	2187	680	244	2022	626
Arrive On Green	0.30	0.30	0.30	0.30	0.30	0.30	0.18	0.43	0.43	0.14	0.40	0.40
Sat Flow, veh/h	1324	546	1110	1285	1522	287	1774	5085	1581	1774	5085	1573
Grp Volume(v), veh/h	21	0	97	274	0	63	347	2095	238	63	2257	15
Grp Sat Flow(s),veh/h/ln	1324	0	1656	1285	0	1809	1774	1695	1581	1774	1695	1573
Q Serve(g_s), s	1.2	0.0	4.3	20.1	0.0	2.5	18.0	39.9	10.1	3.2	39.8	0.6
Cycle Q Clear(g_c), s	3.7	0.0	4.3	24.4	0.0	2.5	18.0	39.9	10.1	3.2	39.8	0.6
Prop In Lane	1.00		0.67	1.00		0.16	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	439	0	501	405	0	547	319	2187	680	244	2022	626
V/C Ratio(X)	0.05	0.00	0.19	0.68	0.00	0.12	1.09	0.96	0.35	0.26	1.12	0.02
Avail Cap(c_a), veh/h	555	0	646	517	0	706	319	2187	680	244	2022	626
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67
Uniform Delay (d), s/veh	26.5	0.0	25.8	34.9	0.0	25.2	41.0	27.6	19.1	38.6	30.1	18.3
Incr Delay (d2), s/veh	0.0	0.0	0.2	2.4	0.0	0.1	75.5	11.6	1.4	0.4	57.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	2.0	7.3	0.0	1.3	15.5	21.0	4.7	1.6	29.3	0.3
LnGrp Delay(d),s/veh	26.6	0.0	26.0	37.3	0.0	25.3	116.5	39.3	20.5	38.9	87.7	18.4
LnGrp LOS	C		C	D		C	F	D	C	D	F	B
Approach Vol, veh/h		118			337			2680			2335	
Approach Delay, s/veh		26.1			35.1			47.6			86.0	
Approach LOS		C			D			D			F	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	18.8	47.0		34.2	22.0	43.8		34.2				
Change Period (Y+Rc), s	5.0	* 5		4.0	4.0	5.0		4.0				
Max Green Setting (Gmax), s	6.0	* 42		39.0	18.0	30.0		39.0				
Max Q Clear Time (g_c+I1), s	5.2	41.9		26.4	20.0	41.8		6.3				
Green Ext Time (p_c), s	0.8	0.1		1.6	0.0	0.0		2.0				
Intersection Summary												
HCM 2010 Ctrl Delay			62.7									
HCM 2010 LOS			E									

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

I-215/University Parkway Interchange
Diverging Diamond Alternative
Cumulative plus Project PM Peak Hour

Intersection	Control	Delay	LOS
12. University Parkway/I 215 Northbound Ramps	Signal	55	D
13. University Parkway/I 215 Southbound Ramps	Signal	22.1	C

	Delay					
University Parkway/I 215 NB Ramps Intersection	**WBL**	**WBR**	**SBT**	**SBR**	**NBL**	**NBT**
12. University Parkway/I 215 Northbound Ramps		93	16.4	9.1		46.7
23. University Parkway SB Approach Merge	145		0.8			
Combined Delay	145	93	17.2	9.1	0	46.7
Volume	430	2058	2353	261	190	692
Approach Delay	102		16.4		36.6	
Approach Volume	2488		2614		882	

	Delay					
University Parkway/I 215 SB Ramps Intersection	**EBL**	**EBR**	**SBL**	**SBT**	**NBT**	**NBR**
13. University Parkway/I 215 Southbound Ramps		8.8		33.6	70.1	
33. University Parkway NB Approach Merge	9.2				5.9	
Combined Delay	9.2	8.8	0	33.6	76	0
Volume	142	70	1793	990	740	400
Approach Delay	9.1		12		49.3	
Approach Volume	212		2783		1140	

Movement	WBR	NBT	SBL	SBR
Lane Configurations				
Traffic Volume (vph)	2058	692	2353	261
Future Volume (vph)	2058	692	2353	261
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	8.0	8.0
Lane Util. Factor	0.88	0.95	0.94	1.00
Frt	0.85	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00
Satd. Flow (prot)	2656	3374	4757	1509
Flt Permitted	1.00	1.00	0.95	1.00
Satd. Flow (perm)	2656	3374	4757	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	2166	728	2477	275
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	2166	728	2477	275
Turn Type	Prot	NA	Prot	Prot
Protected Phases	2	4	6	6
Permitted Phases				
Actuated Green, G (s)	107.0	33.0	103.0	103.0
Effective Green, g (s)	107.0	33.0	103.0	103.0
Actuated g/C Ratio	0.71	0.22	0.69	0.69
Clearance Time (s)	4.0	6.0	8.0	8.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1894	742	3266	1036
v/s Ratio Prot	c0.82	c0.22	0.52	0.18
v/s Ratio Perm				
v/c Ratio	1.14	0.98	0.76	0.27
Uniform Delay, d1	21.5	58.2	15.4	9.0
Progression Factor	1.00	0.39	1.00	1.00
Incremental Delay, d2	71.5	23.8	1.0	0.1
Delay (s)	93.0	46.7	16.4	9.1
Level of Service	F	D	B	A
Approach Delay (s)		46.7		
Approach LOS		D		

Intersection Summary			
HCM 2000 Control Delay	49.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	99.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR2	SER	SWL
Lane Configurations				
Traffic Volume (vph)	740	400	70	990
Future Volume (vph)	740	400	70	990
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	8.0	4.0	4.0	6.0
Lane Util. Factor	0.95	1.00	1.00	1.00
Frt	1.00	0.85	0.86	1.00
Flt Protected	1.00	1.00	1.00	0.95
Satd. Flow (prot)	3374	1509	1536	1687
Flt Permitted	1.00	1.00	1.00	0.95
Satd. Flow (perm)	3374	1509	1536	1687
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	779	421	74	1042
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	779	421	74	1042
Turn Type	NA	Free	Perm	Prot
Protected Phases	6			8
Permitted Phases		Free	4	
Actuated Green, G (s)	38.0	150.0	100.0	98.0
Effective Green, g (s)	38.0	150.0	100.0	98.0
Actuated g/C Ratio	0.25	1.00	0.67	0.65
Clearance Time (s)	8.0		4.0	6.0
Vehicle Extension (s)	3.0		3.0	3.0
Lane Grp Cap (vph)	854	1509	1024	1102
v/s Ratio Prot	c0.23			c0.62
v/s Ratio Perm		0.28	0.05	
v/c Ratio	0.91	0.28	0.07	0.95
Uniform Delay, d1	54.4	0.0	8.8	23.6
Progression Factor	1.00	1.00	1.00	1.08
Incremental Delay, d2	15.7	0.5	0.0	8.1
Delay (s)	70.1	0.5	8.8	33.6
Level of Service	E	A	A	C
Approach Delay (s)	45.6			33.6
Approach LOS	D			C

Intersection Summary			
HCM 2000 Control Delay	39.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Volume (vph)	430	0	0	0	0	2353
Future Volume (vph)	430	0	0	0	0	2353
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0					4.0
Lane Util. Factor	1.00					0.91
Frt	1.00					1.00
Flt Protected	0.95					1.00
Satd. Flow (prot)	1687					4848
Flt Permitted	0.95					1.00
Satd. Flow (perm)	1687					4848
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	453	0	0	0	0	2477
RTOR Reduction (vph)	7	0	0	0	0	0
Lane Group Flow (vph)	446	0	0	0	0	2477
Turn Type	Prot					NA
Protected Phases	8					2
Permitted Phases						
Actuated Green, G (s)	35.0					107.0
Effective Green, g (s)	35.0					107.0
Actuated g/C Ratio	0.23					0.71
Clearance Time (s)	4.0					4.0
Vehicle Extension (s)	3.0					3.0
Lane Grp Cap (vph)	393					3458
v/s Ratio Prot	c0.26					c0.51
v/s Ratio Perm						
v/c Ratio	1.14					0.72
Uniform Delay, d1	57.5					12.6
Progression Factor	1.00					0.02
Incremental Delay, d2	87.5					0.5
Delay (s)	145.0					0.8
Level of Service	F					A
Approach Delay (s)	145.0		0.0			0.8
Approach LOS	F		A			A

Intersection Summary			
HCM 2000 Control Delay	23.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	76.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	142	0	0	740	0	0
Future Volume (vph)	142	0	0	740	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	1687			3374		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	1687			3374		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	149	0	0	779	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	149	0	0	779	0	0
Turn Type	Prot			NA		
Protected Phases	4			2		
Permitted Phases			2			
Actuated Green, G (s)	100.0			42.0		
Effective Green, g (s)	100.0			42.0		
Actuated g/C Ratio	0.67			0.28		
Clearance Time (s)	4.0			4.0		
Vehicle Extension (s)	3.0			3.0		
Lane Grp Cap (vph)	1124			944		
v/s Ratio Prot	c0.09			c0.23		
v/s Ratio Perm						
v/c Ratio	0.13			0.83		
Uniform Delay, d1	9.1			50.6		
Progression Factor	1.00			0.05		
Incremental Delay, d2	0.1			3.4		
Delay (s)	9.2			5.9		
Level of Service	A			A		
Approach Delay (s)	9.2			5.9	0.0	
Approach LOS	A			A	A	

Intersection Summary			
HCM 2000 Control Delay	6.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	780	70	140	620	199	70	299	160	255	465	70
Future Volume (veh/h)	60	780	70	140	620	199	70	299	160	255	465	70
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	0.99		0.97	0.99		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1976	1863	1863	1900	1863	1863	1976	1863	1863	1976
Adj Flow Rate, veh/h	63	821	66	147	653	172	74	315	81	268	489	59
Adj No. of Lanes	1	2	0	1	2	0	1	2	0	1	2	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	376	1271	102	384	1122	295	292	1004	253	355	1145	137
Arrive On Green	0.09	0.38	0.36	0.11	0.41	0.38	0.36	0.36	0.34	0.36	0.36	0.34
Sat Flow, veh/h	1774	3312	266	1774	2759	726	850	2778	701	975	3169	381
Grp Volume(v), veh/h	63	439	448	147	419	406	74	198	198	268	272	276
Grp Sat Flow(s),veh/h/ln	1774	1770	1809	1774	1770	1715	850	1770	1710	975	1770	1780
Q Serve(g_s), s	1.7	17.3	17.3	4.0	15.6	15.8	6.1	6.9	7.2	23.3	9.9	10.0
Cycle Q Clear(g_c), s	1.7	17.3	17.3	4.0	15.6	15.8	16.1	6.9	7.2	30.5	9.9	10.0
Prop In Lane	1.00		0.15	1.00		0.42	1.00		0.41	1.00		0.21
Lane Grp Cap(c), veh/h	376	679	694	384	719	697	292	639	618	355	639	643
V/C Ratio(X)	0.17	0.65	0.65	0.38	0.58	0.58	0.25	0.31	0.32	0.76	0.43	0.43
Avail Cap(c_a), veh/h	424	679	694	391	719	697	292	639	618	355	639	643
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	14.5	21.5	21.6	15.1	19.6	20.0	26.6	19.5	19.9	30.6	20.5	20.7
Incr Delay (d2), s/veh	0.2	4.7	4.6	0.6	3.4	3.5	0.5	0.3	0.3	8.9	0.5	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	9.3	9.5	2.0	8.2	8.2	1.5	3.4	3.4	7.1	4.8	5.0
LnGrp Delay(d),s/veh	14.7	26.2	26.2	15.7	23.0	23.5	27.1	19.8	20.2	39.6	20.9	21.1
LnGrp LOS	B	C	C	B	C	C	C	B	C	D	C	C
Approach Vol, veh/h		950			972			470			816	
Approach Delay, s/veh		25.4			22.1			21.1			27.1	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.7	38.6		34.7	13.7	36.6		34.7
Change Period (Y+Rc), s	4.0	6.0		5.7	4.0	6.0		5.7
Max Green Setting (Gmax), s	10.0	30.3		29.0	10.0	30.3		29.0
Max Q Clear Time (g_c+I1), s	3.7	17.8		32.5	6.0	19.3		18.1
Green Ext Time (p_c), s	0.1	8.5		0.0	0.1	7.7		5.8

Intersection Summary		
HCM 2010 Ctrl Delay		24.2
HCM 2010 LOS		C

APPENDIX F: MITIGATED LEVEL OF SERVICE

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1	27	61	1	14	18	381	551	244	237	0
Future Volume (veh/h)	0	1	27	61	1	14	18	381	551	244	237	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.99	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1800
Adj Flow Rate, veh/h	0	1	25	80	1	11	24	501	221	321	312	0
Adj No. of Lanes	1	1	0	1	1	0	1	1	1	1	2	0
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	2	8	208	101	33	364	36	618	609	366	1835	0
Arrive On Green	0.00	0.15	0.15	0.06	0.26	0.26	0.02	0.35	0.35	0.22	0.55	0.00
Sat Flow, veh/h	1681	56	1397	1681	125	1375	1681	1765	1481	1681	3441	0
Grp Volume(v), veh/h	0	0	26	80	0	12	24	501	221	321	312	0
Grp Sat Flow(s),veh/h/ln	1681	0	1452	1681	0	1500	1681	1765	1481	1681	1676	0
Q Serve(g_s), s	0.0	0.0	1.1	3.4	0.0	0.4	1.0	18.5	7.4	13.3	3.3	0.0
Cycle Q Clear(g_c), s	0.0	0.0	1.1	3.4	0.0	0.4	1.0	18.5	7.4	13.3	3.3	0.0
Prop In Lane	1.00		0.96	1.00		0.92	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	2	0	217	101	0	397	36	618	609	366	1835	0
V/C Ratio(X)	0.00	0.00	0.12	0.79	0.00	0.03	0.67	0.81	0.36	0.88	0.17	0.00
Avail Cap(c_a), veh/h	93	0	707	187	0	813	140	761	728	467	2098	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	26.5	33.4	0.0	19.6	34.9	21.2	14.7	27.2	8.1	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.2	12.9	0.0	0.0	19.9	5.4	0.4	14.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.5	1.9	0.0	0.2	0.7	9.8	3.1	7.6	1.5	0.0
LnGrp Delay(d),s/veh	0.0	0.0	26.7	46.3	0.0	19.6	54.8	26.6	15.1	41.3	8.2	0.0
LnGrp LOS			C	D		B	D	C	B	D	A	
Approach Vol, veh/h		26			92			746			633	
Approach Delay, s/veh		26.7			42.8			24.1			25.0	
Approach LOS		C			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.7	29.2	8.3	14.7	5.5	43.3	0.0	23.0
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	20.0	31.0	8.0	35.0	6.0	45.0	4.0	39.0
Max Q Clear Time (g_c+I1), s	15.3	20.5	5.4	3.1	3.0	5.3	0.0	2.4
Green Ext Time (p_c), s	0.4	4.2	0.0	0.2	0.0	6.6	0.0	0.2

Intersection Summary	
HCM 2010 Ctrl Delay	25.7
HCM 2010 LOS	C

Notes

User approved changes to right turn type.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	4	39	0	6	4	947	140	93	228	1
Future Volume (veh/h)	0	0	4	39	0	6	4	947	140	93	228	1
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	0.98		0.98	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1800	1800	1765	1765	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	0	0	2	40	0	4	4	966	136	95	233	1
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	2	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	0	0	287	443	0	287	839	1802	254	389	2093	9
Arrive On Green	0.00	0.00	0.20	0.20	0.00	0.20	0.61	0.61	0.61	0.61	0.61	0.61
Sat Flow, veh/h	0	0	1472	1376	0	1472	1141	2948	415	509	3424	15
Grp Volume(v), veh/h	0	0	2	40	0	4	4	549	553	95	114	120
Grp Sat Flow(s),veh/h/ln	0	0	1472	1376	0	1472	1141	1676	1687	509	1676	1762
Q Serve(g_s), s	0.0	0.0	0.0	1.0	0.0	0.1	0.1	7.8	7.8	5.5	1.2	1.2
Cycle Q Clear(g_c), s	0.0	0.0	0.0	1.0	0.0	0.1	1.2	7.8	7.8	13.3	1.2	1.2
Prop In Lane	0.00		1.00	1.00		1.00	1.00		0.25	1.00		0.01
Lane Grp Cap(c), veh/h	0	0	287	443	0	287	839	1025	1031	389	1025	1077
V/C Ratio(X)	0.00	0.00	0.01	0.09	0.00	0.01	0.00	0.54	0.54	0.24	0.11	0.11
Avail Cap(c_a), veh/h	0	0	1247	1344	0	1247	1163	1501	1510	533	1501	1578
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	13.4	13.8	0.0	13.4	3.6	4.6	4.6	8.5	3.3	3.4
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.4	0.4	0.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.4	0.0	0.0	0.0	3.6	3.7	0.8	0.6	0.6
LnGrp Delay(d),s/veh	0.0	0.0	13.4	13.9	0.0	13.4	3.6	5.1	5.1	8.8	3.4	3.4
LnGrp LOS			B	B		B	A	A	A	A	A	A
Approach Vol, veh/h		2			44			1106			329	
Approach Delay, s/veh		13.4			13.9			5.1			5.0	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		29.3		12.1		29.3		12.1
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0
Max Green Setting (Gmax), s		37.0		35.0		37.0		35.0
Max Q Clear Time (g_c+I1), s		9.8		2.0		15.3		3.0
Green Ext Time (p_c), s		11.0		0.2		9.9		0.2

Intersection Summary	
HCM 2010 Ctrl Delay	5.3
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	921	772	733	31	130	19	266	150	82	57	91	163
Future Volume (veh/h)	921	772	733	31	130	19	266	150	82	57	91	163
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.92	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1800	1765	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	1012	848	390	34	143	12	175	329	68	63	100	0
Adj No. of Lanes	2	2	1	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	1278	1781	781	81	561	46	417	706	144	104	208	83
Arrive On Green	0.65	0.89	0.89	0.05	0.18	0.17	0.25	0.25	0.24	0.06	0.06	0.00
Sat Flow, veh/h	3261	3353	1471	1681	3112	257	1681	2845	581	1681	3353	1500
Grp Volume(v), veh/h	1012	848	390	34	76	79	175	202	195	63	100	0
Grp Sat Flow(s),veh/h/ln	1630	1676	1471	1681	1676	1693	1681	1765	1661	1681	1676	1500
Q Serve(g_s), s	32.3	7.2	7.8	2.8	5.6	5.8	12.7	14.1	14.5	5.3	4.2	0.0
Cycle Q Clear(g_c), s	32.3	7.2	7.8	2.8	5.6	5.8	12.7	14.1	14.5	5.3	4.2	0.0
Prop In Lane	1.00		1.00	1.00		0.15	1.00		0.35	1.00		1.00
Lane Grp Cap(c), veh/h	1278	1781	781	81	302	305	417	438	412	104	208	83
V/C Ratio(X)	0.79	0.48	0.50	0.42	0.25	0.26	0.42	0.46	0.47	0.60	0.48	0.00
Avail Cap(c_a), veh/h	1278	1781	781	81	358	362	417	438	412	104	208	83
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.37	0.37	0.37	1.00	1.00	1.00	0.88	0.88	0.88	1.00	1.00	0.00
Uniform Delay (d), s/veh	20.8	4.3	4.3	67.0	51.0	51.2	45.7	46.3	46.6	66.3	65.7	0.0
Incr Delay (d2), s/veh	2.0	0.3	0.9	15.1	2.0	2.0	2.7	3.1	3.4	23.2	7.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.6	3.2	3.2	1.7	2.8	2.9	6.2	7.2	7.0	3.1	2.2	0.0
LnGrp Delay(d),s/veh	22.7	4.6	5.1	82.2	53.0	53.2	48.5	49.4	50.0	89.5	73.5	0.0
LnGrp LOS	C	A	A	F	D	D	D	D	D	F	E	
Approach Vol, veh/h		2250			189			572			163	
Approach Delay, s/veh		12.9			58.3			49.3			79.6	
Approach LOS		B			E			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		13.0	61.9	30.1		40.0	11.0	81.0
Change Period (Y+Rc), s		5.0	5.0	* 5		5.0	4.0	5.0
Max Green Setting (Gmax), s		8.0	53.0	* 30		35.0	7.0	76.0
Max Q Clear Time (g_c+I1), s		7.3	34.3	7.8		16.5	4.8	9.8
Green Ext Time (p_c), s		0.0	11.0	0.8		2.5	0.0	17.8

Intersection Summary		
HCM 2010 Ctrl Delay		25.6
HCM 2010 LOS		C

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	197	359	194	212	283	179	102	2032	87	27	471	92
Future Volume (veh/h)	197	359	194	212	283	179	102	2032	87	27	471	92
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	221	403	157	238	318	146	115	2283	95	30	529	45
Adj No. of Lanes	2	2	0	2	2	0	2	3	0	1	3	1
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	280	535	206	247	454	204	476	2288	95	176	2126	632
Arrive On Green	0.09	0.23	0.21	0.08	0.20	0.19	0.15	0.48	0.47	0.21	0.88	0.86
Sat Flow, veh/h	3261	2363	910	3261	2245	1008	3261	4740	196	1681	4818	1479
Grp Volume(v), veh/h	221	284	276	238	236	228	115	1542	836	30	529	45
Grp Sat Flow(s),veh/h/ln	1630	1676	1597	1630	1676	1577	1630	1606	1724	1681	1606	1479
Q Serve(g_s), s	9.6	22.9	23.5	10.6	18.9	19.6	4.5	69.3	70.0	2.1	2.4	0.7
Cycle Q Clear(g_c), s	9.6	22.9	23.5	10.6	18.9	19.6	4.5	69.3	70.0	2.1	2.4	0.7
Prop In Lane	1.00		0.57	1.00		0.64	1.00		0.11	1.00		1.00
Lane Grp Cap(c), veh/h	280	379	361	247	339	319	476	1551	832	176	2126	632
V/C Ratio(X)	0.79	0.75	0.76	0.96	0.69	0.72	0.24	0.99	1.00	0.17	0.25	0.07
Avail Cap(c_a), veh/h	280	509	484	247	509	479	476	1551	832	176	2126	632
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.58	0.58	0.58	0.97	0.97	0.97
Uniform Delay (d), s/veh	65.0	52.3	53.0	66.8	53.7	54.6	54.8	37.3	37.6	52.1	4.9	6.1
Incr Delay (d2), s/veh	14.0	4.2	5.0	46.6	2.6	3.0	0.2	16.3	24.7	0.4	0.3	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	11.0	10.9	6.4	9.0	8.9	2.1	34.1	39.0	1.0	1.1	0.3
LnGrp Delay(d),s/veh	78.9	56.5	58.0	113.4	56.2	57.5	54.9	53.6	62.4	52.6	5.2	6.3
LnGrp LOS	E	E	E	F	E	E	D	D	F	D	A	A
Approach Vol, veh/h		781			702			2493			604	
Approach Delay, s/veh		63.4			76.0			56.6			7.6	
Approach LOS		E			E			E			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.2	74.0	15.0	36.8	25.2	68.0	18.5	33.3
Change Period (Y+Rc), s	4.0	6.0	4.0	6.0	4.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	4.0	68.0	11.0	42.0	10.0	62.0	11.0	* 42
Max Q Clear Time (g_c+I1), s	4.1	72.0	12.6	25.5	6.5	4.4	11.6	21.6
Green Ext Time (p_c), s	0.0	0.0	0.0	2.9	0.1	3.8	0.0	2.4

Intersection Summary	
HCM 2010 Ctrl Delay	54.3
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	37	43	44	74	29	25	42	2134	45	6	855	22
Future Volume (veh/h)	37	43	44	74	29	25	42	2134	45	6	855	22
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.96	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1765	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	46	54	5	92	36	6	52	2668	55	8	1069	27
Adj No. of Lanes	1	1	1	1	1	1	1	3	0	1	3	0
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	96	212	173	96	212	173	362	2603	53	290	2382	60
Arrive On Green	0.06	0.12	0.12	0.06	0.12	0.12	0.43	1.00	1.00	0.17	0.49	0.49
Sat Flow, veh/h	1681	1765	1443	1681	1765	1443	1681	4859	100	1681	4832	122
Grp Volume(v), veh/h	46	54	5	92	36	6	52	1759	964	8	710	386
Grp Sat Flow(s),veh/h/ln	1681	1765	1443	1681	1765	1443	1681	1606	1747	1681	1606	1743
Q Serve(g_s), s	3.7	3.9	0.3	7.6	2.6	0.5	2.6	75.0	71.8	0.6	20.2	20.2
Cycle Q Clear(g_c), s	3.7	3.9	0.3	7.6	2.6	0.5	2.6	75.0	71.8	0.6	20.2	20.2
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.06	1.00		0.07
Lane Grp Cap(c), veh/h	96	212	173	96	212	173	362	1721	936	290	1583	859
V/C Ratio(X)	0.48	0.25	0.03	0.96	0.17	0.03	0.14	1.02	1.03	0.03	0.45	0.45
Avail Cap(c_a), veh/h	96	466	381	96	466	381	362	1721	936	290	1583	859
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.09	0.09	0.09	0.89	0.89	0.89
Uniform Delay (d), s/veh	64.0	55.9	25.9	65.8	55.3	54.4	32.0	0.0	0.0	48.1	23.1	23.1
Incr Delay (d2), s/veh	3.7	0.6	0.1	77.9	0.4	0.1	0.0	13.3	18.0	0.0	0.8	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	1.9	0.1	5.6	1.3	0.2	1.2	3.2	4.7	0.3	9.1	10.0
LnGrp Delay(d),s/veh	67.7	56.5	26.0	143.8	55.7	54.5	32.0	13.3	18.0	48.2	23.9	24.7
LnGrp LOS	E	E	C	F	E	D	C	F	F	D	C	C
Approach Vol, veh/h		105			134			2775			1104	
Approach Delay, s/veh		60.0			116.1			15.3			24.4	
Approach LOS		E			F			B			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	28.2	79.0	12.0	20.8	34.2	73.0	12.0	20.8				
Change Period (Y+Rc), s	4.0	5.0	4.0	4.0	4.0	5.0	4.0	4.0				
Max Green Setting (Gmax), s	4.0	74.0	8.0	37.0	10.0	68.0	8.0	37.0				
Max Q Clear Time (g_c+I1), s	2.6	77.0	9.6	5.9	4.6	22.2	5.7	4.6				
Green Ext Time (p_c), s	0.0	0.0	0.0	0.4	0.0	8.1	0.1	0.2				
Intersection Summary												
HCM 2010 Ctrl Delay			22.1									
HCM 2010 LOS			C									

I-215/University Parkway Interchange
Diverging Diamond Alternative
Existing plus Project with Mitigation AM Peak Hour

Intersection	Control	Delay	LOS
12. University Parkway/I 215 Northbound Ramps	Signal	14.1	B
13. University Parkway/I 215 Southbound Ramps	Signal	9.5	A

	Delay					
University Parkway/I 215 NB Ramps Intersection	**WBL**	**WBR**	**SBT**	**SBR**	**NBL**	**NBT**
12. University Parkway/I 215 Northbound Ramps		4.8	27.7	15.4		13
23. University Parkway SB Approach Merge	16.8		1.3			
Combined Delay	16.8	4.8	29	15.4	0	13
Volume	288	2232	1409	85	24	592
Approach Delay	6.2		28.2		12.5	
Approach Volume	2520		1494		616	

	Delay					
University Parkway/I 215 SB Ramps Intersection	**EBL**	**EBR**	**SBL**	**SBT**	**NBT**	**NBR**
13. University Parkway/I 215 Southbound Ramps		11.5		26.9	15.8	
33. University Parkway NB Approach Merge	12.8				0.5	
Combined Delay	12.8	11.5	0	26.9	16.3	0
Volume	214	76	1124	557	408	277
Approach Delay	12.5		8.9		9.7	
Approach Volume	290		1681		685	

HCM Signalized Intersection Capacity Analysis
12: Universtiy Parkway & University Parkway & I 215 NB Off/On-Ramps 12/06/2016

Movement	WBR	NBT	SBL	SBR
Lane Configurations				
Traffic Volume (vph)	2232	592	1409	85
Future Volume (vph)	2232	592	1409	85
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	8.0	8.0
Lane Util. Factor	0.88	0.95	0.94	1.00
Frt	0.85	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00
Satd. Flow (prot)	2656	3374	4757	1509
Flt Permitted	1.00	1.00	0.95	1.00
Satd. Flow (perm)	2656	3374	4757	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	2349	623	1483	89
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	2349	623	1483	89
Turn Type	Free	NA	Prot	Prot
Protected Phases		4	6	6
Permitted Phases	Free			
Actuated Green, G (s)	70.0	26.5	29.5	29.5
Effective Green, g (s)	70.0	26.5	29.5	29.5
Actuated g/C Ratio	1.00	0.38	0.42	0.42
Clearance Time (s)		6.0	8.0	8.0
Vehicle Extension (s)		3.0	3.0	3.0
Lane Grp Cap (vph)	2656	1277	2004	635
v/s Ratio Prot		0.18	0.31	0.06
v/s Ratio Perm	c0.88			
v/c Ratio	0.88	0.49	0.74	0.14
Uniform Delay, d1	0.0	16.6	17.0	12.5
Progression Factor	1.00	0.71	1.56	1.23
Incremental Delay, d2	4.8	1.3	1.2	0.1
Delay (s)	4.8	13.0	27.7	15.4
Level of Service	A	B	C	B
Approach Delay (s)		13.0		
Approach LOS		B		

Intersection Summary			
HCM 2000 Control Delay	13.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	51.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR2	SER	SWL
Lane Configurations				
Traffic Volume (vph)	408	277	76	557
Future Volume (vph)	408	277	76	557
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	8.0	4.0	4.0	6.0
Lane Util. Factor	0.95	1.00	1.00	1.00
Frt	1.00	0.85	0.86	1.00
Flt Protected	1.00	1.00	1.00	0.95
Satd. Flow (prot)	3374	1509	1536	1687
Flt Permitted	1.00	1.00	1.00	0.95
Satd. Flow (perm)	3374	1509	1536	1687
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	429	292	80	586
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	429	292	80	586
Turn Type	NA	Free	Perm	Prot
Protected Phases	6			8
Permitted Phases		Free	4	
Actuated Green, G (s)	27.0	70.0	31.0	29.0
Effective Green, g (s)	27.0	70.0	31.0	29.0
Actuated g/C Ratio	0.39	1.00	0.44	0.41
Clearance Time (s)	8.0		4.0	6.0
Vehicle Extension (s)	3.0		3.0	3.0
Lane Grp Cap (vph)	1301	1509	680	698
v/s Ratio Prot	c0.13			c0.35
v/s Ratio Perm		0.19	0.05	
v/c Ratio	0.33	0.19	0.12	0.84
Uniform Delay, d1	15.1	0.0	11.5	18.4
Progression Factor	1.00	1.00	1.00	1.05
Incremental Delay, d2	0.7	0.3	0.1	7.6
Delay (s)	15.8	0.3	11.5	26.9
Level of Service	B	A	B	C
Approach Delay (s)	9.5			26.9
Approach LOS	A			C

Intersection Summary			
HCM 2000 Control Delay	17.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↑↑↑
Traffic Volume (vph)	288	0	0	0	0	1409
Future Volume (vph)	288	0	0	0	0	1409
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0					4.0
Lane Util. Factor	1.00					0.91
Frt	1.00					1.00
Flt Protected	0.95					1.00
Satd. Flow (prot)	1687					4848
Flt Permitted	0.95					1.00
Satd. Flow (perm)	1687					4848
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	0	0	0	0	1483
RTOR Reduction (vph)	10	0	0	0	0	0
Lane Group Flow (vph)	293	0	0	0	0	1483
Turn Type	Prot					NA
Protected Phases	8					2
Permitted Phases						
Actuated Green, G (s)	28.5					33.5
Effective Green, g (s)	28.5					33.5
Actuated g/C Ratio	0.41					0.48
Clearance Time (s)	4.0					4.0
Vehicle Extension (s)	3.0					3.0
Lane Grp Cap (vph)	686					2320
v/s Ratio Prot	c0.17					c0.31
v/s Ratio Perm						
v/c Ratio	0.43					0.64
Uniform Delay, d1	14.9					13.7
Progression Factor	1.00					0.07
Incremental Delay, d2	1.9					0.4
Delay (s)	16.8					1.3
Level of Service	B					A
Approach Delay (s)	16.8		0.0			1.3
Approach LOS	B		A			A

Intersection Summary			
HCM 2000 Control Delay	4.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	49.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	214	0	0	408	0	0
Future Volume (vph)	214	0	0	408	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	1687			3374		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	1687			3374		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	225	0	0	429	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	225	0	0	429	0	0
Turn Type	Prot			NA		
Protected Phases	4			2		
Permitted Phases			2			
Actuated Green, G (s)	31.0			31.0		
Effective Green, g (s)	31.0			31.0		
Actuated g/C Ratio	0.44			0.44		
Clearance Time (s)	4.0			4.0		
Vehicle Extension (s)	3.0			3.0		
Lane Grp Cap (vph)	747			1494		
v/s Ratio Prot	c0.13			c0.13		
v/s Ratio Perm						
v/c Ratio	0.30			0.29		
Uniform Delay, d1	12.5			12.4		
Progression Factor	1.00			0.00		
Incremental Delay, d2	0.2			0.5		
Delay (s)	12.8			0.5		
Level of Service	B			A		
Approach Delay (s)	12.8			0.5	0.0	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	4.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	29.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	7	31	476	6	117	25	298	264	88	284	1
Future Volume (veh/h)	1	7	31	476	6	117	25	298	264	88	284	1
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.98	1.00		0.98	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1800
Adj Flow Rate, veh/h	1	10	32	690	9	53	36	432	212	128	412	1
Adj No. of Lanes	1	1	0	1	1	0	1	1	1	1	2	0
Peak Hour Factor	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	2	36	114	715	115	674	45	464	1025	138	1092	3
Arrive On Green	0.00	0.10	0.10	0.43	0.52	0.52	0.03	0.26	0.26	0.08	0.32	0.32
Sat Flow, veh/h	1681	363	1161	1681	219	1289	1681	1765	1471	1681	3431	8
Grp Volume(v), veh/h	1	0	42	690	0	62	36	432	212	128	201	212
Grp Sat Flow(s),veh/h/ln	1681	0	1523	1681	0	1508	1681	1765	1471	1681	1676	1763
Q Serve(g_s), s	0.1	0.0	3.1	48.9	0.0	2.5	2.6	29.2	6.4	9.2	11.4	11.4
Cycle Q Clear(g_c), s	0.1	0.0	3.1	48.9	0.0	2.5	2.6	29.2	6.4	9.2	11.4	11.4
Prop In Lane	1.00		0.76	1.00		0.85	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	2	0	150	715	0	789	45	464	1025	138	533	561
V/C Ratio(X)	0.54	0.00	0.28	0.96	0.00	0.08	0.80	0.93	0.21	0.93	0.38	0.38
Avail Cap(c_a), veh/h	55	0	436	757	0	1061	124	491	1048	138	533	561
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	61.0	0.0	51.0	34.2	0.0	14.5	59.1	43.9	6.9	55.7	32.3	32.3
Incr Delay (d2), s/veh	147.4	0.0	1.0	23.7	0.0	0.0	27.2	23.9	0.1	56.0	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	1.4	27.3	0.0	1.0	1.5	17.2	2.6	6.4	5.3	5.6
LnGrp Delay(d),s/veh	208.3	0.0	52.1	57.9	0.0	14.5	86.3	67.9	7.0	111.7	32.7	32.7
LnGrp LOS	F		D	E		B	F	E	A	F	C	C
Approach Vol, veh/h		43			752			680			541	
Approach Delay, s/veh		55.7			54.3			49.9			51.4	
Approach LOS		E			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.0	36.1	56.0	16.0	7.3	42.9	4.1	67.9
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	10.0	34.0	55.0	35.0	9.0	35.0	4.0	86.0
Max Q Clear Time (g_c+I1), s	11.2	31.2	50.9	5.1	4.6	13.4	2.1	4.5
Green Ext Time (p_c), s	0.0	0.9	1.1	0.6	0.0	5.7	0.0	0.8

Intersection Summary	
HCM 2010 Ctrl Delay	52.1
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	1	215	0	64	2	522	62	10	776	0
Future Volume (veh/h)	0	0	1	215	0	64	2	522	62	10	776	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	0.99		0.98	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1765	1800	1800	1765	1765	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	0	0	1	295	0	36	3	715	70	14	1063	0
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	2	0
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	0	0	424	594	0	423	332	1540	151	429	1675	0
Arrive On Green	0.00	0.00	0.29	0.29	0.00	0.29	0.50	0.50	0.50	0.50	0.50	0.00
Sat Flow, veh/h	0	0	1469	1396	0	1467	528	3083	302	685	3441	0
Grp Volume(v), veh/h	0	0	1	295	0	36	3	389	396	14	1063	0
Grp Sat Flow(s),veh/h/ln	0	0	1469	1396	0	1467	528	1676	1708	685	1676	0
Q Serve(g_s), s	0.0	0.0	0.0	7.2	0.0	0.7	0.2	5.7	5.7	0.5	8.8	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	7.2	0.0	0.7	8.9	5.7	5.7	6.2	8.8	0.0
Prop In Lane	0.00		1.00	1.00		1.00	1.00		0.18	1.00		0.00
Lane Grp Cap(c), veh/h	0	0	424	594	0	423	332	837	853	429	1675	0
V/C Ratio(X)	0.00	0.00	0.00	0.50	0.00	0.09	0.01	0.46	0.46	0.03	0.63	0.00
Avail Cap(c_a), veh/h	0	0	1362	1488	0	1361	376	977	996	486	1955	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	9.6	12.1	0.0	9.8	10.2	6.2	6.2	8.2	6.9	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.6	0.0	0.1	0.0	0.4	0.4	0.0	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	2.8	0.0	0.3	0.0	2.7	2.7	0.1	4.1	0.0
LnGrp Delay(d),s/veh	0.0	0.0	9.6	12.8	0.0	9.9	10.2	6.6	6.5	8.2	7.4	0.0
LnGrp LOS			A	B		A	B	A	A	A	A	
Approach Vol, veh/h		1			331			788			1077	
Approach Delay, s/veh		9.6			12.5			6.6			7.5	
Approach LOS		A			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		22.8		14.9		22.8		14.9
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0
Max Green Setting (Gmax), s		22.0		35.0		22.0		35.0
Max Q Clear Time (g_c+I1), s		10.9		2.0		10.8		9.2
Green Ext Time (p_c), s		7.9		2.1		8.0		2.0

Intersection Summary	
HCM 2010 Ctrl Delay	7.9
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	466	457	560	67	468	47	587	161	42	27	137	879
Future Volume (veh/h)	466	457	560	67	468	47	587	161	42	27	137	879
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.88	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1800	1765	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	621	609	156	89	624	56	783	215	49	36	183	0
Adj No. of Lanes	2	2	1	1	2	0	2	1	0	1	2	1
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	819	1364	586	139	712	64	1113	459	105	116	231	93
Arrive On Green	0.42	0.68	0.68	0.08	0.23	0.22	0.33	0.33	0.32	0.07	0.07	0.00
Sat Flow, veh/h	3261	3353	1440	1681	3075	275	3361	1386	316	1681	3353	1500
Grp Volume(v), veh/h	621	609	156	89	340	340	783	0	264	36	183	0
Grp Sat Flow(s),veh/h/ln	1630	1676	1440	1681	1676	1673	1681	0	1702	1681	1676	1500
Q Serve(g_s), s	23.5	12.1	6.1	7.4	28.3	28.5	29.5	0.0	17.8	3.0	7.8	0.0
Cycle Q Clear(g_c), s	23.5	12.1	6.1	7.4	28.3	28.5	29.5	0.0	17.8	3.0	7.8	0.0
Prop In Lane	1.00		1.00	1.00		0.16	1.00		0.19	1.00		1.00
Lane Grp Cap(c), veh/h	819	1364	586	139	388	387	1113	0	564	116	231	93
V/C Ratio(X)	0.76	0.45	0.27	0.64	0.87	0.88	0.70	0.00	0.47	0.31	0.79	0.00
Avail Cap(c_a), veh/h	819	1364	586	139	428	427	1113	0	564	116	231	93
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.53	0.53	0.53	1.00	1.00	1.00	0.75	0.00	0.75	0.65	0.65	0.00
Uniform Delay (d), s/veh	38.3	15.7	14.8	64.4	53.7	53.8	42.3	0.0	38.5	64.2	66.5	0.0
Incr Delay (d2), s/veh	3.5	0.6	0.6	20.4	23.0	23.5	2.8	0.0	2.1	4.5	16.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.9	5.6	2.5	4.3	15.6	15.7	14.1	0.0	8.7	1.5	4.1	0.0
LnGrp Delay(d),s/veh	41.9	16.3	15.4	84.8	76.7	77.4	45.1	0.0	40.6	68.7	82.8	0.0
LnGrp LOS	D	B	B	F	E	E	D		D	E	F	
Approach Vol, veh/h		1386			769			1047			219	
Approach Delay, s/veh		27.6			77.9			44.0			80.5	
Approach LOS		C			E			D			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		14.0	41.4	37.6		52.0	16.0	63.0
Change Period (Y+Rc), s		5.0	5.0	* 5		5.0	4.0	5.0
Max Green Setting (Gmax), s		9.0	34.0	* 36		47.0	12.0	58.0
Max Q Clear Time (g_c+I1), s		9.8	25.5	30.5		31.5	9.4	14.1
Green Ext Time (p_c), s		0.0	4.3	2.1		4.1	0.0	8.0

Intersection Summary	
HCM 2010 Ctrl Delay	47.3
HCM 2010 LOS	D

Notes
User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	125	355	167	240	377	81	276	1296	213	109	1712	78
Future Volume (veh/h)	125	355	167	240	377	81	276	1296	213	109	1712	78
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1800	1765	1765	1765
Adj Flow Rate, veh/h	151	428	150	289	454	81	333	1561	240	131	2063	33
Adj No. of Lanes	2	2	0	2	2	0	2	3	0	1	3	1
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	272	586	203	270	643	114	519	1737	266	256	1960	581
Arrive On Green	0.08	0.24	0.23	0.08	0.23	0.21	0.16	0.41	0.40	0.30	0.81	0.79
Sat Flow, veh/h	3261	2432	843	3261	2838	503	3261	4198	643	1681	4818	1477
Grp Volume(v), veh/h	151	294	284	289	267	268	333	1193	608	131	2063	33
Grp Sat Flow(s),veh/h/ln	1630	1676	1599	1630	1676	1664	1630	1606	1630	1681	1606	1477
Q Serve(g_s), s	6.5	23.4	23.9	12.0	21.2	21.6	13.9	50.2	50.6	9.3	59.0	0.7
Cycle Q Clear(g_c), s	6.5	23.4	23.9	12.0	21.2	21.6	13.9	50.2	50.6	9.3	59.0	0.7
Prop In Lane	1.00		0.53	1.00		0.30	1.00		0.39	1.00		1.00
Lane Grp Cap(c), veh/h	272	404	385	270	380	377	519	1329	674	256	1960	581
V/C Ratio(X)	0.56	0.73	0.74	1.07	0.70	0.71	0.64	0.90	0.90	0.51	1.05	0.06
Avail Cap(c_a), veh/h	272	509	485	270	509	505	519	1329	674	256	1960	581
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.58	0.58	0.58	0.51	0.51	0.51
Uniform Delay (d), s/veh	63.9	50.6	51.3	66.5	51.6	52.0	57.1	39.6	40.1	46.0	13.5	9.5
Incr Delay (d2), s/veh	2.5	3.9	4.5	74.9	2.8	3.0	1.6	6.0	11.2	0.9	30.8	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	11.3	11.0	8.2	10.2	10.2	6.4	23.3	24.9	4.4	30.1	0.3
LnGrp Delay(d),s/veh	66.4	54.5	55.8	141.4	54.4	55.0	58.7	45.7	51.3	46.9	44.3	9.6
LnGrp LOS	E	D	E	F	D	E	E	D	D	D	F	A
Approach Vol, veh/h		729			824			2134			2227	
Approach Delay, s/veh		57.5			85.1			49.3			44.0	
Approach LOS		E			F			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	26.1	64.0	16.0	38.9	27.1	63.0	18.1	36.9
Change Period (Y+Rc), s	4.0	6.0	4.0	6.0	4.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	13.0	58.0	12.0	42.0	14.0	57.0	12.0	* 42
Max Q Clear Time (g_c+I1), s	11.3	52.6	14.0	25.9	15.9	61.0	8.5	23.6
Green Ext Time (p_c), s	0.3	4.2	0.0	3.3	0.0	0.0	1.3	2.6

Intersection Summary	
HCM 2010 Ctrl Delay	53.3
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	40	36	154	51	48	27	1658	110	191	1834	53
Future Volume (veh/h)	38	40	36	154	51	48	27	1658	110	191	1834	53
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.98	1.00		0.98	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1765	1765	1765	1765	1765	1765	1800	1765	1765	1800
Adj Flow Rate, veh/h	43	45	4	173	57	6	30	1863	121	215	2061	59
Adj No. of Lanes	1	1	1	1	1	1	1	3	0	1	3	0
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	54	204	167	168	324	271	265	2542	165	213	2469	71
Arrive On Green	0.03	0.12	0.12	0.10	0.18	0.18	0.31	1.00	1.00	0.13	0.51	0.51
Sat Flow, veh/h	1681	1765	1438	1681	1765	1475	1681	4616	299	1681	4811	137
Grp Volume(v), veh/h	43	45	4	173	57	6	30	1295	689	215	1375	745
Grp Sat Flow(s),veh/h/ln	1681	1765	1438	1681	1765	1475	1681	1606	1703	1681	1606	1736
Q Serve(g_s), s	3.8	3.5	0.4	15.0	4.1	0.5	1.9	0.0	0.0	19.0	54.6	54.9
Cycle Q Clear(g_c), s	3.8	3.5	0.4	15.0	4.1	0.5	1.9	0.0	0.0	19.0	54.6	54.9
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.18	1.00		0.08
Lane Grp Cap(c), veh/h	54	204	167	168	324	271	265	1769	938	213	1649	891
V/C Ratio(X)	0.79	0.22	0.02	1.03	0.18	0.02	0.11	0.73	0.74	1.01	0.83	0.84
Avail Cap(c_a), veh/h	101	435	355	168	506	423	265	1769	938	213	1649	891
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.57	0.57	0.57	0.25	0.25	0.25
Uniform Delay (d), s/veh	72.1	60.2	58.8	67.5	51.7	50.2	43.9	0.0	0.0	65.5	31.1	31.2
Incr Delay (d2), s/veh	21.9	0.5	0.1	77.3	0.3	0.0	0.1	1.6	3.0	33.1	1.3	2.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	1.7	0.2	10.6	2.0	0.2	0.9	0.4	0.8	10.8	24.4	26.9
LnGrp Delay(d),s/veh	94.0	60.7	58.8	145.1	51.9	50.2	44.0	1.6	3.0	98.7	32.4	33.6
LnGrp LOS	F	E	E	F	D	D	D	A	A	F	C	C
Approach Vol, veh/h		92			236			2014			2335	
Approach Delay, s/veh		76.2			120.2			2.7			38.9	
Approach LOS		E			F			A			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.0	86.6	19.0	21.4	28.6	81.0	8.9	31.5
Change Period (Y+Rc), s	4.0	5.0	4.0	4.0	5.0	* 5	4.0	4.0
Max Green Setting (Gmax), s	19.0	62.0	15.0	37.0	5.0	* 76	9.0	43.0
Max Q Clear Time (g_c+I1), s	21.0	2.0	17.0	5.5	3.9	56.9	5.8	6.1
Green Ext Time (p_c), s	0.0	23.5	0.0	0.2	1.0	13.6	0.0	0.8

Intersection Summary	
HCM 2010 Ctrl Delay	28.1
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	25	203	253	47	27	293	1816	400	60	1867	38
Future Volume (veh/h)	15	25	203	253	47	27	293	1816	400	60	1867	38
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1765	1765	1800	1765	1765	1800	1765	1765	1765	1765	1765	1765
Adj Flow Rate, veh/h	16	27	51	272	51	11	315	1953	255	65	2008	16
Adj No. of Lanes	1	1	0	1	1	0	1	3	1	1	3	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	417	164	310	400	423	91	235	2144	667	208	2114	654
Arrive On Green	0.30	0.30	0.30	0.30	0.30	0.30	0.14	0.45	0.45	0.12	0.44	0.44
Sat Flow, veh/h	1256	545	1029	1238	1405	303	1681	4818	1498	1681	4818	1491
Grp Volume(v), veh/h	16	0	78	272	0	62	315	1953	255	65	2008	16
Grp Sat Flow(s),veh/h/ln	1256	0	1573	1238	0	1708	1681	1606	1498	1681	1606	1491
Q Serve(g_s), s	0.9	0.0	3.6	20.7	0.0	2.6	14.0	37.8	11.4	3.5	40.1	0.6
Cycle Q Clear(g_c), s	3.6	0.0	3.6	24.3	0.0	2.6	14.0	37.8	11.4	3.5	40.1	0.6
Prop In Lane	1.00		0.65	1.00		0.18	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	417	0	474	400	0	515	235	2144	667	208	2114	654
V/C Ratio(X)	0.04	0.00	0.16	0.68	0.00	0.12	1.34	0.91	0.38	0.31	0.95	0.02
Avail Cap(c_a), veh/h	529	0	614	510	0	666	235	2168	674	208	2114	654
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.57	0.57	0.57	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.6	0.0	25.7	34.6	0.0	25.3	43.0	25.9	18.6	39.9	27.0	15.9
Incr Delay (d2), s/veh	0.0	0.0	0.2	2.5	0.0	0.1	168.1	4.4	1.0	0.8	10.9	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	1.6	7.4	0.0	1.3	17.5	17.5	4.9	1.7	19.8	0.3
LnGrp Delay(d),s/veh	26.7	0.0	25.9	37.2	0.0	25.4	211.1	30.3	19.5	40.8	37.9	16.0
LnGrp LOS	C		C	D		C	F	C	B	D	D	B
Approach Vol, veh/h		94			334			2523			2089	
Approach Delay, s/veh		26.0			35.0			51.8			37.8	
Approach LOS		C			C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	17.4	48.5		34.1	18.0	47.9		34.1
Change Period (Y+Rc), s	5.0	* 5		4.0	4.0	5.0		4.0
Max Green Setting (Gmax), s	4.0	* 44		39.0	14.0	34.0		39.0
Max Q Clear Time (g_c+I1), s	5.5	39.8		26.3	16.0	42.1		5.6
Green Ext Time (p_c), s	0.0	3.7		1.5	0.0	0.0		1.9

Intersection Summary		
HCM 2010 Ctrl Delay		44.4
HCM 2010 LOS		D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

I-215/University Parkway Interchange
Diverging Diamond Alternative
Existing plus Project with Mitigation PM Peak Hour

Intersection	Control	Delay	LOS
12. University Parkway/I 215 Northbound Ramps	Signal	17.4	B
13. University Parkway/I 215 Southbound Ramps	Signal	12.7	B

	Delay					
University Parkway/I 215 NB Ramps Intersection	**WBL**	**WBR**	**SBT**	**SBR**	**NBL**	**NBT**
12. University Parkway/I 215 Northbound Ramps		2.6	28.2	11.6		10.9
23. University Parkway SB Approach Merge	32.1		2.8			
Combined Delay	32.1	2.6	31	11.6	0	10.9
Volume	405	2011	2208	232	39	621
Approach Delay	7.5		29.2		10.3	
Approach Volume	2416		2440		660	

	Delay					
University Parkway/I 215 SB Ramps Intersection	**EBL**	**EBR**	**SBL**	**SBT**	**NBT**	**NBR**
13. University Parkway/I 215 Southbound Ramps		7.8		35.6	27.6	
33. University Parkway NB Approach Merge	8.2				1.3	
Combined Delay	8.2	7.8	0	35.6	28.9	0
Volume	136	70	1762	850	534	378
Approach Delay	8.1		11.6		16.9	
Approach Volume	206		2612		912	

Movement	WBR	NBT	SBL	SBR
Lane Configurations				
Traffic Volume (vph)	2011	621	2208	232
Future Volume (vph)	2011	621	2208	232
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	8.0	8.0
Lane Util. Factor	0.88	0.95	0.94	1.00
Frt	0.85	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00
Satd. Flow (prot)	2656	3374	4757	1509
Flt Permitted	1.00	1.00	0.95	1.00
Satd. Flow (perm)	2656	3374	4757	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	2117	654	2324	244
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	2117	654	2324	244
Turn Type	Free	NA	Prot	Prot
Protected Phases		4	6	6
Permitted Phases	Free			
Actuated Green, G (s)	80.0	25.0	41.0	41.0
Effective Green, g (s)	80.0	25.0	41.0	41.0
Actuated g/C Ratio	1.00	0.31	0.51	0.51
Clearance Time (s)		6.0	8.0	8.0
Vehicle Extension (s)		3.0	3.0	3.0
Lane Grp Cap (vph)	2656	1054	2437	773
v/s Ratio Prot		0.19	c0.49	0.16
v/s Ratio Perm	c0.80			
v/c Ratio	0.80	0.62	0.95	0.32
Uniform Delay, d1	0.0	23.5	18.6	11.3
Progression Factor	1.00	0.36	1.00	1.00
Incremental Delay, d2	2.6	2.5	9.6	0.2
Delay (s)	2.6	10.9	28.2	11.6
Level of Service	A	B	C	B
Approach Delay (s)		10.9		
Approach LOS		B		

Intersection Summary			
HCM 2000 Control Delay	15.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	67.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR2	SER	SWL
Lane Configurations				
Traffic Volume (vph)	534	378	70	850
Future Volume (vph)	534	378	70	850
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	8.0	4.0	4.0	6.0
Lane Util. Factor	0.95	1.00	1.00	1.00
Frt	1.00	0.85	0.86	1.00
Flt Protected	1.00	1.00	1.00	0.95
Satd. Flow (prot)	3374	1509	1536	1687
Flt Permitted	1.00	1.00	1.00	0.95
Satd. Flow (perm)	3374	1509	1536	1687
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	562	398	74	895
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	562	398	74	895
Turn Type	NA	Free	Perm	Prot
Protected Phases	6			8
Permitted Phases		Free	4	
Actuated Green, G (s)	22.4	80.0	45.6	43.6
Effective Green, g (s)	22.4	80.0	45.6	43.6
Actuated g/C Ratio	0.28	1.00	0.57	0.55
Clearance Time (s)	8.0		4.0	6.0
Vehicle Extension (s)	3.0		3.0	3.0
Lane Grp Cap (vph)	944	1509	875	919
v/s Ratio Prot	c0.17			c0.53
v/s Ratio Perm		0.26	0.05	
v/c Ratio	0.60	0.26	0.08	0.97
Uniform Delay, d1	24.9	0.0	7.8	17.6
Progression Factor	1.00	1.00	1.00	1.09
Incremental Delay, d2	2.8	0.4	0.0	16.4
Delay (s)	27.6	0.4	7.8	35.6
Level of Service	C	A	A	D
Approach Delay (s)	16.4			35.6
Approach LOS	B			D

Intersection Summary			
HCM 2000 Control Delay	25.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	73.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	405	0	0	0	0	2208
Future Volume (vph)	405	0	0	0	0	2208
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0					4.0
Lane Util. Factor	1.00					0.91
Frt	1.00					1.00
Flt Protected	0.95					1.00
Satd. Flow (prot)	1687					4848
Flt Permitted	0.95					1.00
Satd. Flow (perm)	1687					4848
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	426	0	0	0	0	2324
RTOR Reduction (vph)	2	0	0	0	0	0
Lane Group Flow (vph)	424	0	0	0	0	2324
Turn Type	Prot					NA
Protected Phases	8					2
Permitted Phases						
Actuated Green, G (s)	27.0					45.0
Effective Green, g (s)	27.0					45.0
Actuated g/C Ratio	0.34					0.56
Clearance Time (s)	4.0					4.0
Vehicle Extension (s)	3.0					3.0
Lane Grp Cap (vph)	569					2727
v/s Ratio Prot	c0.25					c0.48
v/s Ratio Perm						
v/c Ratio	0.75					0.85
Uniform Delay, d1	23.5					14.7
Progression Factor	1.00					0.13
Incremental Delay, d2	8.6					0.9
Delay (s)	32.1					2.8
Level of Service	C					A
Approach Delay (s)	32.1		0.0			2.8
Approach LOS	C		A			A

Intersection Summary			
HCM 2000 Control Delay	7.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	71.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	136	0	0	534	0	0
Future Volume (vph)	136	0	0	534	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	1687			3374		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	1687			3374		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	143	0	0	562	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	143	0	0	562	0	0
Turn Type	Prot			NA		
Protected Phases	4			2		
Permitted Phases			2			
Actuated Green, G (s)	45.6			26.4		
Effective Green, g (s)	45.6			26.4		
Actuated g/C Ratio	0.57			0.33		
Clearance Time (s)	4.0			4.0		
Vehicle Extension (s)	3.0			3.0		
Lane Grp Cap (vph)	961			1113		
v/s Ratio Prot	c0.08			c0.17		
v/s Ratio Perm						
v/c Ratio	0.15			0.50		
Uniform Delay, d1	8.1			21.5		
Progression Factor	1.00			0.00		
Incremental Delay, d2	0.1			1.3		
Delay (s)	8.2			1.3		
Level of Service	A			A		
Approach Delay (s)	8.2			1.3	0.0	
Approach LOS	A			A	A	

Intersection Summary			
HCM 2000 Control Delay	2.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	29.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	30	93	10	10	20	249	779	243	333	10
Future Volume (veh/h)	10	10	30	93	10	10	20	249	779	243	333	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.98	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	11	11	6	98	11	3	21	262	575	256	351	10
Adj No. of Lanes	1	1	0	2	1	0	1	1	1	1	2	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	20	179	98	182	283	77	35	739	704	231	1781	51
Arrive On Green	0.01	0.16	0.16	0.05	0.20	0.20	0.02	0.40	0.40	0.13	0.51	0.51
Sat Flow, veh/h	1774	1118	610	3442	1404	383	1774	1863	1565	1774	3513	100
Grp Volume(v), veh/h	11	0	17	98	0	14	21	262	575	256	176	185
Grp Sat Flow(s),veh/h/ln	1774	0	1728	1721	0	1787	1774	1863	1565	1774	1770	1843
Q Serve(g_s), s	0.4	0.0	0.5	1.7	0.0	0.4	0.7	6.1	19.7	8.0	3.4	3.4
Cycle Q Clear(g_c), s	0.4	0.0	0.5	1.7	0.0	0.4	0.7	6.1	19.7	8.0	3.4	3.4
Prop In Lane	1.00		0.35	1.00		0.21	1.00		1.00	1.00		0.05
Lane Grp Cap(c), veh/h	20	0	277	182	0	361	35	739	704	231	897	935
V/C Ratio(X)	0.56	0.00	0.06	0.54	0.00	0.04	0.60	0.35	0.82	1.11	0.20	0.20
Avail Cap(c_a), veh/h	115	0	984	224	0	1018	144	818	771	231	897	935
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.2	0.0	21.9	28.4	0.0	19.7	29.9	13.0	14.7	26.7	8.3	8.3
Incr Delay (d2), s/veh	22.2	0.0	0.1	2.5	0.0	0.0	15.7	0.3	6.3	91.5	0.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.3	0.9	0.0	0.2	0.5	3.2	9.7	9.7	1.6	1.7
LnGrp Delay(d),s/veh	52.4	0.0	22.0	30.8	0.0	19.8	45.6	13.3	21.1	118.2	8.4	8.4
LnGrp LOS	D		C	C		B	D	B	C	F	A	A
Approach Vol, veh/h		28			112			858			617	
Approach Delay, s/veh		34.0			29.5			19.3			54.0	
Approach LOS		C			C			B			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.0	28.4	7.2	13.8	5.2	35.2	4.7	16.4
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	8.0	27.0	4.0	35.0	5.0	30.0	4.0	35.0
Max Q Clear Time (g_c+I1), s	10.0	21.7	3.7	2.5	2.7	5.4	2.4	2.4
Green Ext Time (p_c), s	0.0	2.2	0.0	0.1	0.0	6.1	0.0	0.1

Intersection Summary	
HCM 2010 Ctrl Delay	33.5
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	0	20	40	0	20	10	1009	149	120	326	10
Future Volume (veh/h)	20	0	20	40	0	20	10	1009	149	120	326	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.98	0.98		0.98	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	21	0	5	42	0	5	11	1062	149	126	343	10
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	2	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	303	13	45	391	0	271	788	2083	292	369	2349	68
Arrive On Green	0.17	0.00	0.17	0.17	0.00	0.17	0.67	0.67	0.67	0.67	0.67	0.67
Sat Flow, veh/h	1005	77	258	1429	0	1551	1023	3114	436	459	3512	102
Grp Volume(v), veh/h	26	0	0	42	0	5	11	603	608	126	172	181
Grp Sat Flow(s),veh/h/ln	1340	0	0	1429	0	1551	1023	1770	1781	459	1770	1845
Q Serve(g_s), s	0.2	0.0	0.0	0.0	0.0	0.1	0.2	8.8	8.8	9.7	1.8	1.8
Cycle Q Clear(g_c), s	1.2	0.0	0.0	1.0	0.0	0.1	2.0	8.8	8.8	18.5	1.8	1.8
Prop In Lane	0.81		0.19	1.00		1.00	1.00		0.24	1.00		0.06
Lane Grp Cap(c), veh/h	362	0	0	391	0	271	788	1183	1191	369	1183	1234
V/C Ratio(X)	0.07	0.00	0.00	0.11	0.00	0.02	0.01	0.51	0.51	0.34	0.15	0.15
Avail Cap(c_a), veh/h	1079	0	0	1093	0	1061	1044	1626	1636	483	1626	1694
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.8	0.0	0.0	17.8	0.0	17.5	3.5	4.3	4.3	8.9	3.1	3.1
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.3	0.5	0.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	0.5	0.0	0.1	0.1	4.3	4.3	1.3	0.9	0.9
LnGrp Delay(d),s/veh	17.9	0.0	0.0	18.0	0.0	17.5	3.5	4.6	4.6	9.5	3.2	3.2
LnGrp LOS	B			B		B	A	A	A	A	A	A
Approach Vol, veh/h		26			47			1222			479	
Approach Delay, s/veh		17.9			17.9			4.6			4.8	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		38.2		12.9		38.2		12.9
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0
Max Green Setting (Gmax), s		47.0		35.0		47.0		35.0
Max Q Clear Time (g_c+I1), s		10.8		3.2		20.5		3.0
Green Ext Time (p_c), s		15.9		0.4		13.7		0.4

Intersection Summary		
HCM 2010 Ctrl Delay		5.2
HCM 2010 LOS		A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	921	808	760	50	160	30	330	224	110	80	189	175
Future Volume (veh/h)	921	808	760	50	160	30	330	224	110	80	189	175
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.92	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	969	851	380	53	168	20	225	406	93	84	199	0
Adj No. of Lanes	2	2	1	1	2	0	1	2	0	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	1227	1719	753	114	589	69	456	756	172	139	278	113
Arrive On Green	0.60	0.81	0.81	0.06	0.19	0.18	0.26	0.26	0.25	0.08	0.08	0.00
Sat Flow, veh/h	3442	3539	1550	1774	3161	369	1774	2940	667	1774	3539	1583
Grp Volume(v), veh/h	969	851	380	53	93	95	225	256	243	84	199	0
Grp Sat Flow(s),veh/h/ln	1721	1770	1550	1774	1770	1761	1774	1863	1744	1774	1770	1583
Q Serve(g_s), s	30.1	10.6	11.0	4.0	6.3	6.5	15.1	16.6	16.9	6.4	7.7	0.0
Cycle Q Clear(g_c), s	30.1	10.6	11.0	4.0	6.3	6.5	15.1	16.6	16.9	6.4	7.7	0.0
Prop In Lane	1.00		1.00	1.00		0.21	1.00		0.38	1.00		1.00
Lane Grp Cap(c), veh/h	1227	1719	753	114	330	328	456	479	448	139	278	113
V/C Ratio(X)	0.79	0.50	0.50	0.46	0.28	0.29	0.49	0.53	0.54	0.60	0.72	0.00
Avail Cap(c_a), veh/h	1227	1719	753	114	392	390	456	479	448	139	278	113
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.42	0.42	0.42	1.00	1.00	1.00	0.86	0.86	0.86	1.00	1.00	0.00
Uniform Delay (d), s/veh	24.3	7.8	7.8	63.2	48.9	49.1	44.2	44.8	45.1	62.4	63.0	0.0
Incr Delay (d2), s/veh	2.3	0.4	1.0	13.0	2.1	2.2	3.2	3.6	4.0	17.7	14.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.5	5.0	4.8	2.4	3.3	3.4	7.8	9.0	8.6	3.8	4.3	0.0
LnGrp Delay(d),s/veh	26.6	8.2	8.9	76.2	51.0	51.3	47.5	48.4	49.1	80.1	77.5	0.0
LnGrp LOS	C	A	A	E	D	D	D	D	D	F	E	
Approach Vol, veh/h		2200			241			724			283	
Approach Delay, s/veh		16.4			56.7			48.3			78.3	
Approach LOS		B			E			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		15.0	54.9	30.1		40.0	13.0	72.0
Change Period (Y+Rc), s		5.0	5.0	* 5		5.0	4.0	5.0
Max Green Setting (Gmax), s		10.0	46.0	* 30		35.0	9.0	67.0
Max Q Clear Time (g_c+I1), s		9.7	32.1	8.5		18.9	6.0	13.0
Green Ext Time (p_c), s		0.0	8.9	1.0		3.2	0.0	16.6

Intersection Summary	
HCM 2010 Ctrl Delay	31.0
HCM 2010 LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	214	420	210	240	310	195	110	2082	110	49	508	149
Future Volume (veh/h)	214	420	210	240	310	195	110	2082	110	49	508	149
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.97	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	225	442	169	253	326	140	116	2192	112	52	535	72
Adj No. of Lanes	2	2	0	2	2	0	2	3	0	1	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	335	582	221	270	482	203	504	2263	115	209	2179	647
Arrive On Green	0.10	0.23	0.22	0.08	0.20	0.18	0.15	0.46	0.44	0.24	0.86	0.83
Sat Flow, veh/h	3442	2507	950	3442	2423	1020	3442	4950	251	1774	5085	1561
Grp Volume(v), veh/h	225	311	300	253	236	230	116	1497	807	52	535	72
Grp Sat Flow(s),veh/h/ln	1721	1770	1687	1721	1770	1673	1721	1695	1811	1774	1695	1561
Q Serve(g_s), s	8.8	22.9	23.3	10.2	17.3	17.9	4.2	60.1	61.1	3.3	2.7	1.2
Cycle Q Clear(g_c), s	8.8	22.9	23.3	10.2	17.3	17.9	4.2	60.1	61.1	3.3	2.7	1.2
Prop In Lane	1.00		0.56	1.00		0.61	1.00		0.14	1.00		1.00
Lane Grp Cap(c), veh/h	335	411	392	270	352	333	504	1550	828	209	2179	647
V/C Ratio(X)	0.67	0.76	0.77	0.94	0.67	0.69	0.23	0.97	0.97	0.25	0.25	0.11
Avail Cap(c_a), veh/h	335	556	530	270	556	526	504	1550	828	209	2179	647
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.65	0.65	0.65	0.95	0.95	0.95
Uniform Delay (d), s/veh	61.0	50.1	50.8	64.1	51.8	52.7	52.8	36.9	37.4	48.5	5.9	7.1
Incr Delay (d2), s/veh	5.1	4.0	4.6	37.8	2.2	2.6	0.2	12.0	20.0	0.6	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.5	11.7	11.4	6.3	8.7	8.5	2.0	30.7	35.1	1.7	1.2	0.6
LnGrp Delay(d),s/veh	66.1	54.1	55.4	101.9	54.0	55.2	52.9	49.0	57.3	49.1	6.2	7.5
LnGrp LOS	E	D	E	F	D	E	D	D	E	D	A	A
Approach Vol, veh/h		836			719			2420			659	
Approach Delay, s/veh		57.8			71.3			51.9			9.7	
Approach LOS		E			E			D			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	20.5	68.0	15.0	36.5	24.5	64.0	19.6	31.9
Change Period (Y+Rc), s	4.0	6.0	4.0	6.0	4.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	5.0	62.0	11.0	42.0	9.0	58.0	11.0	* 42
Max Q Clear Time (g_c+I1), s	5.3	63.1	12.2	25.3	6.2	4.7	10.8	19.9
Green Ext Time (p_c), s	0.0	0.0	0.0	2.8	0.1	3.9	0.1	2.4

Intersection Summary	
HCM 2010 Ctrl Delay	50.0
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	50	60	90	30	40	70	2222	70	10	898	30
Future Volume (veh/h)	40	50	60	90	30	40	70	2222	70	10	898	30
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.96	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	42	53	4	95	32	5	74	2339	72	11	945	30
Adj No. of Lanes	1	1	1	1	1	1	1	3	0	1	3	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	96	253	208	97	254	209	501	3314	102	18	1887	60
Arrive On Green	0.05	0.14	0.14	0.05	0.14	0.14	0.56	1.00	1.00	0.01	0.37	0.36
Sat Flow, veh/h	1774	1863	1528	1774	1863	1528	1774	5070	155	1774	5063	161
Grp Volume(v), veh/h	42	53	4	95	32	5	74	1561	850	11	632	343
Grp Sat Flow(s),veh/h/ln	1774	1863	1528	1774	1863	1528	1774	1695	1835	1774	1695	1833
Q Serve(g_s), s	2.5	2.8	0.2	5.9	1.7	0.3	2.2	0.0	0.0	0.7	15.8	15.9
Cycle Q Clear(g_c), s	2.5	2.8	0.2	5.9	1.7	0.3	2.2	0.0	0.0	0.7	15.8	15.9
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.08	1.00		0.09
Lane Grp Cap(c), veh/h	96	253	208	97	254	209	501	2216	1200	18	1264	683
V/C Ratio(X)	0.44	0.21	0.02	0.98	0.13	0.02	0.15	0.70	0.71	0.60	0.50	0.50
Avail Cap(c_a), veh/h	97	627	514	97	627	514	501	2216	1200	65	1264	683
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.26	0.26	0.26	0.90	0.90	0.90
Uniform Delay (d), s/veh	50.4	42.3	41.2	51.9	41.7	33.6	17.7	0.0	0.0	54.2	26.6	26.7
Incr Delay (d2), s/veh	3.1	0.4	0.0	85.3	0.2	0.0	0.0	0.5	0.9	24.7	1.3	2.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	1.5	0.1	5.2	0.9	0.1	1.1	0.2	0.3	0.5	7.6	8.4
LnGrp Delay(d),s/veh	53.6	42.7	41.2	137.3	41.9	33.6	17.7	0.5	0.9	78.9	27.9	29.0
LnGrp LOS	D	D	D	F	D	C	B	A	A	E	C	C
Approach Vol, veh/h		99			132			2485			986	
Approach Delay, s/veh		47.2			110.2			1.2			28.8	
Approach LOS		D			F			A			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.1	75.9	10.0	19.0	36.0	45.0	9.9	19.0
Change Period (Y+Rc), s	4.0	5.0	4.0	4.0	5.0	* 5	4.0	4.0
Max Green Setting (Gmax), s	4.0	46.0	6.0	37.0	10.0	* 40	6.0	37.0
Max Q Clear Time (g_c+I1), s	2.7	2.0	7.9	4.8	4.2	17.9	4.5	3.7
Green Ext Time (p_c), s	0.0	28.4	0.0	0.2	3.0	6.0	0.0	0.1

Intersection Summary	
HCM 2010 Ctrl Delay	13.7
HCM 2010 LOS	B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	20	260	310	40	30	150	2304	460	30	990	30
Future Volume (veh/h)	20	20	260	310	40	30	150	2304	460	30	990	30
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	21	21	103	326	42	10	158	2425	275	32	1042	11
Adj No. of Lanes	1	1	0	1	1	0	1	3	1	1	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	539	97	476	468	514	122	155	2396	745	45	2081	645
Arrive On Green	0.35	0.35	0.35	0.35	0.35	0.35	0.09	0.47	0.47	0.03	0.41	0.41
Sat Flow, veh/h	1345	275	1348	1260	1455	346	1774	5085	1580	1774	5085	1578
Grp Volume(v), veh/h	21	0	124	326	0	52	158	2425	275	32	1042	11
Grp Sat Flow(s),veh/h/ln	1345	0	1622	1260	0	1801	1774	1695	1580	1774	1695	1578
Q Serve(g_s), s	0.8	0.0	4.3	19.5	0.0	1.5	7.0	37.7	8.9	1.4	12.2	0.3
Cycle Q Clear(g_c), s	2.4	0.0	4.3	23.8	0.0	1.5	7.0	37.7	8.9	1.4	12.2	0.3
Prop In Lane	1.00		0.83	1.00		0.19	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	539	0	573	468	0	636	155	2396	745	45	2081	645
V/C Ratio(X)	0.04	0.00	0.22	0.70	0.00	0.08	1.02	1.01	0.37	0.71	0.50	0.02
Avail Cap(c_a), veh/h	720	0	791	637	0	878	155	2396	745	89	2081	645
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.48	0.48	0.48	1.00	1.00	1.00
Uniform Delay (d), s/veh	18.0	0.0	18.1	26.5	0.0	17.2	36.5	21.2	13.5	38.7	17.6	14.1
Incr Delay (d2), s/veh	0.0	0.0	0.2	2.0	0.0	0.1	54.7	15.8	0.7	18.4	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	2.0	7.1	0.0	0.8	5.8	21.0	4.0	0.9	5.9	0.2
LnGrp Delay(d),s/veh	18.0	0.0	18.3	28.5	0.0	17.3	91.3	36.9	14.2	57.1	18.4	14.1
LnGrp LOS	B		B	C		B	F	F	B	E	B	B
Approach Vol, veh/h		145			378			2858			1085	
Approach Delay, s/veh		18.3			27.0			37.8			19.5	
Approach LOS		B			C			D			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.0	41.7		32.3	11.0	36.7		32.3
Change Period (Y+Rc), s	4.0	5.0		4.0	4.0	5.0		4.0
Max Green Setting (Gmax), s	4.0	24.0		39.0	7.0	21.0		39.0
Max Q Clear Time (g_c+I1), s	3.4	39.7		25.8	9.0	14.2		6.3
Green Ext Time (p_c), s	0.0	0.0		1.9	0.0	6.7		2.4

Intersection Summary		
HCM 2010 Ctrl Delay		31.8
HCM 2010 LOS		C

I-215/University Parkway Interchange
Diverging Diamond Alternative
Cumulative plus Project with Mitigation AM Peak Hour

Intersection	Control	Delay	LOS
12. University Parkway/I 215 Northbound Ramps	Signal	11.4	B
13. University Parkway/I 215 Southbound Ramps	Signal	11.2	B

	Delay					
University Parkway/I 215 NB Ramps Intersection	**WBL**	**WBR**	**SBT**	**SBR**	**NBL**	**NBT**
12. University Parkway/I 215 Northbound Ramps		4.8	18.8	12.8		12.5
23. University Parkway SB Approach Merge	18.6		1			
Combined Delay	18.6	4.8	19.8	12.8	0	12.5
Volume	350	2236	1446	114	70	687
Approach Delay	6.7		19.3		11.3	
Approach Volume	2586		1560		757	

	Delay					
University Parkway/I 215 SB Ramps Intersection	**EBL**	**EBR**	**SBL**	**SBT**	**NBT**	**NBR**
13. University Parkway/I 215 Southbound Ramps		11.4		29	19.1	
33. University Parkway NB Approach Merge	11.3				0.8	
Combined Delay	11.3	11.4	0	29	19.9	0
Volume	217	210	1156	640	540	280
Approach Delay	11.3		10.3		13.1	
Approach Volume	427		1796		820	

Movement	WBR	NBT	SBL	SBR
Lane Configurations				
Traffic Volume (vph)	2236	687	1446	114
Future Volume (vph)	2236	687	1446	114
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	8.0	8.0
Lane Util. Factor	0.88	0.95	0.94	1.00
Frt	0.85	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00
Satd. Flow (prot)	2656	3374	4757	1509
Flt Permitted	1.00	1.00	0.95	1.00
Satd. Flow (perm)	2656	3374	4757	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	2354	723	1522	120
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	2354	723	1522	120
Turn Type	Free	NA	Prot	Prot
Protected Phases		4	6	6
Permitted Phases	Free			
Actuated Green, G (s)	70.0	26.4	29.6	29.6
Effective Green, g (s)	70.0	26.4	29.6	29.6
Actuated g/C Ratio	1.00	0.38	0.42	0.42
Clearance Time (s)		6.0	8.0	8.0
Vehicle Extension (s)		3.0	3.0	3.0
Lane Grp Cap (vph)	2656	1272	2011	638
v/s Ratio Prot		0.21	0.32	0.08
v/s Ratio Perm	c0.89			
v/c Ratio	0.89	0.57	0.76	0.19
Uniform Delay, d1	0.0	17.3	17.1	12.7
Progression Factor	1.00	0.62	1.00	1.00
Incremental Delay, d2	4.8	1.8	1.7	0.1
Delay (s)	4.8	12.5	18.8	12.8
Level of Service	A	B	B	B
Approach Delay (s)		12.5		
Approach LOS		B		

Intersection Summary			
HCM 2000 Control Delay	10.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	54.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR2	SER	SWL
Lane Configurations				
Traffic Volume (vph)	540	280	210	640
Future Volume (vph)	540	280	210	640
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	8.0	4.0	4.0	6.0
Lane Util. Factor	0.95	1.00	1.00	1.00
Frt	1.00	0.85	0.86	1.00
Flt Protected	1.00	1.00	1.00	0.95
Satd. Flow (prot)	3374	1509	1536	1687
Flt Permitted	1.00	1.00	1.00	0.95
Satd. Flow (perm)	3374	1509	1536	1687
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	568	295	221	674
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	568	295	221	674
Turn Type	NA	Free	Perm	Prot
Protected Phases	6			8
Permitted Phases		Free	4	
Actuated Green, G (s)	24.6	70.0	33.4	31.4
Effective Green, g (s)	24.6	70.0	33.4	31.4
Actuated g/C Ratio	0.35	1.00	0.48	0.45
Clearance Time (s)	8.0		4.0	6.0
Vehicle Extension (s)	3.0		3.0	3.0
Lane Grp Cap (vph)	1185	1509	732	756
v/s Ratio Prot	c0.17			c0.40
v/s Ratio Perm		0.20	0.14	
v/c Ratio	0.48	0.20	0.30	0.89
Uniform Delay, d1	17.7	0.0	11.2	17.7
Progression Factor	1.00	1.00	1.00	1.03
Incremental Delay, d2	1.4	0.3	0.2	10.8
Delay (s)	19.1	0.3	11.4	29.0
Level of Service	B	A	B	C
Approach Delay (s)	12.7			29.0
Approach LOS	B			C

Intersection Summary			
HCM 2000 Control Delay	18.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	62.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	350	0	0	0	0	1446
Future Volume (vph)	350	0	0	0	0	1446
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0					4.0
Lane Util. Factor	1.00					0.91
Frt	1.00					1.00
Flt Protected	0.95					1.00
Satd. Flow (prot)	1687					4848
Flt Permitted	0.95					1.00
Satd. Flow (perm)	1687					4848
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	368	0	0	0	0	1522
RTOR Reduction (vph)	9	0	0	0	0	0
Lane Group Flow (vph)	359	0	0	0	0	1522
Turn Type	Prot					NA
Protected Phases	8					2
Permitted Phases						
Actuated Green, G (s)	28.4					33.6
Effective Green, g (s)	28.4					33.6
Actuated g/C Ratio	0.41					0.48
Clearance Time (s)	4.0					4.0
Vehicle Extension (s)	3.0					3.0
Lane Grp Cap (vph)	684					2327
v/s Ratio Prot	c0.21					c0.31
v/s Ratio Perm						
v/c Ratio	0.52					0.65
Uniform Delay, d1	15.7					13.8
Progression Factor	1.00					0.04
Incremental Delay, d2	2.9					0.4
Delay (s)	18.6					1.0
Level of Service	B					A
Approach Delay (s)	18.6		0.0			1.0
Approach LOS	B		A			A

Intersection Summary			
HCM 2000 Control Delay	4.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	54.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	217	0	0	540	0	0
Future Volume (vph)	217	0	0	540	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	1687			3374		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	1687			3374		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	228	0	0	568	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	228	0	0	568	0	0
Turn Type	Prot			NA		
Protected Phases	4			2		
Permitted Phases			2			
Actuated Green, G (s)	33.4			28.6		
Effective Green, g (s)	33.4			28.6		
Actuated g/C Ratio	0.48			0.41		
Clearance Time (s)	4.0			4.0		
Vehicle Extension (s)	3.0			3.0		
Lane Grp Cap (vph)	804			1378		
v/s Ratio Prot	c0.14			c0.17		
v/s Ratio Perm						
v/c Ratio	0.28			0.41		
Uniform Delay, d1	11.1			14.7		
Progression Factor	1.00			0.00		
Incremental Delay, d2	0.2			0.8		
Delay (s)	11.3			0.8		
Level of Service	B			A		
Approach Delay (s)	11.3			0.8	0.0	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	3.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	33.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	40	717	10	88	30	327	402	61	268	10
Future Volume (veh/h)	10	10	40	717	10	88	30	327	402	61	268	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.98	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	11	11	6	755	11	38	32	344	297	64	282	8
Adj No. of Lanes	1	1	0	2	1	0	1	1	1	1	2	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	20	142	77	903	136	471	49	547	872	80	1093	31
Arrive On Green	0.01	0.13	0.13	0.26	0.38	0.38	0.03	0.29	0.29	0.05	0.31	0.31
Sat Flow, veh/h	1774	1124	613	3442	361	1249	1774	1863	1556	1774	3511	99
Grp Volume(v), veh/h	11	0	17	755	0	49	32	344	297	64	142	148
Grp Sat Flow(s),veh/h/ln	1774	0	1738	1721	0	1610	1774	1863	1556	1774	1770	1841
Q Serve(g_s), s	0.4	0.0	0.5	12.2	0.0	1.1	1.0	9.4	6.1	2.1	3.5	3.5
Cycle Q Clear(g_c), s	0.4	0.0	0.5	12.2	0.0	1.1	1.0	9.4	6.1	2.1	3.5	3.5
Prop In Lane	1.00		0.35	1.00		0.78	1.00		1.00	1.00		0.05
Lane Grp Cap(c), veh/h	20	0	219	903	0	607	49	547	872	80	551	573
V/C Ratio(X)	0.55	0.00	0.08	0.84	0.00	0.08	0.65	0.63	0.34	0.80	0.26	0.26
Avail Cap(c_a), veh/h	121	0	1036	1056	0	1345	121	857	1131	121	814	847
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	28.9	0.0	22.6	20.5	0.0	11.7	28.2	18.0	7.2	27.7	15.1	15.1
Incr Delay (d2), s/veh	21.9	0.0	0.1	5.3	0.0	0.1	13.6	1.2	0.2	19.2	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.2	6.4	0.0	0.5	0.7	5.0	2.6	1.4	1.7	1.8
LnGrp Delay(d),s/veh	50.8	0.0	22.8	25.7	0.0	11.8	41.8	19.1	7.4	46.9	15.4	15.4
LnGrp LOS	D		C	C		B	D	B	A	D	B	B
Approach Vol, veh/h		28			804			673			354	
Approach Delay, s/veh		33.8			24.9			15.0			21.1	
Approach LOS		C			C			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.7	21.2	19.4	11.4	5.6	22.3	4.7	26.1
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	4.0	27.0	18.0	35.0	4.0	27.0	4.0	49.0
Max Q Clear Time (g_c+I1), s	4.1	11.4	14.2	2.5	3.0	5.5	2.4	3.1
Green Ext Time (p_c), s	0.0	4.2	1.2	0.4	0.0	4.6	0.0	0.4

Intersection Summary	
HCM 2010 Ctrl Delay	20.7
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	0	10	215	0	91	20	658	74	40	955	30
Future Volume (veh/h)	10	0	10	215	0	91	20	658	74	40	955	30
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.98	0.99		0.98	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	11	0	6	226	0	80	21	693	66	42	1005	29
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	2	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	345	37	109	660	0	445	358	1525	145	447	1642	47
Arrive On Green	0.29	0.00	0.29	0.29	0.00	0.29	0.47	0.47	0.47	0.47	0.47	0.47
Sat Flow, veh/h	568	130	381	1530	0	1549	543	3263	311	701	3513	101
Grp Volume(v), veh/h	17	0	0	226	0	80	21	376	383	42	506	528
Grp Sat Flow(s),veh/h/ln	1079	0	0	1530	0	1549	543	1770	1804	701	1770	1844
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	1.3	1.0	4.7	4.7	1.4	7.0	7.0
Cycle Q Clear(g_c), s	3.5	0.0	0.0	3.4	0.0	1.3	8.0	4.7	4.7	6.1	7.0	7.0
Prop In Lane	0.65		0.35	1.00		1.00	1.00		0.17	1.00		0.05
Lane Grp Cap(c), veh/h	492	0	0	660	0	445	358	827	843	447	827	862
V/C Ratio(X)	0.03	0.00	0.00	0.34	0.00	0.18	0.06	0.45	0.45	0.09	0.61	0.61
Avail Cap(c_a), veh/h	1575	0	0	1754	0	1660	387	921	939	485	921	960
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	8.5	0.0	0.0	9.5	0.0	8.7	9.5	5.9	5.9	7.9	6.5	6.5
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.3	0.0	0.2	0.1	0.4	0.4	0.1	1.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	1.7	0.0	0.6	0.2	2.3	2.3	0.3	3.5	3.6
LnGrp Delay(d),s/veh	8.5	0.0	0.0	9.8	0.0	8.9	9.5	6.3	6.3	8.0	7.5	7.5
LnGrp LOS	A			A		A	A	A	A	A	A	A
Approach Vol, veh/h		17			306			780			1076	
Approach Delay, s/veh		8.5			9.6			6.4			7.5	
Approach LOS		A			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		19.3		13.4		19.3		13.4
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0
Max Green Setting (Gmax), s		17.0		35.0		17.0		35.0
Max Q Clear Time (g_c+I1), s		10.0		5.5		9.0		5.4
Green Ext Time (p_c), s		5.3		1.8		5.9		1.8

Intersection Summary	
HCM 2010 Ctrl Delay	7.4
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	468	465	621	112	516	80	637	290	71	50	253	905
Future Volume (veh/h)	468	465	621	112	516	80	637	290	71	50	253	905
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95	1.00		0.88	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	493	489	207	118	543	73	682	289	68	53	266	0
Adj No. of Lanes	2	2	1	1	2	0	2	1	0	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	774	1225	522	205	706	94	1064	436	103	205	408	171
Arrive On Green	0.38	0.58	0.58	0.12	0.23	0.22	0.30	0.30	0.29	0.12	0.12	0.00
Sat Flow, veh/h	3442	3539	1509	1774	3083	412	3548	1453	342	1774	3539	1583
Grp Volume(v), veh/h	493	489	207	118	310	306	682	0	357	53	266	0
Grp Sat Flow(s),veh/h/ln	1721	1770	1509	1774	1770	1725	1774	0	1794	1774	1770	1583
Q Serve(g_s), s	15.3	9.9	9.8	8.2	21.3	21.6	21.7	0.0	22.6	3.5	9.3	0.0
Cycle Q Clear(g_c), s	15.3	9.9	9.8	8.2	21.3	21.6	21.7	0.0	22.6	3.5	9.3	0.0
Prop In Lane	1.00		1.00	1.00		0.24	1.00		0.19	1.00		1.00
Lane Grp Cap(c), veh/h	774	1225	522	205	405	395	1064	0	538	205	408	171
V/C Ratio(X)	0.64	0.40	0.40	0.58	0.77	0.77	0.64	0.00	0.66	0.26	0.65	0.00
Avail Cap(c_a), veh/h	774	1225	522	205	463	451	1064	0	538	205	408	171
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.60	0.60	0.60	1.00	1.00	1.00	0.82	0.00	0.82	0.70	0.70	0.00
Uniform Delay (d), s/veh	36.2	20.0	20.0	54.5	46.9	47.1	39.4	0.0	39.9	52.4	55.0	0.0
Incr Delay (d2), s/veh	2.4	0.6	1.4	11.3	13.0	13.7	2.4	0.0	5.2	2.1	5.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.4	4.8	4.2	4.7	11.9	11.8	11.0	0.0	12.0	1.9	4.9	0.0
LnGrp Delay(d),s/veh	38.6	20.6	21.3	65.8	59.8	60.8	41.9	0.0	45.1	54.6	60.6	0.0
LnGrp LOS	D	C	C	E	E	E	D		D	D	E	
Approach Vol, veh/h		1189			734			1039			319	
Approach Delay, s/veh		28.2			61.2			43.0			59.6	
Approach LOS		C			E			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		19.0	34.2	33.8		43.0	19.0	49.0
Change Period (Y+Rc), s		5.0	5.0	* 5		5.0	4.0	5.0
Max Green Setting (Gmax), s		14.0	26.0	* 33		38.0	15.0	44.0
Max Q Clear Time (g_c+I1), s		11.3	17.3	23.6		24.6	10.2	11.9
Green Ext Time (p_c), s		0.4	3.7	2.8		4.0	0.1	6.1

Intersection Summary	
HCM 2010 Ctrl Delay	43.3
HCM 2010 LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	128	480	170	260	420	90	320	1336	330	120	1852	86
Future Volume (veh/h)	128	480	170	260	420	90	320	1336	330	120	1852	86
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	135	505	143	274	442	76	337	1406	315	126	1949	87
Adj No. of Lanes	2	2	0	2	2	0	2	3	0	1	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	311	695	196	265	684	117	602	1590	355	283	1878	552
Arrive On Green	0.09	0.26	0.24	0.08	0.23	0.21	0.17	0.38	0.37	0.32	0.74	0.71
Sat Flow, veh/h	3442	2717	765	3442	3015	515	3442	4134	924	1774	5085	1559
Grp Volume(v), veh/h	135	328	320	274	258	260	337	1152	569	126	1949	87
Grp Sat Flow(s),veh/h/ln	1721	1770	1713	1721	1770	1760	1721	1695	1667	1774	1695	1559
Q Serve(g_s), s	4.8	22.0	22.3	10.0	17.2	17.5	11.6	41.2	41.5	7.3	48.0	2.4
Cycle Q Clear(g_c), s	4.8	22.0	22.3	10.0	17.2	17.5	11.6	41.2	41.5	7.3	48.0	2.4
Prop In Lane	1.00		0.45	1.00		0.29	1.00		0.55	1.00		1.00
Lane Grp Cap(c), veh/h	311	453	438	265	401	399	602	1304	641	283	1878	552
V/C Ratio(X)	0.43	0.72	0.73	1.03	0.64	0.65	0.56	0.88	0.89	0.45	1.04	0.16
Avail Cap(c_a), veh/h	311	599	580	265	613	609	602	1304	641	283	1878	552
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.59	0.59	0.59	0.71	0.71	0.71
Uniform Delay (d), s/veh	56.0	44.2	44.7	60.0	45.5	45.9	49.0	37.3	37.9	39.7	17.0	12.6
Incr Delay (d2), s/veh	1.0	3.0	3.2	64.7	1.7	1.8	0.7	5.6	10.7	0.8	28.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.3	11.1	10.9	7.1	8.6	8.7	5.6	20.2	21.0	3.6	26.5	1.1
LnGrp Delay(d),s/veh	56.9	47.1	47.9	124.7	47.2	47.7	49.7	42.9	48.6	40.5	45.4	13.1
LnGrp LOS	E	D	D	F	D	D	D	D	D	D	F	B
Approach Vol, veh/h		783			792			2058			2162	
Approach Delay, s/veh		49.2			74.2			45.6			43.8	
Approach LOS		D			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	24.7	54.0	14.0	37.3	26.7	52.0	17.8	33.5
Change Period (Y+Rc), s	4.0	6.0	4.0	6.0	4.0	6.0	6.0	* 6
Max Green Setting (Gmax), s	10.0	48.0	10.0	42.0	12.0	46.0	9.0	* 43
Max Q Clear Time (g_c+I1), s	9.3	43.5	12.0	24.3	13.6	50.0	6.8	19.5
Green Ext Time (p_c), s	0.1	3.5	0.0	3.2	0.0	0.0	0.9	2.7

Intersection Summary	
HCM 2010 Ctrl Delay	49.3
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	40	60	180	60	60	50	1876	140	200	2022	60
Future Volume (veh/h)	50	40	60	180	60	60	50	1876	140	200	2022	60
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		0.97	1.00		0.98	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	53	42	10	189	63	10	53	1975	142	211	2128	61
Adj No. of Lanes	1	1	1	1	1	1	1	3	0	1	3	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	189	216	176	189	216	179	303	2663	190	213	2505	72
Arrive On Green	0.11	0.12	0.12	0.11	0.12	0.12	0.34	1.00	1.00	0.12	0.49	0.49
Sat Flow, veh/h	1774	1863	1518	1774	1863	1542	1774	4836	346	1774	5078	145
Grp Volume(v), veh/h	53	42	10	189	63	10	53	1381	736	211	1419	770
Grp Sat Flow(s),veh/h/ln	1774	1863	1518	1774	1863	1542	1774	1695	1791	1774	1695	1833
Q Serve(g_s), s	4.1	3.1	0.9	16.0	4.6	0.7	3.1	0.0	0.0	17.8	54.7	55.1
Cycle Q Clear(g_c), s	4.1	3.1	0.9	16.0	4.6	0.7	3.1	0.0	0.0	17.8	54.7	55.1
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.19	1.00		0.08
Lane Grp Cap(c), veh/h	189	216	176	189	216	179	303	1867	987	213	1672	904
V/C Ratio(X)	0.28	0.19	0.06	1.00	0.29	0.06	0.17	0.74	0.75	0.99	0.85	0.85
Avail Cap(c_a), veh/h	189	459	375	189	534	442	303	1867	987	213	1672	904
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.61	0.61	0.61	0.35	0.35	0.35
Uniform Delay (d), s/veh	61.7	60.0	59.0	67.0	60.7	38.1	42.0	0.0	0.0	65.9	33.1	33.2
Incr Delay (d2), s/veh	0.8	0.4	0.1	65.0	0.7	0.1	0.2	1.6	3.2	34.3	2.1	3.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	1.6	0.4	11.2	2.4	0.3	1.5	0.4	0.9	10.8	25.9	28.8
LnGrp Delay(d),s/veh	62.5	60.4	59.1	132.0	61.4	38.3	42.1	1.6	3.2	100.3	35.2	37.1
LnGrp LOS	E	E	E	F	E	D	D	A	A	F	D	D
Approach Vol, veh/h		105			262			2170			2400	
Approach Delay, s/veh		61.3			111.5			3.1			41.5	
Approach LOS		E			F			A			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	22.0	86.6	20.0	21.4	30.6	78.0	20.0	21.4
Change Period (Y+Rc), s	4.0	5.0	4.0	4.0	5.0	* 5	4.0	4.0
Max Green Setting (Gmax), s	18.0	62.0	16.0	37.0	7.0	* 73	10.0	43.0
Max Q Clear Time (g_c+I1), s	19.8	2.0	18.0	5.1	5.1	57.1	6.1	6.6
Green Ext Time (p_c), s	0.0	26.8	0.0	0.2	1.6	12.1	0.2	0.3

Intersection Summary	
HCM 2010 Ctrl Delay	28.8
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	30	210	260	50	30	330	1990	430	60	2144	40
Future Volume (veh/h)	20	30	210	260	50	30	330	1990	430	60	2144	40
Number	3	8	18	7	4	14	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	21	32	58	274	53	14	347	2095	281	63	2257	18
Adj No. of Lanes	1	1	0	1	1	0	1	3	1	1	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	430	177	320	406	424	112	231	2274	707	220	2295	711
Arrive On Green	0.30	0.30	0.30	0.30	0.30	0.30	0.13	0.45	0.45	0.12	0.45	0.45
Sat Flow, veh/h	1319	591	1072	1293	1418	375	1774	5085	1582	1774	5085	1575
Grp Volume(v), veh/h	21	0	90	274	0	67	347	2095	281	63	2257	18
Grp Sat Flow(s),veh/h/ln	1319	0	1663	1293	0	1793	1774	1695	1582	1774	1695	1575
Q Serve(g_s), s	1.2	0.0	4.0	19.9	0.0	2.7	13.0	38.7	11.9	3.2	43.8	0.6
Cycle Q Clear(g_c), s	3.9	0.0	4.0	24.0	0.0	2.7	13.0	38.7	11.9	3.2	43.8	0.6
Prop In Lane	1.00		0.64	1.00		0.21	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	430	0	497	406	0	536	231	2274	707	220	2295	711
V/C Ratio(X)	0.05	0.00	0.18	0.67	0.00	0.13	1.50	0.92	0.40	0.29	0.98	0.03
Avail Cap(c_a), veh/h	551	0	649	524	0	699	231	2288	712	220	2295	711
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.50	0.50	0.50	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.0	0.0	26.0	34.9	0.0	25.5	43.5	26.0	18.6	39.8	27.1	15.2
Incr Delay (d2), s/veh	0.0	0.0	0.2	2.3	0.0	0.1	238.2	4.2	0.8	0.7	15.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	1.9	7.3	0.0	1.4	21.6	18.9	5.4	1.6	23.5	0.3
LnGrp Delay(d),s/veh	27.0	0.0	26.2	37.2	0.0	25.7	281.7	30.1	19.4	40.5	42.3	15.3
LnGrp LOS	C		C	D		C	F	C	B	D	D	B
Approach Vol, veh/h		111			341			2723			2338	
Approach Delay, s/veh		26.3			34.9			61.1			42.1	
Approach LOS		C			C			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	17.4	48.7		33.9	17.0	49.1		33.9
Change Period (Y+Rc), s	5.0	* 5		4.0	4.0	5.0		4.0
Max Green Setting (Gmax), s	4.0	* 44		39.0	13.0	35.0		39.0
Max Q Clear Time (g_c+I1), s	5.2	40.7		26.0	15.0	45.8		6.0
Green Ext Time (p_c), s	0.0	3.0		1.6	0.0	0.0		2.0

Intersection Summary	
HCM 2010 Ctrl Delay	50.7
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

I-215/University Parkway Interchange

Diverging Diamond Alternative

Cumulative plus Project with Mitigation PM Peak Hour

Intersection	Control	Delay	LOS
12. University Parkway/I 215 Northbound Ramps	Signal	17.4	B
13. University Parkway/I 215 Southbound Ramps	Signal	22	C

	Delay					
University Parkway/I 215 NB Ramps Intersection	**WBL**	**WBR**	**SBT**	**SBR**	**NBL**	**NBT**
12. University Parkway/I 215 Northbound Ramps		2.9	25.8	11.1		13.5
23. University Parkway SB Approach Merge	45.9		2.4			
Combined Delay	45.9	2.9	28.2	11.1	0	13.5
Volume	430	2058	2353	261	190	692
Approach Delay	10.3		26.5		10.6	
Approach Volume	2488		2614		882	

	Delay					
University Parkway/I 215 SB Ramps Intersection	**EBL**	**EBR**	**SBL**	**SBT**	**NBT**	**NBR**
13. University Parkway/I 215 Southbound Ramps		6.8		46	54	
33. University Parkway NB Approach Merge	7.1				5.3	
Combined Delay	7.1	6.8	0	46	59.3	0
Volume	142	70	1793	990	740	400
Approach Delay	7		16.4		38.5	
Approach Volume	212		2783		1140	

Movement	WBR	NBT	SBL	SBR
Lane Configurations				
Traffic Volume (vph)	2058	692	2353	261
Future Volume (vph)	2058	692	2353	261
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0	8.0	8.0
Lane Util. Factor	0.88	0.95	0.94	1.00
Frt	0.85	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00
Satd. Flow (prot)	2656	3374	4757	1509
Flt Permitted	1.00	1.00	0.95	1.00
Satd. Flow (perm)	2656	3374	4757	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	2166	728	2477	275
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	2166	728	2477	275
Turn Type	Free	NA	Prot	Prot
Protected Phases		4	6	6
Permitted Phases	Free			
Actuated Green, G (s)	90.0	26.0	50.0	50.0
Effective Green, g (s)	90.0	26.0	50.0	50.0
Actuated g/C Ratio	1.00	0.29	0.56	0.56
Clearance Time (s)		6.0	8.0	8.0
Vehicle Extension (s)		3.0	3.0	3.0
Lane Grp Cap (vph)	2656	974	2642	838
v/s Ratio Prot		0.22	0.52	0.18
v/s Ratio Perm	c0.82			
v/c Ratio	0.82	0.75	0.94	0.33
Uniform Delay, d1	0.0	29.0	18.6	10.9
Progression Factor	1.00	0.33	1.00	1.00
Incremental Delay, d2	2.9	3.9	7.2	0.2
Delay (s)	2.9	13.5	25.8	11.1
Level of Service	A	B	C	B
Approach Delay (s)		13.5		
Approach LOS		B		

Intersection Summary			
HCM 2000 Control Delay	14.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR2	SER	SWL
Lane Configurations				
Traffic Volume (vph)	740	400	70	990
Future Volume (vph)	740	400	70	990
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	8.0	4.0	4.0	6.0
Lane Util. Factor	0.95	1.00	1.00	1.00
Frt	1.00	0.85	0.86	1.00
Flt Protected	1.00	1.00	1.00	0.95
Satd. Flow (prot)	3374	1509	1536	1687
Flt Permitted	1.00	1.00	1.00	0.95
Satd. Flow (perm)	3374	1509	1536	1687
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	779	421	74	1042
RTOR Reduction (vph)	0	0	0	0
Lane Group Flow (vph)	779	421	74	1042
Turn Type	NA	Free	Perm	Prot
Protected Phases	6			8
Permitted Phases		Free	4	
Actuated Green, G (s)	22.0	90.0	56.0	54.0
Effective Green, g (s)	22.0	90.0	56.0	54.0
Actuated g/C Ratio	0.24	1.00	0.62	0.60
Clearance Time (s)	8.0		4.0	6.0
Vehicle Extension (s)	3.0		3.0	3.0
Lane Grp Cap (vph)	824	1509	955	1012
v/s Ratio Prot	c0.23			c0.62
v/s Ratio Perm		0.28	0.05	
v/c Ratio	0.95	0.28	0.08	1.03
Uniform Delay, d1	33.4	0.0	6.7	18.0
Progression Factor	1.00	1.00	1.00	1.01
Incremental Delay, d2	20.6	0.5	0.0	27.8
Delay (s)	54.0	0.5	6.8	46.0
Level of Service	D	A	A	D
Approach Delay (s)	35.2			46.0
Approach LOS	D			D

Intersection Summary			
HCM 2000 Control Delay	39.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	430	0	0	0	0	2353
Future Volume (vph)	430	0	0	0	0	2353
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0					4.0
Lane Util. Factor	1.00					0.91
Frt	1.00					1.00
Flt Protected	0.95					1.00
Satd. Flow (prot)	1687					4848
Flt Permitted	0.95					1.00
Satd. Flow (perm)	1687					4848
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	453	0	0	0	0	2477
RTOR Reduction (vph)	2	0	0	0	0	0
Lane Group Flow (vph)	451	0	0	0	0	2477
Turn Type	Prot					NA
Protected Phases	8					2
Permitted Phases						
Actuated Green, G (s)	28.0					54.0
Effective Green, g (s)	28.0					54.0
Actuated g/C Ratio	0.31					0.60
Clearance Time (s)	4.0					4.0
Vehicle Extension (s)	3.0					3.0
Lane Grp Cap (vph)	524					2908
v/s Ratio Prot	c0.27					c0.51
v/s Ratio Perm						
v/c Ratio	0.86					0.85
Uniform Delay, d1	29.2					14.7
Progression Factor	1.00					0.10
Incremental Delay, d2	16.7					0.9
Delay (s)	45.9					2.4
Level of Service	D					A
Approach Delay (s)	45.9		0.0			2.4
Approach LOS	D		A			A

Intersection Summary			
HCM 2000 Control Delay	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	76.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	142	0	0	740	0	0
Future Volume (vph)	142	0	0	740	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		
Lane Util. Factor	1.00			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			1.00		
Satd. Flow (prot)	1687			3374		
Flt Permitted	0.95			1.00		
Satd. Flow (perm)	1687			3374		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	149	0	0	779	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	149	0	0	779	0	0
Turn Type	Prot			NA		
Protected Phases	4			2		
Permitted Phases			2			
Actuated Green, G (s)	56.0			26.0		
Effective Green, g (s)	56.0			26.0		
Actuated g/C Ratio	0.62			0.29		
Clearance Time (s)	4.0			4.0		
Vehicle Extension (s)	3.0			3.0		
Lane Grp Cap (vph)	1049			974		
v/s Ratio Prot	c0.09			c0.23		
v/s Ratio Perm						
v/c Ratio	0.14			0.80		
Uniform Delay, d1	7.0			29.6		
Progression Factor	1.00			0.10		
Incremental Delay, d2	0.1			2.4		
Delay (s)	7.1			5.3		
Level of Service	A			A		
Approach Delay (s)	7.1			5.3	0.0	
Approach LOS	A			A	A	

Intersection Summary			
HCM 2000 Control Delay	5.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX G: TRAFFIC SIGNAL WARRANTS

FEHR PEERS

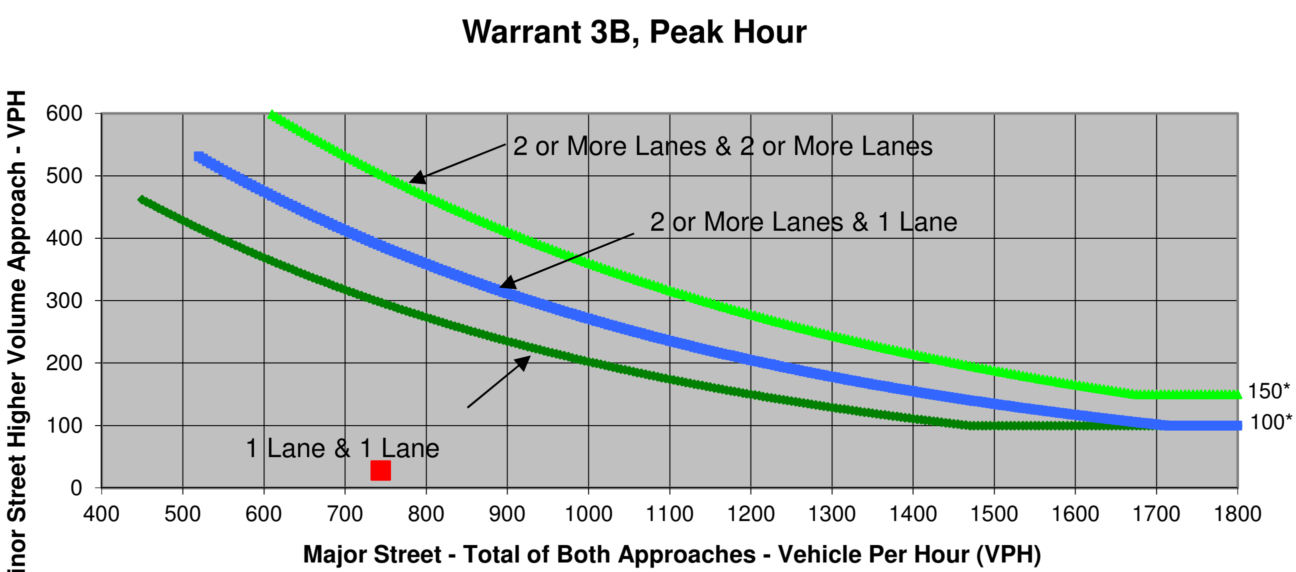
Major Street	Northpark Boulevard/Devils Canyon Road		Project	CSUSB Main Campus Traffic Study
Minor Street	Ash Street		Scenario	Existing Conditions
			Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left	18	225	0	19
Through	109	215	1	1
Right	177	0	27	4
Total	304	440	28	24

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard/Devils Canyon Road	Minor Street Ash Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**744**	**28**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

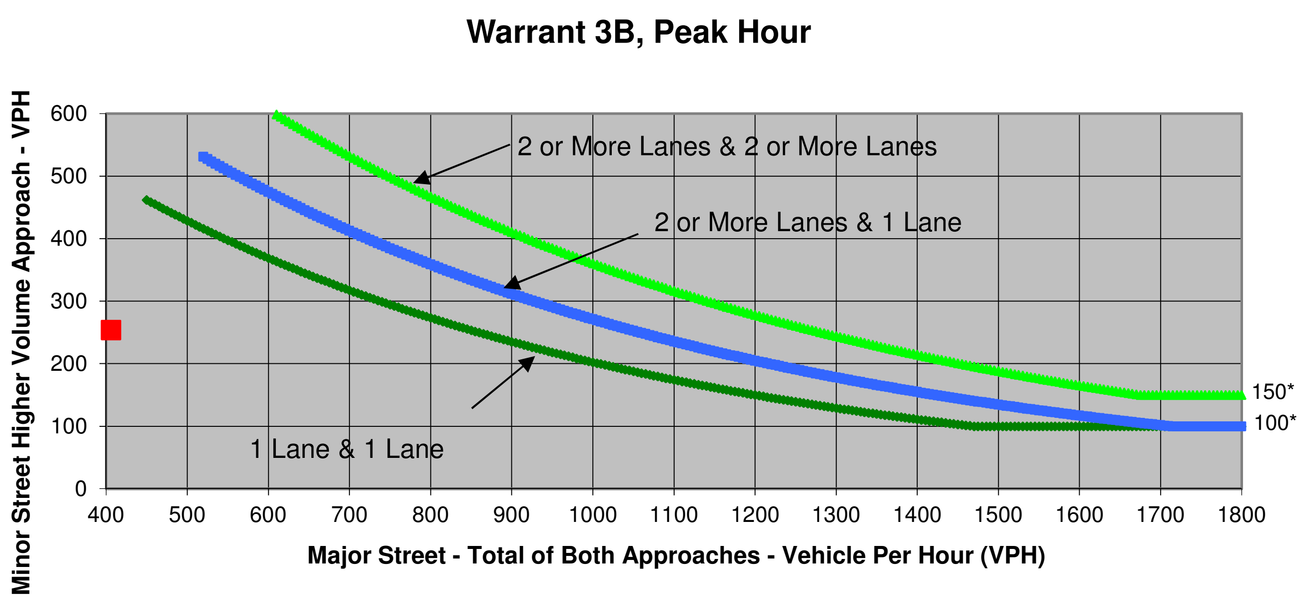
Major Street	Northpark Boulevard/Devils Canyon Road	Project	CSUSB Main Campus Traffic Study
Minor Street	Ash Street	Scenario	Existing Conditions
		Peak Hour	PM

Turn Movement Volumes

	NB	SB	EB	WB
Left	25	59	1	167
Through	169	48	7	6
Right	104	1	31	81
Total	298	108	39	254

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard/Devils Canyon Road	Minor Street Ash Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**406**	**254**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

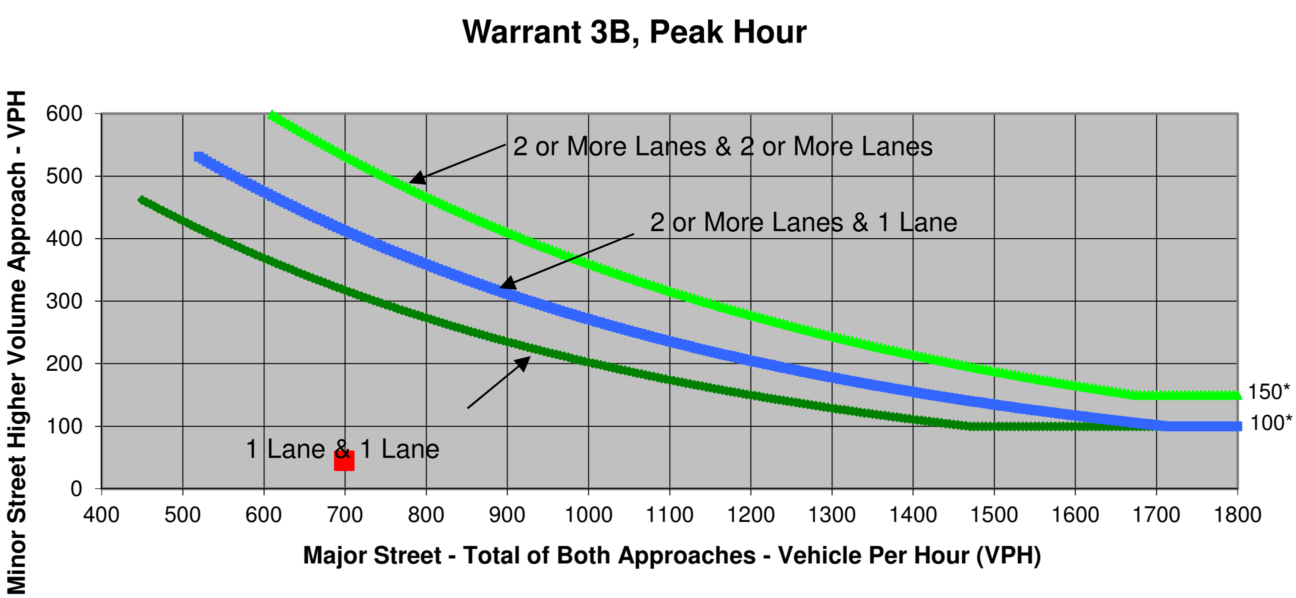
Major Street	Northpark Boulevard		Project	CSUSB Main Campus Traffic Study
Minor Street	Sierra Drive		Scenario	Existing Conditions
			Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left	4	93	0	39
Through	298	162	0	0
Right	141	1	4	6
Total	443	256	4	45

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard	Minor Street Sierra Drive	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**699**	**45**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

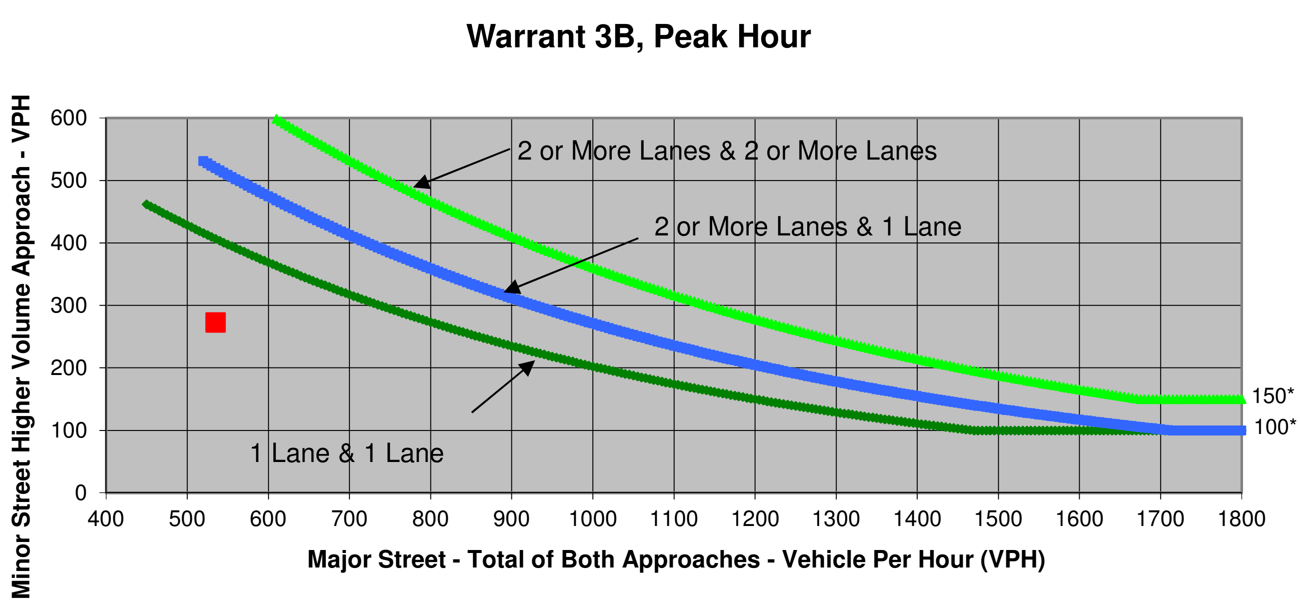
Major Street	Northpark Boulevard		Project	CSUSB Main Campus Traffic Study
Minor Street	Sierra Drive		Scenario	Existing Conditions
			Peak Hour	PM

Turn Movement Volumes

	NB	SB	EB	WB
Left	2	10	0	210
Through	234	231	0	0
Right	58	0	1	63
Total	294	241	1	273

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard	Minor Street Sierra Drive	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**535**	**273**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

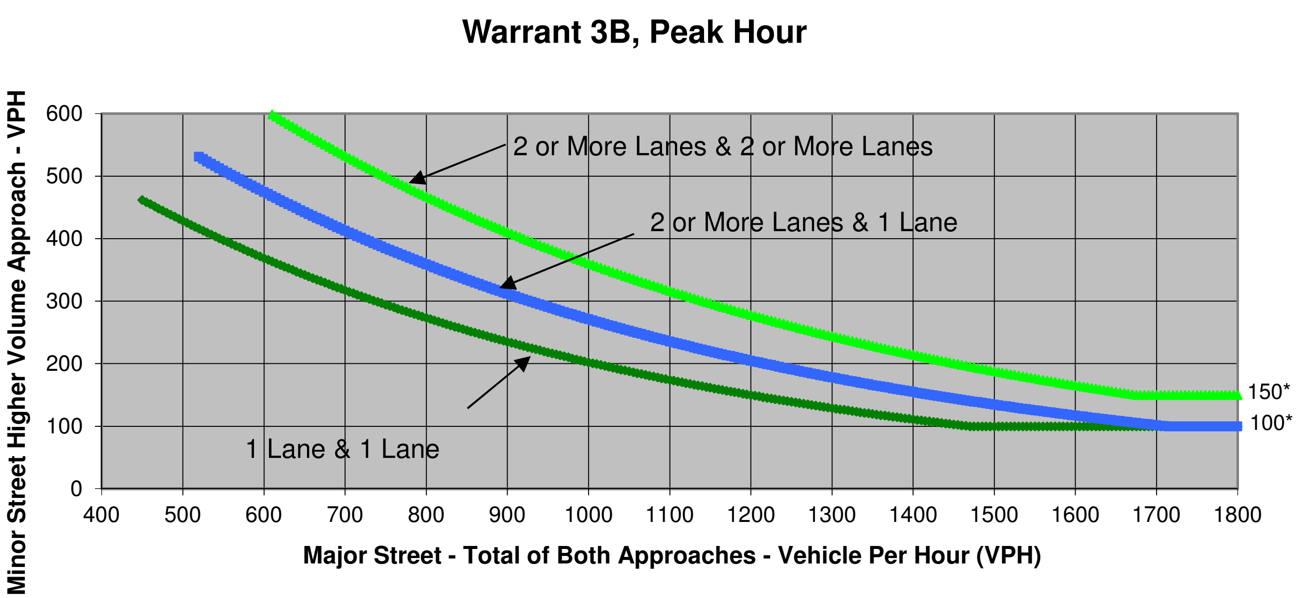
			Project	CSUSB Main Campus Traffic Study
Major Street	North Campus Circle		Scenario	Existing Conditions
Minor Street	Education Lane		Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left	6	0	0	21
Through	0	0	24	150
Right	12	0	52	0
Total	18	0	76	171

Major Street Direction

	North/South
X	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street North Campus Circle	Minor Street Education Lane	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**247**	**18**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

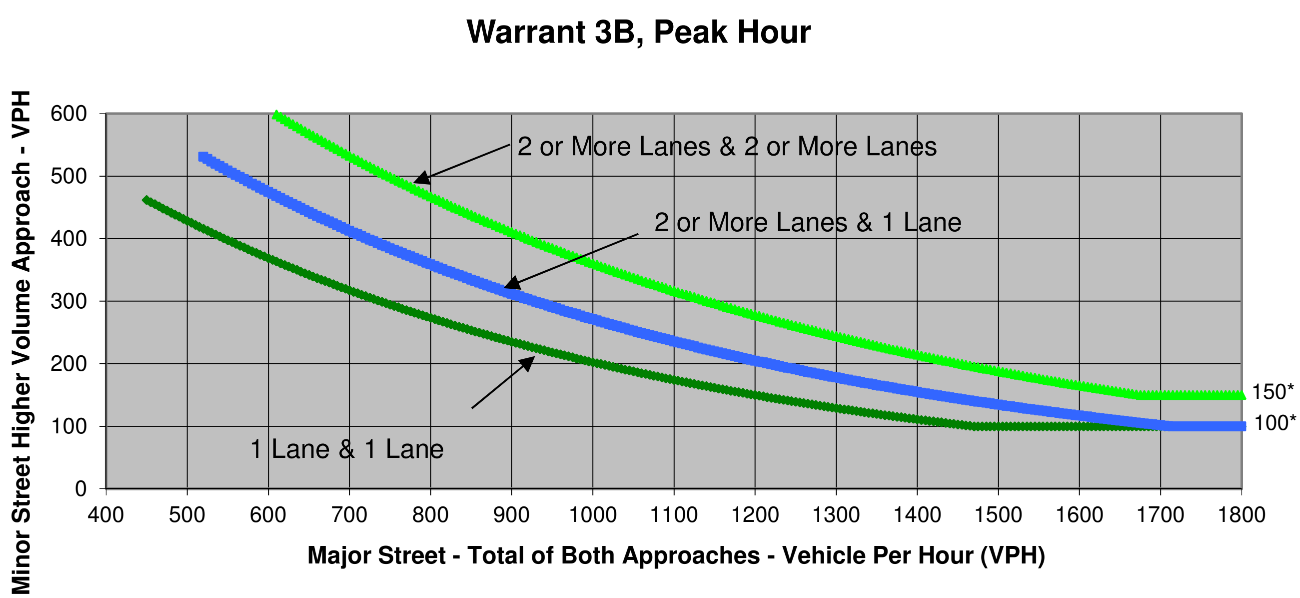
Major Street	North Campus Circle	Project	CSUSB Main Campus Traffic Study
Minor Street	Education Lane	Scenario	Existing Conditions
		Peak Hour	PM

Turn Movement Volumes

	NB	SB	EB	WB
Left	38	0	0	26
Through	0	0	126	84
Right	27	0	34	0
Total	65	0	160	110

Major Street Direction

	North/South
X	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street	Minor Street	Warrant Met
	North Campus Circle	Education Lane	
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**270**	**65**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

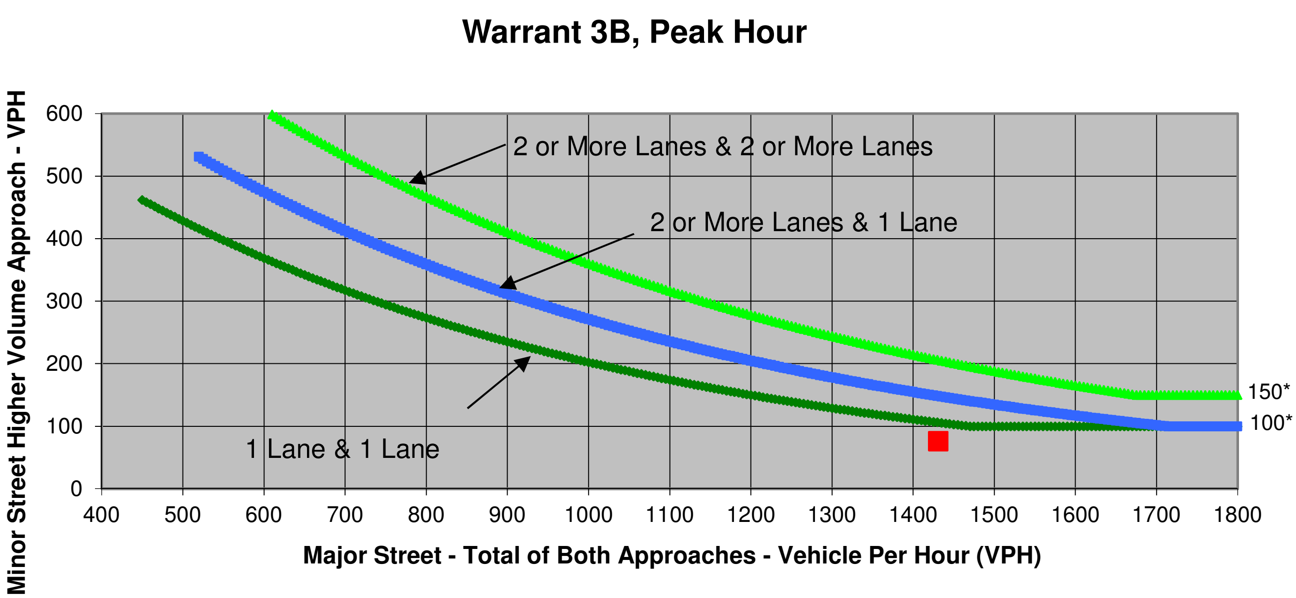
Major Street	Northpark Boulevard/Devils Canyon Road	Project	CSUSB Main Campus Traffic Study
Minor Street	Ash Street	Scenario	Existing Plus Project Conditions
		Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left	18	244	0	61
Through	381	237	1	1
Right	551	0	27	14
Total	950	481	28	76

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard/Devils Canyon Road	Minor Street Ash Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**1,431**	**76**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

Major Street	Northpark Boulevard/Devils Canyon Road		Project	CSUSB Main Campus Traffic Study
Minor Street	Ash Street		Scenario	Existing Plus Project Conditions
			Peak Hour	PM

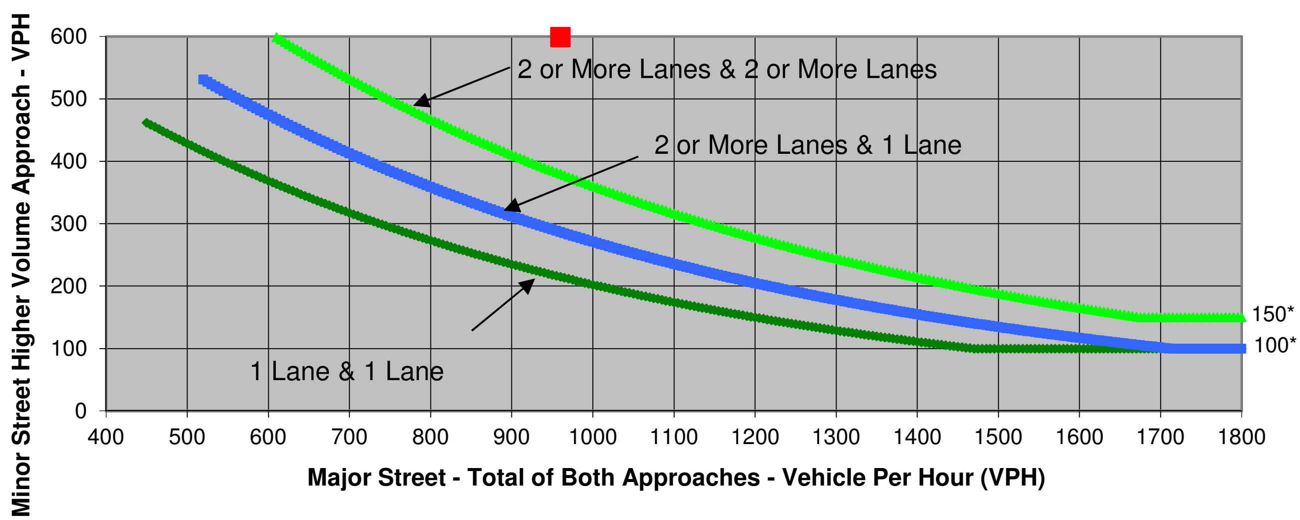
Turn Movement Volumes

	NB	SB	EB	WB
Left	25	88	1	476
Through	298	284	7	6
Right	264	1	31	117
Total	587	373	39	599

Major Street Direction

x	North/South
	East/West

Warrant 3B, Peak Hour



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard/Devils Canyon Road	Minor Street Ash Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**960**	**599**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

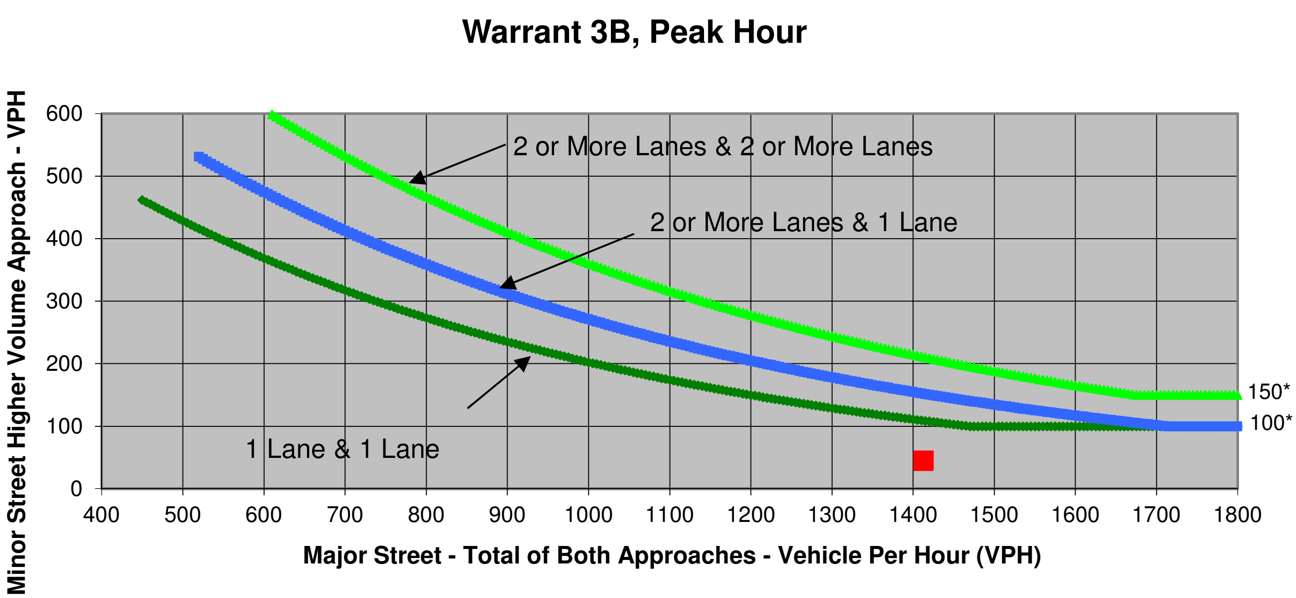
			Project	CSUSB Main Campus Traffic Study
Major Street	Northpark Boulevard		Scenario	Existing Plus Project Conditions
Minor Street	Sierra Drive		Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left	4	93	0	39
Through	947	228	0	0
Right	140	1	4	6
Total	1,091	322	4	45

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard	Minor Street Sierra Drive	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**1,413**	**45**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

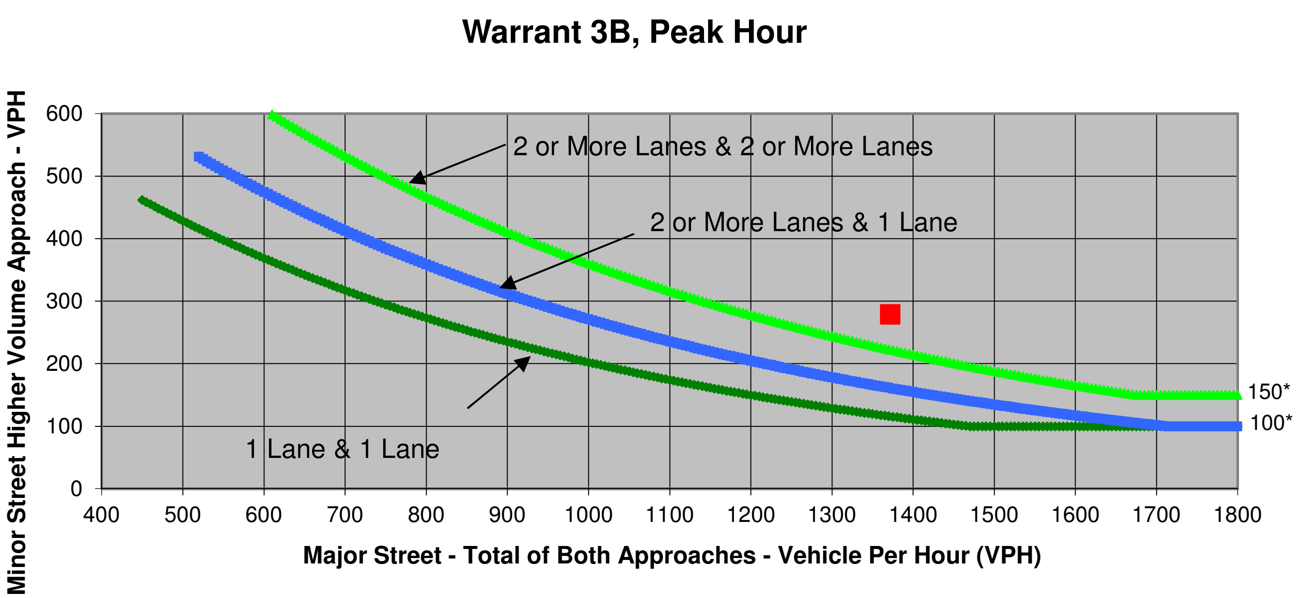
Major Street	Northpark Boulevard		Project	CSUSB Main Campus Traffic Study
Minor Street	Sierra Drive		Scenario	Existing Plus Project Conditions
			Peak Hour	PM

Turn Movement Volumes

	NB	SB	EB	WB
Left	2	10	0	215
Through	522	776	0	0
Right	62	0	1	64
Total	586	786	1	279

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard	Minor Street Sierra Drive	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**1,372**	**279**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

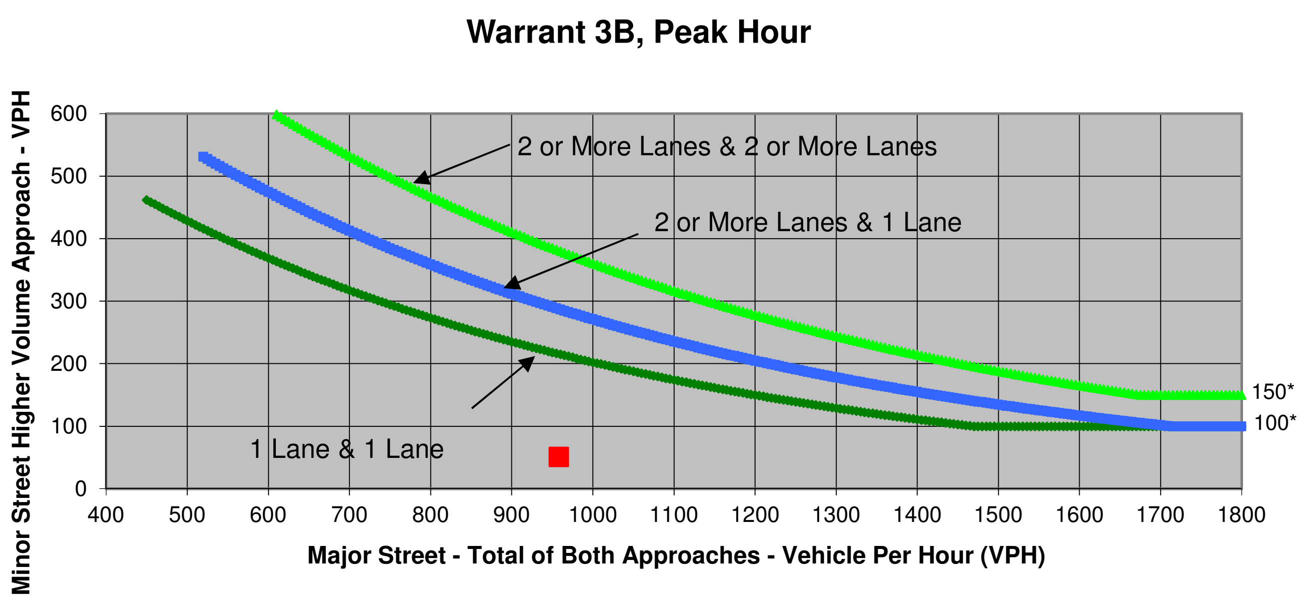
Major Street	North Campus Circle	Project	CSUSB Main Campus Traffic Study
Minor Street	Education Lane	Scenario	Existing Plus Project Conditions
		Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left	21	0	0	132
Through	0	0	95	582
Right	30	0	149	0
Total	51	0	244	714

Major Street Direction

	North/South
X	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street North Campus Circle	Minor Street Education Lane	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**958**	**51**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

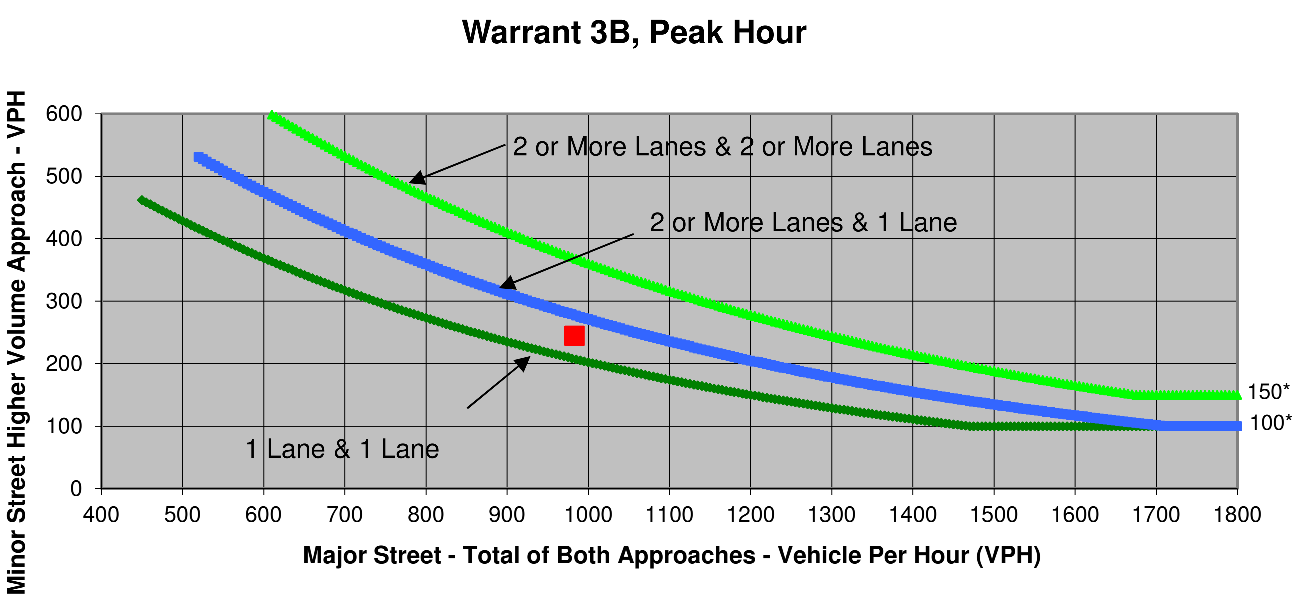
Major Street	North Campus Circle		Project	CSUSB Main Campus Traffic Study
Minor Street	Education Lane		Scenario	Existing Plus Project Conditions
			Peak Hour	PM

Turn Movement Volumes

	NB	SB	EB	WB
Left	122	0	0	89
Through	0	0	492	313
Right	123	0	89	0
Total	245	0	581	402

Major Street Direction

	North/South
X	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street North Campus Circle	Minor Street Education Lane	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**983**	**245**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

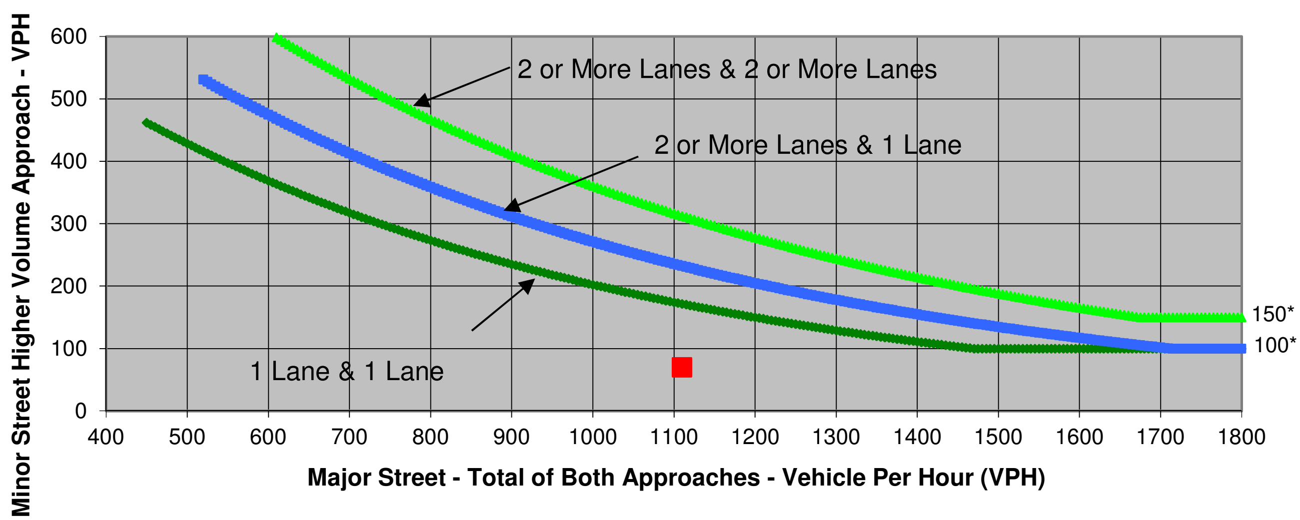
Major Street	Northpark Boulevard/Devils Canyon Road	Project	CSUSB Main Campus Traffic Study
Minor Street	Ash Street	Scenario	Cumulative Conditions
		Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left	20	380	10	40
Through	130	320	10	10
Right	250	10	30	20
Total	400	710	50	70

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard/Devils Canyon Road	Minor Street Ash Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**1,110**	**70**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

Major Street: Northpark Boulevard/Devils Canyon Road
Minor Street: Ash Street

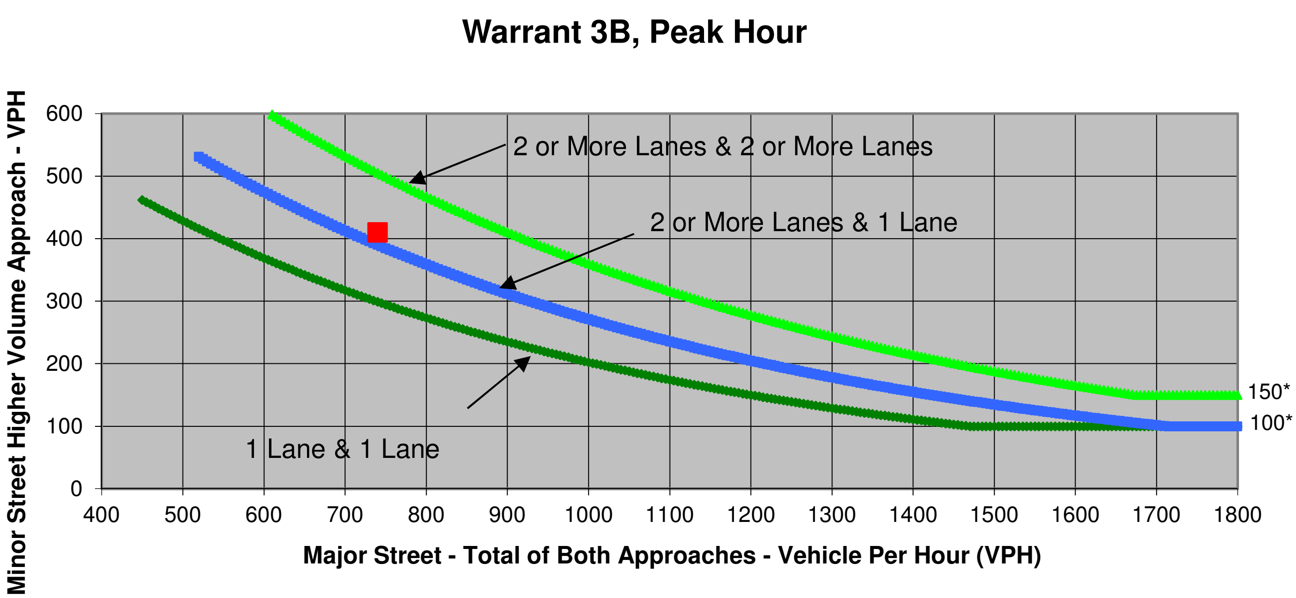
Project: CSUSB Main Campus Traffic Study
Scenario: Cumulative Conditions
Peak Hour: PM

Turn Movement Volumes

	NB	SB	EB	WB
Left	30	80	10	260
Through	280	180	10	10
Right	160	10	40	140
Total	470	270	60	410

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard/Devils Canyon Road	Minor Street Ash Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**740**	**410**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

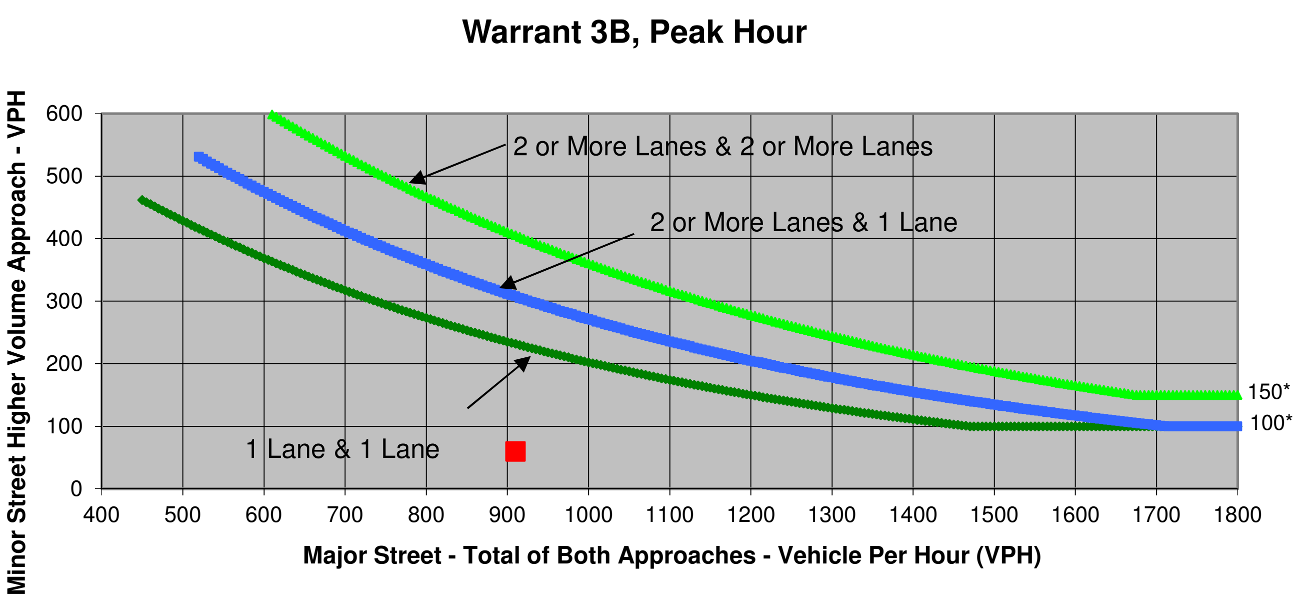
			Project	CSUSB Main Campus Traffic Study
Major Street	Northpark Boulevard		Scenario	Cumulative Conditions
Minor Street	Sierra Drive		Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left	10	120	20	40
Through	360	260	0	0
Right	150	10	20	20
Total	520	390	40	60

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard	Minor Street Sierra Drive	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**910**	**60**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

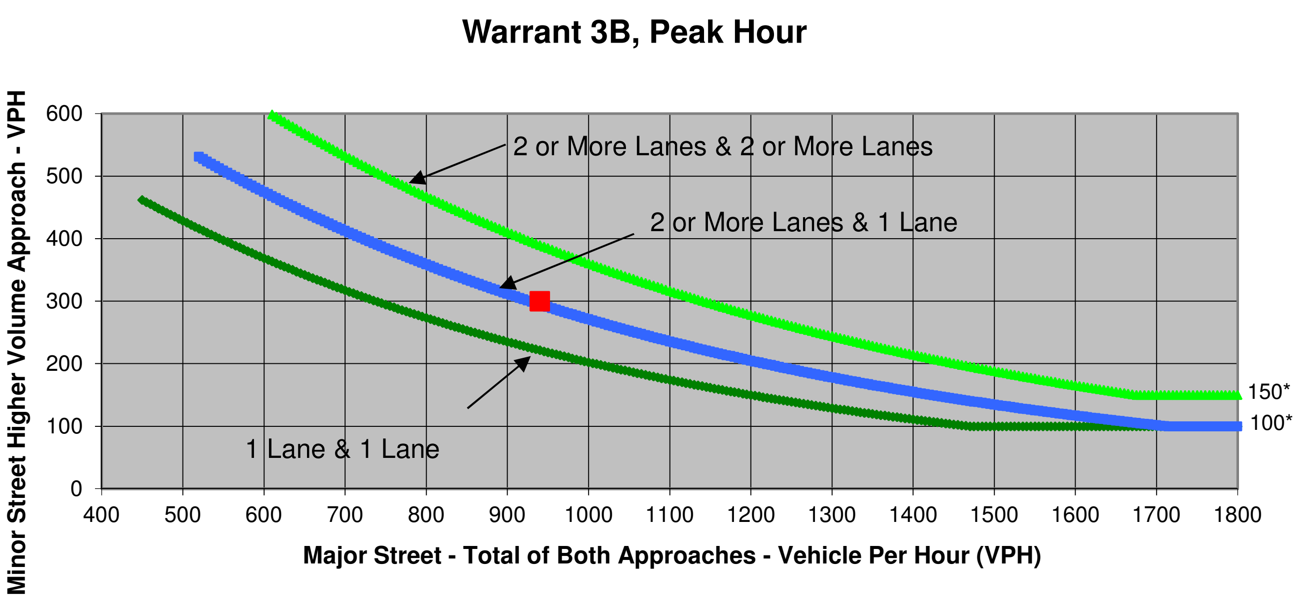
			Project	CSUSB Main Campus Traffic Study
Major Street	Northpark Boulevard		Scenario	Cumulative Conditions
Minor Street	Sierra Drive		Peak Hour	PM

Turn Movement Volumes

	NB	SB	EB	WB
Left	20	40	10	210
Through	370	410	0	0
Right	70	30	10	90
Total	460	480	20	300

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard	Minor Street Sierra Drive	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**940**	**300**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

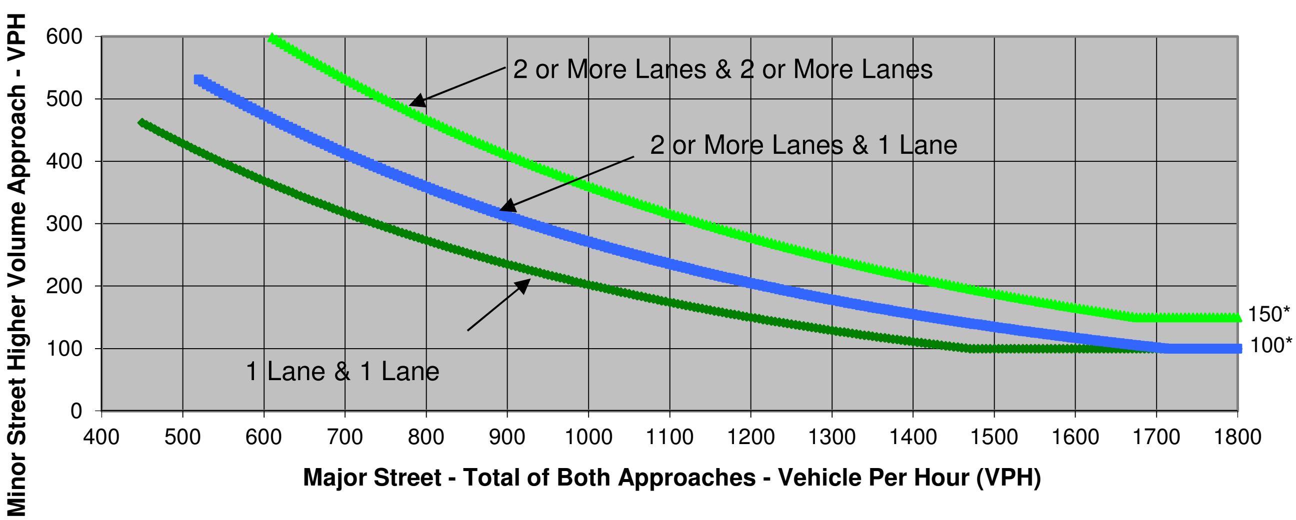
		Project	CSUSB Main Campus Traffic Study
Major Street	North Campus Circle	Scenario	Cumulative Conditions
Minor Street	Education Lane	Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left	10	0	0	30
Through	0	0	50	150
Right	20	0	60	0
Total	30	0	110	180

Major Street Direction

	North/South
X	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street North Campus Circle	Minor Street Education Lane	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**290**	**30**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

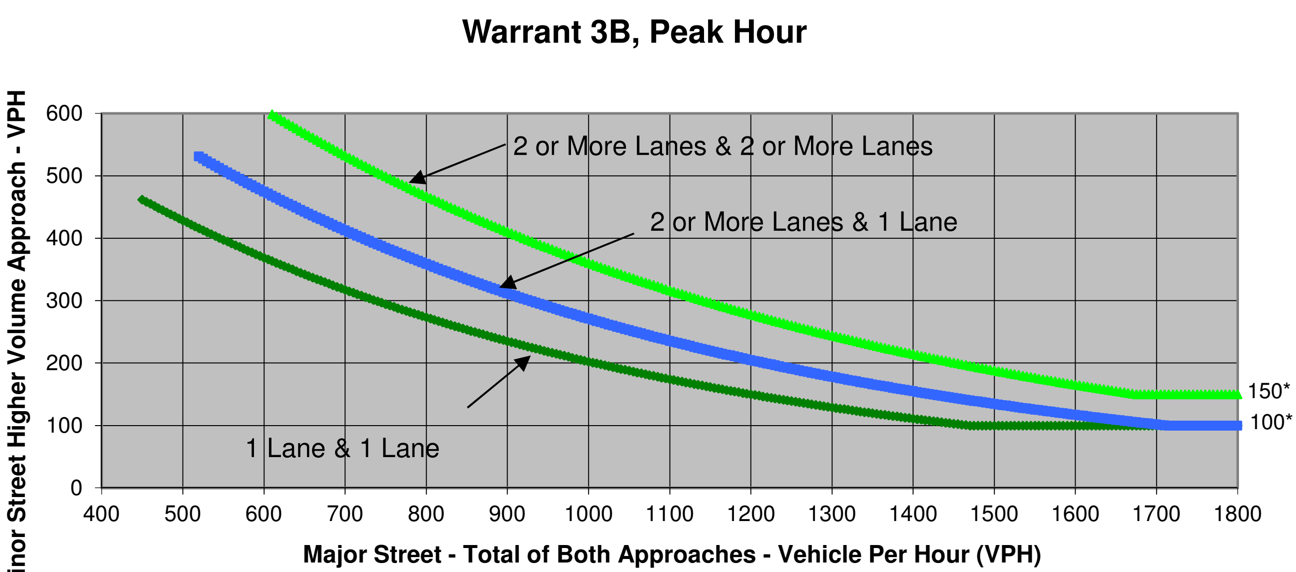
			Project	CSUSB Main Campus Traffic Study
Major Street	North Campus Circle		Scenario	Cumulative Conditions
Minor Street	Education Lane		Peak Hour	PM

Turn Movement Volumes

	NB	SB	EB	WB
Left	40	0	0	30
Through	0	0	130	90
Right	30	0	40	0
Total	70	0	170	120

Major Street Direction

	North/South
X	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street North Campus Circle	Minor Street Education Lane	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**290**	**70**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

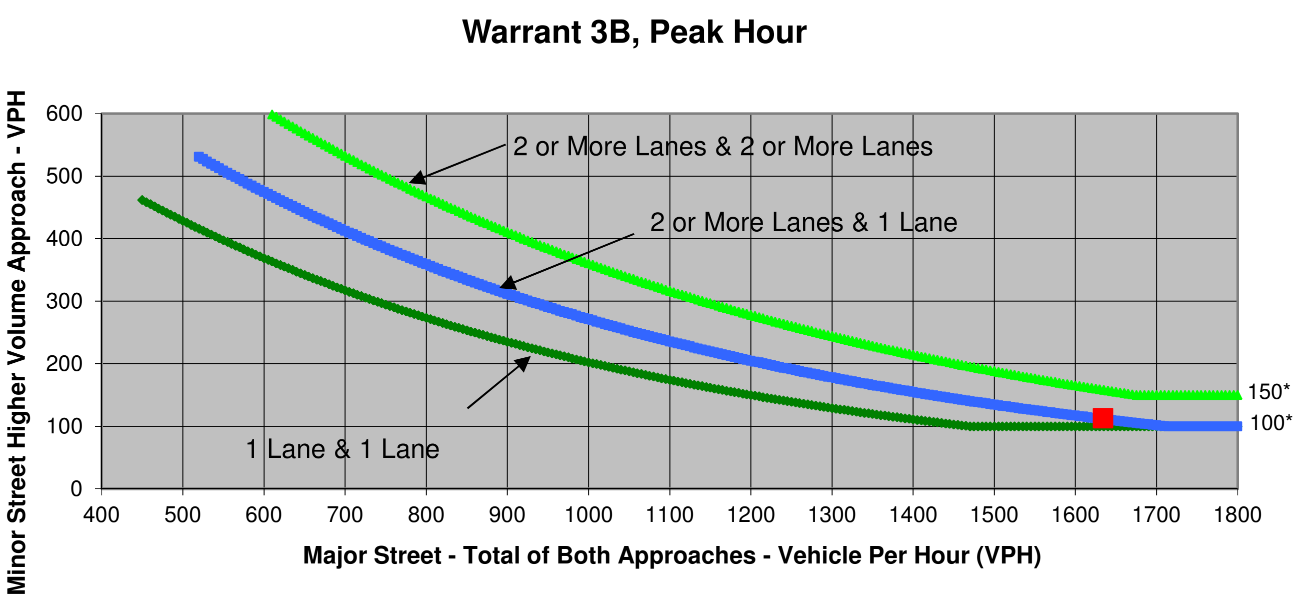
			Project	CSUSB Main Campus Traffic Study
Major Street	Northpark Boulevard/Devils Canyon Road		Scenario	Cumulative plus Project Conditions
Minor Street	Ash Street		Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left	20	243	10	93
Through	249	333	10	10
Right	779	10	30	10
Total	1,048	586	50	113

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard/Devils Canyon Road	Minor Street Ash Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**1,634**	**113**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

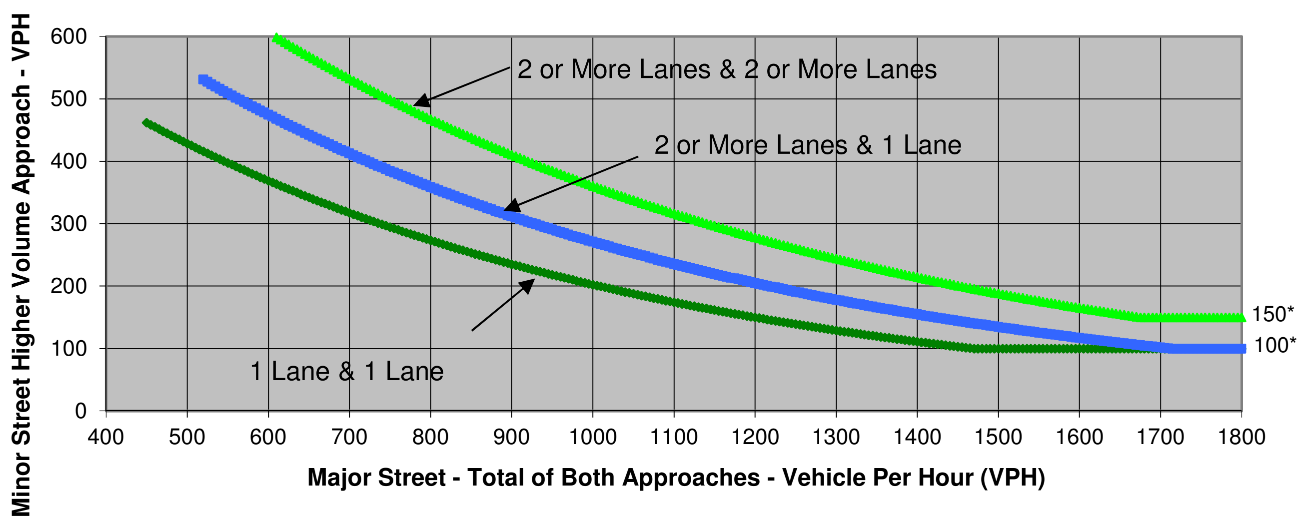
Major Street	Northpark Boulevard/Devils Canyon Road		Project	CSUSB Main Campus Traffic Study
Minor Street	Ash Street		Scenario	Cumulative plus Project Conditions
			Peak Hour	PM

Turn Movement Volumes

	NB	SB	EB	WB
Left	30	61	10	717
Through	327	268	10	10
Right	402	10	40	88
Total	759	339	60	815

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard/Devils Canyon Road	Minor Street Ash Street	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**1,098**	**815**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

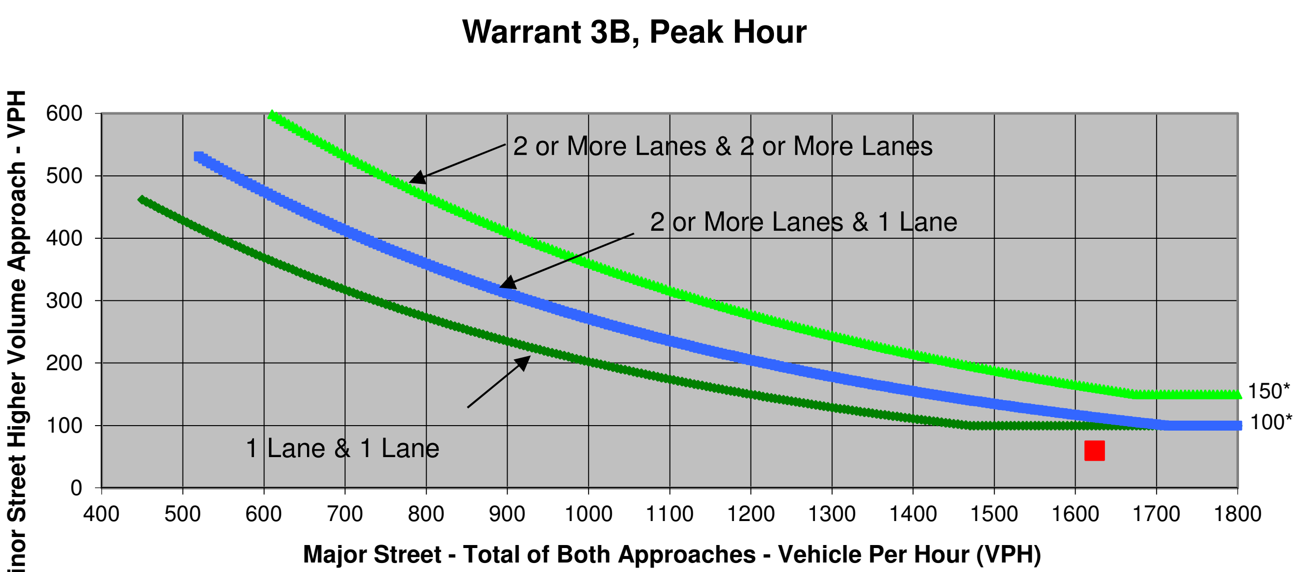
Major Street	Northpark Boulevard	Project	CSUSB Main Campus Traffic Study
Minor Street	Sierra Drive	Scenario	Cumulative plus Project Conditions
		Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left	10	120	20	40
Through	1,009	326	0	0
Right	149	10	20	20
Total	1,168	456	40	60

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard	Minor Street Sierra Drive	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**1,624**	**60**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

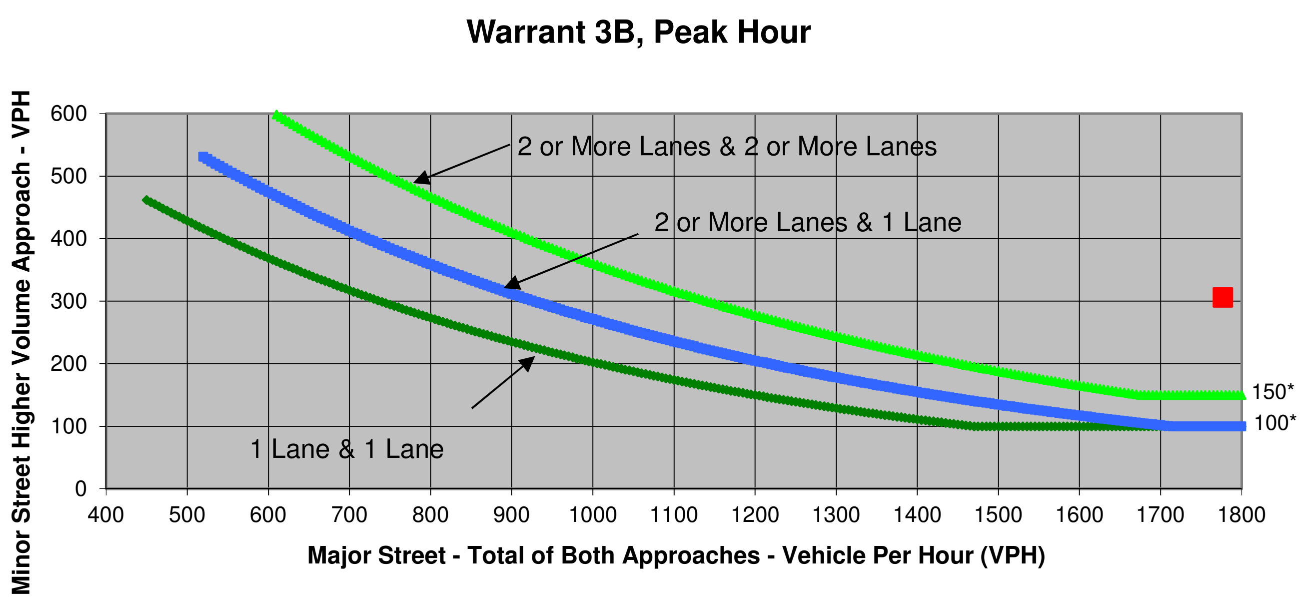
			Project	CSUSB Main Campus Traffic Study
Major Street	Northpark Boulevard		Scenario	Cumulative plus Project Conditions
Minor Street	Sierra Drive		Peak Hour	PM

Turn Movement Volumes

	NB	SB	EB	WB
Left	20	40	10	215
Through	658	955	0	0
Right	74	30	10	91
Total	752	1,025	20	306

Major Street Direction

x	North/South
	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street Northpark Boulevard	Minor Street Sierra Drive	Warrant Met
Number of Approach Lanes	**2**	**1**	**YES**
Traffic Volume (VPH) *	**1,777**	**306**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR PEERS

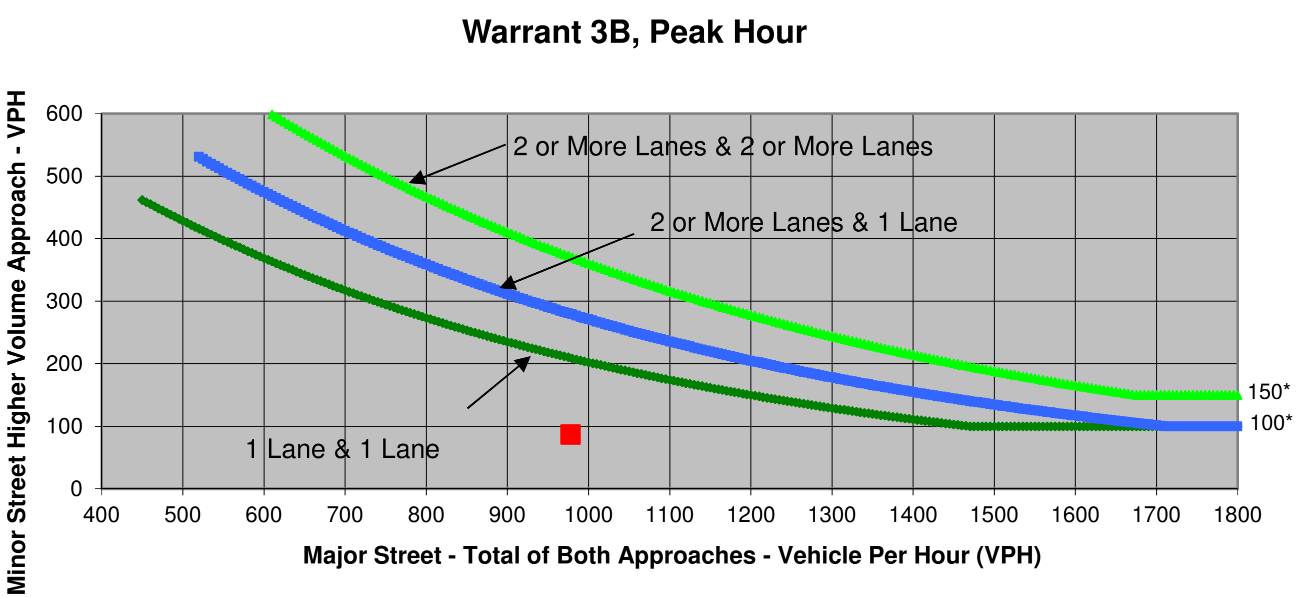
		Project	CSUSB Main Campus Traffic Study
Major Street	North Campus Circle	Scenario	Cumulative plus Project Conditions
Minor Street	Education Lane	Peak Hour	AM

Turn Movement Volumes

	NB	SB	EB	WB
Left	49	0	0	141
Through	0	0	121	582
Right	38	0	134	0
Total	87	0	255	723

Major Street Direction

	North/South
X	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street North Campus Circle	Minor Street Education Lane	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**978**	**87**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

FEHR & PEERS

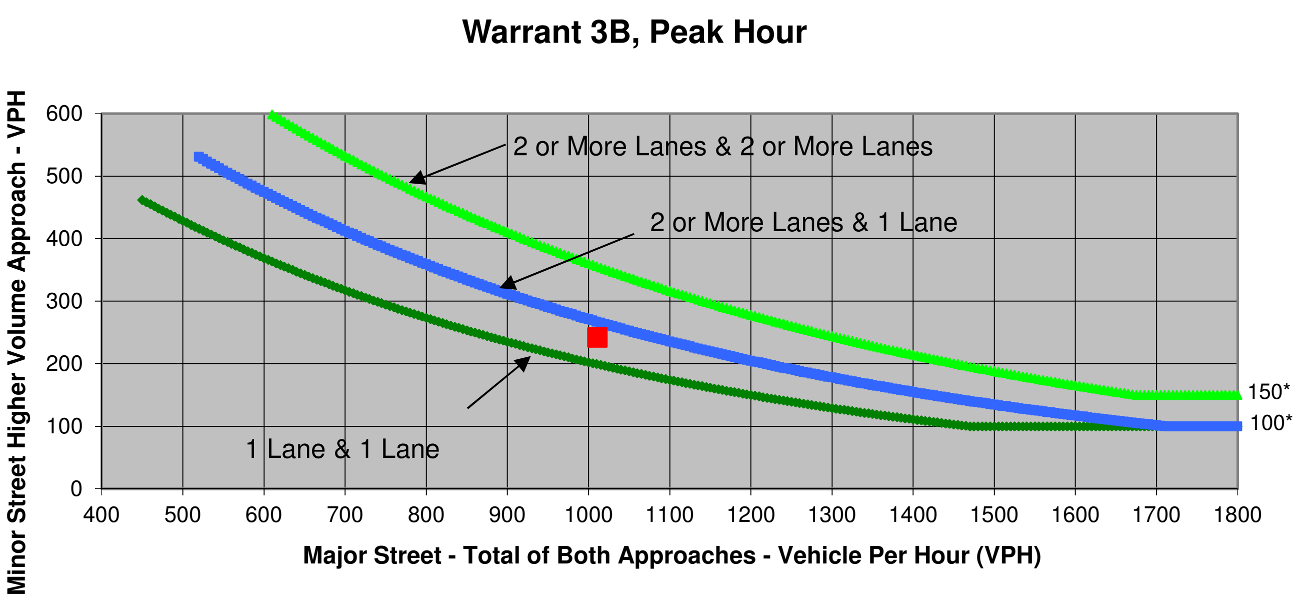
Major Street	North Campus Circle	Project	CSUSB Main Campus Traffic Study
Minor Street	Education Lane	Scenario	Cumulative plus Project Conditions
		Peak Hour	PM

Turn Movement Volumes

	NB	SB	EB	WB
Left	116	0	0	93
Through	0	0	496	319
Right	126	0	103	0
Total	242	0	599	412

Major Street Direction

	North/South
X	East/West



* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Source: *California Manual on Uniform Traffic Control Devices*, Caltrans, 2014

	Major Street North Campus Circle	Minor Street Education Lane	Warrant Met
Number of Approach Lanes	**2**	**1**	**NO**
Traffic Volume (VPH) *	**1,011**	**242**	

* Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

APPENDIX H: FREEWAY ANALYSIS WORKSHEETS

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Existing
Time period	AM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	4,300	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	2,014	vph
Length of deceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	4,300	2,014		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	1,132	547		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	4,730	2,222		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Existing
Time period	AM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =			(Equation 13-9, 13-10, or 13-11)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	4,730	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	2,508	pcph	7,050	pcph	No
Ramp volume, v_R	2,222	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off to On Ramp
Alternative	Existing
Time period	AM Peak Hour

Flow Inputs and Adjustments

Volume, V	2,286	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	602	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	2,515	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,257	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.54	
Density, D	19.3	pcpmpl
Level of service, LOS	C	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Existing
Time period	AM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	2,286	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	96	vph
Length of acceleration lane(s)	100	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	2,286	96		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	602	26		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	2,515	106		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Existing
Time period	AM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =	1.000		(Equation 13-3, 13-4, or 13-5)
v_{12} =	2,515	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	2,515	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	2,621	pcph	4,700	pcph	No
Ramp volume, v_R	106	pcph	1,900	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}	2,621	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.57	
Density, D_R	25.2	pcpmpl
Level of service for ramp-freeway junction area of influence	C	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.369	
Space mean speed in ramp influence area, S_R	56.5	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	56.5	mph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Existing
Time period	PM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	5,887	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	2,168	vph
Length of deceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	5,887	2,168		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	1,549	589		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	6,476	2,392		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Existing
Time period	PM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =			(Equation 13-9, 13-10, or 13-11)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	6,476	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	4,084	pcph	7,050	pcph	No
Ramp volume, v_R	2,392	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off to On Ramp
Alternative	Existing
Time period	PM Peak Hour

Flow Inputs and Adjustments

Volume, V	3,719	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	979	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	4,091	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	2,045	pcphpl
Average passenger-car speed, S	59.1	mph
Volume-to-capacity ratio, v/c	0.87	
Density, D	34.6	pcpmpl
Level of service, LOS	D	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Existing
Time period	PM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	3,719	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	165	vph
Length of acceleration lane(s)	100	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	3,719	165		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	979	45		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	4,091	182		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Existing
Time period	PM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =	1.000		(Equation 13-3, 13-4, or 13-5)
v_{12} =	4,091	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	4,091	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	4,273	pcph	4,700	pcph	No
Ramp volume, v_R	182	pcph	1,900	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}	4,273	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.93	
Density, D_R	38.1	pcpmpl
Level of service for ramp-freeway junction area of influence	E	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.595	
Space mean speed in ramp influence area, S_R	51.3	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	51.3	mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	Palm Off to University On
Alternative	Existing
Time period	AM Peak Hour

Flow Inputs and Adjustments

Volume, V	3,368	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	886	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	3,705	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,852	pcphpl
Average passenger-car speed, S	62.1	mph
Volume-to-capacity ratio, v/c	0.79	
Density, D	29.8	pcpmpl
Level of service, LOS	D	

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Existing
Time period	AM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	3,368	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	163	vph
Length of deceleration lane(s)	140	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	3,368	163		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	886	44		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	3,705	180		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Existing
Time period	AM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =	1.000		(Equation 13-9, 13-10, or 13-11)
v_{12} =	3,705	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	3,705	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	3,525	pcph	4,700	pcph	No
Ramp volume, v_R	180	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}	3,705	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.84	
Density, D_R	34.9	pcpmpl
Level of service for ramp-freeway junction area of influence	D	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.314	
Space mean speed in ramp influence area, S_R	57.8	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	57.8	mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Off to On Ramps
Alternative	Existing
Time period	AM Peak Hour

Flow Inputs and Adjustments

Volume, V	3,205	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	843	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	3,526	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,763	pcphpl
Average passenger-car speed, S	63.1	mph
Volume-to-capacity ratio, v/c	0.75	
Density, D	27.9	pcpmpl
Level of service, LOS	D	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Existing
Time period	AM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	3,205	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	1,346	vph
Length of acceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	3,205	1,346		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	843	366		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	3,526	1,485		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Existing
Time period	AM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =			(Equation 13-3, 13-4, or 13-5)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	3,526	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	5,010	pcph	7,050	pcph	No
Ramp volume, v_R	1,485	pcph	1,900	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	Palm Off to University On
Alternative	Existing
Time period	PM Peak Hour

Flow Inputs and Adjustments

Volume, V	2,180	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	574	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	2,398	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,199	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.51	
Density, D	18.4	pcpmpl
Level of service, LOS	C	

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Existing
Time period	PM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	2,180	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	144	vph
Length of deceleration lane(s)	140	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	2,180	144		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	574	39		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	2,398	159		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Existing
Time period	PM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =	1.000		(Equation 13-9, 13-10, or 13-11)
v_{12} =	2,398	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	2,398	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	2,239	pcph	4,700	pcph	No
Ramp volume, v_R	159	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}	2,398	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.55	
Density, D_R	23.6	pcpmpl
Level of service for ramp-freeway junction area of influence	C	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.312	
Space mean speed in ramp influence area, S_R	57.8	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	57.8	mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Off to On Ramps
Alternative	Existing
Time period	PM Peak Hour

Flow Inputs and Adjustments

Volume, V	2,036	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	536	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	2,240	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,120	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.48	
Density, D	17.2	pcpmpl
Level of service, LOS	B	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Existing
Time period	PM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	2,036	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	1,697	vph
Length of acceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	2,036	1,697		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	536	461		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	2,240	1,872		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Existing
Time period	PM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =			(Equation 13-3, 13-4, or 13-5)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	2,240	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	4,112	pcph	7,050	pcph	No
Ramp volume, v_R	1,872	pcph	1,900	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Existing Plus Project
Time period	AM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	4,806	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	2,520	vph
Length of deceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	4,806	2,520		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	1,265	685		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	5,287	2,780		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Existing Plus Project
Time period	AM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =			(Equation 13-9, 13-10, or 13-11)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	5,287	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	2,506	pcph	7,050	pcph	No
Ramp volume, v_R	2,780	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off to On Ramp
Alternative	Existing Plus Project
Time period	AM Peak Hour

Flow Inputs and Adjustments

Volume, V	2,286	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	602	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	2,515	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,257	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.54	
Density, D	19.3	pcpmpl
Level of service, LOS	C	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Existing Plus Project
Time period	AM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	2,286	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	109	vph
Length of acceleration lane(s)	100	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	2,286	109		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	602	30		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	2,515	120		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Existing Plus Project
Time period	AM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =	1.000		(Equation 13-3, 13-4, or 13-5)
v_{12} =	2,515	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	2,515	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	2,635	pcph	4,700	pcph	No
Ramp volume, v_R	120	pcph	1,900	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}	2,635	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.57	
Density, D_R	25.3	pcpmpl
Level of service for ramp-freeway junction area of influence	C	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.369	
Space mean speed in ramp influence area, S_R	56.5	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	56.5	mph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Existing Plus Project
Time period	PM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	6,467	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	2,416	vph
Length of deceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	6,467	2,416		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	1,702	657		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	7,114	2,665		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Existing Plus Project
Time period	PM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =			(Equation 13-9, 13-10, or 13-11)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	7,114	pcph	7,050	pcph	Yes
Exiting freeway volume, v_{FO}	4,448	pcph	7,050	pcph	No
Ramp volume, v_R	2,665	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off to On Ramp
Alternative	Existing Plus Project
Time period	PM Peak Hour

Flow Inputs and Adjustments

Volume, V	4,051	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	1,066	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	4,456	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	2,228	pcphpl
Average passenger-car speed, S	55.3	mph
Volume-to-capacity ratio, v/c	0.95	
Density, D	40.3	pcpmpl
Level of service, LOS	E	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Existing Plus Project
Time period	PM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	4,051	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	271	vph
Length of acceleration lane(s)	100	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	4,051	271		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	1,066	74		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	4,456	299		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Existing Plus Project
Time period	PM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =	1.000		(Equation 13-3, 13-4, or 13-5)
v_{12} =	4,456	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	4,456	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	4,755	pcph	4,700	pcph	Yes
Ramp volume, v_R	299	pcph	1,900	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}	4,755	pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c	1.03	
Density, D_R	-	pcpmpl
Level of service for ramp-freeway junction area of influence	F	

Speed Estimation

Intermediate speed variable, M_S or D_S	-	
Space mean speed in ramp influence area, S_R	-	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	Palm Off to University On
Alternative	Existing Plus Project
Time period	AM Peak Hour

Flow Inputs and Adjustments

Volume, V	3,513	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	924	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	3,864	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,932	pcphpl
Average passenger-car speed, S	61.0	mph
Volume-to-capacity ratio, v/c	0.82	
Density, D	31.7	pcpmpl
Level of service, LOS	D	

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Existing Plus Project
Time period	AM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	3,513	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	290	vph
Length of deceleration lane(s)	140	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	3,513	290		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	924	79		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	3,864	320		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Existing Plus Project
Time period	AM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =	1.000		(Equation 13-9, 13-10, or 13-11)
v_{12} =	3,864	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	3,864	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	3,544	pcph	4,700	pcph	No
Ramp volume, v_R	320	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}	3,864	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.88	
Density, D_R	36.2	pcpmpl
Level of service for ramp-freeway junction area of influence	E	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.327	
Space mean speed in ramp influence area, S_R	57.5	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	57.5	mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Off to On Ramps
Alternative	Existing Plus Project
Time period	AM Peak Hour

Flow Inputs and Adjustments

Volume, V	3,223	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	848	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	3,545	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,773	pcphpl
Average passenger-car speed, S	63.0	mph
Volume-to-capacity ratio, v/c	0.75	
Density, D	28.1	pcpmpl
Level of service, LOS	D	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Existing Plus Project
Time period	AM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	3,223	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	1,401	vph
Length of acceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	3,223	1,401		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	848	381		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	3,545	1,546		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Existing Plus Project
Time period	AM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =			(Equation 13-3, 13-4, or 13-5)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	3,545	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	5,091	pcph	7,050	pcph	No
Ramp volume, v_R	1,546	pcph	1,900	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	Palm Off to University On
Alternative	Existing Plus Project
Time period	PM Peak Hour

Flow Inputs and Adjustments

Volume, V	2,258	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	594	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	2,484	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,242	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.53	
Density, D	19.1	pcpmpl
Level of service, LOS	C	

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Existing Plus Project
Time period	PM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	2,258	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	206	vph
Length of deceleration lane(s)	140	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	2,258	206		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	594	56		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	2,484	227		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Existing Plus Project
Time period	PM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =	1.000		(Equation 13-9, 13-10, or 13-11)
v_{12} =	2,484	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	2,484	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	2,257	pcph	4,700	pcph	No
Ramp volume, v_R	227	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}	2,484	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.56	
Density, D_R	24.4	pcpmpl
Level of service for ramp-freeway junction area of influence	C	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.318	
Space mean speed in ramp influence area, S_R	57.7	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	57.7	mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Off to On Ramps
Alternative	Existing Plus Project
Time period	PM Peak Hour

Flow Inputs and Adjustments

Volume, V	2,052	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	540	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	2,257	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,129	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.48	
Density, D	17.4	pcpmpl
Level of service, LOS	B	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Existing Plus Project
Time period	PM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	2,052	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	2,140	vph
Length of acceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	2,052	2,140		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	540	582		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	2,257	2,361		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Existing Plus Project
Time period	PM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =			(Equation 13-3, 13-4, or 13-5)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	2,257	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	4,618	pcph	7,050	pcph	No
Ramp volume, v_R	2,361	pcph	1,900	pcph	Yes
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Cumulative No Project
Time period	AM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	3,687	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	2,080	vph
Length of deceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	3,687	2,080		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	970	565		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	4,056	2,295		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Cumulative No Project
Time period	AM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =			(Equation 13-9, 13-10, or 13-11)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	4,056	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	1,761	pcph	7,050	pcph	No
Ramp volume, v_R	2,295	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off to On Ramp
Alternative	Cumulative No Project
Time period	AM Peak Hour

Flow Inputs and Adjustments

Volume, V	1,607	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	423	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	1,768	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	884	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.38	
Density, D	13.6	pcpmpl
Level of service, LOS	B	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Cumulative No Project
Time period	AM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	1,607	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	170	vph
Length of acceleration lane(s)	100	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	1,607	170		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	423	46		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	1,768	188		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Cumulative No Project
Time period	AM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =	1.000		(Equation 13-3, 13-4, or 13-5)
v_{12} =	1,768	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	1,768	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	1,956	pcph	4,700	pcph	No
Ramp volume, v_R	188	pcph	1,900	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}	1,956	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.43	
Density, D_R	20.0	pcpmpl
Level of service for ramp-freeway junction area of influence	C	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.343	
Space mean speed in ramp influence area, S_R	57.1	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	57.1	mph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Cumulative No Project
Time period	PM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	5,339	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	2,240	vph
Length of deceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	5,339	2,240		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	1,405	609		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	5,872	2,471		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Cumulative No Project
Time period	PM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =			(Equation 13-9, 13-10, or 13-11)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	5,872	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	3,401	pcph	7,050	pcph	No
Ramp volume, v_R	2,471	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off to On Ramp
Alternative	Cumulative No Project
Time period	PM Peak Hour

Flow Inputs and Adjustments

Volume, V	3,099	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	815	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	3,408	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,704	pcphpl
Average passenger-car speed, S	63.7	mph
Volume-to-capacity ratio, v/c	0.73	
Density, D	26.8	pcpmpl
Level of service, LOS	D	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Cumulative No Project
Time period	PM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	3,099	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	340	vph
Length of acceleration lane(s)	100	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	3,099	340		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	815	92		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	3,408	375		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Cumulative No Project
Time period	PM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =	1.000		(Equation 13-3, 13-4, or 13-5)
v_{12} =	3,408	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	3,408	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	3,783	pcph	4,700	pcph	No
Ramp volume, v_R	375	pcph	1,900	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}	3,783	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.82	
Density, D_R	34.2	pcpmpl
Level of service for ramp-freeway junction area of influence	D	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.486	
Space mean speed in ramp influence area, S_R	53.8	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	53.8	mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	Palm Off to University On
Alternative	Cumulative No Project
Time period	AM Peak Hour

Flow Inputs and Adjustments

Volume, V	2,489	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	655	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	2,738	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,369	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.58	
Density, D	21.1	pcpmpl
Level of service, LOS	C	

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Cumulative No Project
Time period	AM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	2,489	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	300	vph
Length of deceleration lane(s)	140	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	2,489	300		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	655	82		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	2,738	331		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Cumulative No Project
Time period	AM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =	1.000		(Equation 13-9, 13-10, or 13-11)
v_{12} =	2,738	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	2,738	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	2,407	pcph	4,700	pcph	No
Ramp volume, v_R	331	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}	2,738	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.62	
Density, D_R	26.5	pcpmpl
Level of service for ramp-freeway junction area of influence	C	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.328	
Space mean speed in ramp influence area, S_R	57.5	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	57.5	mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Off to On Ramps
Alternative	Cumulative No Project
Time period	AM Peak Hour

Flow Inputs and Adjustments

Volume, V	2,189	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	576	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	2,408	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,204	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.51	
Density, D	18.5	pcpmpl
Level of service, LOS	C	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Cumulative No Project
Time period	AM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	2,189	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	1,380	vph
Length of acceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	2,189	1,380		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	576	375		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	2,408	1,523		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Cumulative No Project
Time period	AM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =			(Equation 13-3, 13-4, or 13-5)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	2,408	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	3,931	pcph	7,050	pcph	No
Ramp volume, v_R	1,523	pcph	1,900	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	Palm Off to University On
Alternative	Cumulative No Project
Time period	PM Peak Hour

Flow Inputs and Adjustments

Volume, V	1,499	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	395	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	1,649	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	825	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.35	
Density, D	12.7	pcpmpl
Level of service, LOS	B	

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Cumulative No Project
Time period	PM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	1,499	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	150	vph
Length of deceleration lane(s)	140	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	1,499	150		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	395	41		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	1,649	165		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Cumulative No Project
Time period	PM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =	1.000		(Equation 13-9, 13-10, or 13-11)
v_{12} =	1,649	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	1,649	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	1,484	pcph	4,700	pcph	No
Ramp volume, v_R	165	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}	1,649	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.37	
Density, D_R	17.2	pcpmpl
Level of service for ramp-freeway junction area of influence	B	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.313	
Space mean speed in ramp influence area, S_R	57.8	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	57.8	mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Off to On Ramps
Alternative	Cumulative No Project
Time period	PM Peak Hour

Flow Inputs and Adjustments

Volume, V	1,349	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	355	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	1,484	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	742	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.32	
Density, D	11.4	pcpmpl
Level of service, LOS	B	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Cumulative No Project
Time period	PM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	1,349	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	1,750	vph
Length of acceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	1,349	1,750		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	355	476		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	1,484	1,931		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Cumulative No Project
Time period	PM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =			(Equation 13-3, 13-4, or 13-5)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	1,484	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	3,415	pcph	7,050	pcph	No
Ramp volume, v_R	1,931	pcph	1,900	pcph	Yes
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Cumulative Plus Project
Time period	AM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	4,193	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	2,586	vph
Length of deceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	4,193	2,586		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	1,104	703		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	4,613	2,853		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Cumulative Plus Project
Time period	AM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =			(Equation 13-9, 13-10, or 13-11)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	4,613	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	1,760	pcph	7,050	pcph	No
Ramp volume, v_R	2,853	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off to On Ramp
Alternative	Cumulative Plus Project
Time period	AM Peak Hour

Flow Inputs and Adjustments

Volume, V	1,607	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	423	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	1,768	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	884	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.38	
Density, D	13.6	pcpmpl
Level of service, LOS	B	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Cumulative Plus Project
Time period	AM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	1,607	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	184	vph
Length of acceleration lane(s)	100	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	1,607	184		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	423	50		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	1,768	203		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Cumulative Plus Project
Time period	AM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =	1.000		(Equation 13-3, 13-4, or 13-5)
v_{12} =	1,768	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	1,768	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	1,971	pcph	4,700	pcph	No
Ramp volume, v_R	203	pcph	1,900	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}	1,971	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.43	
Density, D_R	20.1	pcpmpl
Level of service for ramp-freeway junction area of influence	C	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.343	
Space mean speed in ramp influence area, S_R	57.1	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	57.1	mph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Cumulative Plus Project
Time period	PM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	5,587	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	2,488	vph
Length of deceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	5,587	2,488		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	1,470	676		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	6,145	2,745		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off Ramp
Alternative	Cumulative Plus Project
Time period	PM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =			(Equation 13-9, 13-10, or 13-11)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	6,145	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	3,400	pcph	7,050	pcph	No
Ramp volume, v_R	2,745	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy Off to On Ramp
Alternative	Cumulative Plus Project
Time period	PM Peak Hour

Flow Inputs and Adjustments

Volume, V	3,099	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	815	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	3,408	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,704	pcphpl
Average passenger-car speed, S	63.7	mph
Volume-to-capacity ratio, v/c	0.73	
Density, D	26.8	pcpmpl
Level of service, LOS	D	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Cumulative Plus Project
Time period	PM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	3,099	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	451	vph
Length of acceleration lane(s)	100	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	3,099	451		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	815	123		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	3,408	498		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Northbound I-215
Segment	University Pkwy On Ramp
Alternative	Cumulative Plus Project
Time period	PM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =	1.000		(Equation 13-3, 13-4, or 13-5)
v_{12} =	3,408	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	3,408	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	3,906	pcph	4,700	pcph	No
Ramp volume, v_R	498	pcph	1,900	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}	3,906	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.85	
Density, D_R	35.1	pcpmpl
Level of service for ramp-freeway junction area of influence	E	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.509	
Space mean speed in ramp influence area, S_R	53.3	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	53.3	mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	Palm Off to University On
Alternative	Cumulative Plus Project
Time period	AM Peak Hour

Flow Inputs and Adjustments

Volume, V	2,616	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	688	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	2,878	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,439	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.61	
Density, D	22.1	pcpmpl
Level of service, LOS	C	

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Cumulative Plus Project
Time period	AM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	2,616	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	427	vph
Length of deceleration lane(s)	140	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	2,616	427		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	688	116		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	2,878	471		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Cumulative Plus Project
Time period	AM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =	1.000		(Equation 13-9, 13-10, or 13-11)
v_{12} =	2,878	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	2,878	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	2,407	pcph	4,700	pcph	No
Ramp volume, v_R	471	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}	2,878	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.65	
Density, D_R	27.7	pcpmpl
Level of service for ramp-freeway junction area of influence	C	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.340	
Space mean speed in ramp influence area, S_R	57.2	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	57.2	mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Off to On Ramps
Alternative	Cumulative Plus Project
Time period	AM Peak Hour

Flow Inputs and Adjustments

Volume, V	2,189	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	576	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	2,408	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	1,204	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.51	
Density, D	18.5	pcpmpl
Level of service, LOS	C	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Cumulative Plus Project
Time period	AM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	2,189	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	1,436	vph
Length of acceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	2,189	1,436		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	576	390		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	2,408	1,584		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Cumulative Plus Project
Time period	AM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =			(Equation 13-3, 13-4, or 13-5)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	2,408	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	3,992	pcph	7,050	pcph	No
Ramp volume, v_R	1,584	pcph	1,900	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	Palm Off to University On
Alternative	Cumulative Plus Project
Time period	PM Peak Hour

Flow Inputs and Adjustments

Volume, V	1,581	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	416	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	1,739	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	870	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.37	
Density, D	13.4	pcpmpl
Level of service, LOS	B	

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Cumulative Plus Project
Time period	PM Peak Hour

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65	mph
Volume on freeway	1,581	vph

Off Ramp Data

Type of diverge	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	45	mph
Volume on ramp	232	vph
Length of deceleration lane(s)	140	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	1,581	232		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	416	63		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	1,739	256		pcph

HCM 2010: Freeway Diverge Segment

Diverge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Pkwy Off-Ramp
Alternative	Cumulative Plus Project
Time period	PM Peak Hour

Estimation of Volume in Diverge Area

L_{EQ} =		ft	(Equation 13-12 or 13-13)
P_{FM} =	1.000		(Equation 13-9, 13-10, or 13-11)
v_{12} =	1,739	pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	1,739	pcph	4,700	pcph	No
Exiting freeway volume, v_{FO}	1,483	pcph	4,700	pcph	No
Ramp volume, v_R	256	pcph	4,200	pcph	No
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Diverge Influence Area

	Actual		Maximum		Violation?
v_{12A}	1,739	pcph	4,600	pcph	No

Level of Service Determination

Volume-to-capacity ratio, v/c	0.40	
Density, D_R	18.0	pcpmpl
Level of service for ramp-freeway junction area of influence	B	

Speed Estimation

Intermediate speed variable, M_S or D_S	0.321	
Space mean speed in ramp influence area, S_R	57.6	mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S	57.6	mph

HCM 2010: Freeway Basic Segment

Basic Operational Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University Off to On Ramps
Alternative	Cumulative Plus Project
Time period	PM Peak Hour

Flow Inputs and Adjustments

Volume, V	1,349	vph
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v_{15}	355	veh
Trucks and buses	9.0%	
Recreational vehicles	0.0%	
Terrain type	Level	
Grade		
Length		mi
Trucks and buses PCE, E_T	1.5	
Recreational vehicle PCE, E_R	1.2	
Heavy vehicle adjustment, f_{HV}	0.957	
Driver popoulation factor, f_P	1.00	
Flow rate, v_p	1,484	pcph
Number of lanes, N	2	

Speed Inputs and Adjustments

Lane width		ft
Right-side lateral clearance		ft
Total ramp density, TRD		ramps/mi
Lane width adjustment, f_{LW}		mph
Lateral clearance adjustment, f_{LC}		mph
TRD adjustment		mph
Calculated free-flow speed, FFS		mph
Measured free-flow speed, FFS		mph
Free-flow speed curve	65	mph

Capacity Checks for Segments with Ramps

	Actual		Maximum		Violation?
Entering freeway volume		pcph		pcph	
Exiting freeway volume		pcph		pcph	
On-ramp volume		pcph		pcph	
Off-ramp volume		pcph		pcph	

LOS and Performance Measures

Flow rate, v_p	742	pcphpl
Average passenger-car speed, S	65.0	mph
Volume-to-capacity ratio, v/c	0.32	
Density, D	11.4	pcpmpl
Level of service, LOS	B	

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Cumulative Plus Project
Time period	PM Peak Hour

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65	mph
Volume on freeway	1,349	vph

On Ramp Data

Type of merge	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	30	mph
Volume on ramp	2,193	vph
Length of acceleration lane(s)	0	ft

Adjacent Ramp Data

	Upstream		Downstream	
Does adjacent ramp exist?	No		No	
Volume on adjacent ramp		vph		vph
Type of adjacent ramp				
Distance to adjacent ramp		ft		ft

Conversion to pcph Under Base Conditions

Junction Components	Freeway	Ramp	Adj. Ramp	
Volume, V	1,349	2,193		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v_{15}	355	596		veh
Trucks and buses	9.0%	3.0%		
Recreational vehicles	0.0%	0.0%		
Terrain type	Level	Level		
Grade				
Length				mi
Trucks and buses PCE, E_T	1.5	1.5		
Recreational vehicle PCE, E_R	1.2	1.2		
Heavy vehicle adjustment, f_{HV}	0.957	0.985		
Driver popoulation factor, f_P	1.00	1.00		
Flow rate, v_p	1,484	2,419		pcph

HCM 2010: Freeway Merge Segment

Merge Analysis

Project	CSUSB EIR
Freeway	Southbound I-215
Segment	University On to SR 210 Off
Alternative	Cumulative Plus Project
Time period	PM Peak Hour

Estimation of Volume in Merge Area

L_{EQ} =		ft	(Equation 13-6 or 13-7)
P_{FM} =			(Equation 13-3, 13-4, or 13-5)
v_{12} =		pcph	

Capacity Checks

	Actual		Maximum		LOS F?
Entering freeway volume, v_{Fi}	1,484	pcph	7,050	pcph	No
Exiting freeway volume, v_{FO}	3,904	pcph	7,050	pcph	No
Ramp volume, v_R	2,419	pcph	1,900	pcph	Yes
Outer lanes volume, v_3 or v_{av34}	#VALUE!	pcph	(Equation 13-14 or 13-17)		
Is v_3 or v_{av34} > 2,700 pcph?	#VALUE!				
Is v_3 or v_{av34} > 1.5 v_{12} / 2?	#VALUE!				
If yes, v_{12A} =	#VALUE!	pcph	(Equation 13-15, 13-16, 13-18, or 13-19)		

Flow Entering Merge Influence Area

	Actual		Maximum		Violation?
v_{R12}		pcph	4,600	pcph	Yes

Level of Service Determination

Volume-to-capacity ratio, v/c		
Density, D_R		pcpmpl
Level of service for ramp-freeway junction area of influence		

Speed Estimation

Intermediate speed variable, M_S or D_S		
Space mean speed in ramp influence area, S_R		mph
Space mean speed in outer lanes, S_O		mph
Space mean speed for all vehicles, S		mph

Appendix D
Air Quality

CSUSB 2035 Master Plan

San Bernardino-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
University/College (4Yr)	11,722.00	Student	49.46	2,886,100.00	11722

1.2 Other Project Characteristics

Urbanization Urban **Wind Speed (m/s)** 2.2 **Precipitation Freq (Days)** 32

Climate Zone 10 **Operational Year** 2035

Utility Company Southern California Edison

CO2 Intensity (lb/MWhr) 702.44 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - .

Architectural Coating -

Vehicle Trips - Generated from an assumptin of 20,045 new trips (2.89M x 6.95) (ksf)

Table Name	Column Name	Default Value	New Value
tblLandUse	BuildingSpaceSquareFeet	2,154,473.92	2,886,100.00
tblLandUse	LandUseSquareFeet	2,154,473.92	2,886,100.00
tblLandUse	Population	0.00	11,722.00
tblProjectCharacteristics	OperationalYear	2018	2035
tblVehicleTrips	ST_TR	1.30	1.71
tblVehicleTrips	SU_TR	0.00	1.71

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2033	0.0463	0.2155	0.4212	1.0400e-003	3.6200e-003	7.7400e-003	0.0114	9.6000e-004	7.7400e-003	8.7000e-003	0.0000	89.4789	89.4789	3.7100e-003	0.0000	89.5718
2034	0.2742	1.2809	2.4819	6.1400e-003	1.6474	0.0459	1.6933	0.8995	0.0459	0.9453	0.0000	528.6392	528.6392	0.0220	0.0000	529.1889
2035	0.3172	1.3025	2.3960	7.2300e-003	3.6692	0.0391	3.7083	1.7370	0.0391	1.7761	0.0000	645.1184	645.1184	0.0251	0.0000	645.7463
2036	0.3861	1.2595	2.9863	9.3400e-003	2.0453	0.0413	2.0865	0.8438	0.0413	0.8851	0.0000	873.3331	873.3331	0.0306	0.0000	874.0980
2037	0.4716	3.4696	4.1026	0.0207	3.1929	0.0301	3.2230	1.1535	0.0298	1.1833	0.0000	1,918.5942	1,918.5942	0.0679	0.0000	1,920.2925
2038	0.5433	5.2973	5.0331	0.0301	2.1234	0.0210	2.1444	0.5729	0.0204	0.5933	0.0000	2,783.8679	2,783.8679	0.0988	0.0000	2,786.3388
2039	0.5412	5.2770	5.0138	0.0300	2.1152	0.0209	2.1362	0.5707	0.0203	0.5910	0.0000	2,773.2017	2,773.2017	0.0985	0.0000	2,775.6631
2040	0.4733	5.2057	4.6757	0.0296	2.1234	0.0176	2.1409	0.5729	0.0171	0.5900	0.0000	2,743.1069	2,743.1069	0.0946	0.0000	2,745.4715
2041	0.4733	5.2057	4.6757	0.0296	2.1234	0.0176	2.1409	0.5729	0.0171	0.5900	0.0000	2,743.1069	2,743.1069	0.0946	0.0000	2,745.4715
2042	0.4733	5.2057	4.6757	0.0296	2.1234	0.0176	2.1409	0.5729	0.0171	0.5900	0.0000	2,743.1069	2,743.1069	0.0946	0.0000	2,745.4715
2043	0.4733	5.2057	4.6757	0.0296	2.1234	0.0176	2.1409	0.5729	0.0171	0.5900	0.0000	2,743.1069	2,743.1069	0.0946	0.0000	2,745.4715
2044	0.4733	5.2057	4.6757	0.0296	2.1234	0.0176	2.1409	0.5729	0.0171	0.5900	0.0000	2,743.1069	2,743.1069	0.0946	0.0000	2,745.4715
2045	0.4467	5.1667	4.5263	0.0293	2.1152	0.0170	2.1322	0.5707	0.0165	0.5872	0.0000	2,715.1866	2,715.1866	0.0926	0.0000	2,717.5024
2046	0.4484	5.1866	4.5437	0.0294	2.1234	0.0170	2.1404	0.5729	0.0166	0.5895	0.0000	2,725.6296	2,725.6296	0.0930	0.0000	2,727.9543
2047	0.4484	5.1866	4.5437	0.0294	2.1234	0.0170	2.1404	0.5729	0.0166	0.5895	0.0000	2,725.6296	2,725.6296	0.0930	0.0000	2,727.9543
2048	0.4501	5.2064	4.5611	0.0295	2.1315	0.0171	2.1486	0.5751	0.0166	0.5917	0.0000	2,736.0726	2,736.0726	0.0933	0.0000	2,738.4062

2049	0.4484	5.1866	4.5437	0.0294	2.1234	0.0170	2.1404	0.5729	0.0166	0.5895	0.0000	2,725.6296	2,725.6296	0.0930	0.0000	2,727.9543
2050	0.4398	5.1625	4.4873	0.0293	2.1152	0.0168	2.1320	0.5707	0.0163	0.5870	0.0000	2,711.8234	2,711.8234	0.0916	0.0000	2,714.1134
2051	0.1556	0.8957	2.0954	4.0200e-003	1.7719	9.5800e-003	1.7814	0.4349	9.5800e-003	0.4445	0.0000	341.7194	341.7194	0.0123	0.0000	342.0264
2052	0.1568	0.9026	2.1115	4.0600e-003	1.7855	9.6600e-003	1.7952	0.4383	9.6600e-003	0.4479	0.0000	344.3480	344.3480	0.0124	0.0000	344.6574
2053	0.1562	0.8992	2.1035	4.0400e-003	1.7787	9.6200e-003	1.7883	0.4366	9.6200e-003	0.4462	0.0000	343.0337	343.0337	0.0123	0.0000	343.3419
2054	0.1562	0.8992	2.1035	4.0400e-003	1.7787	9.6200e-003	1.7883	0.4366	9.6200e-003	0.4462	0.0000	343.0337	343.0337	0.0123	0.0000	343.3419
2055	0.1387	0.5936	2.0750	3.7600e-003	0.5041	0.0137	0.5178	0.1237	0.0137	0.1374	0.0000	322.3704	322.3704	0.0111	0.0000	322.6468
2056	29.0213	0.3011	1.2218	2.1500e-003	0.1469	8.6500e-003	0.1556	0.0361	8.6500e-003	0.0447	0.0000	185.0934	185.0934	6.2400e-003	0.0000	185.2496
2057	51.3314	0.0767	0.1891	3.1000e-004	0.2427	7.8000e-004	0.2434	0.0596	7.8000e-004	0.0604	0.0000	26.9368	26.9368	9.5000e-004	0.0000	26.9605
Maximum	**51.3314**	**5.2973**	**5.0331**	**0.0301**	**3.6692**	**0.0459**	**3.7083**	**1.7370**	**0.0459**	**1.7761**	**0.0000**	**2,783.8679**	**2,783.8679**	**0.0988**	**0.0000**	**2,786.3388**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	11.7802	1.3400e-003	0.1488	1.0000e-005		5.3000e-004	5.3000e-004		5.3000e-004	5.3000e-004	0.0000	0.2909	0.2909	7.5000e-004	0.0000	0.3097
Energy	0.2163	1.9665	1.6519	0.0118		0.1495	0.1495		0.1495	0.1495	0.0000	9,580.1326	9,580.1326	0.3482	0.1028	9,619.4687
Mobile	3.2942	31.3902	38.9797	0.2399	22.9108	0.1000	23.0109	6.1362	0.0933	6.2295	0.0000	22,416.0845	22,416.0845	0.9738	0.0000	22,440.4304
Waste						0.0000	0.0000		0.0000	0.0000	434.2505	0.0000	434.2505	25.6635	0.0000	1,075.8371
Water						0.0000	0.0000		0.0000	0.0000	7.9624	243.0867	251.0491	0.8279	0.0214	278.1188
Total	**15.2907**	**33.3580**	**40.7803**	**0.2517**	**22.9108**	**0.2500**	**23.1609**	**6.1362**	**0.2432**	**6.3795**	**442.2129**	**32,239.5948**	**32,681.8077**	**27.8141**	**0.1242**	**33,414.1646**

CSUSB 2035 Master Plan

San Bernardino-South Coast County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
University/College (4Yr)	11,722.00	Student	49.46	2,886,100.00	11722

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	32
Climate Zone	10			**Operational Year**	2035
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	702.44	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - .

Architectural Coating -

Vehicle Trips - Generated from an assumptin of 20,045 new trips (2.89M x 6.95) (ksf)

Table Name	Column Name	Default Value	New Value
tblLandUse	BuildingSpaceSquareFeet	2,154,473.92	2,886,100.00
tblLandUse	LandUseSquareFeet	2,154,473.92	2,886,100.00
tblLandUse	Population	0.00	11,722.00
tblProjectCharacteristics	OperationalYear	2018	2035
tblVehicleTrips	ST_TR	1.30	1.71
tblVehicleTrips	SU_TR	0.00	1.71

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2033	2.1083	9.7925	19.1861	0.0474	0.1677	0.3517	0.5193	0.0445	0.3516	0.3961	0.0000	4,492.9069	4,492.9069	0.1862	0.0000	4,497.5623
2034	2.4776	13.6853	19.1712	0.0479	18.2675	0.4373	18.7048	9.9840	0.4373	10.4213	0.0000	4,544.8021	4,544.8021	0.2192	0.0000	4,550.2830
2035	2.9508	10.1562	22.8477	0.0714	18.2675	0.3149	18.5592	9.9840	0.3149	10.2757	0.0000	7,361.1383	7,361.1383	0.2576	0.0000	7,367.5792
2036	2.9508	9.6123	22.8477	0.0714	8.8969	0.3149	9.2118	3.6558	0.3149	3.9707	0.0000	7,361.1383	7,361.1383	0.2576	0.0000	7,367.5792
2037	4.3363	40.4211	41.1973	0.2399	16.5764	0.3149	16.7373	4.4650	0.3149	4.6212	0.0000	24,464.0440	24,464.0440	0.8175	0.0000	24,484.4817
2038	4.3363	40.4211	41.1973	0.2399	16.5764	0.1609	16.7373	4.4650	0.1563	4.6212	0.0000	24,464.0440	24,464.0440	0.8175	0.0000	24,484.4817
2039	4.3363	40.4211	41.1973	0.2399	16.5764	0.1609	16.7373	4.4650	0.1563	4.6212	0.0000	24,464.0440	24,464.0440	0.8175	0.0000	24,484.4817
2040	3.7347	39.7496	38.0663	0.2361	16.5764	0.1344	16.7108	4.4650	0.1305	4.5955	0.0000	24,090.5595	24,090.5595	0.7798	0.0000	24,110.0533
2041	3.7347	39.7496	38.0663	0.2361	16.5764	0.1344	16.7108	4.4650	0.1305	4.5955	0.0000	24,090.5595	24,090.5595	0.7798	0.0000	24,110.0533
2042	3.7347	39.7496	38.0663	0.2361	16.5764	0.1344	16.7108	4.4650	0.1305	4.5955	0.0000	24,090.5595	24,090.5595	0.7798	0.0000	24,110.0533
2043	3.7347	39.7496	38.0663	0.2361	16.5764	0.1344	16.7108	4.4650	0.1305	4.5955	0.0000	24,090.5595	24,090.5595	0.7798	0.0000	24,110.0533
2044	3.7347	39.7496	38.0663	0.2361	16.5764	0.1344	16.7108	4.4650	0.1305	4.5955	0.0000	24,090.5595	24,090.5595	0.7798	0.0000	24,110.0533
2045	3.5227	39.6093	36.9137	0.2345	16.5765	0.1302	16.7067	4.4650	0.1267	4.5917	0.0000	23,930.6550	23,930.6550	0.7660	0.0000	23,949.8039
2046	3.5227	39.6093	36.9137	0.2345	16.5765	0.1302	16.7067	4.4650	0.1267	4.5917	0.0000	23,930.6550	23,930.6550	0.7660	0.0000	23,949.8039
2047	3.5227	39.6093	36.9137	0.2345	16.5765	0.1302	16.7067	4.4650	0.1267	4.5917	0.0000	23,930.6550	23,930.6550	0.7660	0.0000	23,949.8039
2048	3.5227	39.6093	36.9137	0.2345	16.5765	0.1302	16.7067	4.4650	0.1267	4.5917	0.0000	23,930.6550	23,930.6550	0.7660	0.0000	23,949.8039
2049	3.5227	39.6093	36.9137	0.2345	16.5765	0.1302	16.7067	4.4650	0.1267	4.5917	0.0000	23,930.6550	23,930.6550	0.7660	0.0000	23,949.8039

2050	3.4639	39.5741	36.5724	0.2342	16.5765	0.1288	16.7053	4.4650	0.1254	4.5904	0.0000	23,897.9391	23,897.9391	0.7573	0.0000	23,916.8710
2051	1.1970	6.8903	16.1185	0.0310	13.9351	0.0737	14.0089	3.4204	0.0737	3.4942	0.0000	2,897.5471	2,897.5471	0.1041	0.0000	2,900.1503
2052	1.1970	6.8903	16.1185	0.0310	13.9351	0.0737	14.0089	3.4204	0.0737	3.4942	0.0000	2,897.5471	2,897.5471	0.1041	0.0000	2,900.1503
2053	1.1970	6.8903	16.1185	0.0310	13.9351	0.0737	14.0089	3.4204	0.0737	3.4942	0.0000	2,897.5471	2,897.5471	0.1041	0.0000	2,900.1503
2054	1.1970	6.8903	16.1185	0.0310	13.9351	0.0737	14.0089	3.4204	0.0737	3.4942	0.0000	2,897.5471	2,897.5471	0.1041	0.0000	2,900.1503
2055	1.1970	6.8903	16.1185	0.0310	13.9351	0.1164	14.0089	3.4204	0.1164	3.4942	0.0000	2,897.5471	2,897.5471	0.1041	0.0000	2,900.1503
2056	486.5539	3.6566	15.8177	0.0281	2.3516	0.1164	2.3591	0.5772	0.1164	0.5847	0.0000	2,656.5168	2,656.5168	0.0893	0.0000	2,658.7489
2057	486.5539	0.7270	1.7923	2.9700e-003	2.3516	7.4300e-003	2.3591	0.5772	7.4300e-003	0.5847	0.0000	281.4481	281.4481	9.9000e-003	0.0000	281.6957
Maximum	**486.5539**	**40.4211**	**41.1973**	**0.2399**	**18.2675**	**0.4373**	**18.7048**	**9.9840**	**0.4373**	**10.4213**	**0.0000**	**24,464.0440**	**24,464.0440**	**0.8175**	**0.0000**	**24,484.4817**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	64.5835	0.0107	1.1900	9.0000e-005		4.2200e-003	4.2200e-003		4.2200e-003	4.2200e-003		2.5654	2.5654	6.6100e-003		2.7306
Energy	1.1853	10.7754	9.0513	0.0647		0.8189	0.8189		0.8189	0.8189		12,930.4722	12,930.4722	0.2478	0.2371	13,007.3115
Mobile	21.2905	171.0410	235.6503	1.3934	128.2804	0.5492	128.8296	34.3039	0.5119	34.8158		143,350.5128	143,350.5128	5.8126		143,495.8279
Total	**87.0593**	**181.8271**	**245.8916**	**1.4582**	**128.2804**	**1.3724**	**129.6528**	**34.3039**	**1.3351**	**35.6389**		**156,283.5503**	**156,283.5503**	**6.0670**	**0.2371**	**156,505.8700**

CSUSB 2035 Master Plan

San Bernardino-South Coast County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
University/College (4Yr)	11,722.00	Student	49.46	2,886,100.00	11722

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	32
Climate Zone	10			**Operational Year**	2035
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	702.44	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - .

Architectural Coating -

Vehicle Trips - Generated from an assumptin of 20,045 new trips (2.89M x 6.95) (ksf)

Table Name	Column Name	Default Value	New Value
tblLandUse	BuildingSpaceSquareFeet	2,154,473.92	2,886,100.00
tblLandUse	LandUseSquareFeet	2,154,473.92	2,886,100.00
tblLandUse	Population	0.00	11,722.00
tblProjectCharacteristics	OperationalYear	2018	2035
tblVehicleTrips	ST_TR	1.30	1.71
tblVehicleTrips	SU_TR	0.00	1.71

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2033	2.1092	9.7932	19.1331	0.0473	0.1677	0.3517	0.5193	0.0445	0.3516	0.3961	0.0000	4,481.0931	4,481.0931	0.1860	0.0000	4,485.7438
2034	2.4786	13.6860	19.1207	0.0478	18.2675	0.4373	18.7048	9.9840	0.4373	10.4213	0.0000	4,530.8343	4,530.8343	0.2190	0.0000	4,536.3100
2035	2.9520	10.1569	22.7832	0.0713	18.2675	0.3149	18.5592	9.9840	0.3149	10.2757	0.0000	7,345.8174	7,345.8174	0.2574	0.0000	7,352.2530
2036	2.9520	9.6130	22.7832	0.0713	8.8969	0.3149	9.2118	3.6558	0.3149	3.9707	0.0000	7,345.8174	7,345.8174	0.2574	0.0000	7,352.2530
2037	4.4553	40.0140	38.2045	0.2261	16.5764	0.3149	16.7378	4.4650	0.3149	4.6217	0.0000	23,064.5273	23,064.5273	0.8683	0.0000	23,086.2355
2038	4.4553	40.0140	38.2045	0.2261	16.5764	0.1614	16.7378	4.4650	0.1567	4.6217	0.0000	23,064.5273	23,064.5273	0.8683	0.0000	23,086.2355
2039	4.4553	40.0140	38.2045	0.2261	16.5764	0.1614	16.7378	4.4650	0.1567	4.6217	0.0000	23,064.5273	23,064.5273	0.8683	0.0000	23,086.2355
2040	3.8571	39.3268	35.5881	0.2227	16.5764	0.1348	16.7112	4.4650	0.1309	4.5959	0.0000	22,725.9144	22,725.9144	0.8324	0.0000	22,746.7244
2041	3.8571	39.3268	35.5881	0.2227	16.5764	0.1348	16.7112	4.4650	0.1309	4.5959	0.0000	22,725.9144	22,725.9144	0.8324	0.0000	22,746.7244
2042	3.8571	39.3268	35.5881	0.2227	16.5764	0.1348	16.7112	4.4650	0.1309	4.5959	0.0000	22,725.9144	22,725.9144	0.8324	0.0000	22,746.7244
2043	3.8571	39.3268	35.5881	0.2227	16.5764	0.1348	16.7112	4.4650	0.1309	4.5959	0.0000	22,725.9144	22,725.9144	0.8324	0.0000	22,746.7244
2044	3.8571	39.3268	35.5881	0.2227	16.5764	0.1348	16.7112	4.4650	0.1309	4.5959	0.0000	22,725.9144	22,725.9144	0.8324	0.0000	22,746.7244
2045	3.6493	39.1859	34.6202	0.2212	16.5765	0.1306	16.7070	4.4650	0.1271	4.5921	0.0000	22,581.4304	22,581.4304	0.8188	0.0000	22,601.8994
2046	3.6493	39.1859	34.6202	0.2212	16.5765	0.1306	16.7070	4.4650	0.1271	4.5921	0.0000	22,581.4304	22,581.4304	0.8188	0.0000	22,601.8994
2047	3.6493	39.1859	34.6202	0.2212	16.5765	0.1306	16.7070	4.4650	0.1271	4.5921	0.0000	22,581.4304	22,581.4304	0.8188	0.0000	22,601.8994
2048	3.6493	39.1859	34.6202	0.2212	16.5765	0.1306	16.7070	4.4650	0.1271	4.5921	0.0000	22,581.4304	22,581.4304	0.8188	0.0000	22,601.8994

2049	3.6493	39.1859	34.6202	0.2212	16.5765	0.1306	16.7070	4.4650	0.1271	4.5921	0.0000	22,581.4304	22,581.4304	0.8188	0.0000	22,601.8994
2050	3.5936	39.1569	34.3314	0.2210	16.5765	0.1291	16.7056	4.4650	0.1257	4.5907	0.0000	22,553.4035	22,553.4035	0.8097	0.0000	22,573.6459
2051	1.1970	6.8903	16.1185	0.0310	13.9351	0.0737	14.0089	3.4204	0.0737	3.4942	0.0000	2,897.5471	2,897.5471	0.1041	0.0000	2,900.1503
2052	1.1970	6.8903	16.1185	0.0310	13.9351	0.0737	14.0089	3.4204	0.0737	3.4942	0.0000	2,897.5471	2,897.5471	0.1041	0.0000	2,900.1503
2053	1.1970	6.8903	16.1185	0.0310	13.9351	0.0737	14.0089	3.4204	0.0737	3.4942	0.0000	2,897.5471	2,897.5471	0.1041	0.0000	2,900.1503
2054	1.1970	6.8903	16.1185	0.0310	13.9351	0.0737	14.0089	3.4204	0.0737	3.4942	0.0000	2,897.5471	2,897.5471	0.1041	0.0000	2,900.1503
2055	1.1970	6.8903	16.1185	0.0310	13.9351	0.1164	14.0089	3.4204	0.1164	3.4942	0.0000	2,897.5471	2,897.5471	0.1041	0.0000	2,900.1503
2056	486.5539	3.6566	15.8177	0.0281	2.3516	0.1164	2.3591	0.5772	0.1164	0.5847	0.0000	2,656.5168	2,656.5168	0.0893	0.0000	2,658.7489
2057	486.5539	0.7270	1.7923	2.9700e-003	2.3516	7.4300e-003	2.3591	0.5772	7.4300e-003	0.5847	0.0000	281.4481	281.4481	9.9000e-003	0.0000	281.6957
Maximum	**486.5539**	**40.0140**	**38.2045**	**0.2261**	**18.2675**	**0.4373**	**18.7048**	**9.9840**	**0.4373**	**10.4213**	**0.0000**	**23,064.5273**	**23,064.5273**	**0.8683**	**0.0000**	**23,086.2355**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	64.5835	0.0107	1.1900	9.0000e-005		4.2200e-003	4.2200e-003		4.2200e-003	4.2200e-003		2.5654	2.5654	6.6100e-003		2.7306
Energy	1.1853	10.7754	9.0513	0.0647		0.8189	0.8189		0.8189	0.8189		12,930.4722	12,930.4722	0.2478	0.2371	13,007.3115
Mobile	18.5254	169.1488	208.7193	1.2902	128.2804	0.5519	128.8323	34.3039	0.5145	34.8184		132,894.9541	132,894.9541	6.0787		133,046.9207
Total	**84.2942**	**179.9349**	**218.9606**	**1.3550**	**128.2804**	**1.3750**	**129.6554**	**34.3039**	**1.3377**	**35.6415**		**145,827.9917**	**145,827.9917**	**6.3331**	**0.2371**	**146,056.9628**

CSUSB 2035 Master Plan

San Bernardino-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
University/College (4Yr)	25,000.00	Student	5.00	217,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	32
Climate Zone	10			**Operational Year**	2019
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	702.44	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - .

Vehicle Trips - Generated from an assumptin of 20,045 new trips (2.89M x 6.95) (ksf)

Construction Phase -

Architectural Coating -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	PhaseEndDate	12/20/2041	3/1/2019
tblConstructionPhase	PhaseEndDate	6/10/2039	1/1/2019
tblConstructionPhase	PhaseEndDate	2/22/2019	1/26/2018
tblConstructionPhase	PhaseEndDate	8/13/2021	2/13/2018
tblConstructionPhase	PhaseEndDate	9/14/2040	2/5/2019
tblConstructionPhase	PhaseEndDate	11/1/2019	2/2/2018

tblConstructionPhase	PhaseStartDate	9/15/2040	2/6/2019
tblConstructionPhase	PhaseStartDate	8/14/2021	2/14/2018
tblConstructionPhase	PhaseStartDate	11/2/2019	2/2/2018
tblConstructionPhase	PhaseStartDate	6/11/2039	1/11/2019
tblConstructionPhase	PhaseStartDate	2/23/2019	1/27/2018
tblLandUse	BuildingSpaceSquareFeet	4,594,936.71	217,000.00
tblLandUse	LandUseSquareFeet	4,594,936.71	217,000.00
tblLandUse	LotAcreage	105.49	5.00
tblProjectCharacteristics	OperationalYear	2018	2019

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	0.4464	3.8710	2.9951	5.9900e-003	0.2144	0.2081	0.4225	0.0769	0.1953	0.2721	0.0000	541.1428	541.1428	0.0942	0.0000	543.4967
2019	1.0244	0.1679	0.1724	2.9000e-004	3.8700e-003	9.2600e-003	0.0131	1.0300e-003	8.6300e-003	9.6600e-003	0.0000	25.6863	25.6863	6.4500e-003	0.0000	25.8477
Maximum	**1.0244**	**3.8710**	**2.9951**	**5.9900e-003**	**0.2144**	**0.2081**	**0.4225**	**0.0769**	**0.1953**	**0.2721**	**0.0000**	**541.1428**	**541.1428**	**0.0942**	**0.0000**	**543.4967**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Area	0.9152	2.9900e-003	0.3222	2.0000e-005		1.1600e-003	1.1600e-003		1.1600e-003	1.1600e-003	0.0000	0.6204	0.6204	1.6800e-003	0.0000	0.6625
Energy	0.0163	0.1479	0.1242	8.9000e-004		0.0112	0.0112		0.0112	0.0112	0.0000	720.3107	720.3107	0.0262	7.7300e-003	723.2683
Mobile	14.0486	102.0120	170.8367	0.5669	40.2394	0.5926	40.8321	10.7865	0.5591	11.3456	0.0000	52,383.0077	52,383.0077	3.0608	0.0000	52,459.5274
Waste						0.0000	0.0000		0.0000	0.0000	926.1463	0.0000	926.1463	54.7337	0.0000	2,294.4882
Water						0.0000	0.0000		0.0000	0.0000	16.9818	518.4412	535.4230	1.7656	0.0456	593.1555
Total	**14.9801**	**102.1629**	**171.2831**	**0.5678**	**40.2394**	**0.6050**	**40.8445**	**10.7865**	**0.5715**	**11.3580**	**943.1281**	**53,622.3801**	**54,565.5082**	**59.5879**	**0.0533**	**56,071.1019**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2018	1/26/2018	5	20	
2	Site Preparation	Site Preparation	1/27/2018	2/2/2018	5	5	
3	Grading	Grading	2/2/2018	2/13/2018	5	8	
4	Building Construction	Building Construction	2/14/2018	1/1/2019	5	230	
5	Paving	Paving	1/11/2019	2/5/2019	5	18	
6	Architectural Coating	Architectural Coating	2/6/2019	3/1/2019	5	18	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 4

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 325,500; Non-Residential Outdoor: 108,500; Striped Parking

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73

Demolition	Excavators	3	8.00	158	0.38
Demolition	Rubber Tired Dozers	2	8.00	247	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	15.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	91.00	36.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	18.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT

3.2 Demolition - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0372	0.3832	0.2230	3.9000e-004		0.0194	0.0194		0.0181	0.0181	0.0000	35.1241	35.1241	9.6800e-003	0.0000	35.3660
Total	**0.0372**	**0.3832**	**0.2230**	**3.9000e-004**		**0.0194**	**0.0194**		**0.0181**	**0.0181**	**0.0000**	**35.1241**	**35.1241**	**9.6800e-003**	**0.0000**	**35.3660**

3.3 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0452	0.0000	0.0452	0.0248	0.0000	0.0248	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0114	0.1205	0.0562	1.0000e-004		6.4400e-003	6.4400e-003		5.9300e-003	5.9300e-003	0.0000	8.6900	8.6900	2.7100e-003	0.0000	8.7576
Total	**0.0114**	**0.1205**	**0.0562**	**1.0000e-004**	**0.0452**	**6.4400e-003**	**0.0516**	**0.0248**	**5.9300e-003**	**0.0308**	**0.0000**	**8.6900**	**8.6900**	**2.7100e-003**	**0.0000**	**8.7576**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Fugitive Dust					0.0262	0.0000	0.0262	0.0135	0.0000	0.0135	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0111	0.1227	0.0663	1.2000e-004		6.2100e-003	6.2100e-003		5.7100e-003	5.7100e-003	0.0000	10.8428	10.8428	3.3800e-003	0.0000	10.9271
Total	**0.0111**	**0.1227**	**0.0663**	**1.2000e-004**	**0.0262**	**6.2100e-003**	**0.0324**	**0.0135**	**5.7100e-003**	**0.0192**	**0.0000**	**10.8428**	**10.8428**	**3.3800e-003**	**0.0000**	**10.9271**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3068	2.6782	2.0130	3.0800e-003		0.1717	0.1717		0.1614	0.1614	0.0000	272.2435	272.2435	0.0667	0.0000	273.9110
Total	**0.3068**	**2.6782**	**2.0130**	**3.0800e-003**		**0.1717**	**0.1717**		**0.1614**	**0.1614**	**0.0000**	**272.2435**	**272.2435**	**0.0667**	**0.0000**	**273.9110**

3.5 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	1.1800e-003	0.0105	8.5800e-003	1.0000e-005		6.4000e-004	6.4000e-004		6.1000e-004	6.1000e-004	0.0000	1.1755	1.1755	2.9000e-004	0.0000	1.1827
Total	**1.1800e-003**	**0.0105**	**8.5800e-003**	**1.0000e-005**		**6.4000e-004**	**6.4000e-004**		**6.1000e-004**	**6.1000e-004**	**0.0000**	**1.1755**	**1.1755**	**2.9000e-004**	**0.0000**	**1.1827**

3.6 Paving - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0131	0.1372	0.1320	2.1000e-004		7.4200e-003	7.4200e-003		6.8300e-003	6.8300e-003	0.0000	18.4277	18.4277	5.8300e-003	0.0000	18.5734
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0131**	**0.1372**	**0.1320**	**2.1000e-004**		**7.4200e-003**	**7.4200e-003**		**6.8300e-003**	**6.8300e-003**	**0.0000**	**18.4277**	**18.4277**	**5.8300e-003**	**0.0000**	**18.5734**

3.7 Architectural Coating - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.0058					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.4000e-003	0.0165	0.0166	3.0000e-005		1.1600e-003	1.1600e-003		1.1600e-003	1.1600e-003	0.0000	2.2979	2.2979	1.9000e-004	0.0000	2.3028
Total	**1.0082**	**0.0165**	**0.0166**	**3.0000e-005**		**1.1600e-003**	**1.1600e-003**		**1.1600e-003**	**1.1600e-003**	**0.0000**	**2.2979**	**2.2979**	**1.9000e-004**	**0.0000**	**2.3028**

CSUSB 2035 Master Plan

San Bernardino-South Coast County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
University/College (4Yr)	25,000.00	Student	5.00	217,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	32
Climate Zone	10			**Operational Year**	2019
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	702.44	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - .

Vehicle Trips - Generated from an assumptin of 20,045 new trips (2.89M x 6.95) (ksf)

Construction Phase -

Architectural Coating -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	PhaseEndDate	12/20/2041	3/1/2019
tblConstructionPhase	PhaseEndDate	6/10/2039	1/1/2019
tblConstructionPhase	PhaseEndDate	2/22/2019	1/26/2018
tblConstructionPhase	PhaseEndDate	8/13/2021	2/13/2018
tblConstructionPhase	PhaseEndDate	9/14/2040	2/5/2019
tblConstructionPhase	PhaseEndDate	11/1/2019	2/2/2018

tblConstructionPhase	PhaseStartDate	9/15/2040	2/6/2019
tblConstructionPhase	PhaseStartDate	8/14/2021	2/14/2018
tblConstructionPhase	PhaseStartDate	11/2/2019	2/2/2018
tblConstructionPhase	PhaseStartDate	6/11/2039	1/11/2019
tblConstructionPhase	PhaseStartDate	2/23/2019	1/27/2018
tblLandUse	BuildingSpaceSquareFeet	4,594,936.71	217,000.00
tblLandUse	LandUseSquareFeet	4,594,936.71	217,000.00
tblLandUse	LotAcreage	105.49	5.00
tblProjectCharacteristics	OperationalYear	2018	2019

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2018	7.5513	79.0193	40.9089	0.0717	24.9875	4.1308	29.1183	13.3960	3.8003	17.1963	0.0000	7,218.0969	7,218.0969	2.1377	0.0000	7,271.5402
2019	112.1282	25.5830	22.5429	0.0474	1.2478	1.3226	2.5704	0.3362	1.2438	1.5800	0.0000	4,689.9904	4,689.9904	0.7370	0.0000	4,708.4165
Maximum	**112.1282**	**79.0193**	**40.9089**	**0.0717**	**24.9875**	**4.1308**	**29.1183**	**13.3960**	**3.8003**	**17.1963**	**0.0000**	**7,218.0969**	**7,218.0969**	**2.1377**	**0.0000**	**7,271.5402**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2018	1/26/2018	5	20	

2	Site Preparation	Site Preparation	1/27/2018	2/2/2018	5	5	
3	Grading	Grading	2/2/2018	2/13/2018	5	8	
4	Building Construction	Building Construction	2/14/2018	1/1/2019	5	230	
5	Paving	Paving	1/11/2019	2/5/2019	5	18	
6	Architectural Coating	Architectural Coating	2/6/2019	3/1/2019	5	18	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 4

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 325,500; Non-Residential Outdoor: 108,500; Striped Parking

<u>OffRoad Equipment</u>

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	158	0.38
Demolition	Rubber Tired Dozers	2	8.00	247	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38

Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	15.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	91.00	36.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	18.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.7190	38.3225	22.3040	0.0388		1.9386	1.9386		1.8048	1.8048		3,871.7665	3,871.7665	1.0667		3,898.4344
Total	**3.7190**	**38.3225**	**22.3040**	**0.0388**		**1.9386**	**1.9386**		**1.8048**	**1.8048**		**3,871.7665**	**3,871.7665**	**1.0667**		**3,898.4344**

3.3 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.5627	48.1988	22.4763	0.0380		2.5769	2.5769		2.3708	2.3708		3,831.623 9	3,831.623 9	1.1928		3,861.444 8
Total	**4.5627**	**48.1988**	**22.4763**	**0.0380**	**18.0663**	**2.5769**	**20.6432**	**9.9307**	**2.3708**	**12.3014**		**3,831.623 9**	**3,831.623 9**	**1.1928**		**3,861.444 8**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.5523	0.0000	6.5523	3.3675	0.0000	3.3675			0.0000			0.0000
Off-Road	2.7733	30.6725	16.5770	0.0297		1.5513	1.5513		1.4272	1.4272		2,988.021 6	2,988.021 6	0.9302		3,011.276 9
Total	**2.7733**	**30.6725**	**16.5770**	**0.0297**	**6.5523**	**1.5513**	**8.1037**	**3.3675**	**1.4272**	**4.7947**		**2,988.021 6**	**2,988.021 6**	**0.9302**		**3,011.276 9**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	lb/day										lb/day					
Off-Road	2.6795	23.3900	17.5804	0.0269		1.4999	1.4999		1.4099	1.4099		2,620.9351	2,620.9351	0.6421		2,636.9883
Total	**2.6795**	**23.3900**	**17.5804**	**0.0269**		**1.4999**	**1.4999**		**1.4099**	**1.4099**		**2,620.9351**	**2,620.9351**	**0.6421**		**2,636.9883**

3.5 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3612	21.0788	17.1638	0.0269		1.2899	1.2899		1.2127	1.2127		2,591.5802	2,591.5802	0.6313		2,607.3635
Total	**2.3612**	**21.0788**	**17.1638**	**0.0269**		**1.2899**	**1.2899**		**1.2127**	**1.2127**		**2,591.5802**	**2,591.5802**	**0.6313**		**2,607.3635**

3.6 Paving - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4544	15.2441	14.6648	0.0228		0.8246	0.8246		0.7586	0.7586		2,257.0025	2,257.0025	0.7141		2,274.8548
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000

Total	**1.4544**	**15.2441**	**14.6648**	**0.0228**		**0.8246**	**0.8246**		**0.7586**	**0.7586**		**2,257.0025**	**2,257.0025**	**0.7141**		**2,274.8548**

3.7 Architectural Coating - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	111.7550					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2664	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288		281.4481	281.4481	0.0238		282.0423
Total	**112.0214**	**1.8354**	**1.8413**	**2.9700e-003**		**0.1288**	**0.1288**		**0.1288**	**0.1288**		**281.4481**	**281.4481**	**0.0238**		**282.0423**

CSUSB 2035 Master Plan

San Bernardino-South Coast County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
University/College (4Yr)	25,000.00	Student	5.00	217,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	32
Climate Zone	10			**Operational Year**	2019
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	702.44	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - .

Vehicle Trips - Generated from an assumptin of 20,045 new trips (2.89M x 6.95) (ksf)

Construction Phase -

Architectural Coating -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	PhaseEndDate	12/20/2041	3/1/2019
tblConstructionPhase	PhaseEndDate	6/10/2039	1/1/2019
tblConstructionPhase	PhaseEndDate	2/22/2019	1/26/2018
tblConstructionPhase	PhaseEndDate	8/13/2021	2/13/2018
tblConstructionPhase	PhaseEndDate	9/14/2040	2/5/2019
tblConstructionPhase	PhaseEndDate	11/1/2019	2/2/2018

tblConstructionPhase	PhaseStartDate	9/15/2040	2/6/2019
tblConstructionPhase	PhaseStartDate	8/14/2021	2/14/2018
tblConstructionPhase	PhaseStartDate	11/2/2019	2/2/2018
tblConstructionPhase	PhaseStartDate	6/11/2039	1/11/2019
tblConstructionPhase	PhaseStartDate	2/23/2019	1/27/2018
tblLandUse	BuildingSpaceSquareFeet	4,594,936.71	217,000.00
tblLandUse	LandUseSquareFeet	4,594,936.71	217,000.00
tblLandUse	LotAcreage	105.49	5.00
tblProjectCharacteristics	OperationalYear	2018	2019

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2018	7.5506	79.0273	40.5843	0.0713	24.9875	4.1308	29.1183	13.3960	3.8003	17.1963	0.0000	7,177.1113	7,177.1113	2.1360	0.0000	7,230.5103
2019	112.1280	25.5781	21.8682	0.0459	1.2478	1.3230	2.5707	0.3362	1.2442	1.5803	0.0000	4,540.8030	4,540.8030	0.7399	0.0000	4,559.3010
Maximum	**112.1280**	**79.0273**	**40.5843**	**0.0713**	**24.9875**	**4.1308**	**29.1183**	**13.3960**	**3.8003**	**17.1963**	**0.0000**	**7,177.1113**	**7,177.1113**	**2.1360**	**0.0000**	**7,230.5103**

2.2 Overall Operational

Unmitigated Operational

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Area	5.0920	0.0240	2.5774	1.9000e-004		9.2600e-003	9.2600e-003		9.2600e-003	9.2600e-003		5.4713	5.4713	0.0148		5.8420
Energy	0.0891	0.8102	0.6806	4.8600e-003		0.0616	0.0616		0.0616	0.0616		972.2160	972.2160	0.0186	0.0178	977.9934
Mobile	96.1279	665.2455	1,104.3260	3.7069	273.7934	3.9862	277.7796	73.2771	3.7609	77.0381		377,645.2845	377,645.2845	22.8991		378,217.7627
Total	**101.3090**	**666.0797**	**1,107.5840**	**3.7119**	**273.7934**	**4.0570**	**277.8504**	**73.2771**	**3.8318**	**77.1089**		**378,622.9718**	**378,622.9718**	**22.9326**	**0.0178**	**379,201.5981**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2018	1/26/2018	5	20	
2	Site Preparation	Site Preparation	1/27/2018	2/2/2018	5	5	
3	Grading	Grading	2/2/2018	2/13/2018	5	8	
4	Building Construction	Building Construction	2/14/2018	1/1/2019	5	230	
5	Paving	Paving	1/11/2019	2/5/2019	5	18	
6	Architectural Coating	Architectural Coating	2/6/2019	3/1/2019	5	18	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 4

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 325,500; Non-Residential Outdoor: 108,500; Striped Parking

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73

Demolition	Excavators	3	8.00	158	0.38
Demolition	Rubber Tired Dozers	2	8.00	247	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	15.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	91.00	36.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	18.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.7190	38.3225	22.3040	0.0388		1.9386	1.9386		1.8048	1.8048		3,871.7665	3,871.7665	1.0667		3,898.4344
Total	**3.7190**	**38.3225**	**22.3040**	**0.0388**		**1.9386**	**1.9386**		**1.8048**	**1.8048**		**3,871.7665**	**3,871.7665**	**1.0667**		**3,898.4344**

3.3 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.5627	48.1988	22.4763	0.0380		2.5769	2.5769		2.3708	2.3708		3,831.6239	3,831.6239	1.1928		3,861.4448
Total	**4.5627**	**48.1988**	**22.4763**	**0.0380**	**18.0663**	**2.5769**	**20.6432**	**9.9307**	**2.3708**	**12.3014**		**3,831.6239**	**3,831.6239**	**1.1928**		**3,861.4448**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	lb/day										lb/day					
Fugitive Dust					6.5523	0.0000	6.5523	3.3675	0.0000	3.3675			0.0000			0.0000
Off-Road	2.7733	30.6725	16.5770	0.0297		1.5513	1.5513		1.4272	1.4272		2,988.0216	2,988.0216	0.9302		3,011.2769
Total	**2.7733**	**30.6725**	**16.5770**	**0.0297**	**6.5523**	**1.5513**	**8.1037**	**3.3675**	**1.4272**	**4.7947**		**2,988.0216**	**2,988.0216**	**0.9302**		**3,011.2769**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.6795	23.3900	17.5804	0.0269		1.4999	1.4999		1.4099	1.4099		2,620.9351	2,620.9351	0.6421		2,636.9883
Total	**2.6795**	**23.3900**	**17.5804**	**0.0269**		**1.4999**	**1.4999**		**1.4099**	**1.4099**		**2,620.9351**	**2,620.9351**	**0.6421**		**2,636.9883**

3.5 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3612	21.0788	17.1638	0.0269		1.2899	1.2899		1.2127	1.2127		2,591.5802	2,591.5802	0.6313		2,607.3635
Total	**2.3612**	**21.0788**	**17.1638**	**0.0269**		**1.2899**	**1.2899**		**1.2127**	**1.2127**		**2,591.5802**	**2,591.5802**	**0.6313**		**2,607.3635**

3.6 Paving - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4544	15.2441	14.6648	0.0228		0.8246	0.8246		0.7586	0.7586		2,257.0025	2,257.0025	0.7141		2,274.8548
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**1.4544**	**15.2441**	**14.6648**	**0.0228**		**0.8246**	**0.8246**		**0.7586**	**0.7586**		**2,257.0025**	**2,257.0025**	**0.7141**		**2,274.8548**

3.7 Architectural Coating - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	111.7550					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2664	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288		281.4481	281.4481	0.0238		282.0423
Total	**112.0214**	**1.8354**	**1.8413**	**2.9700e-003**		**0.1288**	**0.1288**		**0.1288**	**0.1288**		**281.4481**	**281.4481**	**0.0238**		**282.0423**

CSUSB 2035 Master Plan

San Bernardino-South Coast County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Office Park	106.00	1000sqft	2.43	106,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	32
Climate Zone	10			**Operational Year**	2035
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	702.44	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - .

Vehicle Trips - Generated from an assumptin of 20,045 new trips (2.89M x 6.95) (ksf)

Architectural Coating -

Table Name	Column Name	Default Value	New Value
tblProjectCharacteristics	OperationalYear	2018	2035
tblVehicleTrips	ST_TR	1.64	11.42
tblVehicleTrips	SU_TR	0.76	11.42

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2033	0.0289	0.1668	0.2617	6.5000e-004	0.0349	4.1200e-003	0.0390	0.0152	4.1200e-003	0.0193	0.0000	56.3599	56.3599	2.3900e-003	0.0000	56.4197
2034	1.0412	1.0577	1.7024	3.9600e-003	0.0547	0.0180	0.0727	0.0148	0.0179	0.0327	0.0000	335.9443	335.9443	0.0144	0.0000	336.3042
Maximum	**1.0412**	**1.0577**	**1.7024**	**3.9600e-003**	**0.0547**	**0.0180**	**0.0727**	**0.0152**	**0.0179**	**0.0327**	**0.0000**	**335.9443**	**335.9443**	**0.0144**	**0.0000**	**336.3042**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	**11-1-2033**	**1-31-2034**	0.3100	0.3100
2	**2-1-2034**	**4-30-2034**	0.3311	0.3311
3	**5-1-2034**	**7-31-2034**	0.3425	0.3425
4	**8-1-2034**	**9-30-2034**	0.2271	0.2271
		Highest	0.3425	0.3425

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.4323	1.0000e-005	1.3500e-003	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.6300e-003	2.6300e-003	1.0000e-005	0.0000	2.8000e-003
Energy	1.6700e-003	0.0152	0.0128	9.0000e-005		1.1600e-003	1.1600e-003		1.1600e-003	1.1600e-003	0.0000	360.0540	360.0540	0.0145	3.2400e-003	361.3813
Mobile	0.2095	1.9581	2.5905	0.0160	1.5562	6.7000e-003	1.5629	0.4168	6.2500e-003	0.4231	0.0000	1,496.7634	1,496.7634	0.0625	0.0000	1,498.3265

Waste						0.0000	0.0000		0.0000	0.0000	20.0109	0.0000	20.0109	1.1826	0.0000	49.5760
Water						0.0000	0.0000		0.0000	0.0000	5.9770	119.0368	125.0138	0.6188	0.0155	145.1066
Total	**0.6435**	**1.9733**	**2.6047**	**0.0161**	**1.5562**	**7.8600e-003**	**1.5641**	**0.4168**	**7.4100e-003**	**0.4242**	**25.9878**	**1,975.8569**	**2,001.8447**	**1.8785**	**0.0188**	**2,054.3932**

CSUSB 2035 Master Plan

San Bernardino-South Coast County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Office Park	106.00	1000sqft	2.43	106,000.00	0

1.2 Other Project Characteristics

Urbanization Urban **Wind Speed (m/s)** 2.2 **Precipitation Freq (Days)** 32

Climate Zone 10 **Operational Year** 2035

Utility Company Southern California Edison

CO2 Intensity (lb/MWhr) 702.44 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - .

Vehicle Trips - Generated from an assumptin of 20,045 new trips (2.89M x 6.95) (ksf)

Architectural Coating -

Table Name	Column Name	Default Value	New Value
tblProjectCharacteristics	OperationalYear	2018	2035
tblVehicleTrips	ST_TR	1.64	11.42
tblVehicleTrips	SU_TR	0.76	11.42

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2033	1.3600	9.0943	14.4523	0.0344	6.6641	0.2153	6.8504	3.3971	0.2152	3.5834	0.0000	3,211.0307	3,211.0307	0.1356	0.0000	3,214.4199
2034	98.4074	9.0886	14.4175	0.0343	0.4889	0.2346	0.6319	0.1321	0.2345	0.2790	0.0000	3,206.8234	3,206.8234	0.1352	0.0000	3,210.2023
Maximum	**98.4074**	**9.0943**	**14.4523**	**0.0344**	**6.6641**	**0.2346**	**6.8504**	**3.3971**	**0.2345**	**3.5834**	**0.0000**	**3,211.0307**	**3,211.0307**	**0.1356**	**0.0000**	**3,214.4199**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	2.3690	1.0000e-004	0.0108	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0232	0.0232	6.0000e-005		0.0247
Energy	9.1800e-003	0.0834	0.0701	5.0000e-004		6.3400e-003	6.3400e-003		6.3400e-003	6.3400e-003		100.1064	100.1064	1.9200e-003	1.8400e-003	100.7013
Mobile	1.3450	10.6484	15.7412	0.0931	8.7135	0.0368	8.7503	2.3301	0.0343	2.3644		9,571.8880	9,571.8880	0.3742		9,581.2419
Total	**3.7232**	**10.7319**	**15.8220**	**0.0936**	**8.7135**	**0.0432**	**8.7567**	**2.3301**	**0.0407**	**2.3708**		**9,672.0176**	**9,672.0176**	**0.3761**	**1.8400e-003**	**9,681.9678**

CSUSB 2035 Master Plan

San Bernardino-South Coast County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Office Park	106.00	1000sqft	2.43	106,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	32
Climate Zone	10			**Operational Year**	2035
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	702.44	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - .

Vehicle Trips - Generated from an assumptin of 20,045 new trips (2.89M x 6.95) (ksf)

Architectural Coating -

Table Name	Column Name	Default Value	New Value
tblProjectCharacteristics	OperationalYear	2018	2035
tblVehicleTrips	ST_TR	1.64	11.42
tblVehicleTrips	SU_TR	0.76	11.42

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2033	1.3607	9.0797	14.3651	0.0339	6.6641	0.2153	6.8504	3.3971	0.2152	3.5834	0.0000	3,167.3852	3,167.3852	0.1375	0.0000	3,170.8220
2034	98.4078	9.0738	14.3360	0.0339	0.4889	0.2346	0.6319	0.1321	0.2345	0.2790	0.0000	3,163.5409	3,163.5409	0.1371	0.0000	3,166.9677
Maximum	**98.4078**	**9.0797**	**14.3651**	**0.0339**	**6.6641**	**0.2346**	**6.8504**	**3.3971**	**0.2345**	**3.5834**	**0.0000**	**3,167.3852**	**3,167.3852**	**0.1375**	**0.0000**	**3,170.8220**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	2.3690	1.0000e-004	0.0108	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005		0.0232	0.0232	6.0000e-005		0.0247
Energy	9.1800e-003	0.0834	0.0701	5.0000e-004		6.3400e-003	6.3400e-003		6.3400e-003	6.3400e-003		100.1064	100.1064	1.9200e-003	1.8400e-003	100.7013
Mobile	1.1760	10.5498	13.8478	0.0863	8.7135	0.0370	8.7505	2.3301	0.0345	2.3646		8,881.8178	8,881.8178	0.3894		8,891.5523
Total	**3.5542**	**10.6334**	**13.9287**	**0.0868**	**8.7135**	**0.0434**	**8.7569**	**2.3301**	**0.0409**	**2.3710**		**8,981.9474**	**8,981.9474**	**0.3914**	**1.8400e-003**	**8,992.2783**