# Inland Empire Regional Mobility Dialogue Series

## **Results and Summary**





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Integrating Smart City Concepts into Local Transportation Infrastructure

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### Introduction

Technology is making it easier for everyone and everything to become more connected. Cities have begun to harness the power of technology through the usage of "Smart City" strategies. In the realm of transportation, smart cities projects are created with the idea of taking on the challenges of improving mobility and reducing traffic congestion. Smart cities engage governments, citizens, and businesses, with the hope of creating sustainable environments where people can thrive. The overall goal is to utilize technology to reshape core city operations and develop a more seamless transportation infrastructure for our communities. These concepts will facilitate better decision-making through the use of data for all stakeholders.

This dialogue looked at and discussed ways the Inland Empire cities can adopt Smart City concepts in order to address these challenges. The panel of experts provided an in-depth look at the general concept of Smart City initiatives, as well as an insight into different initiatives undertaken by municipalities and businesses.

The panel of experts to discuss integrating smart city concepts into local transportation infrastructure included:

- Jason Anderson, CEO/President, Cleantech San Diego
- Adrian Pearmine, National Director for Smart Cities and Connected Vehicles, DKS Associates

The main takeaways from this discussion included learning about a variety of steps the Inland Empire can take to implement smart city concepts. By looking at what Cleantech San Diego is doing, our local agencies, businesses and institutions can work together to develop a smart cities roadmap and determine the best course of action for our region. Smart cities go hand in hand with connected autonomous vehicles. By integrating connected and autonomous vehicles into our day to day lives, we can reduce congestions and traffic related deaths. In order to transition to connected vehicles, we will need to incorporate smart technology into our transportation infrastructure.

## Jason Anderson, President/CEO, Cleantech San Diego

Jason Anderson, President and CEO of Cleantech San Diego, headed the discussion on smart city concepts. Anderson went over the steps the City of San Diego has taken to become a connected city. Cleantech San Diego was developed 13 years ago and is renewable energy and clean technology organization. The organization was formed as a partnership between local utilities, the University of California San Diego, the



City of San Diego, and companies like General Electric. With the passing of SB 32 – law, the requirements included a major reduction of greenhouse gas (GHG) emissions, and a push towards the preparation and

transition to a more sustainable, low-carbon future. Cleantech wanted to ascertain that they were well positioned to benefit from these emerging initiatives.

"We wanted to make sure in San Diego that we were well positioned to not only benefit from those initiatives at a state level environmentally, but more importantly from our perspective at that time, from an economic development perspective; making sure that as the state was going to move forward in renewable energy goals, energy storage goals, electric vehicle goals – whatever it may be – that we were well positioned in San Diego to develop those technologies [and] integrate those technologies in our day to day lives and adopt those technologies," said Anderson.



As California continues to pass aggressive climate and energy related legislation, it is important for Cleantech to be well positioned from an economic perspective to deploy new smart cities technologies. From an energy perspective, San Diego is always in the top five cities of the country in terms of renewable energy and clean technology leadership. "This industry in San Diego alone has about an \$8 billion dollar impact on our

regional economy, which is not insignificant. We obviously have a large biotech industry in San Diego, our IT, communication space isn't too bad, with Qualcomm and other companies there," said Anderson. There are roughly 45,000 jobs in the solar industry in the San Diego region. Of the 18 cities in San Diego, nine cities have already adopted climate action plans. From a renewable energy perspective, 45% of San Diego's local energy comes from renewable energy resources. And with a boost in cities adopting these climate action plans, they hope to increase this to 100%.

When it comes to transportation, currently San Diego has around 32,000 electric vehicles (EV) and there is a huge push throughout the state to electrify transportation systems. "There are a lot of efforts underway to increase those EV numbers, SDG&E and our utility has a pretty robust program, the "Power Your Drive" – where they are encouraging the adoption of electric vehicles – creating time of use frames for the owners of those electric vehicles" said Anderson. "And really trying to make sure that we are plugging into the grid to charge our cars when there is an abundant amount of renewable resources during the day," Anderson added. Currently, with how their systems are set up, if users plug in at night, charging rates are higher because their systems do not have as much renewable energy resources on the grid. As they build out storage units, this will no longer be an issue. San Diego currently has the world's second largest energy storage facility and there is a new one under development that will be delivered in 2020, which will be the world's largest.



At the forefront of this new wave of technology is Chula Vista, the second largest City in San Diego. Chula Vista is an autonomous vehicle proving ground designated by the Department of Transportation (DOT). Chula Vista played an important part in demonstrating the major role cities have when developing smart cities. They are working closely with Caltrans and SANDAG (San Diego Association of

Governments) and opened up their city to test emerging autonomous vehicle technology. SANDAG has been making an effort to involve the community and allow the public to provide input on transportation planning. As part of SANDAG's 2021 regional plan, they want to create a new operating system that helps streamline and incorporate into today how transportation is being designed, developed and used in the San Diego region. Also as part of the 2021 regional plan, SANDAG is also working to improve the public transportation system by using mixed use transportation modes to get people around, such as, light rail, Uber and Lyft. San Diego was named one of the DOT's eleven electric vehicle cities. Cleantech saw this as an opportunity to build out their electric vehicle infrastructure to support the increasing demand of EV's. "We started Smart City San Diego really as kind of an effort to work with, not only the DOT and others, to really make sure that we have the necessary electric vehicle infrastructure in the ground to support the growing number of vehicles," said Anderson. However, they were unable to meet those demands. "We failed miserably, we were supposed to put about 9,000 electric vehicle charging stations in the ground and I think we put maybe 90. We realized pretty quickly that when dealing with cities, when dealing with permits, when dealing with right of ways and then trying to put charging stations on those, it was a whole new world that no one really had a clue about what to do," said Anderson.

As an organization, Cleantech believes that implementation of environment regulations generates economic growth in California. As clean technology progresses, San Diego wants to make sure it was creating economic opportunity and equity across the community. One of the projects that is currently underway is the usage sensors to collect transportation data. The city of San Diego has the largest IoT platform – which is a sensor network that has been embedded into the streetlights though a partnership with General Electric. There are six different sensors that are located primarily in urban areas gathering different data points. The city has created an open data portal where the collected data is pushed out to the community. Application developers and other companies can then analyze the information and work to create a more seamless transportation system. "Most of the applications out there right now are really around traffic management, around crowd control, those types of things, but we are seeing interesting concepts come up or interesting applications coming up. I think one example is, with these sensors we can see where open parking spaces are; we can see where crowds have gathered," said Anderson. These sensors have a wide variety of uses, they have the ability to detect gun shots, aid with Vision Zero projects (Multi-national road safety project), and can be used at the curb level.

In addition to sensor implementation, the city of San Diego is also focused on developing a smart cities roadmap. When designing a roadmap for their region, they wanted to make certain that they started in low income communities first – taking into consideration the equity perspective. Using CDBG (Community Development Block Grant) dollars, they are in the process of creating that roadmap. The priorities as it relates to smart cities technologies from the community are laid out as:

- Vocational training
- Housing
- Technology
- Transit
- Food

The city is working Black and Veatch, a consulting and construction company, to assess the priorities and identify technologies to help address the focus areas listed above.

The City of Carlsbad, a city just north of San Diego, is in the process of adopting a smart cities action plan as well. They currently have a small smart traffic signal operation, which at the moment is just one person monitoring camera footage and determining how they can move people in an efficient way in and out of Carlsbad using technology. Similar to San Diego, Carlsbad is using an app based approach to solve problems within the city from a



community perspective. "So a lot of this smart cities stuff, is really how to engage the community members in a different way, and the city of San Diego has an app called 'Get It Done,' the city of Carlsbad has 'At Your Service,' where the community can go in and report pot holes, report graffiti, report if their trash has not been picked up, report their neighbors for doing something, just creating this app based solution where the community is engaging with the city in a whole different way," said Anderson.

Another project under development is the Smart Bayfront Project. The Bayfront will be built in Chula Vista and will include a convention center, hotel, office space, and residential space. It is the largest west coast development of its kind and integrated into its design is smart cities technology. As the build out of the project begins, planners will be looking at how to incorporate technology into the roads, sidewalks, and buildings in order to move



people around more adequately. To get support for the construction of the Smart Bayfront Project, the city entered into an agreement with the environmental community stating they would reduce their onsite energy use, increase their onsite energy generation and look at how to integrate smart technologies to create a more seamless experience for the user. Chula Vista is on the cutting edge of understanding how technology should be integrated into communities, not only from an energy and climate standpoint, but also from a public safety and transportation perspective.

The smart cities space does not solely pertain to cities, it also includes public agencies and institutions, such as the San Diego Airport and the Port of San Diego. The airport is focusing on the energy aspect. "When they upgraded terminal two, they really looked at energy, sustainability, technology and integrated a lot of those concepts into the development of that plan," said Anderson. The airport took the old commuter terminal and turned it into



an onsite innovation lab where they are incubating startup companies that are in the airport space. Additionally, they have a micro grid onsite where they are generating 80% of their energy. Parking in San Diego is expensive and limited, and the airport is no exception. A lot of their focus from a smart perspective is figuring out parking and traffic congestion.



The Port of San Diego is researching things from a public safety mindset. They have been looking at homeland security and the role smart technology will have. They also plan on implementing a sensor network throughout their facilities and are looking at how public safety plays into their overall operations. Finally, the Port is looking at how to deploy new technologies in freight, not just light duty vehicles, but medium to heavy

duty vehicles. The goal is to start electrifying freight vehicles to reduce the overall greenhouse gas emissions. "So again, being kind of a test bed for new technologies and looking at how they might invest in those technologies and how those technologies impact their overall operations, and also the environment around them," said Anderson. In addition to cities, public agencies and institutions, San Diego has the largest concertation of military personnel, who are also involved the smart city space. When it comes to energy, the local military bases play a big role in the deployment and in the conservation of energy. The Camp Pendleton Military Base signed smart city MOU to start being a proving ground for technologies within the military realm. They are using smart technologies for security purposes,



such as drone technology, and public works projects. With all of these different agencies and cities in the smart city space, Cleantech saw an opportunity to get everyone working together. Last year Cleantech San Diego launched a smart cities regional plan. "We started seeing the City of Carlsbad, City of Chula Vista, San Diego Airport, [and] the Port were all doing smart city things sort of in their own silo. We knew that in order to really do things at scale they were going to have to come together and start working together," said Anderson. When dealing with public safety, energy, or transportation, a holistic regional approach is smarter. Facilitated by Cleantech San Diego, they pulled together Carlsbad, San Diego, Chula Vista, the airport, the port, and SANDAG, to figure out smart cities technology deployment from a regional perspective.

These agencies came together and established guiding principles in terms of technology deployment. The guiding principles include:

- Enhancing connectivity
- Ensure equity and inclusivity
- Make data informed decisions
- Accelerate new economic development
- Facilitate digital transformation through, open, secure, accountable, transparent process that protects citizen data privacy

With the growing amounts of new technology San Diego has found that privacy issues are surfacing. Right now, the agencies mentioned above, including Cleantech San Diego, are in the process of conducting a smart cities inventory of their region. They are also drafting privacy policies together so that all cities' privacy policies can be streamlined and unified.

#### San Diego Regional Smart Cities Initiative

Opportunity Areas

- Increase and enhance mobility and transportation options across the San Diego region
- Implement an open and transparent digital transformation of agency systems and services
- Enhance public safety across the San Diego region
- Facilitate clean energy expansion and sustainability goals across the San Diego region
- Create more career and job training opportunities across the San Diego region
- Foster citizen engagement in all levels of government across the San Diego region

Adrian Pearmine, National Director for Smart Cities and Connected Vehicles, DKS Associates

Adrian Pearmine led with a quote by Robert F. Kennedy, "May you live in interesting times." With the advancements of technology, everything is rapidly changing. "Those of us in the transportation space right now that are doing traffic engineering and transportation planning and consulting work are living in some of the most interesting times," said Pearmine. Pearmine believes that we are currently undergoing a major transportation transformation, and that everything is about to change in that space. Companies like General Motors and Ford no longer call themselves car manufacturers, they are referred to as mobility



companies. These companies are purchasing parking management equipment, shared mobility, and electric vehicles – gambling on what is next in the mobility sector. As an example of how quickly things can change, Pearmine showed a slide of the Easter Parade in New York City during the 1900s. In the image, there was one motor vehicle and numerous pedestrians, horses and buggies. "Thirteen years later, same Easter Parade and there is one horse and buggy and all automobiles on the road," said Pearmine. We are entering the fifth revolution of transportation mobility, shifting to automation, connectivity, electrification and shared. What is most interesting about this transformation is all four of these changes are happening at the same time, converging together, which is going to change the mobility space altogether.



Looking at today's traditional model and vehicle ownership, there is a trend developing toward shared automated vehicles. In the image, we see a Tesla on the top left side – electric vehicles have increasing amounts of automation but are still individually owned. On the bottom right side there are TNC's (Transportation Network Companies). They have been changing the business model of how people are moved around. What we see is a trend shifting from the original model of the individually owned vehicle, over to electric, shared and autonomous vehicles. Connected and autonomous vehicles are often lumped together as CAVs, or connected autonomous vehicles. They are complimentary to one another, but are also *different*. "Why I care about these things is mostly the safety issue. Now as traffic engineers, we are often working on trying to solve safety. Also, mobility is reducing congestion and giving people more affordable access to transportation and environmentally friendly solutions," said Pearmine. Connected autonomous vehicles are addressing all three of these issues. We have around 30 to 35,000 people a year killed on our



roadway system. The good news is the promise of the connected autonomous vehicle is to significantly reduce the number of deaths.



What does autonomous mean? When thinking about the future of autonomy as it relates to transportation and mobility, big fleets, long haul trucks and local delivery vehicles are some of the earliest at scale type of implementation of autonomous vehicles. There are a number of incentives that come with autonomy for shipping companies, long haul shippers, and companies like Amazon, so they are going to do what they can to become autonomous as quickly as possible. In addition to autonomous fleets, there is the public transit aspect. There is a push to go get people out of their individually owned vehicles and have autonomous 10 to 12 person shuttles running So what does connected mean? Connected vehicles may or may not have any level of automation built into them. They are not necessarily autonomous vehicles. They may not even be partially autonomous, but they are connected. When looking at connected and autonomous vehicles, there are two aspects: vehicle-to-vehicle (V2V), and vehicle-toinfrastructure (V2I).



around residential areas taking people from point A to point B in order to make transit more efficient. Once this becomes a reality, it will eventually solve the first-mile-last-mile issue. "Autonomous, from a technical standpoint, is a combination of technologies where there are onboard computers running GIS (Geographic Information System) mapping and very high precision maps. So the vehicle has GPS (Global Positioning System) and its own GIS – everyone knows these acronyms right – the vehicle knows pretty well where it is," said Pearmine.

There are a series of sensors, LIDAR (Light Detection and Ranging), RADAR (Radio Detection and Ranging), and cameras combined to give the vehicle situational awareness and provides the information needed to make decisions. Right now most autonomous vehicles that are being built are not connected because we do not have the infrastructure readily available. Essentially, as we build out the connected components with vehicles talking to vehicles and connected components talking to infrastructure in vehicles, then this could become one more



sensor input. "Where the vehicle uses not only localized sensors to see what is going on around it, but it is actually talking to other vehicles. And when it is talking to other vehicles saying, 'I am here, here is my speed and heading and I have my right turn signal on and I might be coming your way,' " said Pearmine.



In addition to V2V and V2I, there is V2X – vehicles connected to everything – pedestrians, trains, central systems, and infotainment. More and more vehicles are being built with cellular connections so they can talk to all kinds of things, including the vehicles around them. It is estimated that just the connected vehicle piece of this has the potential to address up to 81% of unimpaired crash scenarios of vehicles sharing information with one another. The unimpaired piece is important here because if the driver is drunk, or if the driver is asleep or on their phone, it does not matter what feedback they are getting from the car, unless the car is

autonomous. If the car is self-driving, and it gets this feedback, even the impaired piece would be significantly reduced. Unfortunately, this scenario is based on the assumption that 100% of the vehicles are connected, so currently we are decades away from getting to that 81%.



Pearmine went on to discuss a project he is working on with the Oregon Department of Transportation (DOT). The Oregon DOT is inching closer towards user charge as opposed to gas tax and they have a pilot demonstration. "I took a 2004 Jeep Cherokee that was not connected or smart – hardly at all – plug in an OBD2 (Onboard Diagnostics 2 Port) and my car is communicating back into their system and giving them all kinds of data about me," said Pearmine. An OBD2 is the same port that mechanics use to determine what issues your vehicle is having. For example, when your check engine light comes on. It has a cellular

modem in it that is talking to the vehicles diagnostic system and it extracts the data. For traffic engineers, this connected vehicle brings about three things:

- i. having radios installed at the infrastructure themselves,
- ii. having replacement of the traffic controller itself, or
- iii. having a new computer that goes into that box that talks to the traffic signals. In order for traffic engineers to get ready for connected vehicles streaming information, they need to figure out the fiber optics and other communication aspects.

In the world of connected vehicles, there are a variety of acronyms used to describe primary components. One important one to remember is SPaT data. SPat data is the information coming out of the traffic signal, such as, signal phase and timing. Additionally there is MAP, which simply refers to maps. It is the data that shows the configuration of the intersection so that the signal phase timing can say what is next. Those are the two fundamental blocks of data that are coming out of the intersection. "Then on the vehicle side, it is BSM – Basic Safety Message. This



component is what I was talking about, 'I am here, here is my destination, here is my speed, I am slamming on my brakes, and my right turn signal is on,'" said Pearmine. There is an ongoing SPaT challenge to try and get 20 states to have 20 connected vehicle intersections by 2020. So far, we are doing better than expected. There are 26 states that have committed and as of last year over 200 signals are now connected. By next year there is expected to be over 2000 connected signals.



On a final note. Pearmine discussed connected vehicle applications. There are a number of applications and they fall into the following categories: V2I Safety, V2V Safety, Agency Data, Environment, Road Weather, Mobility, and Smart Roadside. "What is a little confusing about this menu is that it implies that all these different applications are at the same level of development, in reality, some of these are developed and are in implementation right now; some are being developed and tested in different pilots and demonstrations and some are still vaporware," said Pearmine.

Pearmine worked with the Oregon DOT to prioritize the applications based on high value and what they have control over.

One other application is Curve Speed Warning, which is the idea where the vehicle hits an icy patch and spins out of control and the vehicle then communicates to the cars further upstream that there is a potential accident up ahead and that the road is icy. There are all kinds of applications that are being developed in the safety and convenience sector, the rest of the applications that come with connected vehicles will be deployed later down the line.

## Moving the Dialogue Forward: Ideas from the Participants

After the presentations, the Dialogue attendees discussed the ideas presented and worked together in groups to discuss solutions to move it forward. The top three ideas from each table have been categorized and summarized below.

**Cyber threats and security issues.** With the implantation of smart city technology into our infrastructure, participants were concerned about security measures to safeguard our systems.

- What impact will cybersecurity issues have on smart cities programs and implementation?
- We need to develop recovery and safety measures in the event that our systems do get infiltrated how will we ensure the public's privacy is protected?
- When preparing for smart cities, we must incorporate privacy and cybersecurity precautions into smart city road maps.

**The integration of connected and autonomous vehicles.** There were a number of participants that were curious about the effects connected autonomous vehicles would have if/when they become streamlined.

• How will rural America respond to autonomous vehicles with less infrastructure and funding to build the network needed?

- Are connected autonomous vehicles already obsolete? Should we be implementing newer technology?
- Can autonomous vehicle technology be included into scooters to make them safer?
- We need to take advantage of the connected autonomous vehicle data being collected to improve the safety and efficiency in our region.

**Capitalize on smart city technology**. There were a few participants expressing that we should research ways smart city technology can improve the Inland Empire (IE).

- Pinpoint regional areas that can be improved through smart cities, especially keeping equity in mind.
- The Inland Empire should do what San Diego is doing and take inventory of smart city initiatives happening in our region.
- We should create more user friendly smart city applications in the IE, similar to what the City of Redlands has done.
- How do smart cities affect low income regions?

The Leonard Transportation Center (LTC) at California State University San Bernardino (CSUSB), presented a bi-monthly dialogue series on topics relevant to the future of transportation in the Inland Empire. The series, which was open to the public, was sponsored by HNTB Corporation and was held every other month starting in February 2018.

Dialogue topics ranged from understanding the current mobility dilemma and its causes to potential solutions like congestion pricing, transit; emerging technologies such as autonomous and connected vehicles and new ways of funding transportation infrastructure. Attendees had the opportunity to hear from transportation experts and engage in vigorous discussion about the transportation challenges facing the Inland Empire.

## About Leonard Transportation Center

The Leonard Transportation Center (LTC) at California State University, San Bernardino opened in 2006 with a focus on regional transportation needs. The vision of Bill and Barbara Leonard was to create a center that focuses on the unique transportation opportunities and challenges the Inland Empire faces. Today, the LTC is working to expand its research and student engagement programs. Focal points include transportation management and governance issues, development of new technologies, and transnational studies. Their vision is to work collaboratively to seek solutions to assist residents, businesses, government and nonprofit agencies, and international partners to work together on improving sustainability and quality of life in the Inland Empire. For more information, visit <u>www.csusb.edu/ltc</u>.

## About HNTB

HNTB Corporation is an employee-owned infrastructure solutions firm serving public and private owners and contractors. HNTB's work in California dates back to its founding in 1914. Today, HNTB continues to grow in size and service offerings to clients in California from seven office locations, currently employing more than 350 full-time professionals. With more than a century of service, HNTB understands the life cycle of infrastructure and addresses clients' most complex technical, financial and operational challenges. Professionals nationwide deliver a full range of infrastructure-related services, including award-winning planning, design, program management and construction management. For more information, visit <u>www.hntb.com</u>

## About San Bernardino International Airport

Conveniently located in the heart of the Inland Empire, close to major freeways and just 60 miles from Los Angeles, San Bernardino (SBD) International Airport is strategically positioned to meet growing aviation activity, including cargo, business aviation, general aviation, and commercial airlines by providing competitive rates for aviation companies and local businesses looking to stretch their wings and expand their horizons. With extensive stretches of pristine runway and acres of prime land available for aviation development, SBD International Airport is ready to help our community and region reach new destinations.