

Issue 2

Contemporary Conversations: From Startups to Smart Cities in the Era of Autonomous Vehicles



Contemporary Conversation: From Startups to Smart Cities in the Era of Autonomous Vehicles

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Introduction

About These Series

The Contemporary Conversation (CCs) Series is a compilation of voices from experts in the transportation sector, focusing on specific topics and divided into their relevant subtopics. These pieces are taken from the Regional Mobility Dialogue Series, a series of conversations made from Dialogues organized by the Leonard Transportation Center (LTC). These Dialogues include a diverse panel of experts, from researchers and PhD professors, to key players/stakeholders in the transportation sector.

The purpose of the CCs is to provide the reader with an overview of the transportation issues faced in the Inland Empire and California. It is to do so by including a wide variety of perspectives which bring about a further understanding of the issues faced and their respective solutions proposed. The topics discussed can vary from housing, sustainability, fiscal policy, among others.

About This Issue

This Contemporary Conversation is about technology and the future. Many have heard the concept of smart cities and even more about autonomous vehicles, but these ideas often seem like dreams far in the future. This conversation will explore these topics, and by the time you finish reading this issue, you may see that they are not as distant as we once thought. Smart cities and autonomous vehicles are poised to solve many of our problems on the road, such as heavy traffic and the risk of accidents.

This Contemporary Conversation is organized into three topics:

- **Smart Cities:** This section will focus on the changes in infrastructure that cities can go through in the future in order to bring about a concept that has been around for a couple of years already, create smart cities.
- **Autonomous Vehicles:** Bringing connectivity to the next level is not an easy task. This section is about how we are creating the cars of the future using our newest technologies, Internet of Things (IoT) combined with upgrades in infrastructure can allow for the safest carpooling option for the future, autonomous vehicles.
- **Empowering Entrepreneurs:** Both smart cities and autonomous vehicles have and will require innovation, an attitude that allows people to think outside the box. This section has a big focus on entrepreneurship as the way to make the innovations of the future real, there is no smart cities without smart people that creates them.

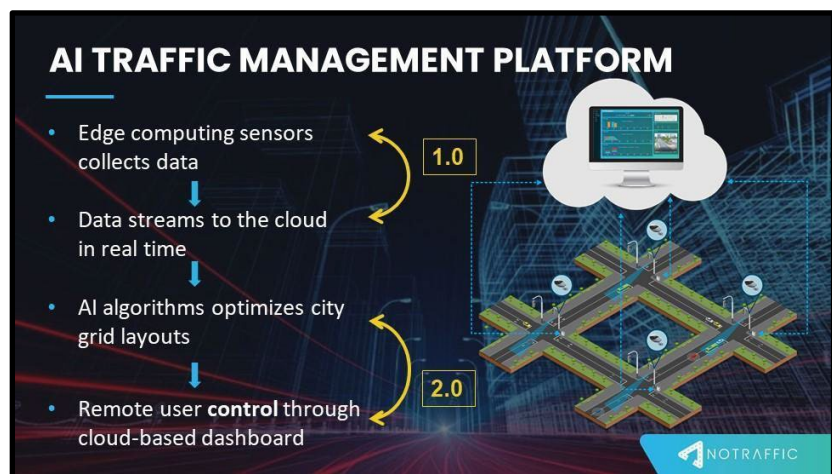
Creating Smart Cities

Cities are entering the next stage of the Fourth Industrial Revolution, marked by a greater use of technology. This evolution is bringing about major developments in travel, changing telecommunications, offering innovative shopping options, and establishing more sustainable technology focused at lowering our carbon impact.

Applying Big Data in a Smart City: AI Traffic Management

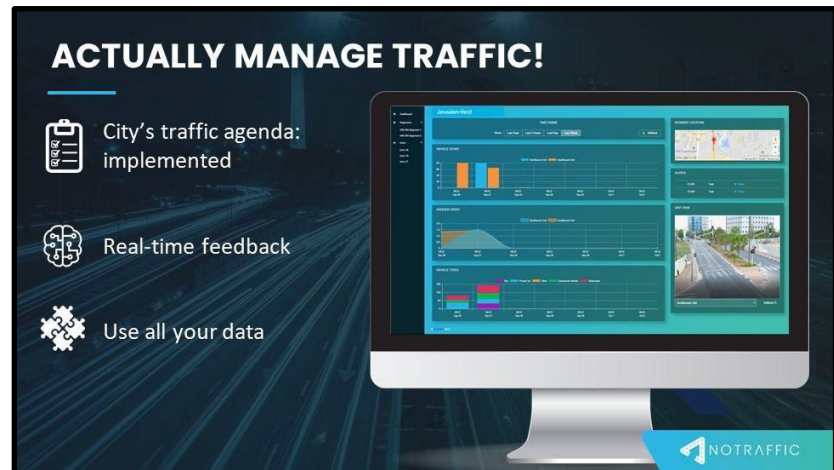
Kjeld Lindsted, Product Manager, NoTraffic

NoTraffic is an Israeli tech startup that is working on traffic management systems. Lindsted believes we are moving into the “smart city 2.0” phase. Smart cities are a concept that developed from the private sector where commercial tech experiences from companies, such as online shopping with Amazon, search engines from Google and communication with Apple, have allowed consumers a whole new way of doing things. The shopping, searching, communicating experience is pushing governments to process various procedures such as, giving out licenses and permits with newer technology to increase efficiency. Local governments have been playing catchup, but it has not worked out the way people expected. Smart cities 2.0 concepts have a lot more to do with equity and how to make things fair in terms of access, and transportation.



“Most people when they think of innovation, they think of taking the process in the way it’s existed from the last decade or few decades, whatever the case might be, and somehow digitizing it,” said Lindsted. In the City of Redlands when there was a problem, such as a streetlight going out, people were able to report it using the 3-1-1 app and eventually that streetlight was changed, but no one knows how long it will take. People had no insight on the process. Lindsted and his colleagues concluded that they should be responsive to all the complaints and let the customers know the stage of the process, and when it is fixed.

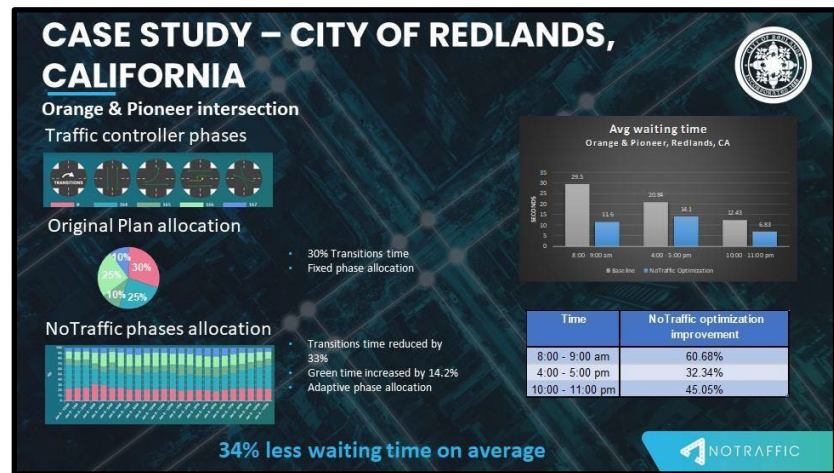
NoTraffic is using innovative thinking and applying it to traffic management. The goal is to fix the underlying problem, instead of trying to improve an existing output from the problem. NoTraffic approaches our infrastructural needs by visualizing what it would look like using today’s technology, for example the kind of technology we have in our cell phones.



NoTraffic’s platform, as Lindsted elaborated, “Is built on installing sensors at traffic signals. Those sensors understand the flow of traffic, and the demand for all the road users. It doesn’t matter if it’s pedestrians, school buses, or passenger vehicles. And then that data streams to the cloud in real time and that’s where we start to do some interesting things with it.” Lindsted added that the next level of the process includes sending the data collected from the sensors to a central space that makes decisions on the overall city traffic grid through artificial intelligence (AI) algorithms. Therefore, the decisions made by the system are based on real time demand. “You have a congestion problem on your particular street, what kinds of policies do you want to run? Are we prioritizing pedestrians? Are we setting up a transit corridor? Are we allowed an emergency vehicle preemption?” said Lindsted. It is now possible to set a series of policies for a city’s traffic signals that can be implemented through connected signaling. This improves decision making and the traffic flow.

The results seem to be very promising as noted by Lindsted. In the City of Redlands, NoTraffic is running a pilot program and the results are beginning to be noted. At one specific site, there are rush hour peaks with people traveling to and from work. There is also a school nearby, which creates double peaks. There is a rush hour peak and then a school peak. And these peaks, at times, overlap from different directions. So, for at least a short period of time, roughly half an hour, there is extremely heavy traffic congestion in this location.

Prior to implementing the smart traffic signal at this location, there were long turning queues that made it very difficult for the traffic to move efficiently. For example, a left turn signal would turn green and no cars would be able to turn left. This made it impossible for the through traffic on the opposite side to advance. Therefore, at this one particular intersection, the traffic back up would impact the main crossroads. “People were not able to make their turn and would be blocking the through traffic and it was kind of a worst-case scenario for a traffic signal,” said Lindsted.



After the smart traffic signal was installed, the system can calculate the demand from all of the users in real time. From there, intelligent decisions are made on how to allocate the right amount of green time most efficiently. According to Lindsted, there was a 60% reduction in delay, which was equivalent to adding 60% street capacity without having to build any real infrastructure.

Again, having a proper understanding of the underlying problem can significantly increase the chances of delivering the right solutions to effectively resolve resident’s concerns. Lastly, Lindsted believes that this process has brought the smart city movement full circle and delivers on the promises made by experts and pundits alike. It shows the public why we should continue to invest in the smart city space.

Kjeld Lindsted talked about underlying issues and addressing citizen complaints, emphasis on equity and access to technology, and introduction of smart traffic signals. The next speaker, Sanjiv S. Gupta, will take a closer look at implementing new technologies, further emphasis on smart traffic lights and logistics, understanding the four pillars to smart cities, and advocating for digital tokens.

Transportation Planning and Smart Cities: The Next Steps for the Coachella Valley

Sanjiv S. Gupta, Chairman/Co-Founder, Irepa International

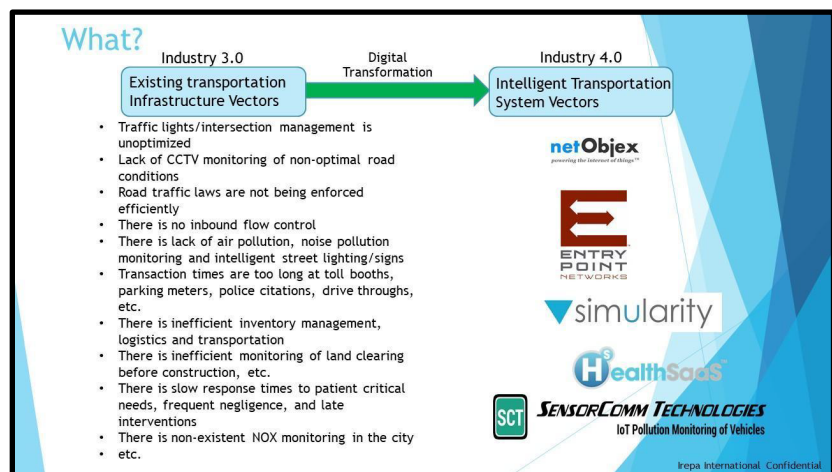
Sanjiv Gupta presentation began with a description of the region as being primarily a resort town—with high levels of tourism, legacy agriculture, wind farms, cultural events, retail, golfing, retirees,

casinos, resorts and parks. The challenge of extreme traffic congestion, which large cities with a denser urban population experience, has not yet impacted the Coachella Valley (CV). With the current level of development, the CV has an opportunity to become a technology and innovation corridor without destroying the natural biodiversity.



Mr. Gupta believes that this is the perfect time to transform the Valley by implementing new technologies in the region. “The Valley can be very autonomous, it can be very sustainable without the urban sprawl that you see in all the other counties in California,” said Gupta.

There are also a number of things that can be changed with the digital transformation from the existing infrastructure to the intelligent transportation system (Industry 4.0 or the Fourth Industrial Revolution). With the advancement and popularity of autonomous electric cars, and connected electric cars, there is huge potential to transform. One of the possible solutions is the implementation of smart traffic intersections. “Traffic lights and intersections today are not smart nor dynamic. You’ll be sitting at a traffic light near the Home Depot off of 111 forever,” said Gupta.



With the Internet of Things (IoT), we can monitor whether conditions for a faster response to make corrective actions are possible. All updates and management of the IoT devices can be done remotely—reducing time and money spent on fixing problems.

Gupta also discussed road traffic laws and enforcement. Our roads today are filled with distracted drivers on cell phones and aggressive drivers. Gupta states that there should be technology implemented to deter such behavior with the right corrective actions. “So, road traffic laws need to be enforced using those cameras. They are doing this in Oregon already, if you run a red light, you will see a ticket in your mailbox that will need to be paid,” said Gupta.

Gupta also talked about inbound flow control. Given the popularity of seasonal events in the region, there may not be adequate infrastructure to accommodate the influx of people and cars, resulting in gridlocked intersections and neighborhoods. This also brings pollution, namely air pollution and noise pollution have an impact on human well-being, both physical and mental health. Intelligent street lighting and signs as well as smart parking can help combat this problem.

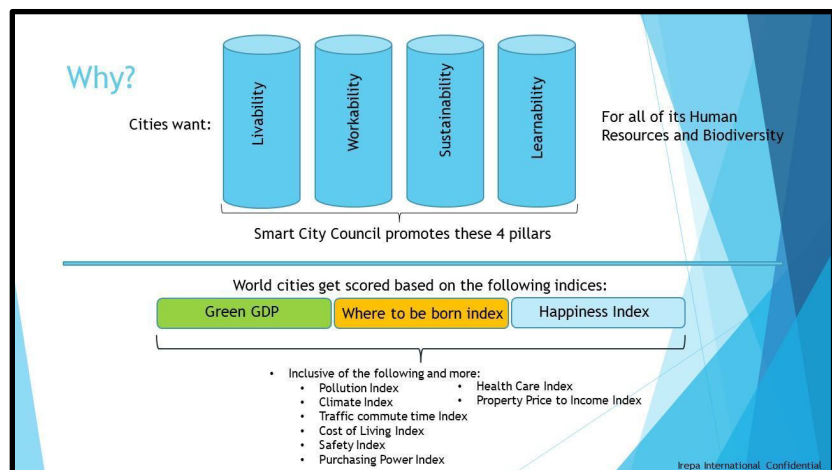
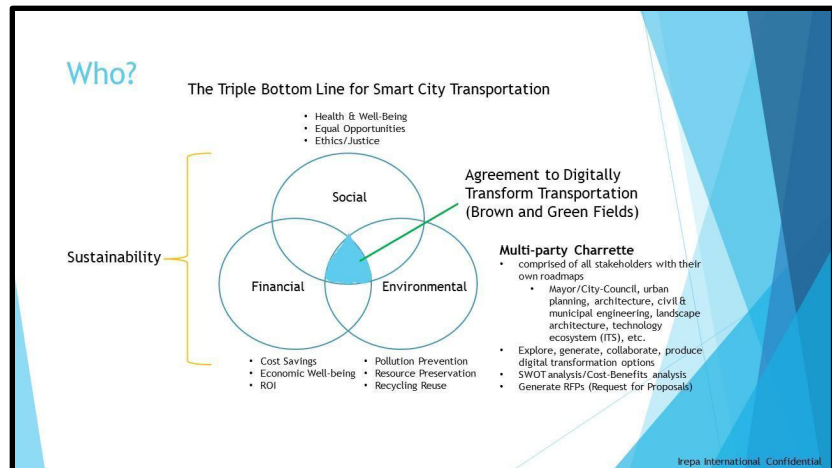
Today, we are still experiencing long transaction times for simple things like toll booths and police citations. Gupta proposes a more efficient approach by way of digital tokens to better facilitate these processes. Gupta also touched on efficient transportation in the logistics industry saying, “fleet management, asset

management, the integrity of the products that you're sending, making sure they don't spoil, all of that needs to be done with the IoT.”

The four pillars to a smart city council are:

- Livability
- Workability
- Learnability
- Sustainability

These four pillars provide a metric to evaluate various indices. For example, a green GDP is important. “Green GDP is where you produce a lot of goods and services, however, you do it without destroying the environment.” “You can have a great GDP, but only after destroying the entire environment. This is a great GDP, but it's not a green GDP,” said Gupta.



This is a concerted effort that needs to be made by all the cities in the region as well as technology leaders. Gupta believes the call to action is now. “We’re in a perfect storm here, we have a great opportunity to make change now. So, the key is to assemble the stakeholders, review road maps, perform SWOT (Strengths, weaknesses, opportunities, threats), and a cost benefit analysis,” said Gupta.

Sanjiv S. Gupta looked at the importance and use of new technologies within a city and furthermore we also understand the four pillars that create smart cities. The next speaker, Jason Anderson, will focus on how to make San Diego a more connected city, economic development opportunities that arose from renewable energy, collaborations with transportation agencies and smart city technology deployment.

Cleantech San Diego: Smart San Diego

Jason Anderson, President/CEO, Cleantech San Diego

Jason Anderson went over the steps that the City of San Diego has taken to become a connected city. Cleantech San Diego was developed 13 years ago and is a 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 that San Diego is well positioned to not only benefit from those initiatives at a state level environmentally, but more importantly from an economic development perspective; making sure that as the state is moving forward into renewable energy goals, energy storage goals, electric vehicle goals – whatever it may be – that we were well positioned to develop, integrate, and adopt those technologies in our day to day lives,” said Anderson.

As California continues to pass aggressive climate and energy related legislation, it’s 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 number 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 many 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 was 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

California Regulatory Framework

- SB 32**
 - Reduce GHG levels 40% below 1990 levels by 2030
- Electric Vehicle Goals**
 - 1.5 million EVs by 2025; 5 million EV's by 2030
 - Add EV charging infrastructure
- Energy Storage Goal**
 - 1.3GW by 2020
- SB 350**
 - 100% increase in energy savings in homes, businesses, and factories
 - 50% of electricity to come from renewables by 2030 (up from 33%)
- SB 100**
 - Increase RPS to 100% renewable energy



“California has proven that sustainable values and job creation go hand-in-hand, and that economies thrive when we seek to capture the future”

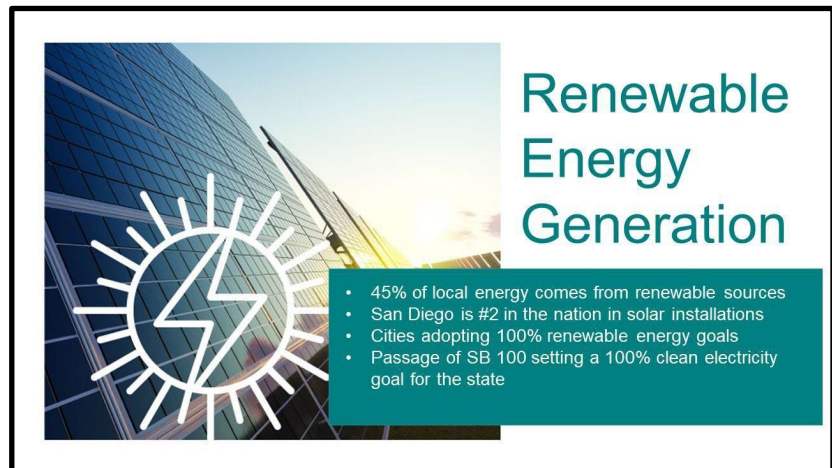


planning. As part of SANDAG's 2021 regional plan, they want to create a new operating system that helps streamline and incorporate how transportation is being designed, developed and used in the San Diego region. Also, as part of the 2021 regional plan, SANDAG is also working to improve the public transportation system by using a mix of 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, their permits, their 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.

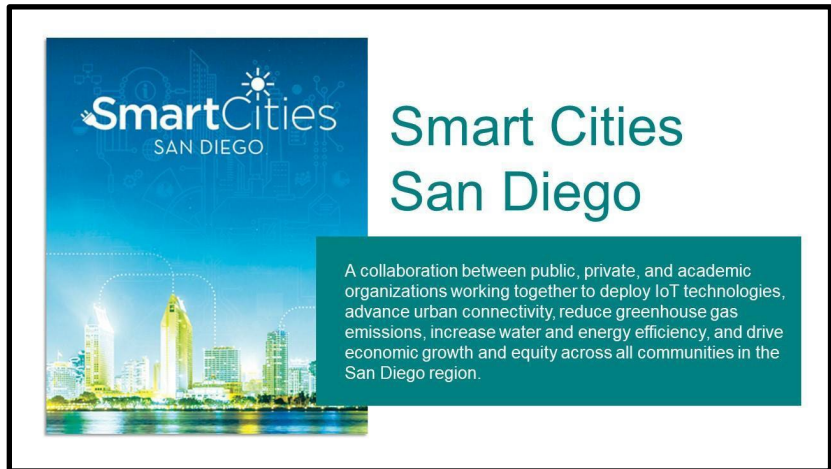
As an organization, Cleantech believes that implementation of environment regulations generates economic growth in California. As clean technology progresses, San Diego wants to make sure it is creating economic opportunity and equity across the community. One of the projects that is currently underway is the usage of 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 street lights through 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 gunshots, 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 with Black and Veatch, a consulting and construction company, to assess with 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 potholes, 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 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 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 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.

In addition to cities, public agencies and institutions, San Diego has the largest concentration of military personnel, who are also involved in the smart city space. When it comes to energy, the local military bases play a big role in the deployment and conservation of energy. The Camp Pendleton Military Base signed a smart city MOU that provides 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. 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 includes:

- 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.

Having gone over how cities are evolving into a more technological integrated one due to the Fourth Industrial Revolution and how it changes how we view cities, planning and building, but also it will affect the Inland Empire cities. This next section will cover a range of topics regarding the importance and sustainability of electric vehicles, problems with electric vehicles, the need for an improved workforce to handle the new vehicles, and how electric and smart vehicles interact with the city around them.



Autonomous Vehicles

The rise of the electric vehicles brought many changes to the transportation industry, however with any change there needs to be preparation to account for everything. The new electric vehicles are equipped with new and complex systems such as the Advanced Driver Assistance Systems (ADAS); with these new complex systems quickly becoming the norm would mean there is a very large gap in the number of mechanics who understand and can operate the complex systems. This section will delve into several initiatives aimed at lessening the gap.

CleanTech San Diego: The Electric Shift

Jason Anderson, President/CEO, Cleantech San Diego

Cleantech San Diego, started about 12 years ago as a renewable energy trade association. The purpose was to create an economic development organization focused on the development of technology and renewable energy and clean technology in San Diego. There is a major shift across California for more green technology, and with this major shift comes benefits; this incentive gives great opportunity to San Diego to expand and improve infrastructure. Over 100 businesses, universities, governments and Non-Governmental Organizations (NGO) collaborate to work with Cleantech San Diego to achieve more sustainable development for both the economy and the environment.

Some private sector members include: AT&T; Black & Veatch; Cisco; Bank of America; Qualcomm; ENGIE; Nuvve; Avangrid Renewables; Solar Turbines; Current powered by GE; Measurable; Primo Wind; Baker Electric Home Energy; EDF Renewable Energy; and Itron. The public sector members and academic institutions



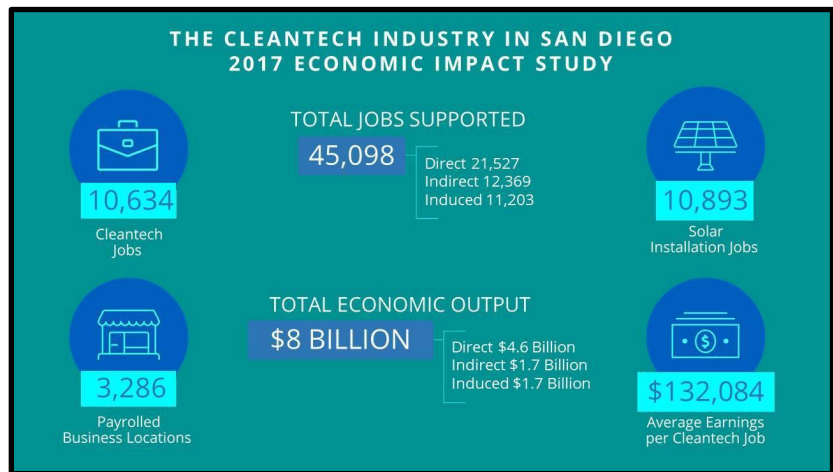
include: the City of San Diego; San Diego International Airport; Port of San Diego; City of Chula Vista; City of Carlsbad; San Diego Gas & Electric (SDG&E); Helix Water District; the Metropolitan Water District; UC San Diego; Scripps Institution of Oceanography; CSU San Marcos; and the University of San Diego. The cleantech space has grown dramatically and the impacts on the economy are significant.

The 2016 Economic Impact Study on the Cleantech Industry in San Diego shows that there are a total of 45,518 jobs in the industry with 21,853 directly attributed to Cleantech, an additional 12,347 indirectly, and 11,318 induced jobs. Meanwhile, there is a total economic output of \$8 billion with \$4.6 billion directly, \$1.8 billion indirectly, and \$1.6 billion induced.

Energy Storage

- SDG&E operating the 2nd largest lithium-ion battery storage facility in the world
- SDG&E received approval to add four more energy storage projects
- 814 energy storage projects installed (21 MW) in San Diego County (commercial and residential)
- New battery storage projects in process at San Diego Zoo and San Diego Airport

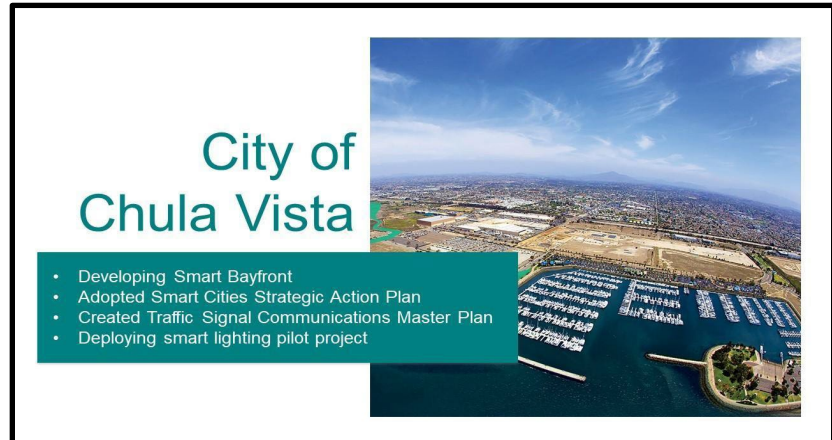
Anderson stated that there are nine San Diego cities that have adopted Climate Action Plans, which is very significant from both an environmental perspective as well as an economic perspective. There is a constant monitoring of the progress of the Climate Action Plans in conjunction with the annual report to gauge the progress and impact they have on the region. From a renewable energy generation perspective, 45% of the local energy is sourced from renewables, mainly due to SDG&E Sunrise Powerlink that connects San Diego and Imperial County. In addition, as more cities adopt Climate Action Plans and renewable energy goals, solar installations have begun to rise. Solar installations play a significant role, to which San Diego ranks number two in the country in the quantity of solar installations.



In the advanced transportation space, there is a concentrated focus on electric vehicles. According to Anderson, there are about 32,000 electric vehicles in the San Diego region with about 1,600

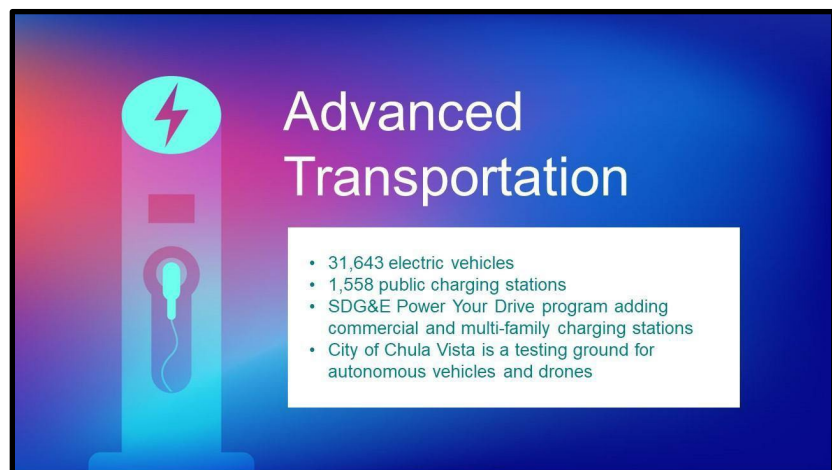
public charging stations. SDG&E, through its “Power Your Drive Program”, is building out infrastructure for public charging to support the increased growth of electric vehicles.

The city of Chula Vista has become a testing ground for autonomous vehicles and drones. The SANDAG and Caltrans are working together to build this research park. An important component to all of this is energy storage. As Anderson states, “you can generate all the renewable energy in the world but if you can’t store it, sometimes it means nothing. We’ve seen that quite often but, again from a regional perspective, and from a state



perspective, we are very focused on building the energy storage into our grid. So, we've got the world's second largest battery storage facility.” Currently there are 814 energy storage projects installed with a total of 21MW in San Diego County.

Smart Cities San Diego started with the goal of building out the infrastructure to support electric vehicles. “We are working now with public, private, and academic organizations to really advance our smart cities deployment in our region,” said Anderson. The focus has been on greenhouse gas emissions and economic



development, but given the advancement in technology, there has been an added focus on tying in IoT and equity as it pertains to adopting the climate action plans. The City of San Diego has deployed the world’s largest city-based IoT streetlights platform. General Electric is in the process of installing 4,200 street lights sensors in the region. Meanwhile the City of Carlsbad is in the process of adopting a smart cities road map, which will be dubbed “Connective Carlsbad.” Finally, in the City of Chula Vista, there is a “Smart Bayfront” project. “They're doing on-site energy generation and distribution, they’ll have autonomous vehicles connected to cars—all within the blueprint of this project,” said Anderson.

The City of Chula is also working on a smart lighting project, among other things. “We have identified our priorities, we have identified our guiding principles, we are finalizing our governance structure, and then we will start to move forward on how we want to develop projects while maintaining some autonomy with the cities and SANDAG,” said Anderson. Cleantech is focused on maintaining safety, mobility, energy and sustainability. “We have a number of guiding principles, especially around ensuring equity, enhancing connectivity in our region and at the same time creating platforms that are open, secure, and private,” said Anderson. It is also very important that all this moves forward without the public feeling threatened, in a big brother manner as it relates to privacy concerns. Anderson concluded that there are nearly 30 projects on the books and Cleantech San Diego is currently working to build them out.

Jason Anderson focused on a greater push toward renewable energy and all-electric vehicles and their respective benefits in San Diego and the greater San Diego area. The next speaker, Daniel Brown, will look at an apprenticeship model, challenges for vehicles and the technologies to assist driving, and the increased need for a new type of mechanic to understand the complexities of new electric vehicles.

The Future of Automotive Training

Daniel Brown, Manager of the LN Academy, the training and qualifications department of Lucas-Nülle GmbH from Cologne, Germany

Lucas-Nuelle is a Germany based company that has been around for more than 40 years, they are focused on education around the energy application industry, they take care of developing training equipment, supporting teachers and students, as well as selling products and services such as microcomputing services or industry 4.0. Mr. Brown identified some of the main challenges faced in the automotive industry today: the development of Advanced Driver Assistance Systems (ADAS), the processing power needed to operate these kinds of vehicles, and the need for students to learn more for certification in less time. He explained the training process and demonstrated how students may go about learning parts of vehicles, understanding automotive

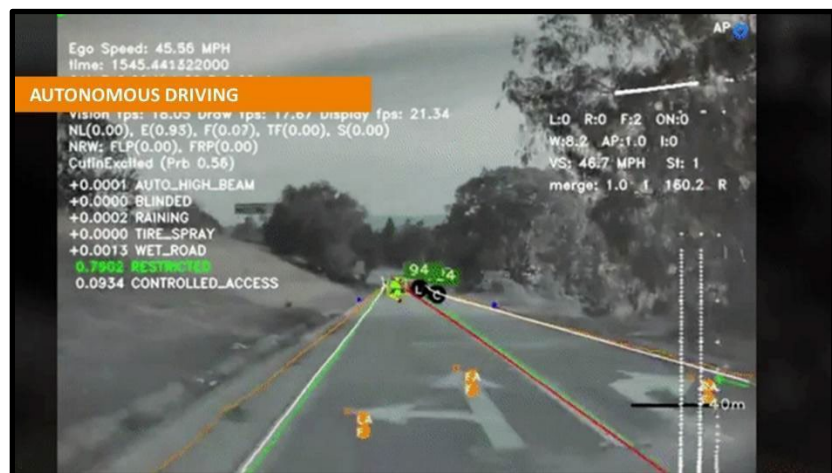
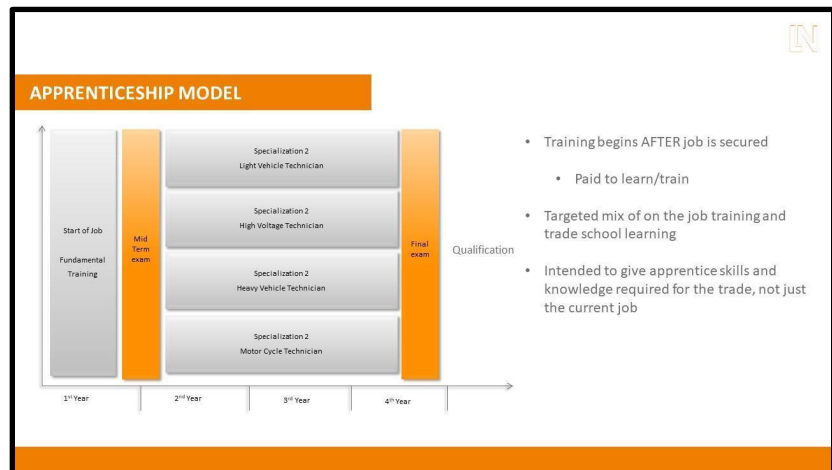


systems and eventually moving on to diagnostics through listening, reading and doing in order to build on their experience and skills.

Mr. Brown clarified the complexities of vehicle automation and how much information a vehicle must be able to process to have awareness of what is going on around it. This requires sensors to be integrated into the vehicles, which is not new technology, but does require advanced experience and understanding of the vehicle to work. Students are able to learn complex systems like this by breaking them down into individual components. Mr. Brown stated that electric vehicles present some of the biggest challenges for technicians because of safety issues related to the necessary high voltage to make them functional. Adapting to electric vehicle technology

requires integrating new protective equipment and techniques to manage the hardware of these vehicles. Students need to be exposed to this technology and safety around it early, because it is here to stay.

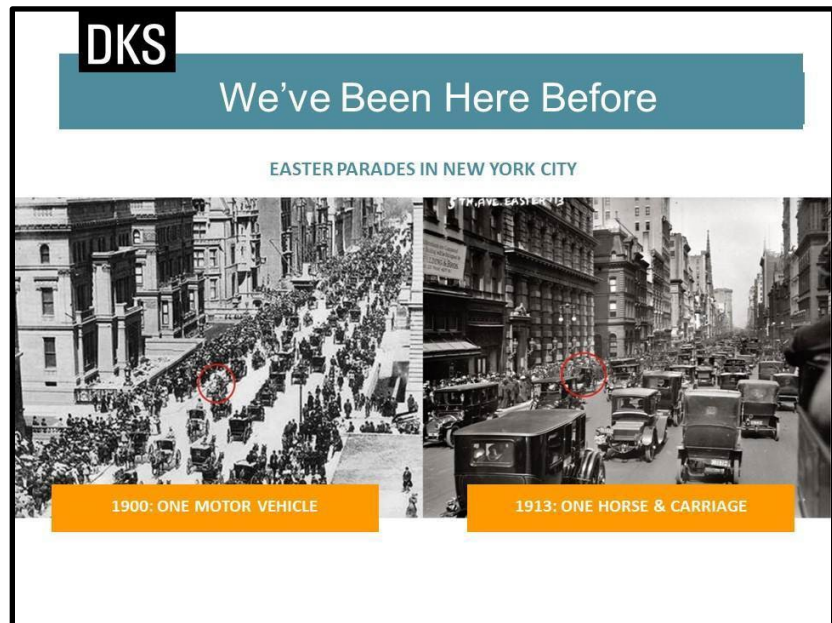
Daniel Brown went over vehicle technology, challenges for new vehicles, and the need for more and new mechanics to understand the new complexities of these vehicles. The next speaker, Adrian Pearmine, will go over the advancements made in the transportation industry, trend toward autonomous vehicles, new developments of Vehicle-To-Vehicle(V2V) and Vehicle-To-Infrastructure (VOI) communication, and potential for Connected and Autonomous Vehicles (CAV) and applications.



Integrating Smart City Concepts into the Local Transportation Infrastructure

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



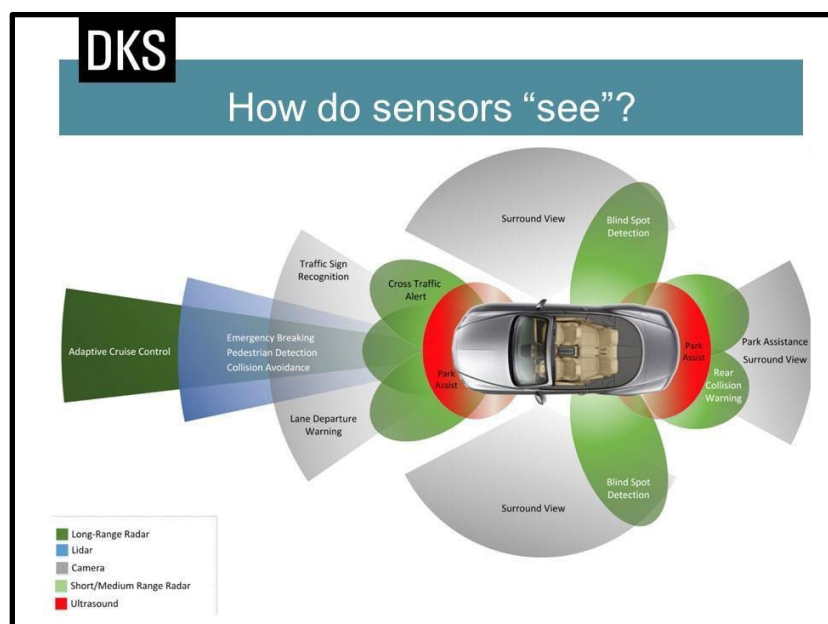
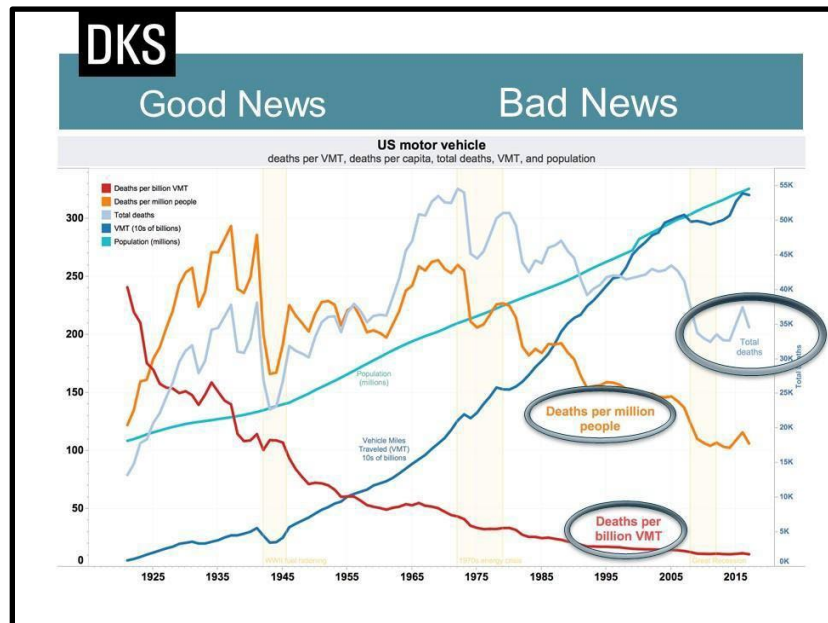
transportation transformation, and that everything is about to change in that space. Companies like General Motors and Ford no longer call themselves car manufacturers, they are referred to as mobility companies. These companies are purchasing parking management equipment, shared mobility, and electric 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, and electrification. 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 Transportation Network Companies (TNC’s). 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 complementary 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 problems. 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.

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-to-infrastructure (V2I). 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

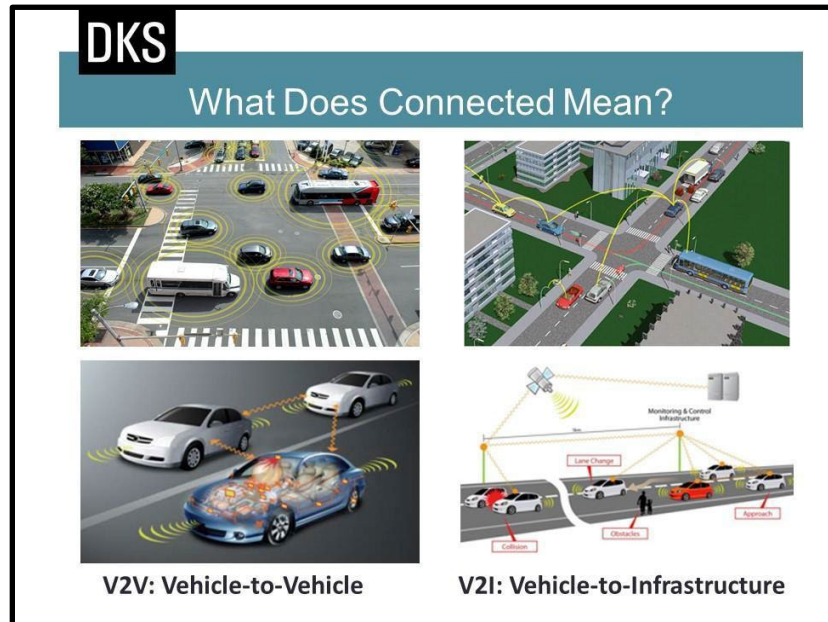


autonomous as quickly as possible. In addition to autonomous fleets, there is the public transit aspect. There is a push to get people out of their individually owned vehicles and have autonomous 10 to 12 person shuttles running around residential areas taking people from point A to point B in order 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 Geographic Information System (GIS) mapping and very high precision maps.” 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 provide 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 are 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%.

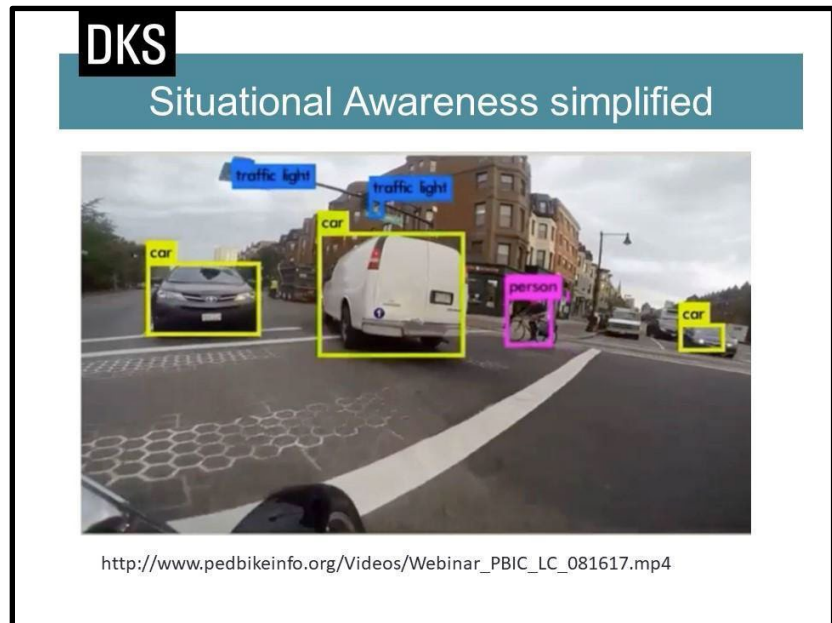


Pearmine went on to discuss a project he is working on with the Oregon Department of Transportation (DOT). The Oregon DOT is inching closer towards user charge as opposed to gas tax and they have a pilot demonstration. “I took a 2004 Jeep Cherokee that was not connected or smart – hardly at all – plugged 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 vehicle's diagnostic system and it extracts the data. For traffic engineers, this connected vehicle brings about three things:

- Having radios installed at the infrastructure themselves,
- Having replacement of the traffic controller itself, or
- 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 2018 over 200 signals are now connected. By 2019 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’s 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.

Now we have clear what kind of technologies we can use, as well as what kind of planning is required for these technologies to be implemented in the cities and cars of the new roads. However, there is still a couple things missing on the puzzle, things that still need to be created in order to integrate everything, for this we will need innovation, and that is exactly what our last Dialogue is about, innovation and entrepreneurship.

DKS

V2X – What else?

- Vehicle to Central Systems & Service Providers (V2X)
- Vehicle to “nomadic travelers” - Pedestrians, bicyclist, motorcyclists (V2X)



Empowering Entrepreneurs

Data enables us to gain insight into how the numerous entrepreneurs in the Inland Empire influence the cities in which they live and how they affect transportation industry technologies. A prominent illustration of this is Amazon's Web Services (AWS), which covers a variety of areas, such as the secure and efficient movement of the essential assets and the accessibility of cutting-edge technology such as cloud computing.

The School of Entrepreneurship at CSUSB

Dr. Mike Stull, Professor of Entrepreneurship, Director of the School of Entrepreneurship, and Director of the Inland Empire Center for Entrepreneurship (IECE) in the Jack H. Brown College of Business and Public Administration at California State University, San Bernardino (CSUSB).

Dr. Stull began by sharing a definition of entrepreneurship, borrowed from Howard Stevenson at Harvard, stating, “we view entrepreneurship as the pursuit of opportunity without regard to resources control.” He points out that this definition does not include the topic of starting a business specifically because, “entrepreneurship can take place in any context.” The idea of entrepreneurship is rooted in “driving progress forward and innovation so we view it as both a mindset and a set of competencies that can really be developed and deployed in just about any setting.”

Dr. Stull went on to explain his professional roles and projects, highlighting work he

IE BUSINESSES

- No specific industry trends
- Interest in startups has risen during pandemic
- Large and diverse region with increasing resources coming into the entrepreneurial ecosystem
- Access to capital remains a significant issue

Why the School of Entrepreneurship?

FUNDAMENTAL REASONS FOR ESTABLISHMENT

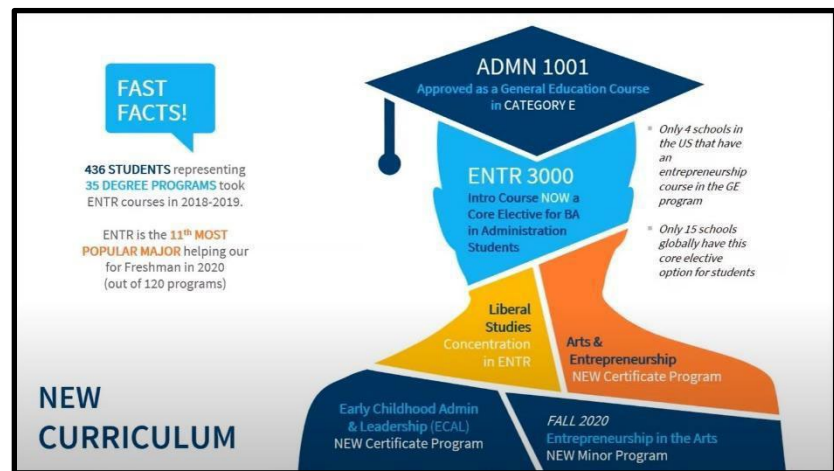
- #1 A DISTINCT DISCIPLINE THAT IS UNIQUE
- #2 CONTINUES CSUSB STATUS AS A LEADER & INNOVATOR
- #3 CREATES A "DESTINATION" PROGRAM FOR CSUSB
- #4 PRESENTS ADVANTAGES IN FUNDING & RECRUITMENT
- #5 INTERDISCIPLINARY COLLABORATION
- #6 SCALE UP THE # OF ENTREPRENEURS

has done in capturing and consolidating data from Riverside and San Bernardino Counties about entrepreneurial establishments, their size, demographics, and the work they do. 97 percent of companies in the Inland Empire are small to mid-sized with less than 100 employees. While there is no specific field or trend that dominates the region, Dr. Stull does identify a growing interest in startup businesses by individuals attending workshops and inquiring about the process as well as new college students enrolling in college courses at CSUSB School of Entrepreneurship. Ultimately, he states, “what we're seeing in this process is that we do have a pretty large and diverse region with increasing resources coming into the entrepreneurial ecosystem.” Dr. Stull identifies resources and capital as a significant issue with increased interest in entrepreneurship in the Inland Empire and states that he is working with an organization in Los Angeles to begin an investment fund for small businesses that want to get their start in the region.

Dr. Stull then pivoted to talking about features of the School of Entrepreneurship, a first of its kind in California and one of very few in the world, which teaches competencies and instills and mindset that students can be agents of change in their communities. 48 percent of graduates of the school have gone on to start their own

business within five years and many of the remaining have entered entrepreneurship roles in their fields by “being change agents and driving processes in existing organizations.” Dr. Stull discussed some of the program opportunities, including collaborating across other disciplines and graduate programs, their goal is to “get students that are going to go out and create an impact on the community.” The school is expanding their efforts to reach high school students and undergraduates early in the programs to create pathways to entrepreneurship and support students seeking to enter the field.

In the last speaker, Dr. Mike Stull, explained the entrepreneurial landscape in the Inland Empire, identification of resources being a major challenge for entrepreneurs and establishing new ways to help them, the opening of the school of entrepreneurship at California State University San Bernardino (CSUSB) and its benefits. The next speaker, Phil Silver, will focus on Amazon Web Services (AWS) and what it offers to customers, while highlighting one of its selling points; the benefits of cloud computing.



Empowerment of Entrepreneurs Through AWS Cloud

Phil Silver, Amazon Web Services' (AWS) state and local government transportation vertical, including activities with airports, seaports, transit agencies, tolling authorities, traffic departments, parking, DOTs, MPOs, and COGs.

Through Amazon Web Services (AWS), Mr. Silver is working towards the goals to “support the agencies tasked with moving people or things safely, efficiently, economically, and equitably working with customers and partners who recognize the power of cloud computing as key to their future” through “our engagements with

departments of transportation traffic authorities, tollways, airports, seaports, municipal and regional planning organizations, and public transit agencies.”

Mr. Silver emphasized the importance of cloud computing for entrepreneurs and that AWS supports an array of businesses in “every imaginable use case.” He explained that AWS is “usually customer focused”, while other organizations are competitor focused. At AWS, “ninety percent of what we build is driven by what customers tell us what matters and the other ten percent are things we hear from customers when they may not articulate exactly what they want,” He also shared that many larger cloud companies are focused more on acquiring innovation than creating it. Another benefit of working with AWS is that they are “unusually long-term oriented” and their goal is “trying to build relationships and a business that lasts longer than all of us in this room and

you do that by doing right by customers over a long period of time, it's part of the example that we set for many of the companies who were born in the cloud.” He defined cloud computing as “the

The AWS Cloud in mobility and transportation

- Agility:** Develop and roll out new applications, quickly.
- Cost savings:** Pay for what you use. Total cost of ownership.
- Elasticity:** Only provision resources you actually need.
- Innovation:** Focus IT resources on transforming customer experiences.
- Global reach:** Deploy globally in minutes.

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What the cloud brings to mobility and transportation

- Migrate and free-up resources
- Ensure security, compliance and resiliency
- Adopt modern application development practices
- Gain faster, deeper insights with analytics
- Organize for speed and agility
- Bridge skills and experience gaps rapidly

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on-demand delivery of IT resources via the internet with pay-as-you-go pricing instead of buying, owning, and maintaining your own data center and servers a big investment organizations can acquire technology such as compute power storage databases and other services on an as-needed basis,” which allows companies to “innovate faster” because “they can focus their highly valuable IT resources on developing applications that differentiate their business and transform customer experiences instead of the undifferentiated heavy lifting of managing infrastructures and data centers.” Mr. Silver shared the experiences of some AWS clients who have innovated new ways to address today’s transportation problems and “are demonstrating the value of migrating traditional and on-premises computing platforms into an entirely new generation of built for the cloud solutions growing in popularity because they

answer key challenges faced by public agencies and authorities in these times. With the AWS cloud, they are able to modernize, increase resiliency, and reduce cost with an eye on what’s important today and what is needed to sustain and serve their customers over the long haul – 10, 20, or more years in the future.” They are able to do this by not spending their capital on IT infrastructure, only paying for the cloud services they need, and having the flexibility to scale up as necessary. They can focus their efforts on innovation and long-term planning rather than IT infrastructure, the freedom from which has driven small business growth and innovation potential.

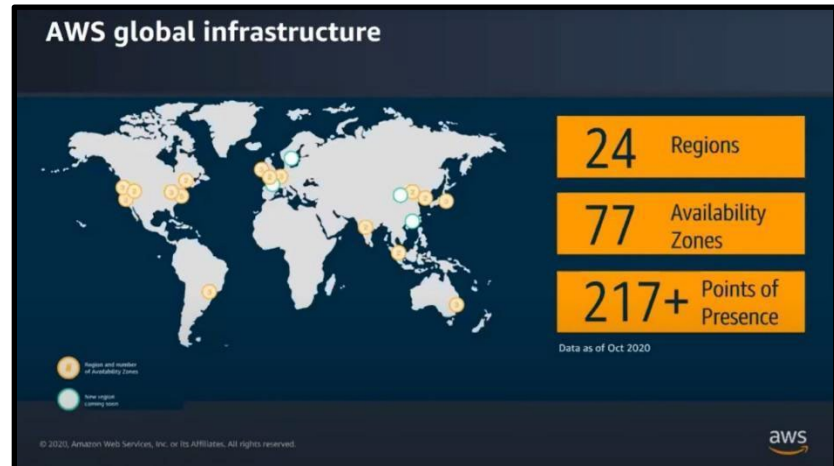
The last speaker, Phil Silver, focused on AWS and the benefit of cloud computing. We are now shifting focus to Zachary Browne and the importance and use of the transit token, the benefits of a transit token, and recommendations for entrepreneurs, and smart vehicles; their inherent benefits and challenges.

The last speaker, Phil Silver, focused on AWS and the benefit of cloud computing. We are now shifting focus to Zachary Browne and the importance and use of the transit token, the benefits of a transit token, and recommendations for entrepreneurs, and smart vehicles; their inherent benefits and challenges.

Token Transit: An Example of Entrepreneurship

Zachary Browne, founder of Token Transit, the mobile app for riders to purchase transit fares.

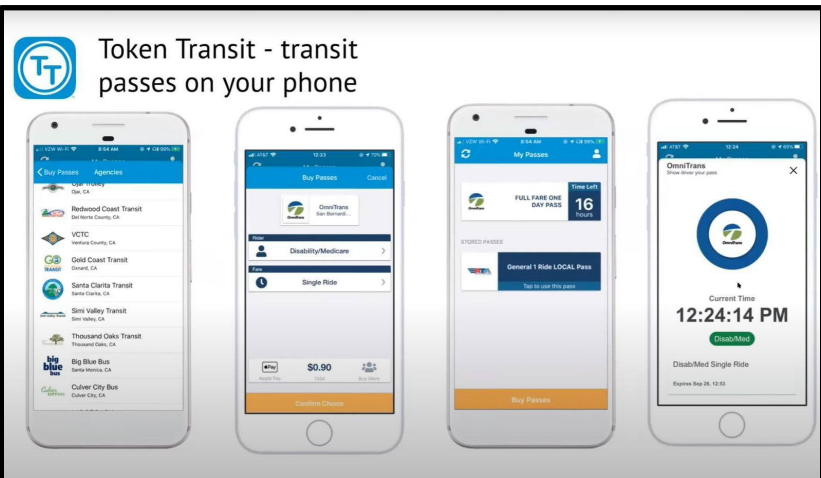
Mr. Browne offered an overview of his company, Transit Token, who aims to “make transit better through payments” and to streamline processes, such as paying fares, acquiring passes, and looking up bus times and maps in a local app, speed up boarding times, and make public transit a faster experience. He described his thought process as an entrepreneur in founding this business and trying to make transit easier, including spending a lot of time interacting with the transit system to



understand what would be important in making boarding easier and faster. He was able to identify many areas of improvement to the transit process firsthand and worked to address them with his business. Token Transit was developed to allow people to buy bus passes on their smartphones through a variety of agencies. They also discovered through personal experience that people do not want to download multiple apps for one task, so they worked on a feature that allows people to use their system to download passes through other apps as well. They also developed a way for bus bases to be texted to people, which allows workplaces, social services agencies, schools or family members to send bus passes to others. They created ways to track the number of single rides purchases on the app and convert your account to a monthly pass when you have spent the equivalent amount of money that would have cost. This is preventing people from paying much more over time on single rides if they cannot afford a monthly pass up front. A study done in Florida revealed that Token Transit has saved riders both time and money.

What we've learned as entrepreneurs





- **Pick up the phone** - We called 200+ transit agencies and spent months talking to them about what problems they faced with fare collection.
- **Find partners who believe in your vision** - We started working with small transit agencies who were excited about Token Transit.
- **Launch and iterate** - Don't concern yourself with building the perfect product right away. Get it out to users asap and improve on it from there.
- **Use the products you work on** - We are public transit riders and none of us have ever owned cars. Payments are a problem we face every day and using public transit is essential for Token Transit

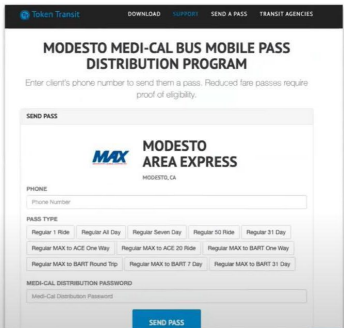


Mr. Browne shares four recommendations for entrepreneurs. One is to start by making phone calls, rather than emails or researching online, to companies and leaders in the field you are looking at to learn, gather information, and determine what needs may be underserved. Second, was identified as “finding partners who believe in your vision...that allows us to get a strong footing and to build our product from there.” Third, “just launch a product and iterate and build off of it.” He elaborated that it is not important to focus solely on putting out a perfect product right away when there will always be room to improve and grow as you learn more. Striving for perfection can keep a lot of people from making any moves and they end up “never getting off the ground.” Lastly, he said he could not stress the importance of using your own product enough. He explained that, as

an entrepreneur, you learn so much by using your own product and working to make it functional for people who can benefit from it. Essentially, he advised to be your own customer and work to make the user experience better from that perspective by being in touch with issues and understanding the practical problems. Understanding how entrepreneurs and smart cities can move onto the last thing that is evolving because of new innovations in their respective industry, vehicles.

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Conclusion:

A future characterized by innovation and sustainability is being marked by the synergy between smart cities, which is fueled by technology advancement, entrepreneurial endeavors, and the rapid advancements of autonomous vehicles.

Incorporating cutting-edge technologies into urban areas is going to become important as it transforms transportation, communications, commerce, and also moves us closer to a more environmentally friendly future. The arrival of electric cars and the advancement of autonomous driving skills highlight a commitment to a transportation environment that is both technologically sophisticated and environmentally friendly. Here are three main takeaways that demonstrate this:

1. Through IoT, AVs, and Infrastructure development, Smart Cities are a realistic concept

The creation of autonomous vehicles together with the internet of things is going to be able to connect our cities in a way that was never imagined, new technologies like AI for city planning will need to be developed in order to make everything connect and function in the most efficient way possible. If we look at our presentations, neither of these technologies is far from being developed or have already been developed, a smart city is a real concept.

2. Smart Cities will allow better outcomes for citizens

It was mentioned a couple of times that these cities will be able to allow reductions in time stuck in both lights and traffic, connected with everything else allow for a more sustainable city overall, give more precise travel times, safer riding in the streets. Smart Cities are the way to improve an overall city experience.

3. Innovation is the power key of a brighter future

All of what was previously mentioned can only be powered by the innovation that entrepreneurs bring into the table, so for the last conclusion, entrepreneurs are the final key to bring a new future in which technology makes all of our processes more efficient which then follows a better standard of life in the cities.

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 www.csusb.edu/lc

About APTA

The American Public Transportation Association (APTA) is a nonprofit international association of more than 1,500 public and private sector member organizations. Benefits to our members include advocacy for federal funding and policies, research, technical expertise and consulting services, workforce development programs, educational conferences and seminars, and 135 subject-matter working committees. For more information, visit <https://www.apta.com/>

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 www.hntb.com

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



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<https://www.csusb.edu/leonard-transportation-center>

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