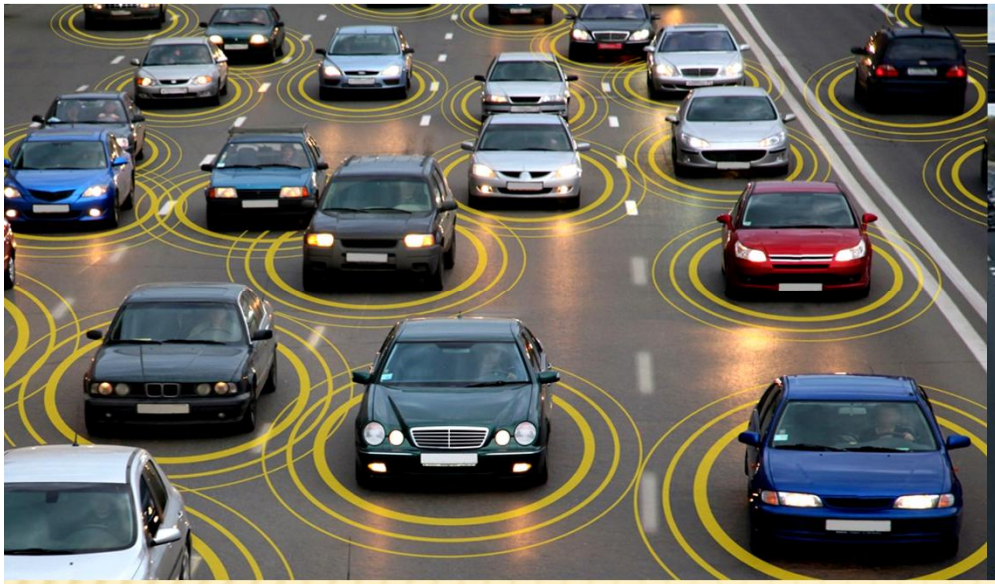

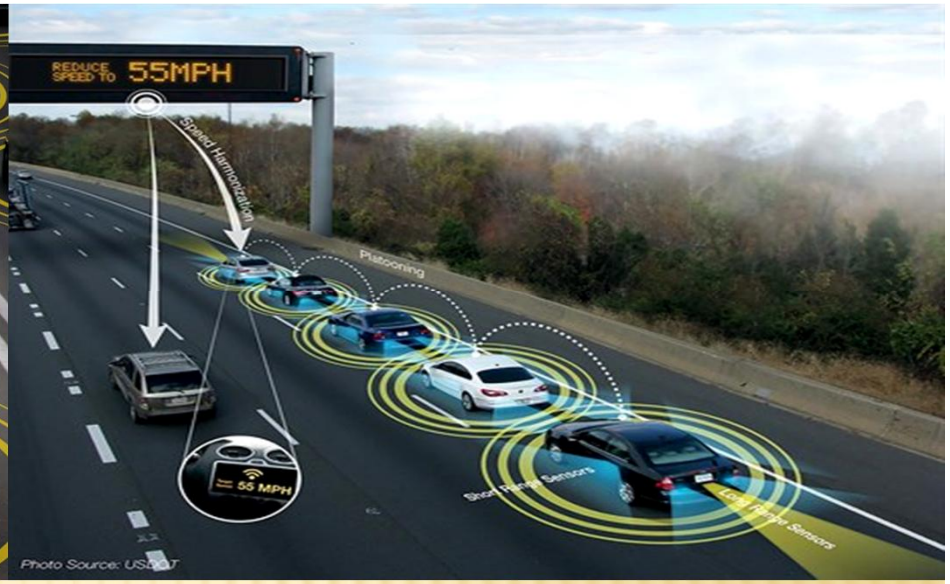

ITE WESTERN DISTRICT MEETING – ALBUQUERQUE, NEW MEXICO

"THE PARADIGM SHIFT OF OUR TRANSPORTATION INDUSTRY"

Presentation By: Carlos A. Ortiz, PE, TE, PTOE

ADVANTEC* Consulting Engineers – *Chief Operating Officer
ITE Western District Past-President and Board Member
ITS California Board Member

July 13, 2016

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Consulting Engineers

Presentation Outline

- Today's Transportation Challenges
- Connected and Automated Vehicle Overview
- CV Pilot Deployment Program
- Smart City Challenge Program
- Challenges to Our Profession

Paradigm Shift

The car as we know it, and how it's used in people's lives, is going to change really dramatically and it's going to change fast..

Bill Ford Jr., Executive Chairman (April 2013)

- The next revolution of our transportation system since the Interstate Highway System
- Major enhancements to improve safety, mobility, and environment
- Impacts to our lives, careers, and industries

Connected and Autonomous Vehicles

Connected and Autonomous Vehicles

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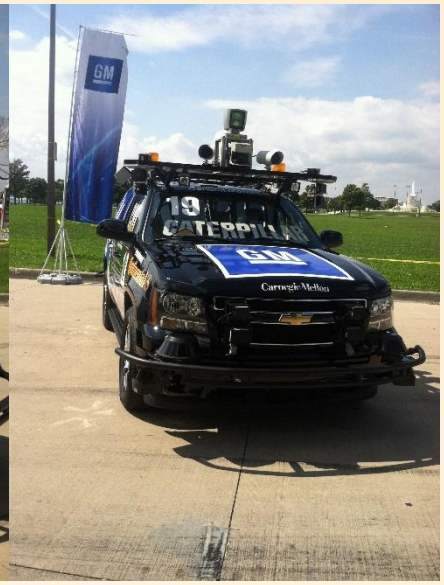
Connected and Autonomous Vehicles

- National Automated Highway System Consortium (NAHSC)
- Highlight was the 1997 Demo on I-15 in San Diego
- Passenger car automation demonstrated

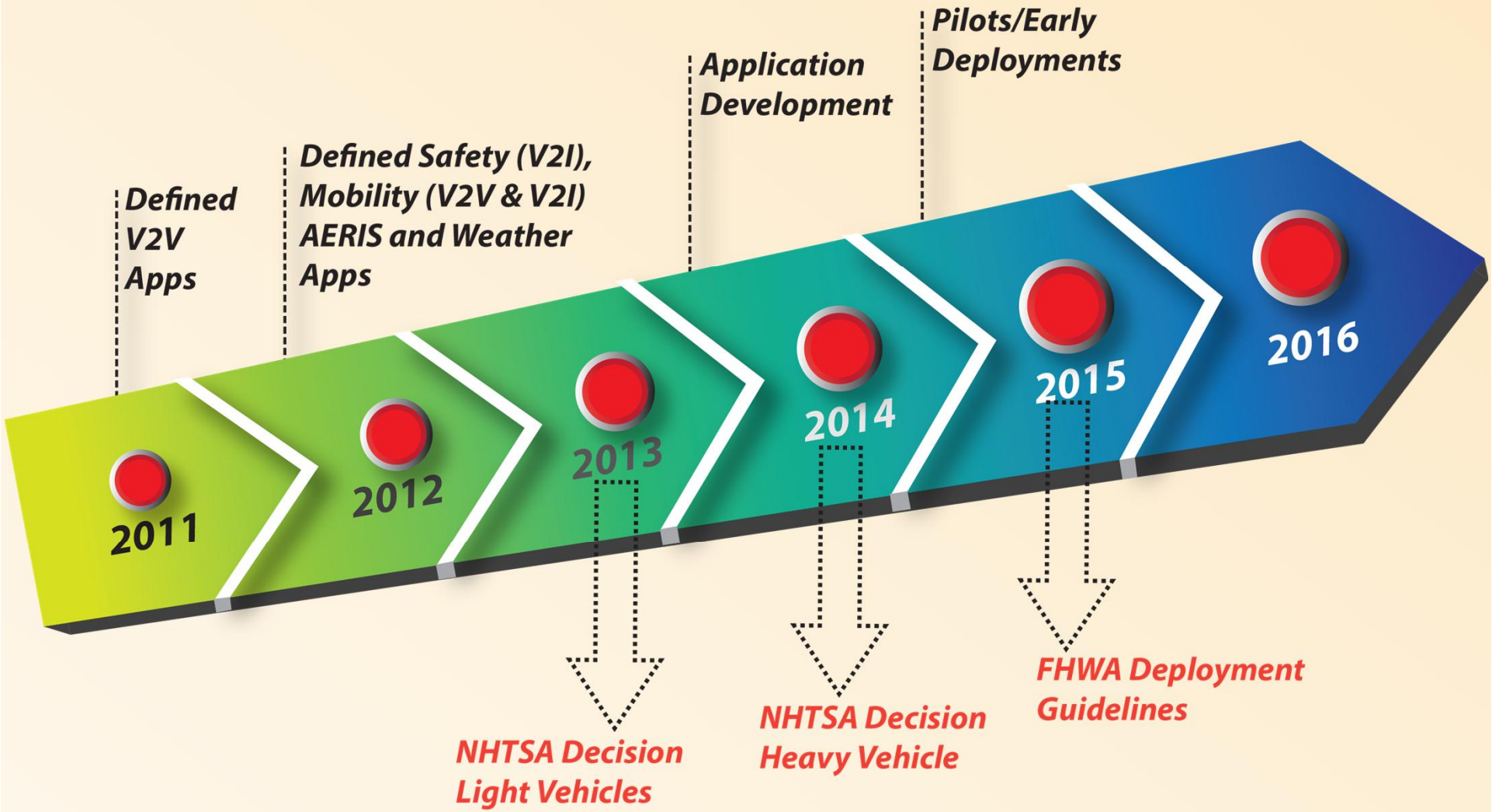
California PATH

Connected and Autonomous Vehicles

- 2004 Defense Advanced Research Projects Agency (DARPA) Grand Challenge – No winners
- 2005 DARPA Grand Challenge - 5 vehicles completed the course
- 2007 DARPA Urban Challenge – 6 vehicles completed the course
- Created another push for development of AV



Connected and Autonomous Vehicles



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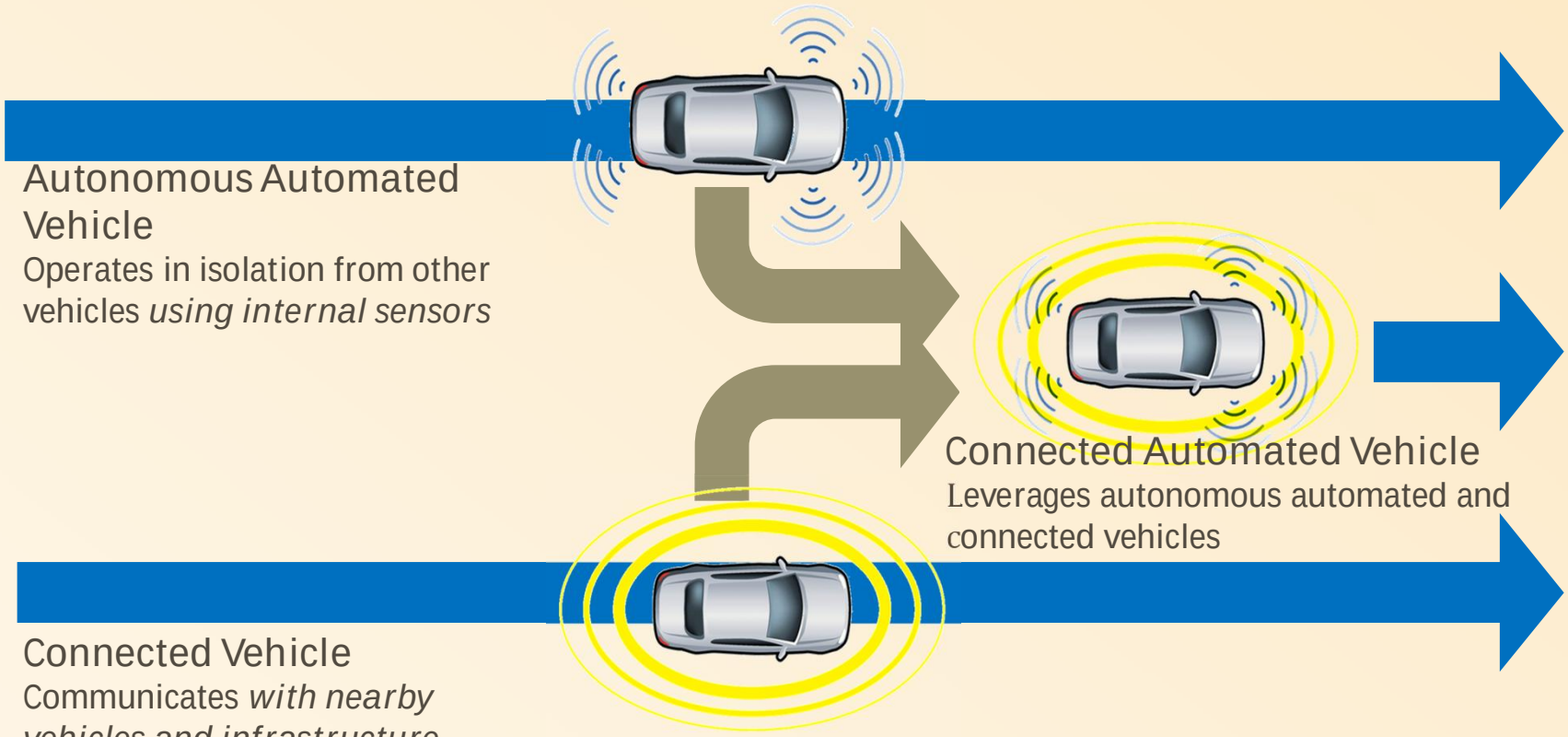
Connected and Autonomous Vehicles



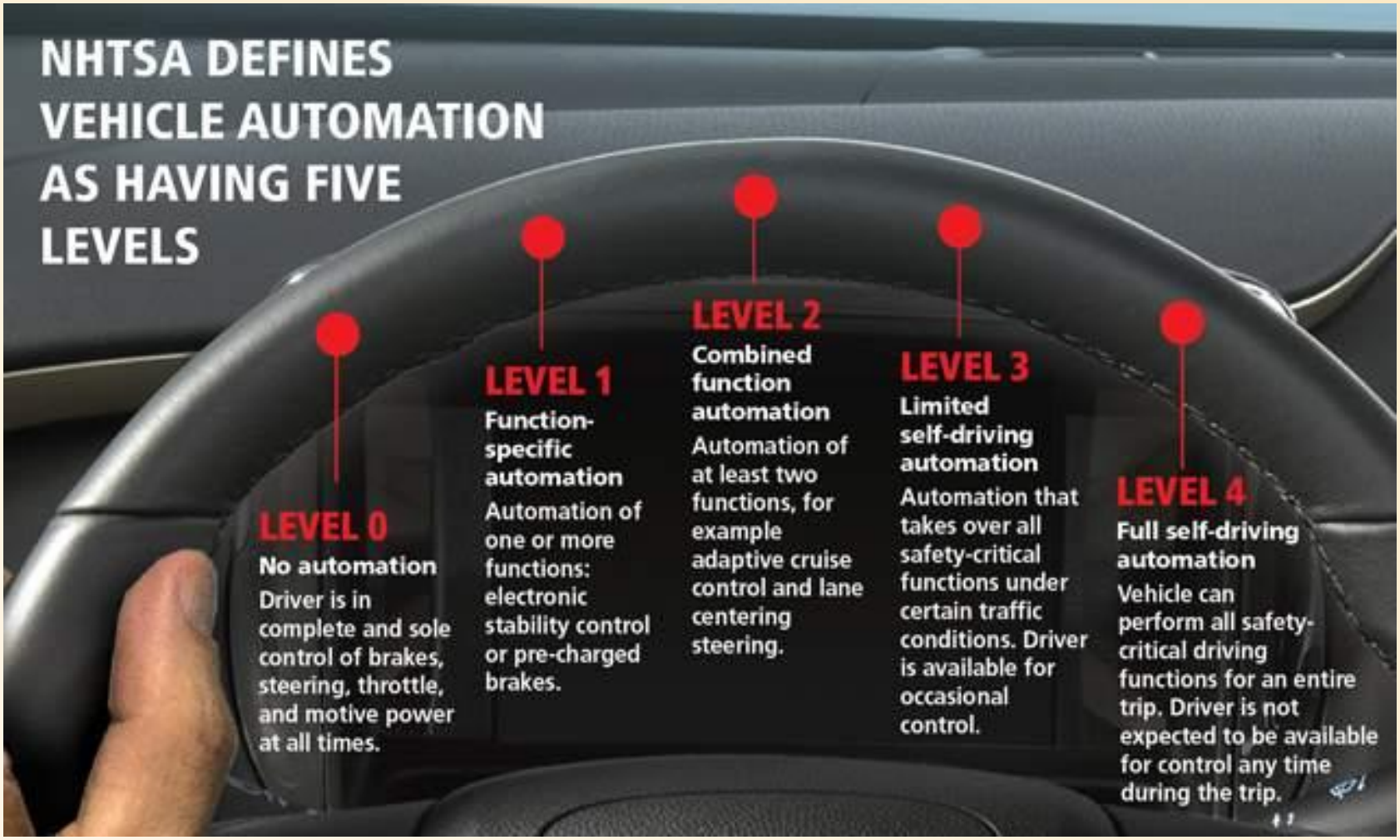
Autonomous Automated Vehicle
Operates in isolation from other vehicles *using internal sensors*

Connected Automated Vehicle
Leverages autonomous automated and connected vehicles

Connected Vehicle
Communicates *with nearby vehicles and infrastructure*

https://www.youtube.com/watch?v=YxmLkqVrg4c

Connected and Autonomous Vehicles



§ ***Connected Vehicles*** - we will see a connected fleet with level 1-3 automation in the next ~~10~~ **5 years**

§ ***Automated Vehicles*** - estimated that up to 30 percent of the fleet will be automated by 2030

Connected and Autonomous Vehicles

§ ***SAE LEVELS OF AUTOMATION***

SAE Level	Name	Narrative Definition	Execution of Steering/ Acceleration/ Deceleration	*Monitoring of* Driving Environment	Fallback Performance of *Dynamic Driving Task*	System Capability (*Driving Modes*)
Human driver monitors the driving environment						
0	No Automation	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	Driver Assistance	the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes
2	Partial Automation	the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	**System**	Human driver	Human driver	Some driving modes
Automated driving system ("system") monitors the driving environment						
3	Conditional Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task* with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	**System**	Human driver	Some driving modes
4	High Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes
5	Full Automation	the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	**All driving modes**

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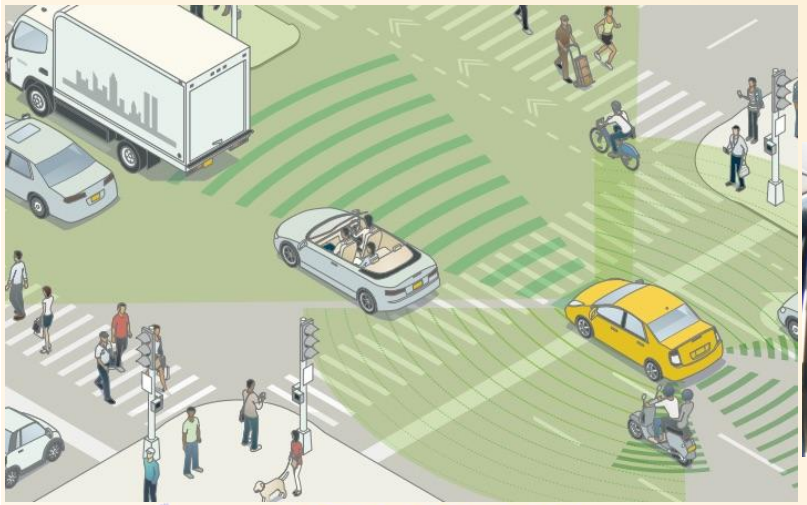
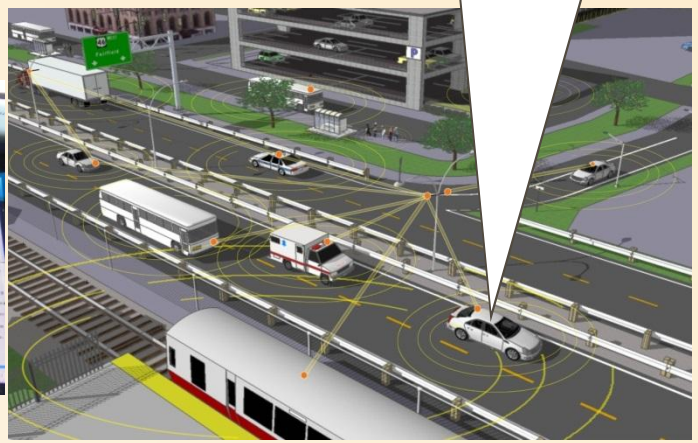
Connected and Autonomous Vehicles

- Connected Vehicles use ***wireless technology*** to "connect" vehicles to each other and/or to infrastructure (for example, cell tower, roadside equipment, hand-held device)
  - Dedicated short-range communication (DSRC)
  - Cellular

- Vehicle- to-Vehicle (V2V) Communications
- Vehicle-to-Infrastructure (V2I) Communications
- Vehicle-to-Vehicle and Vehicle-to-Infrastructure (V2X) Technology
- Vehicle-to-pedestrian (V2P) Communications

latitude, longitude, time, heading angle, speed, lateral acceleration, longitudinal acceleration, yaw rate, throttle position, brake status, steering angle, headlight status, wiper status, external temperature, turn signal status, vehicle length, vehicle width, vehicle mass, bumper height





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Connected and Autonomous Vehicles

- **Autonomous Vehicles**
  - Sense their surroundings with such techniques as ***radar, sensor technologies (LiDAR), GPS***, and computer vision
  - Advanced control systems interpret sensory information to identify appropriate ***navigation paths, as well as obstacles and relevant signage, traffic signals, etc.***
  - Some autonomous vehicles ***update their maps*** based on sensory input, allowing the vehicles to keep track of their position even when conditions change or when they enter uncharted environments

Connected and Autonomous Vehicles

- **CV: V2V and V2I Communications Overview**

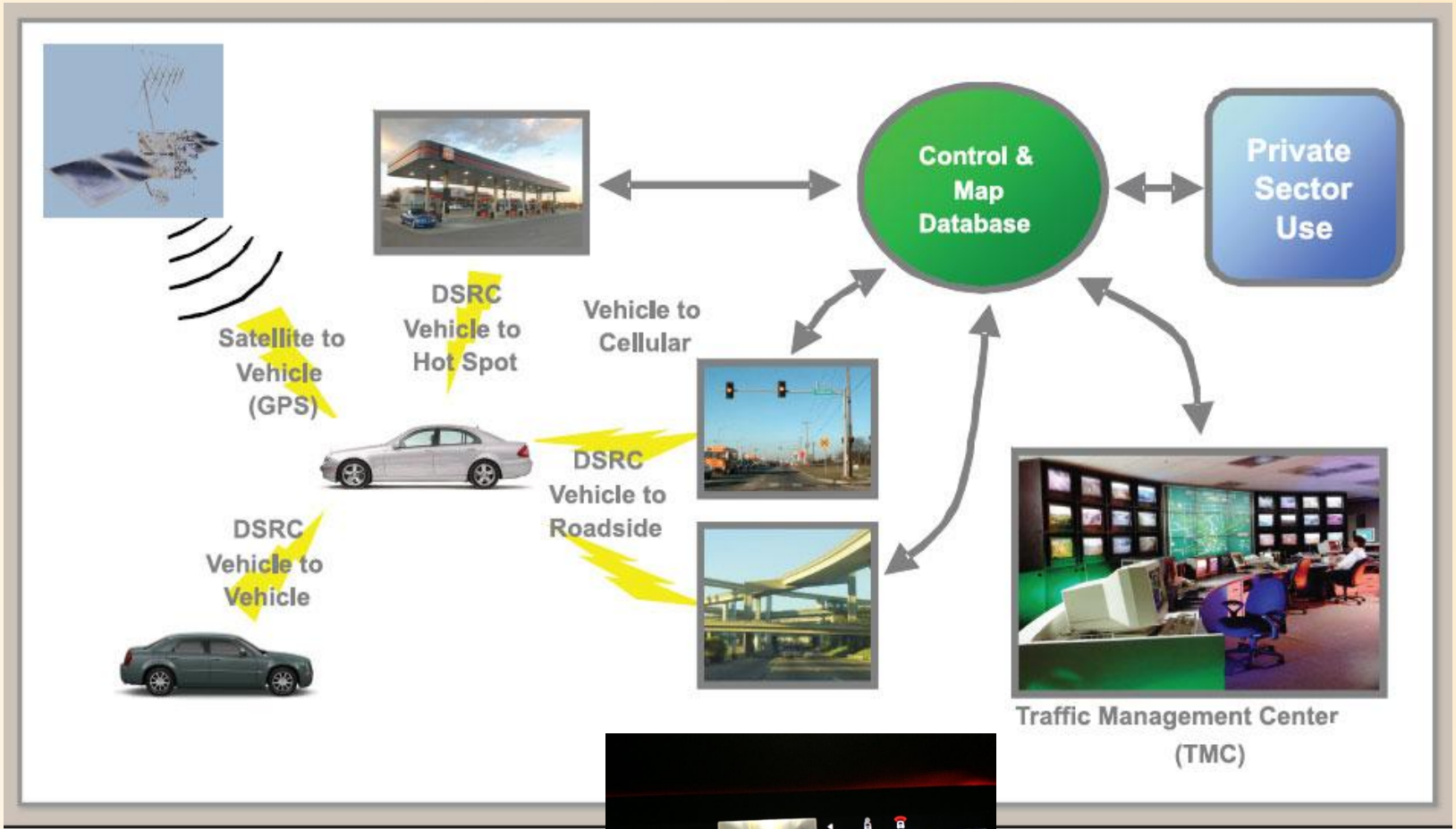


Figure 1. Wireless communications between the infrastr... Dedicated Short Range Communication (DSRC) network[4].

CV / AV Applications

V2I Safety

Red Light Violation Warning
Curve Speed Warning
Stop Sign Gap Assist
Spot Weather Impact Warning
Reduced Speed/Work Zone Warning
Pedestrian in Signalized Crosswalk Warning (Transit)

V2V Safety

Emergency Electronic Brake Lights (EEBL)
Forward Collision Warning (FCW)
Intersection Movement Assist (IMA)
Left Turn Assist (LTA)
Blind Spot/Lane Change Warning (BSW/LCW)
Do Not Pass Warning (DNPW)
Vehicle Turning Right in Front of Bus Warning (Transit)

Agency Data

Probe-based Pavement Maintenance
Probe-enabled Traffic Monitoring
Vehicle Classification-based Traffic Studies
CV-enabled Turning Movement & Intersection Analysis
CV-enabled Origin-Destination Studies
Work Zone Traveler Information

Environment

Eco-Approach and Departure at Signalized Intersections
Eco-Traffic Signal Timing
Eco-Traffic Signal Priority
Connected Eco-Driving
Wireless Inductive/Resonance Charging
Eco-Lanes Management
Eco-Speed Harmonization
Eco-Cooperative Adaptive Cruise Control
Eco-Traveler Information
Eco-Ramp Metering
Low Emissions Zone Management
AFV Charging / Fueling Information
Eco-Smart Parking
Dynamic Eco-Routing (light vehicle, transit, freight)
Eco-ICM Decision Support System

Road Weather

Motorist Advisories and Warnings (MAW)
Enhanced MDSS
Vehicle Data Translator (VDT)
Weather Response Traffic Information (WxTINFO)

Mobility

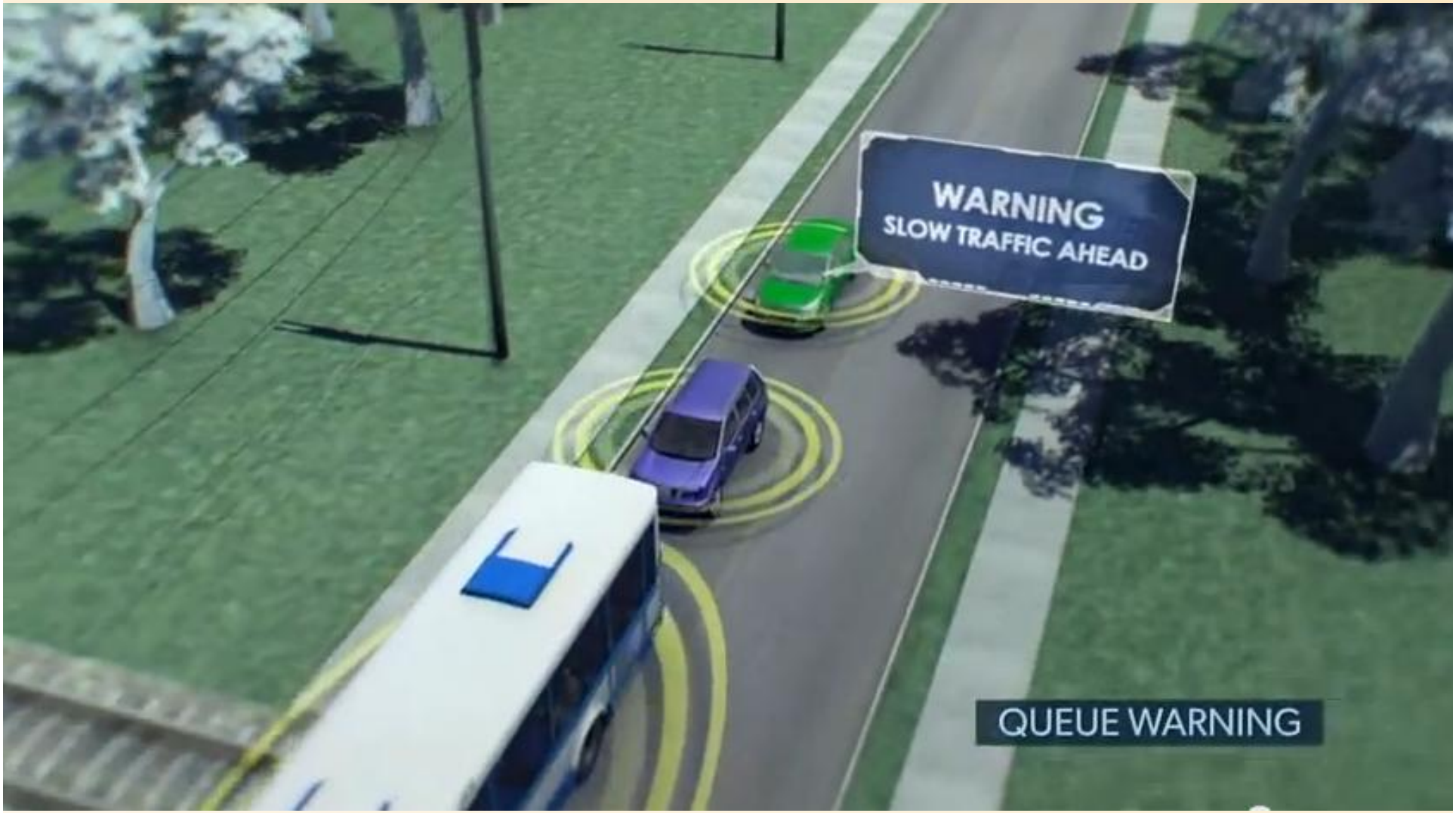
Advanced Traveler Information System
Intelligent Traffic Signal System (I-SIG)
Signal Priority (transit, freight)
Mobile Accessible Pedestrian Signal System (PED-SIG)
Emergency Vehicle Preemption (PREEMPT)
Dynamic Speed Harmonization (SPD-HARM)
Queue Warning (Q-WARN)
Cooperative Adaptive Cruise Control (CACC)
Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)
Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)
Emergency Communications and Evacuation (EVAC)
Connection Protection (T-CONNECT)
Dynamic Transit Operations (T-DISP)
Dynamic Ridesharing (D-RIDE)
Freight-Specific Dynamic Travel Planning and Performance
Drayage Optimization

Smart Roadside

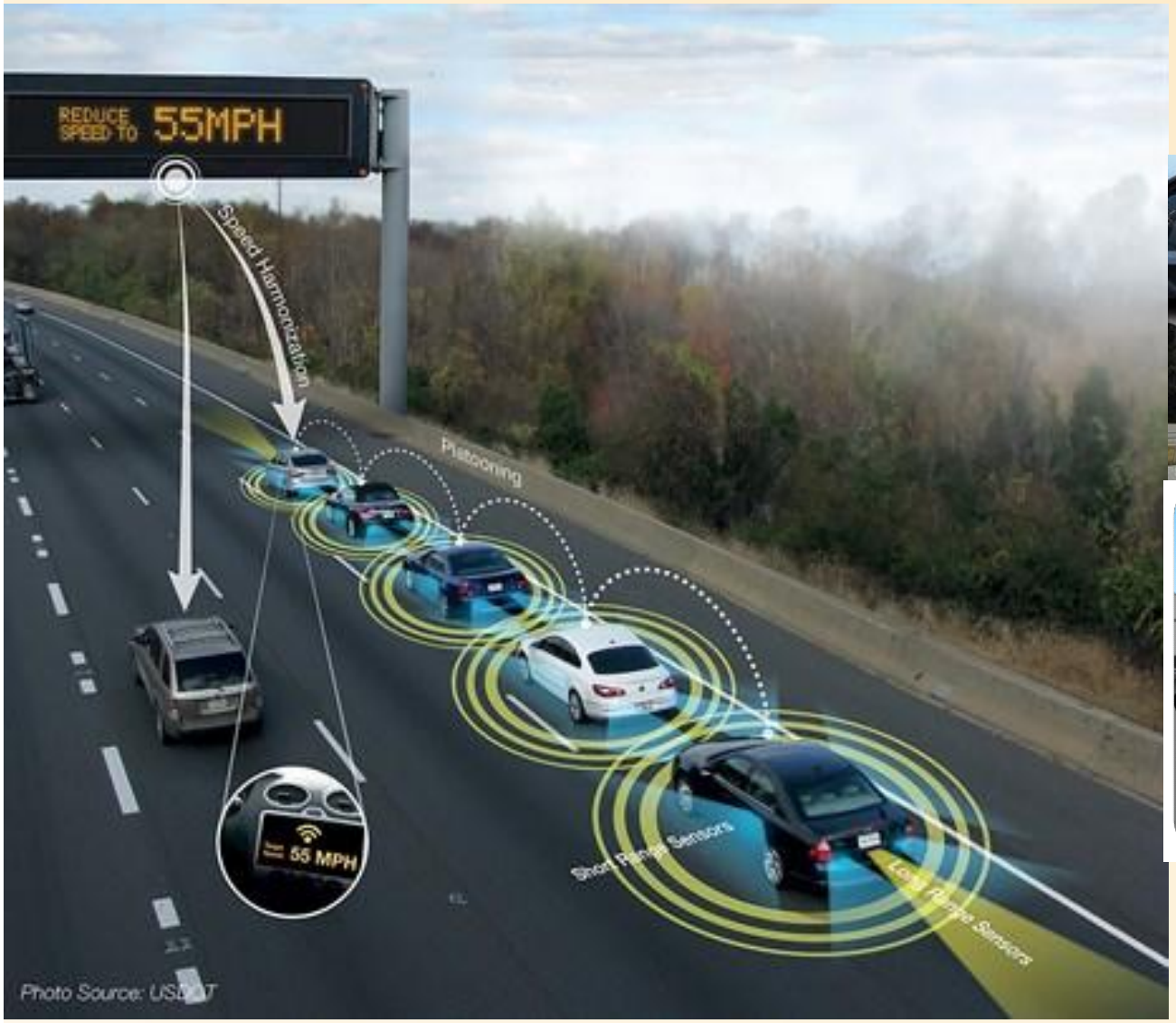
Wireless Inspection
Smart Truck Parking

Traffic Incident Management Applications

Traffic Incident Management Applications



Traffic Management Applications



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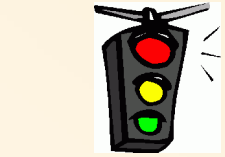
Traffic Management Applications

- **Connected Signals**
  - EnLighten
- Traffic Technology Services
  - Personal Signal Assistant



Pasadena TMC

Connected Signals

tts TRAFFIC TECHNOLOGY SERVICES

BMW Audi VW

ADVANTEC Consulting Engineers

Weather Management Applications

Other Applications

- Automated Transit (2014 – 14 pilot projects)
- Automated Taxis (UBER?)
- Automated Parking

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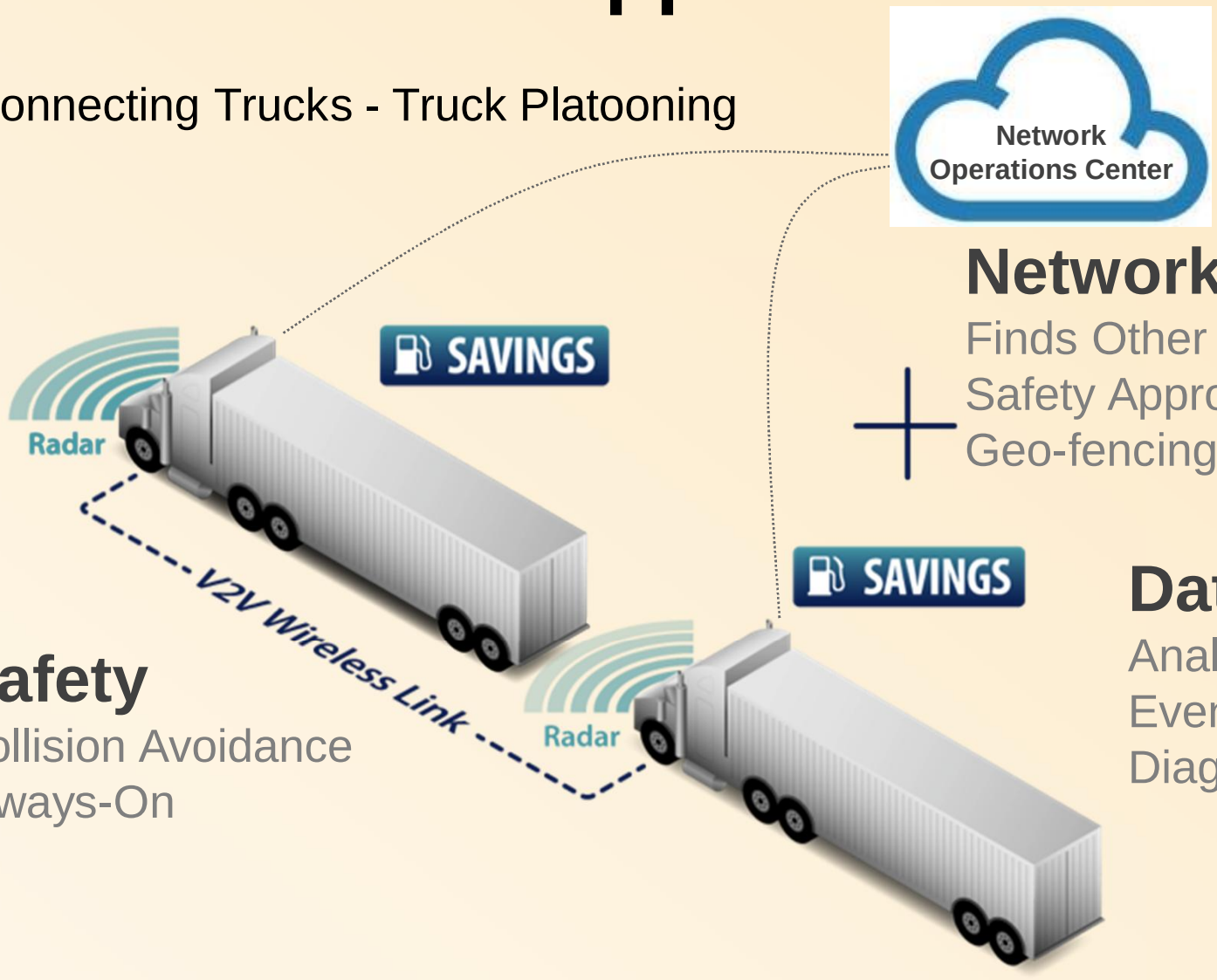
Other Applications

§ Connecting Trucks - Truck Platooning



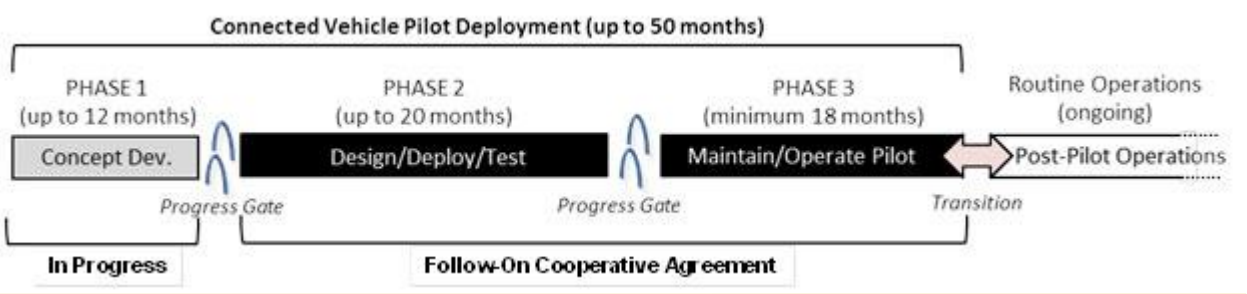
Networked
Finds Other Trucks
Safety Approval
Geo-fencing

Safety
Collision Avoidance
Always-On

Data
Analytics
Event Capture
Diagnostics

FHWA CV Pilot Deployment Program

- Awarded $42 million in Next Generation Connected Vehicle Technologies
- ***NY City*** - install V2V technology in 10,000 city-owned vehicles
  - Upgrading traffic signals to V2I
- ***Wyoming*** - efficient and safe movement of freight using V2V and V2I
- ***Tampa, Florida*** - solve congestion and safety issues; equipping smart phones to provide V2P
- Proposed FHWA Rulemaking (2016)
  - It will require installation of V2V communications in all new light vehicles



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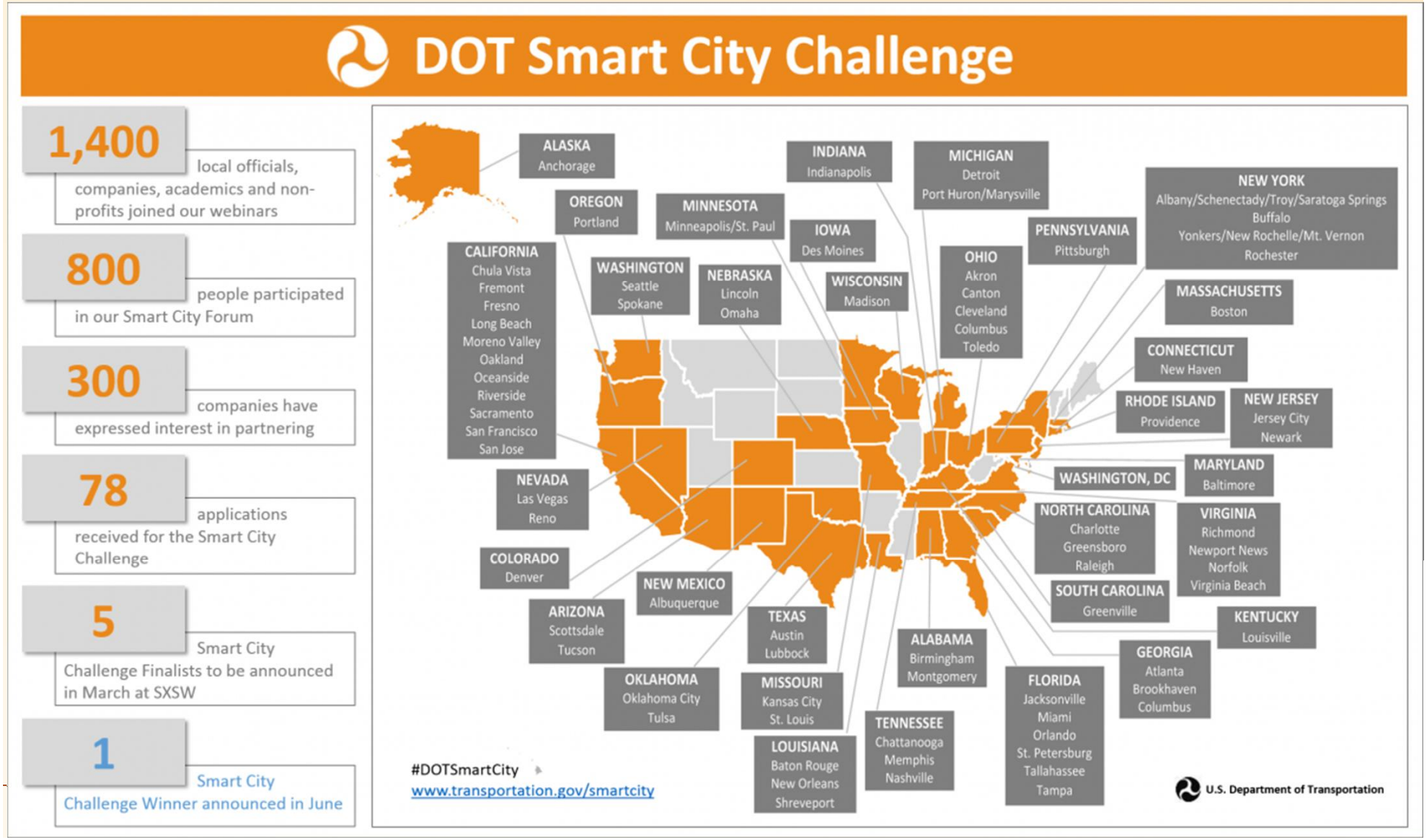
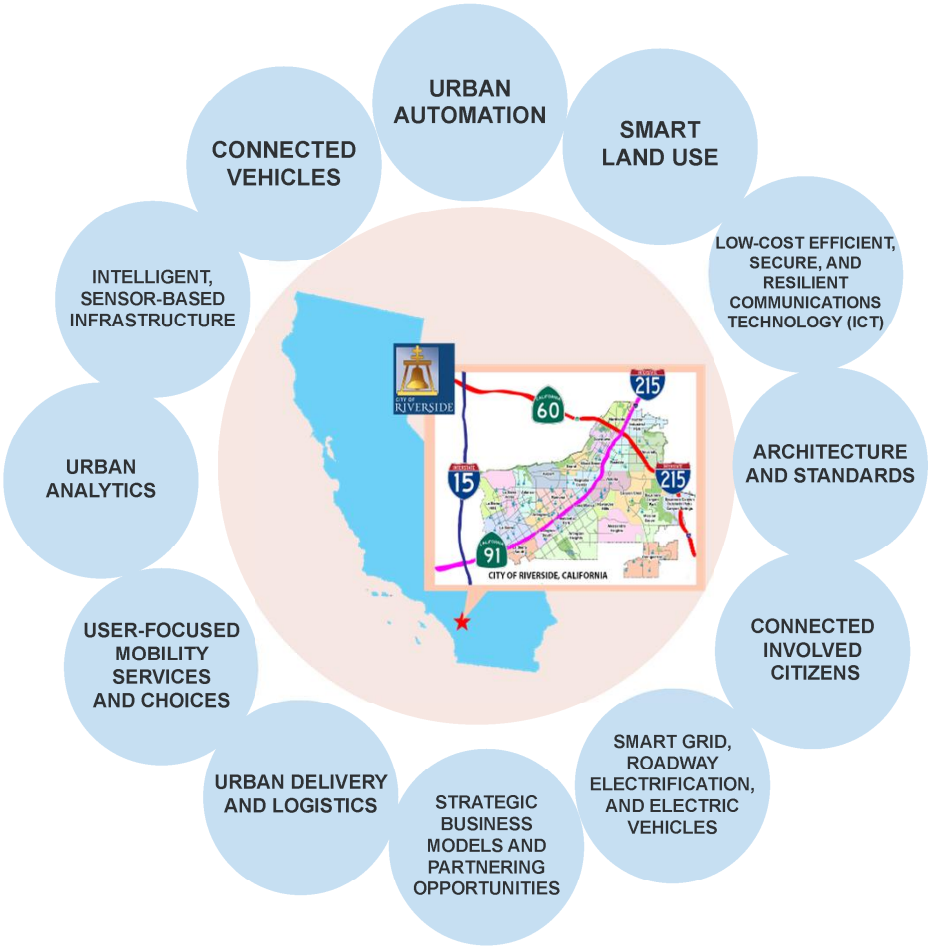
USDOT Beyond Traffic: The Smart Transportation Challenge Grant Application

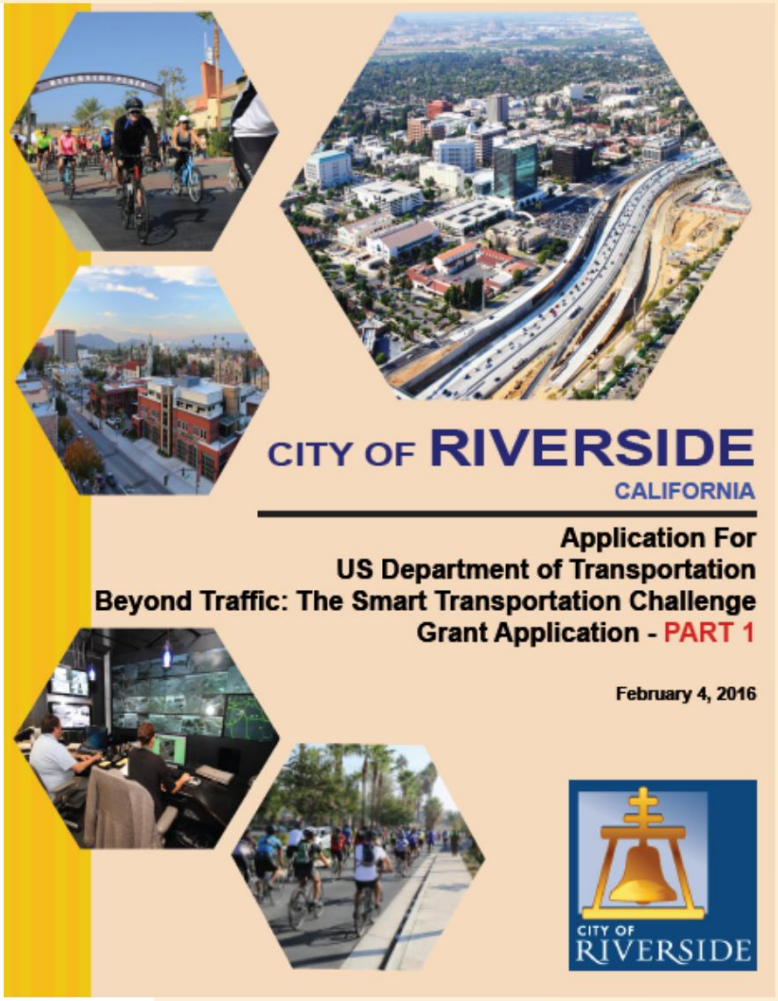
- Opportunity to highlight the role of **public-private partnerships** in addressing our transportation challenges
- USDOT **($40 million**) will partner with Vulcan Philanthropy for this competition
- Vulcan is offering up to an additional **$10 million** to support the deployment of electric vehicles and other carbon emission reduction strategies
- Winning city will view Intelligent Transportation Systems (ITS), connected vehicles, and automated vehicles as the next logical step in its existing, robust transportation infrastructure
- It should also aim to have critical systems in vehicles and infrastructure that communicate with each other, allow for active citizen participation, and integrate new concepts that leverage the sharing economy

USDOT Beyond Traffic: The Smart Transportation Challenge Grant Application



USDOT Beyond Traffic: The Smart Transportation Challenge Grant Application





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Google
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Consulting Engineers
Microsoft
IBM
BOSCH
Invented for life
Caltrans
CALIFORNIA DEPARTMENT OF TRANSPORTATION
Riverside
University
HEALTH SYSTEM
WRCOG
WESTERN RIVERSIDE
COUNCIL OF GOVERNMENTS
SOUTHERN CALIFORNIA
ASSOCIATION of
GOVERNMENTS
METROLINK.
RTA
Riverside Transit Agency
RCTC
Riverside County Transportation Commission
CALIFORNIA
PATH
UC RIVERSIDE
UNIVERSITY OF CALIFORNIA
CALIFORNIA STATE POLYTECHNIC UNIVERSITY
19 38
POMONA
THE OHIO STATE
UNIVERSITY
airsage
INRIX
TOMTOM
QUANERGY
swarco
Trafficware
Engineered by Naztec
WMC
verizon
SIEMENS
Peloton
PHILIPS
SENSYS
networks
Savari
www.savari.net
CUBIC
DENSO
ORACLE
ECONOLITE
Solutions that Move the World
ITERIS
McCain
QUALCOMM
APEX
Connected
Signals
Citilog
cisco
HITACHI
Inspire the Next
EtherWAN

USDOT Beyond Traffic: The Smart Transportation Challenge Grant Application

BEYOND TRAFFIC: THE SMART CITY CHALLENGE
CITY OF RIVERSIDE, CALIFORNIA
ACADEMIA

PARTNER TYPE	RIVERSIDE TEAM PARTNERS	LETTER OF SUPPORT RECEIVED	VISION ELEMENTS #1 URBAN AUTOMATION	#2 CONNECTED VEHICLES	#3 INTELLIGENT, SENSOR-BASED INFRASTRUCTURE	#4 URBAN ANALYTICS	#5 USER-FOCUSED MOBILITY SERVICES AND CHOICES	#6 URBAN DELIVERY AND LOGISTICS	#7 STRATEGIC BUSINESS MODELS AND PARTNERING OPPORTUNITIES	#8 SMART GRID, ROADWAY ELECTRIFICATION, AND ELECTRIC VEHICLES	#9 CONNECTED INVOLVED CITIZENS	#10 ARCHITECTURE AND STANDARDS	#11 LOW-COST EFFICIENT, SECURE, AND RESILIENT COMMUNICATIONS TECHNOLOGY (ICT)	#12 SMART LAND USE
	UC RIVERSIDE	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	
	PATH	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	
	UCIrvine													
		✓			✓	✓			✓	✓				
	CAL POLY SAN LUIS OBISPO	✓			✓	✓			✓	✓				
	THE OHIO STATE UNIVERSITY	---												

BEYOND TRAFFIC: THE SMART CITY CHALLENGE
CITY OF RIVERSIDE, CALIFORNIA
SHARED MOBILITY

PARTNER TYPE	RIVERSIDE TEAM PARTNERS	LETTER OF SUPPORT RECEIVED	VISION ELEMENTS #1 URBAN AUTOMATION	#2 CONNECTED VEHICLES	#3 INTELLIGENT, SENSOR-BASED INFRASTRUCTURE	#4 URBAN ANALYTICS	#5 USER-FOCUSED MOBILITY SERVICES AND CHOICES	#6 URBAN DELIVERY AND LOGISTICS	#7 STRATEGIC BUSINESS MODELS AND PARTNERING OPPORTUNITIES	#8 SMART GRID, ROADWAY ELECTRIFICATION, AND ELECTRIC VEHICLES	#9 CONNECTED INVOLVED CITIZENS	#10 ARCHITECTURE AND STANDARDS	#11 LOW-COST EFFICIENT, SECURE, AND RESILIENT COMMUNICATIONS TECHNOLOGY (ICT)	#12 SMART LAND USE
SHARED MOBILITY PROVIDER - RIDE SHARING	lyft	✓				✓	✓		✓		✓		✓	✓
	vRide	✓				✓	✓		✓		✓		✓	✓
SHARED MOBILITY PROVIDER - CAR SHARING	zipcar	✓		✓		✓	✓		✓	✓	✓		✓	✓
SHARED MOBILITY PROVIDER - BIKE SHARING	BCycle	✓				✓	✓		✓		✓		✓	✓
	sobi SOCIALCYCLES	✓				✓	✓		✓		✓		✓	✓
	Zagster	✓				✓	✓		✓		✓		✓	✓

USDOT Beyond Traffic: The Smart Transportation Challenge Grant Application

BEYOND TRAFFIC: THE SMART CITY CHALLENGE
CITY OF RIVERSIDE, CALIFORNIA
PROFESSIONAL ASSOCIATIONS

PARTNER TYPE	RIVERSIDE TEAM PARTNERS	LETTER OF SUPPORT RECEIVED	#1 URBAN AUTOMATION	#2 CONNECTED VEHICLES	#3 INTELLIGENT, SENSOR-BASED INFRASTRUCTURE	#4 URBAN ANALYTICS	#5 USER-FOCUSED MOBILITY SERVICES AND CHOICES
PROFESSIONAL ASSOCIATIONS	SAE INTERNATIONAL	✓					
	SmartCitiesCouncil	✓					
	ite	✓					
	ASCE						

BEYOND TRAFFIC: THE SMART CITY CHALLENGE
CITY OF RIVERSIDE, CALIFORNIA
TECHNOLOGY COMPANIES

PARTNER TYPE	RIVERSIDE TEAM PARTNERS	LETTER OF SUPPORT RECEIVED	#1 URBAN AUTOMATION	#2 CONNECTED VEHICLES	#3 INTELLIGENT, SENSOR-BASED INFRASTRUCTURE	#4 URBAN ANALYTICS	#5 USER-FOCUSED MOBILITY SERVICES AND CHOICES	#6 URBAN DELIVERY AND LOGISTICS	#7 STRATEGIC BUSINESS MODELS AND PARTNERING OPPORTUNITIES	#8 SMART GRID, ROADWAY ELECTRIFICATION, AND ELECTRIC VEHICLES	#9 CONNECTED INVOLVED CITIZENS	#10 ARCHITECTURE AND STANDARDS	#11 LOW-COST EFFICIENT, SECURE, AND RESILIENT COMMUNICATION S TECHNOLOGY (ICT)	#12 SMART LAND USE
TECHNOLOGY COMPANIES	McCain	✓		✓	✓	✓			✓			✓	✓	
	ORACLE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Peloton	✓		✓	✓	✓		✓	✓			✓	✓	
	PHILIPS	✓		✓	✓	✓			✓	✓		✓	✓	✓
	AECOM	✓		✓	✓	✓		✓	✓			✓	✓	
	QUALCOMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	QUANERGY	✓	✓	✓	✓				✓					
	RENESAS	✓		✓	✓	✓			✓			✓	✓	✓
	Savari	✓		✓	✓	✓			✓			✓	✓	✓
	SENSYS networks	✓			✓	✓	✓	✓	✓			✓	✓	✓
	SIEMENS	✓		✓	✓		✓		✓			✓		
	swarco	✓		✓	✓		✓		✓		✓			✓
	TrafficWare	✓		✓	✓	✓			✓			✓	✓	
	UBER													
	CUBIC	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	WMC	✓		✓	✓	✓			✓			✓	✓	✓
	verizon	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓

HONDA	2013 - Traffic Jam Assist (Lane Keeping + Adaptive Cruise Control) tested
Mercedes-Benz	2014 – Steering Assist (Lane Keeping + Adaptive Cruise Control) in U.S. production vehicles Self-driving vehicle for sale by 2020
VOLVO	2015 – Traffic Jam Assist (Lane Keeping + Adaptive Cruise Control) in U.S. production vehicles
Audi	2016 – Traffic Jam Assist (Lane Keeping + Adaptive Cruise Control) in U.S. production vehicles
BOSCH	2014 - Traffic Jam Assist technology
NISSAN	Self-driving vehicle for sale by 2020
General Motors	Self-driving vehicle for sale by 2020
Google	Self-driving vehicle for sale by 2017
TOYOTA	Researching a semi-autonomous vehicle designed to keep the driver in the control loop and takeover in case of an imminent accident
TESLA	Self-driving vehicle for sale in 2016

Connected and Autonomous Vehicles

BUSINESS INSIDER BI INTELLIGENCE

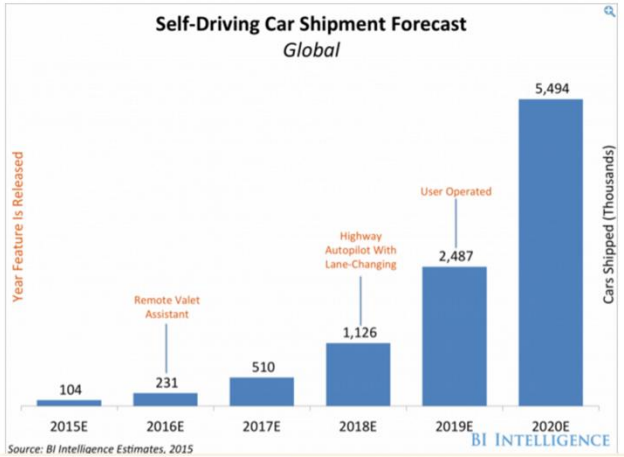
How Google will put self-driving cars on the road in four years

Jonathan Camhi
Oct. 6, 2015, 5:20 PM 2,410 1

FACEBOOK LINKEDIN TWITTER EMAIL PRINT

Google is taking a different approach to developing self-driving cars than the many automakers and auto parts providers that are also developing them. Auto companies plan to roll out automated functions – like automatic braking and lane departure warning – to their cars piecemeal over the next few years. These automated functions will help prevent accidents and make driving safer, and (automakers hope) train consumers to trust their cars to drive themselves. That trust will should build a viable market for self-driving cars down the road.

Google isn't concerned with taking these stepping-stones to habituate consumers to self-driving technology. It's going directly to a self-driving car, and plans to have a completely autonomous vehicle available for the public in four years, according to WIRED.



Technology Smartphones Toyota

Toyota promises self-driving car with 'autopilot switch' by 2020

By Alistair Charlton
October 6, 2015 11:35 BST

13 15

Toyota plans to get cars with an autopilot function into showrooms by 2020 (Reuters)

Toyota plans to sell semi-autonomous cars capable of driving themselves on motorways by 2020. The vehicles will have an autopilot system that can be turned on by the driver at the flick of a switch, giving full control – in certain circumstances – to the car.

This vision sees Toyota join Nissan, Tesla, Honda and many other car companies – plus Google and, if rumours are to be believed, Apple – in the race to produce a new type of car capable of driving itself. This week also saw Google demonstrate its self-driving cars to journalists for the first time. Its pod-like vehicles have no conventional car controls at all, making them fully

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Volkswagen Shares Plunge as Emissions Scandal Spreads

San Francisco Rejects 'Airbnb Initiative'

Glencore Says It Is Cutting Debt Faster Than Expected

Deadline for AB InBev, SABMiller Deal Extended

Tim... Gives W... Shares S...

BUSINESS

Nissan Speeds Ahead of Rivals With Plans for Driverless Car

Japanese auto maker plans to have a version of its autonomous vehicle ready for consumers by 2020

By MIKE RAMSEY
Updated Oct. 29, 2015 8:43 p.m. ET

Nissan Motor Co. is aggressively pushing forward with plans for a mostly autonomous car that will be ready for sale to consumers by 2020, putting it well ahead of its global competitors.

Chief Executive Carlos Ghosn said the technology would be ready by the Japanese auto maker's self-imposed deadline—though he wasn't sure if it would be legal on any nation's roads.

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ORACLE

Cadillac to Introduce Advanced 'Intelligent and Connected' Vehicle Technologies on Select 2017 Models

Super Cruise and V2V technologies slated for production in about two years

2014-09-07

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DETROIT – Cadillac will begin offering advanced "intelligent and connected" vehicle technologies on certain 2017 model year vehicles, General Motors CEO Mary Barra said Sunday during her keynote address at the Intelligent Transport System (ITS) World Congress in Detroit.

In about two years, an all-new 2017 Cadillac vehicle will offer customers an advanced driver assist technology called Super Cruise and in the same timeframe the 2017 Cadillac CTS will be enabled with vehicle-to-vehicle (V2V) communication technology.

"A tide of innovation has invigorated the global auto industry, and we are taking these giant leaps forward to remain a leader of new technology," Barra said. "We are not doing this for the sake of the technology itself. We're doing it because it's what customers around the world want. Through technology and innovation, we will make driving safer."

Reality is Here!

Volvo: We will be responsible for accidents caused by our driverless cars

By Alistair Charlton
October 9, 2015 12:22 BST

463 135

Volvo asks US and Europe to improve self-driving cars laws as it takes full responsibility for future autonomous accidents (Reuters)

Volvo has become one of the first car companies to confirm that it will accept full responsibility for any accidents caused by its future driverless cars. The carmaker's stance is an effort to speed up regulations which currently fail to fully recognise how autonomous cars and their manufacturers should be liable.

Mercedes and Google have made similar claims, as they and the industry as a whole work to develop autonomous features which take control and responsibility away from the driver. Volvo has described current US and European law regarding self-driving cars and liability as "a patchwork of rules and regulations".

Last Updated: October 26, 2015 01:56pm ET

OTHER NEW TECHNOLOGY

Driverless Technology Hits Residential

By Carrie Rossenfeld | San Diego

What's your success story? Let Real Estate Forum and GlobeSt.com know for a new feature, Fastest Growing Companies. Nominate your company by November 9.

Lilac Hills Ranch will be the first community in the state that will implement this technology.

BONSALL/VALLEY CENTER, CA—Driverless technology, run by an app, will allow **Lilac Hills Ranch** to operate as a pedestrian-friendly community with state-of-the-art **sustainability** features, **developer Accretive Investments Inc.**'s president **Jon Rilling** tells GlobeSt.com. The proposed **development** is a half mile off the I-15 freeway to the east here and is the first master-planned community to go through the new county general plan process.

The development will feature a village-style approach whereby every home will be within a 10-minute walk to the **grocery store** and village center. The proposed 1,700-unit build out in five phases will have a K-8 school, a 50-room country inn, senior center, water-reclamation plant and other amenities and is expected to go before the **County Board of Supervisors** soon. It's been approved by county staff and the planning commission, and Accretive plans to start development in about a year. We spoke exclusively with Rilling about the proposed driverless technology and how it will impact community development.

GlobeSt.com: Please explain how driverless technology is coming to this community.

Rilling: We've collaborated with **5B Robotics**, a local technology firm in Carlsbad, CA, to introduce in concept autonomous or driverless vehicles in the Lilac Hills Ranch community that would provide services to establish a more pedestrian-oriented community and more interconnected neighborhoods. It's widely accepted that people will walk more if there are alternative modes of travel available to them. This technology would allow somebody to pull up an app on their smartphone and order a driverless electric vehicle to pick them up and take them to another point in the community. It could also be used to deliver groceries or household goods. Technology like this can reduce greenhouse-gas emissions by reducing the number of car trips that a household would need to take in a given day.

The goal is to use 21st-Century technology to augment and promote the pedestrian experience in the community. The plan is to integrate these vehicles throughout the community, and they would only be available to residents in the community to help people with daily household chores. They can also be used to increase safety by providing advanced life-support systems such as automatic external defibrillators. We're primarily focused on introducing the technology and allowing the use to be adapted and used as necessary. It works on a localized virtual rail network—not a GPS system—that keeps the vehicles on a defined pathway. If someone summons a car, it will be preprogrammed to follow a certain route, and the resident can take it anywhere within the community. The car can come in a lot of different shapes and forms; it's platform adaptable.

Last week, during the approval of the **SANDAG** San Diego Forward regional plan, there was a discussion of the future of our roads and **infrastructure** being focused on driverless technology. This will be the first community in the state that will implement that technology.

Reality is Here!

The Washington Post

Business

General Motors invests $500m in Lyft, forms partnership

By Dee-Ann Durbin | AP January 4

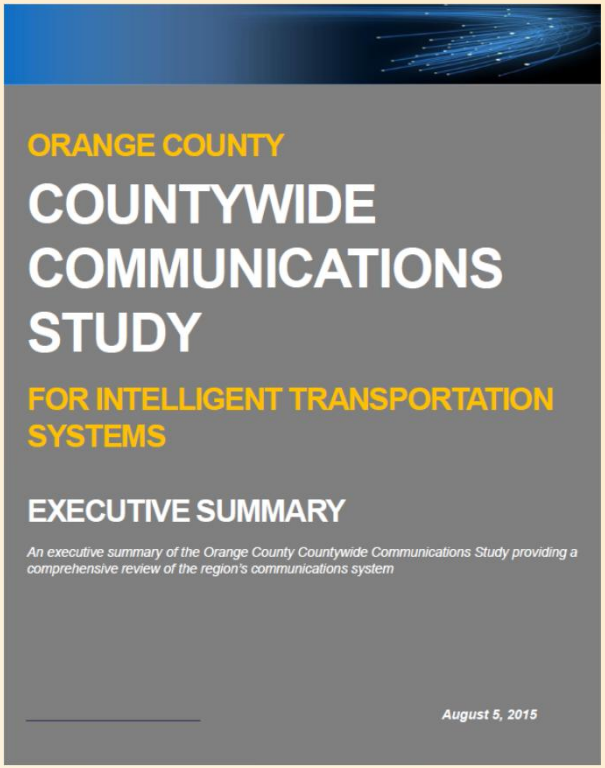
DETROIT — The automotive industry is placing its biggest bet yet that using a device to hail a ride — with or without a driver — is the future of transportation.

General Motors Co. said Monday it is investing $500 million in ride-hailing company Lyft Inc. and forming an unprecedented partnership that could eventually lead to on-demand, self-driving cars. It's the largest investment yet by a traditional automaker in a new mobility company, and is an acknowledgement by GM that the transportation landscape is changing fast.

"We see the world of mobility changing more in the next five years than it has in the last 50," GM President Dan Ammann told The Associated Press.

Challenges to Our Profession

- **Understanding CV/AV Challenges**
  - Incorporating CV/AV in Transportation Planning, Design, O&M, Funding Process and Policies
  - Public Policy Challenges
  - Agency Indemnification
  - Cyber Security
  - Wireless Connectivity
  - Truck Automation/Platooning
  - First and Last Mile (transit)
  - Electrification
  - Vehicle Insurance Challenges
  - Human Factors in Automated Vehicles



Challenges to Our Profession

- **City of Vancouver, Canada**

B.4

MOTION ON NOTICE

4. Preparing Vancouver for Autonomous and Driverless Cars

MOVER: Councillor Meggs
SECONDER:

WHEREAS

3. Driverless or autonomous vehicle technology is now progressing so rapidly that Ontario has permitted testing of such vehicles in 2016 and may allow regular use in the near future;

4. This new technology poses new challenges to protection of privacy in its collection of data, and offers new margins of safety, dramatic improvements in efficiency and the potential to free large areas of urban land for better use;

THEREFORE BE IT RESOLVED THAT Council direct staff to report back on:

- the implications, both positive and negative, of this technology on the City's transportation, land use, economic and sustainability plans, as well as the steps necessary to update those plans; and
- the views of the City's planning, transportation and technology experts on the best ways to maximize the benefits of this technology for the city and its economy while mitigating potential negative impacts.

Challenges to Our Profession

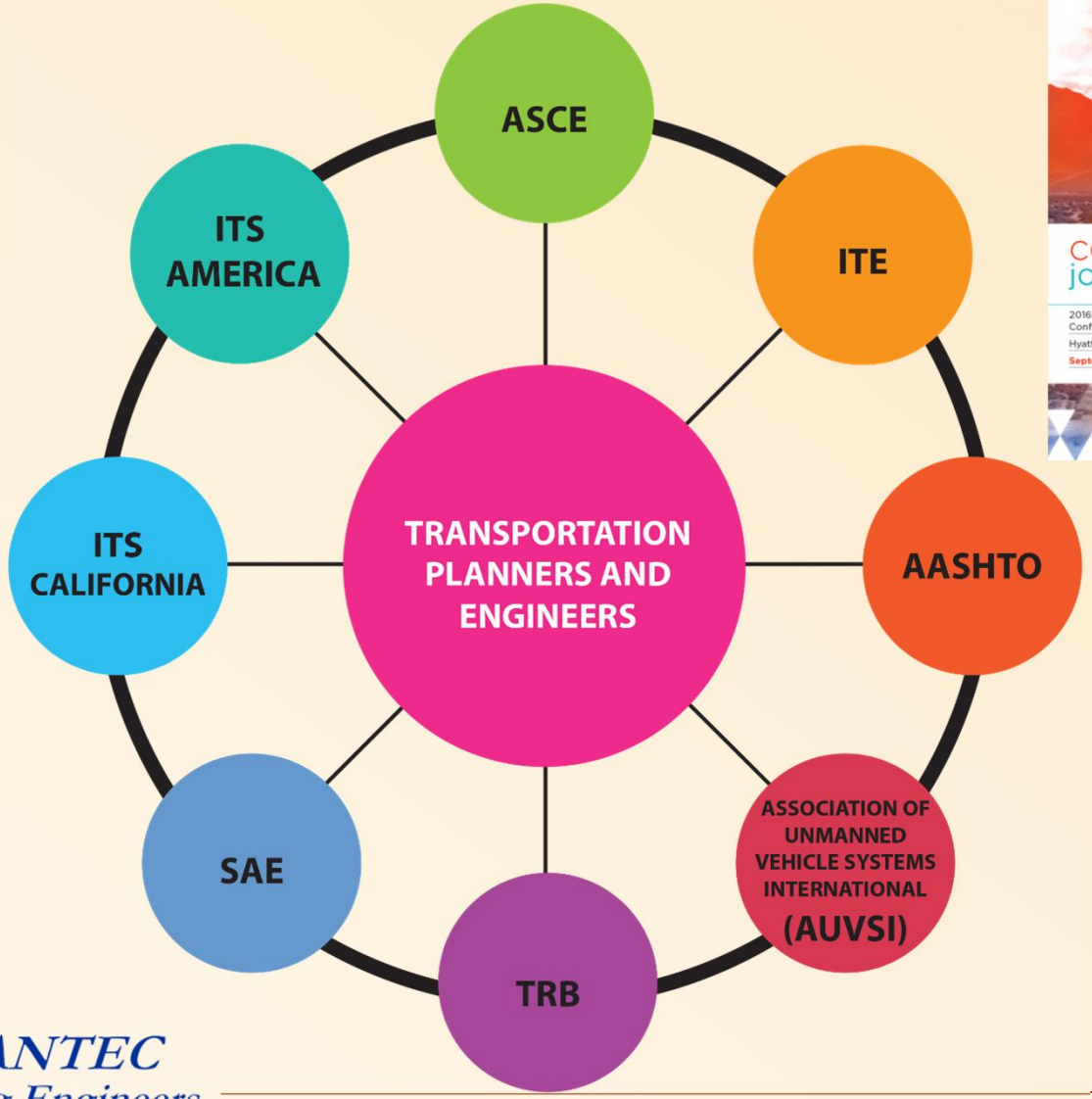
- **Funding Policies**
  - Investment in ***Smart Roadway Technologies***
  - ***Installation, Maintenance, and Operations***
  - Educate our DOTs, MPOs, cities, agencies
  - Educate agency management team
  - California is always the leader!

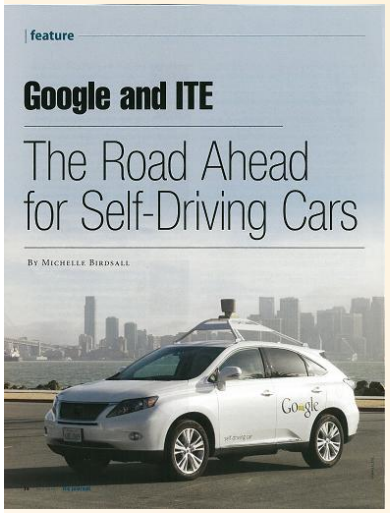
- Changes to Our Workforce
  - Traffic Engineering
  - Electrical Engineering
  - ITS and communication networks
  - IT
  - Cyber security
  - System engineering

- Driverless Bus – Switzerland, Spring 2016

Challenges to Our Profession

Challenges to Our Profession





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QUESTIONS?

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