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FutureStructure

November 2014

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IN MOTION:
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100 Blue Ravine Road
Folsom, CA 95630
916-932-1300

Special Report
Cars equipped with vehicle-to-vehicle (V2V) communication share data with each other about their speed, heading and direction. With V2V all cars know where they are in relation to other cars on the road.

Buses with connected vehicle technology will know whether there are riders waiting at bus stops and whether those riders need extra time to load bikes or wheelchairs. This data will help optimize routes in real time.

V2V technology alerts drivers of potentially unsafe situations, such as making a right turn when another vehicle may pose a collision risk. Drivers will receive audio, visual or haptic alerts to help prevent accidents.

Pedestrians and cyclists with smartphones or wearable devices will make their presence known to drivers and vice versa. Cars and citizens utilizing this vehicle-to-pedestrian technology will make streets safer for everyone.

Vehicle-to-infrastructure (V2I) technology facilitates communication among vehicles and roadside infrastructure, such as traffic signals, helping drivers hit more green lights to avoid stop and go driving.

Instead of laying a cable across the road once per year to measure traffic, V2I will feed real-time traffic and road condition data to traffic operations centers, greatly improving understanding of citywide traffic.
By Janice King, Contributing Writer

OH THE PLACES WE’LL GO!

HOW THE NEW TRANSPORTATION INFRASTRUCTURE

Special Report
A STRUCTURE WILL CHANGE EVERYTHING.

Connected and autonomous vehicle technology will help optimize roadway utilization, potentially saving billions in future infrastructure expansion.
The transportation systems around which the modern world has been built are on the verge of a significant transformation. Intelligent transportation systems (ITS) are making driving and traffic management better and safer for everyone. Transportation typifies the Future-Structure framework. Soft infrastructure — the realm of concepts, policies and legislation — is rapidly evolving to accommodate the demand for global investment in hard transportation infrastructure. Technology is bridging the two as vehicles and the infrastructure on which they operate become increasingly connected.

Traffic and population growth create demand for more transportation infrastructure, but many jurisdictions don’t have sufficient money or space to build more roads and rail. Despite cities lacking funds population growth will continue — the World Health Organization expects 7 out of 10 people on the planet will live in cities by mid-century. Coupled with climate change concerns, cities leaders must start rethinking the very nature of existing transportation systems.

New transportation technologies are emerging to meet these challenges, including connected and autonomous vehicles, alternative fuels, keyless fleet management and traffic analytics, as well as local zoning and planning policies that support transit-oriented development. New technology for on-road communications will dramatically change how vehicles operate and provide information and capabilities for better, real-time traffic management — if the necessary network infrastructure is in place.

The Promise of ITS

“Cities are struggling with transportation today and will struggle even more in the future,” said Bill Ford, Jr., executive chairman of the Ford Motor Company, while addressing the ITS World Congress in Detroit in September 2014. “We need to redefine what mobility is for the coming century.”

According to the U.S. Department of Transportation, ITS improves transportation safety and mobility by integrating advanced, wireless communications technologies into transportation infrastructure and vehicles. The purpose of ITS is to process and share information that can prevent vehicle collisions, keep traffic moving and reduce environmental impacts.

Coordinating traffic signals, giving signal priority to transit lanes, electronic information signs and variable speed limit signs are all part of the burgeoning ITS industry. Also part of ITS is the ability to automatically distribute real-time traffic data to websites, social media feeds, mobile apps, and local TV and radio stations. “Instead of a bunch of independent systems on the local, national or even global level, ITS creates a transportation network that works like the Internet, where everything is connected, but also open for standards-based communication, which reduces costs and creates value for everyone involved in managing traffic,” said David Pickeral, who leads the Industry Smarter Solutions Team for Transportation at IBM.

Autonomous and Connected Vehicles

Perhaps the most anticipated element of ITS is the connected vehicle. The imminent arrival of connected vehicles.
vehicles is one reason for new visions of transportation within a metro area. Connected technology focuses on wireless communication: vehicle-to-vehicle (V2V), vehicle-to-pedestrian (V2P) and vehicle-to-infrastructure (V2I), collectively referred to as V2X. Intended primarily to improve safety, V2X technology allows cars to continually communicate to the vehicles around them so each are aware of the others’ speed, heading and direction. Connected vehicles also help in recognizing and alerting drivers to dangerous situations. By adding communication points in hazardous road areas and intersections, V2I technology extends crash-reduction capabilities by allowing automatic control of signal timing, speed management, and operation of transit and commercial vehicles.

“The connected vehicle technologies are ready,” said Suzanne Murtha, senior program manager for intelligent transportation initiatives at Atkins Global. “Now it’s a matter of governments capturing and sharing data about real-time, on-the-street traffic conditions so drivers can make better choices.”

A different but related technology is that of autonomous vehicles, perhaps the most famous example of which is the Google self-driving car. Autonomous cars use a combination of LIDAR (similar to sonar but with laser light), GPS, optical cameras and high-time processing power to analyze millions of possible roadway scenarios and then take the appropriate action. The ultimate goal for autonomous vehicle technology is to make the vehicle so intelligent that no driver input is needed. However, truly autonomous vehicles, wherein the driver can give up complete control to the car, remain on the distant horizon. According to Ford, it is incremental technological advancement that will one day lead to driverless cars.

“By the time we get to full autonomy, the last step won’t seem like such a big deal,” he said. “Even as we put in a lot of these features the driver still has to be vigilant and in control.”

Malcolm Dougherty, director of the California Department of Transportation, agreed. At the ITS World Congress he said that while he believed “the development of autonomous vehicle technology is going to accelerate — for the time being the motorist will always be responsible for the vehicle.”

If you buy a new car today, you’re getting a preview of how driving will change as we move into the era of autonomous, connected vehicles. Features that help you park the car in a tight spot, automatically adjust cruise control speeds and sound an alert when the car drifts out of its lane are examples of technology now offered by automakers. Several states have already passed laws that allow autonomous vehicles to operate on public roads.

In September, California approved three permits for Volkswagen, Mercedes and Google to start autonomous vehicle testing under Senate Bill 1298, which requires the state to adopt formal autonomous vehicle testing rules by 2015.

“When SB 1298 was working its way through, everyone thought that the technology was quite a number of years away — and we were all very surprised as we met with the car manufacturers and industry, about how far along the technology really is,” California Department of Motor Vehicles CIO Bernard Soriano told FutureStructure’s sister publication Techwire. “Getting a chance to see the technology up close and being able to experience it is mind-boggling. It’s exciting to be working on this because we’re on the cusp of societal change. I’m not one to use hyperbole, but this one is a game-changer. It will change the way we function as a society, for the better.”

California State Sen. Alex Padilla (D-Pacoima), who introduced SB 1298.
two years ago, shared in the excitement, saying in a statement that “this technology takes a bold step forward. DRIVERLESS VEHICLES WILL REVOLUTIONIZE TRANSPORTATION, REDUCE TRAFFIC ACCIDENTS AND SAVE LIVES. ESTABLISHING SAFETY STANDARDS FOR THESE VEHICLES IS AN ESSENTIAL STEP IN THAT PROCESS.”

Terry D. Bennett, senior industry program manager, civil engineering and planning at Autodesk, said while the autonomous vehicle concept is compelling, focusing on V2I and V2V makes more practical sense in cities. “I think [autonomous cars] more than anything create a lot of space for people to think differently,” he said. “But with Detroit and other cities looking at dedicated roads for vehicle-to-vehicle or vehicle-to-infrastructure communication, you’re starting to see the point that having infrastructure that’s intelligent, has sensors and can communicate, is a much better long term approach than trying to automate a single car.”

Indeed, the U.S. Department of Transportation estimates that V2V technology may eliminate or reduce the impact of up to 80 percent of crashes involving unimpaired drivers. In a Governing Institute survey, 62 percent of local officials agreed that autonomous and connected vehicles will mean fewer crashes. Fifty-one percent also foresee improved mobility and reduced congestion as more intelligent vehicles take to the road.

**Electric Vehicles**

Oregon is gaining both environmental and economic development benefits from its infrastructure and program investments to support electric vehicles (EVs). The most visible of these investments is the West Coast Electric Highway, which includes charging stations along Interstate 5 in Oregon, Washington and eventually California. Based on positive public response, Oregon is installing EV charging stations along other key highways and encouraging private businesses to install stations as well.

Travel Oregon, the state’s tourism office, runs a targeted EV tourism program, “Oregon Electric Byways,” with suggested itineraries and a partnership with Enterprise Rent-a-Car for EV rental.

“It’s hard to separate the infrastructure from economic development because the infrastructure starts the conversation about EVs, especially outside of major cities,” said Ashley Horvat, Oregon’s chief electric vehicle officer, and the first person in the public sector to hold this role. “By placing charging stations around the state, we went into communities that had never seen EVs, which really increased adoption and created a positive perception for Oregon within the EV industry.”

In September, California Gov. Jerry Brown signed Senate Bill 1275, which sets a goal for the state to put 1 million zero-emission vehicles on the road by 2023. The bill also authorizes the state to provide financial incentives for consumers to purchase such vehicles, part of the governor’s effort to make electric cars affordable for lower-income workers.

“I’m excited that California is charging ahead with plans to have electric

**EVs**

- The Tesla Model S is perhaps the most popular among an increasing number of all-electric vehicles.
- The Toyota FCV is a hydrogen fuel cell vehicle. It is expected to be on sale in the U.S. next year.
- Indian automaker Tata has a vehicle powered by compressed air. It has a top speed of 50 mph and a range of 125 miles.
- While not practical for everyday use, solar vehicle technology is being added to electric vehicles to increase range.
vehicles in every zip code across the state,” the bill’s author, California State Sen. Kevin De León (D-Los Angeles) said in a statement. “We’re going to lead the way in the fight against climate change by putting a million EVs on the roads, which means making them affordable to all drivers, not just the wealthy.”

**Driving Data**

Intelligent infrastructure generates data that helps civic leadership make better decisions. For local transportation managers, connected vehicles and connected infrastructure will be tools for traffic data collection and analytics. Better traffic flow is achievable in part with better systems for collecting and analyzing real-time traffic data. In this arena, transportation managers can learn from the technologies and practices deployed by private companies, especially those with large fleets.

For instance, some keen-eyed observ- ers know that the familiar brown UPS trucks rarely make a left turn. The reason is that for decades UPS has worked to optimize routes. The UPS On-Road Integrated Optimization Navigation (ORION) software, which provides analytics for routing the company’s delivery trucks, is the latest in route optimization. The system combines daily data on package delivery commitments and historical route tracking to identify the optimal path (out of hundreds of thousands of possibilities) for each UPS driver to follow that day. UPS expects the ORION system to significantly reduce fuel consumption and miles driven in its trucks. Public transportation departments will benefit from using similar analytics tools said Tom Madrecki, strategic communications manager at UPS.

“It’s really about diving into the data and, based on where people need to go, determining how to make the transportation system the best it can be, then investing in the needed technology to realize those improvements,” Madrecki said.

**ITS and the Path to Smart Cities**

No matter how promising the new technology, local transportation officials are caught in a classic funding bind — it’s impossible to reduce costs without making investments, but funding for infrastructure investments is scarce or nonexistent. In a recent Governing Institute survey, 78 percent of respondents indicated lack of funding was the key barrier to developing ITS, well ahead of the 45 percent who cited an aging infrastructure as the key barrier.

“We need to create a framework for private entrepreneurship to lead the way,” argued Florida Department of Transportation Secretary Ananth Prasad during a panel at the ITS World Congress.

In many cases, public-private partnerships will have a larger role in financing new transportation projects. “Many state and local governments don’t have the staff and other resources to implement projects on this large scale,” said Nicholas Pluehr, a managing director at Wells Fargo. “Although municipal bond financing is still a viable option, partnering with the private sector can be a good option from both a cost and efficiency standpoint.”

As traffic volumes continue to grow in the coming decades, the public sector will need to consider every possible opportunity to better manage all transportation systems and infrastructure.

“For state and local governments, the question is which investments will allow them to more effectively and efficiently utilize the existing transportation infrastructure,” said Murtha. “You can spend billions on new roads and light rail or you can make a much smaller investment in the communications technology that will allow more vehicles to operate intelligently on current streets and highways.”

One of the recurring themes of the ITS World Congress was that we’re on the cusp of an extraordinary revolution in transportation, one that may save government billions of dollars by facilitating far better utilization of existing transportation infrastructure.

“Investing in last century’s infrastructure is cheaper in the short run but more costly in the long run,” said Verizon Chairman and CEO Lowell C. McAdam in a keynote address at the ITS World Congress.

“That’s why the smart cities of the future will be those that embrace and integrate intelligent transportation systems. While driverless cars may be a long way off, vehicle connectivity is not. “A smart, connected infrastructure will improve the quality of all our lives,” McAdam said. “Job No.1 in achieving this potential is bringing connectivity to every car.”

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**Editorial Notes**

For more information on this topic, please visit the following websites:

- [California State Senate](http://www.ca-senate.ca.gov)
- [World Economic Forum](https://www.weforum.org)
- [Insurance Institute for Highway Safety](https://www.iihs.org)
- [National Association of City Transportation Officials](http://www.nacto.org)
- [American Association of State Highway and Transportation Officials](http://www.aashot.org)

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**Special Report**

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**Designer Creative Dir.**

**Editorial Prepress**

**Other OK to go**

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**Bicycles are the original zero-emission vehicle. New technology such as the Copenhagen Wheel turns bikes into hybrid electric vehicles.**