



Photo Source: USDOT

CONNECTED VEHICLE BENEFITS



Connected vehicles have the potential to transform the way Americans travel through the creation of a safe, interoperable wireless communications network—a system that includes cars, buses, trucks, trains, traffic signals, smart phones, and other devices. Private signals shared between the vehicles and with infrastructure will generate new data about how, when, and where vehicles travel. This exciting new data-rich environment will be the genesis for a multitude of new applications that will make our roads safer, less congested, and more ecofriendly.

Imagine, for instance, apps that alert you to a car in your blind spot or icy roads ahead, help you find open parking spaces or locate available last-minute ride-share partners, or provide speed recommendations to help eliminate unnecessary stops and vehicles reach optimal fuel efficiency. The potential benefits of connected vehicle applications are tremendous.

Connected Vehicle Research

The U.S. Department of Transportation (USDOT) Intelligent Transportation Systems Joint Program Office (ITS JPO), Federal Highway Administration (FHWA), Federal Transit Administration (FTA), Federal Motor Carrier Safety Administration (FMCSA), and the National Highway Traffic Safety Administration (NHTSA) are collaborating to research and spur the deployment of connected vehicle technology. Over the last 5 years, these USDOT agencies have focused on prototyping and assessing applications that realize the full potential of connected vehicles, travelers, and infrastructure.



Photo Source: USDOT

A recent USDOT study assessed the safety, mobility, and environmental impacts of applications developed through four connected vehicle research programs—Vehicle-to-Infrastructure (V2I) Safety, Dynamic Mobility Applications, Applications for the Environment: Real-Time Information Synthesis, and Road-Weather Management.

To date, these programs have resulted in the development of nearly 50 V2I applications to help reduce crashes and fatalities, decrease travel times, and reduce emissions and fuel consumption. Field demonstrations and analyses have estimated the impacts of broader deployment of these applications.

Why Connected Vehicle Technology Is Needed

Connected vehicle technology aims to tackle some of the biggest challenges in the surface transportation industry—in the areas of safety, mobility, and environment.

- **Safety:** There were 5.6 million crashes in 2013, according to NHTSA. The number of fatalities from vehicle crashes is falling but still accounted for 32,719 deaths. Connected vehicle safety applications will give drivers the tools they need to avoid potential crashes and significantly reduce the number of lives lost each year.
- **Mobility:** U.S. highway users wasted 6.9 billion hours stuck in traffic in 2014, according to the Texas Transportation Institute (TTI). Connected vehicle mobility applications will help drivers navigate the roads more efficiently, as well as help system operators improve the operation of our nation's transportation system, reducing congesting, travel delay, and our overall mobility.
- **Environment:** According to TTI, the total amount of wasted fuel topped 3.1 billion gallons in 2014. Connected vehicle environmental applications will give motorists the real-time information they need to make "green" transportation choices.



Connected Vehicle Benefits

Multiple connected vehicle application development efforts and studies have demonstrated the potential for significant safety, mobility, and environmental benefits from the V2I applications. The magnitude of the benefits depends on the level of technology deployment at the roadside, in vehicles, or within mobile devices.

The following are highlights of the results and findings.



Safety Benefits

Combinations of V2I safety and road weather applications are effective in reducing crashes:

- Red Light Violation Warning and Pedestrian in Signalized Crosswalk Warning applications together have the potential to address more than 250,000 crashes and 2,000 fatalities each year. ■
- The Curve Speed Warning application has the potential to address more than 169,000 crashes and 5,000 fatal crashes per year. ■
- Traffic management applications on freeways can reduce the number of crash-related incidents by 25 percent during winter weather conditions. ▲



Mobility Benefits

Combinations of V2I applications are effective in prioritizing signal timing and reducing travel time and overall delay:

- Combinations of signal control applications (Intelligent Traffic Signal System, Freight Signal Priority, and Transit Signal Priority and Freight Signal Priority) reduced travel time by up to 27 percent. ▲
- The Incident Scene Pre-Arrival Staging Guidance for Emergency Responders application can potentially reduce travel time for emergency vehicles by up to 23 percent and their number of stops by up to 15 percent. ▲
- When cooperative adaptive cruise control and speed harmonization applications are optimized for the environment, they can potentially reduce travel time on freeways by up to 42 percent. ●



Environmental Benefits

V2I applications have potential congestion and lane management capabilities and can reduce fuel consumption and emissions:

- When signal operations and freeway lane management applications are optimized for the environment, they could yield fuel savings of up to 22 percent. ●
- The Low Emissions Zone application resulted in a 20-percent reduction in vehicle-miles traveled. ●
- Three coordinating eco-signal operations applications (Eco-Approach and Departure, Eco-Signal Timing, and Eco-Signal Priority) resulted in an 11-percent reduction in carbon dioxide emissions and fuel consumption. ●

To read the full report, *Estimated Benefits of Connected Vehicle Applications: Dynamic Mobility Applications, AERIS, V2I Safety, and Road Weather Management*, visit: <http://ntl.bts.gov/lib/56000/56200/56238/FHWA-JPO-16-255.pdf>

Socioeconomic Benefits of Connected Vehicles

A 2015 Intelligent Transportation Society of America study examined existing research to estimate the comprehensive costs of a crash and the number of crashes that four connected vehicle safety applications may prevent. These applications include intersection movement assist, left turn assist, forward collision warning, and lane change warning/blind spot warning.

The study concluded that the applications can result in \$178.8 billion in societal benefits annually if deployed across the entire U.S. vehicle fleet. This includes tangible economic benefits such as avoided medical care costs and productivity losses, as well as intangible benefits such as reductions in quality of life as a result of a motor vehicle crash.

- Precursor safety analysis finding
- ▲ Results based on field testing
- Result based on simulation/analytical study

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