Connected Vehicles: Benefits, Roles, Outcomes

Advancements in communications technologies are spurring a revolution within the United States transportation network. Short-range dedicated radio and mobile phone technology allow drivers, pedestrians, transit passengers, freight operators, and transportation management personnel to communicate with each other within a connected transportation network. This Connected Vehicles (CV) concept is moving rapidly from the experimental phase into real-world deployments in New York City, Tampa, Florida and Wyoming. As this technology develops and spreads, the public will realize safety, mobility, environmental benefits improving how we move about our daily lives.

What are Connected Vehicles?

The Connected Vehicle concept refers to the capability of the various elements of the modern surface transportation system (personal, transit, and freight vehicles, pedestrians, bicyclists, roadside infrastructure, transportation management centers, etc.) to electronically communicate with each other on a rapid and continuous basis. No personally identifiable information is shared between the vehicles. This communication can occur via several mechanisms. Dedicated short-range communications (DSRC) allow rapid communications (up to 10 times per second) between elements of a connected vehicle network, in particular for safety critical applications. Cellular phone technology is also anticipated to facilitate the use of many connected vehicle concepts. With safety as a primary goal, connected vehicle technology is anticipated to aid motorists in actively avoiding crashes and other incidents. Connected vehicle technology is distinct from vehicle automation, although the development of both technologies is a high priority for the U.S. Department of Transportation (USDOT), and the concurrent development of both technologies is anticipated to provide reinforcing, synergistic benefits.

Anticipated Benefits

The first priority of the USDOT is to improve roadway safety conditions for American motorists. Connected vehicle technology promises to exhibit profound effects on driver, passenger, and pedestrian safety. More than 30,000 motor fatalities that occur every year on American roads, and connected vehicle technology can play a role in reducing this unacceptably high number. Over 80 percent of non-impaired incidents could be mitigated by the implementation of connected vehicle technology. The groundbreaking communications technology utilized by connected vehicle applications will provide drivers with advance warnings of turning and stopped vehicles and other situations, allowing time for reaction and avoidance.

A widespread deployment of connected vehicle technology is anticipated to provide numerous additional benefits beyond safety. DSRC technology will enable innovative mobility deployments such cooperative cruise control and vehicle platooning, increasing roadway throughput and reducing congestion. Coordination between vehicles and infrastructure will mitigate unnecessary breaking and stopping at intersections, resulting in reduced fuel consumption and lowered emissions. Road weather information gathered from the various nodes of the system will be gathered and analyzed by transportation management centers, allowing for advanced warnings and more efficient deployment of

DOT road crews. These benefits are expected to increase in proportion to the total fleet penetration of CV technology.

USDOT's Role

The USDOT's Intelligent Transportation Systems Joint Program Office (ITS JPO) is at the forefront of the development and promotion of this exciting technology. The ITS JPO's role is to coordinate the Federally-sponsored research conducted across the USDOT's various agencies and programs. Collaboration amongst stakeholders, including state officials, industry and manufacturers, academia, private citizens, and other organizations, is a hallmark of the ITS JPO's research and engagement process. The USDOT will also develop and issue regulatory and policy rulings as required to foster the growth of connected vehicle and other ITS technologies. For example, the National Highway Traffic Safety Administration (NHTSA) is shortly expected to release a proposed rulemaking that would require the installation of vehicle-to-vehicle (V2V) connected vehicle technology and equipment in newly manufactured automobiles.[1] Rulemaking activity on heavy vehicles is expected in 2016.

Industry's Role

For more than a decade USDOT has been developing connected vehicle technology in partnership with the Crash Avoidance Metrics Partnership, an alliance of eight of the major automobile companies. The private sector is expected to be the "engine" that accelerates connected vehicle technology through to widespread deployment. Whether via regulatory requirement or as a point of differentiation for the consumer, automobile manufacturers increasingly will integrate these technologies into their new car models. This trend may be complemented by the parallel development of automotive automation. ITS vendors, including wireless technology developers, roadside equipment manufacturers, software developers, and data storage providers, will be pivotal in developing solutions for both new car models as well as retrofits for cars and trucks currently in the fleet. Private industry boasts the resources and market incentives to facilitate the adoption of connected vehicle technology. The ITS JPO stands ready to assist industry with policy guidance, knowledge transfer, research support, and eventually, device testing and certification.

Economic and Societal Impacts

The deployment of connected vehicle technology will produce numerous positive economic and societal impacts. The economic impact of reducing roadway fatalities is profound. NHTSA estimates $242 billion in economic costs resulted from motor vehicle crashes in 2010, including lost productivity, medical costs, legal and court costs, emergency service costs (EMS), insurance administration costs, congestion costs, property damage, and workplace losses.[2]

Both freight companies and consumers will benefit from optimized freight operations and improved throughput. A high level of connected vehicle technology adoption would improve congestion on

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[1] http://www.nhtsa.gov/About+NHTSA/Press+Releases/2015/nhtsa-will-accelerate-v2v-efforts

[2] Lawrence Blincoe, et al., "The Economic and Societal Impact of Motor Vehicle Crashes, 2010," National Highway Traffic Safety Administration, May 2014.

crowded roads. That time saved has both an economic and social value for the average commuter, who according to the *2015 Urban Mobility Scorecard* spends 42 hours per year in traffic, at a cost of $160 billion, or $960 per commuter.[3] The development of connected vehicle technology would also create a demand for relevant goods and services, fostering the expansion of the ITS industry that would supply the specialized equipment to enable public deployments. Secondary impacts could be felt by the insurance industry in the form of altered policies and premiums based on improving road safety. Total impacts will ultimately depend on the total level of fleet penetration as well as state and local interest and commitment to introducing sustainable infrastructure deployments.

The Future

The future of connected vehicle technology is already coming into focus. The ITS JPO has selected three pilot sites for the first wave of its CV Pilots deployment program. This program will provide selected deployers with financial and technical support as they develop and deploy connected vehicle applications and technology in the real world. The first three sites are located in Tampa, New York City, and Interstate 85 in southern Wyoming, and showcase a variety of vehicle-to-infrastructure safety, mobility, and other applications. The ITS JPO expects the successful deployment of these pilots to further advance the proof of concept and serve as a springboard for future efforts. Please visit the ITS JPO's CV Pilots website for future updates and documentation.

In December 2015, USDOT launched **The Smart City Challenge** to create a fully integrated, first-of-its-kind city that uses data, technology and creativity to shape how people and goods move in the future. The winning city will be awarded up to $40 million from the U.S. DOT and connected vehicle technology is expected to be large part of this pilot.

Detailed predictions of future fleet composition are difficult, if not impossible, to ascertain. However, if connected vehicle technology receives regulatory approval and addresses the public's concerns about security and personal privacy, the USDOT anticipates widespread deployment of CV technology over the coming decades. Some automobile manufacturers have announced that they will provide onboard CV technology by as early as 2017, and retrofitting of CV equipment on older models may also occur as the benefits become more apparent. Rapid adoption by government-owned vehicles and freight operators will also speed market penetration of CV technology. An even more rapid transformation would occur in the case of a regulatory requirement for CV technology on newly-manufactured and/or existing vehicles. By 2045, total CV fleet penetration upwards of 95 percent well within reach.
Connected vehicle technology is expected to develop concurrently with autonomous vehicles. These two fields of technology, while separate, are two foundational areas of research within the ITS JPO, and their advancement is considered a key strategic priority for the USDOT. An envisioned future fleet of connected autonomous vehicles will create even more pronounced benefits for travelers and will have transformative effects on American society as a whole.

[3] Schrank, David, et al., "The 2015 Urban Mobility Scorecard," The Texas A&M Transportation Institute, August 2015.