Smart Trucks

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Photo: Courtesy of Craig Shankwitz, WTI

Description: A smart truck is a commercial truck that uses connected vehicle technology to communicate with other vehicles or infrastructure. These communications work to reduce collisions, improve safety, and provide real-time information. Commercial vehicles equipped with this technology are also able to travel in a platoon, or a group of vehicles that are driven using communications technology between the vehicles. Platooning allows following vehicles to react immediately to the lead vehicle. Platooning works to improve traffic safety and reduce fuel consumption. Smart trucks may also have cameras and sensors installed that help with blind spot warnings, drowsy driving warnings, and lane assistance. Furthermore, a smart truck may be equipped with automatic vehicle location (AVL) for fleet management, which can allow for tracking the safe transportation of hazardous materials (HAZMAT).

Rural Transportation Critical Needs

- ☑ Crash Countermeasures
- ☐ Emergency Services
- ☐ Operations & Maintenance
- ☐ Rural Transit & Mobility
- ☐ Surface Transportation & Weather
- ☐ Tourism & Travel Information
- ☑ Traffic Management

Issues Addressed

- ☑ Road Geometry Warning
- ☑ Highway-Rail Crossing Warning
- ☑ Intersection Collision Warning
- ☑ Pedestrian Safety
- ☑ Bicycle Warning
- ☑ Animal Warning
- ☑ Collision Avoidance
- ☐ Collision Notification
- ☑ Weather Warning

Strategies Achieved

- ☑ Road User
- ☐ Road
- ☑ Vehicle
- ☑ Safety Culture
- ☑ Engineering
- ☐ Emergency Response
- ☑ Enforcement
- ☑ Education

Applicability

- Smart trucks work to enhance safety for operators of heavy trucks in both urban and rural environments. Vehicle to vehicle (V2V) applications work to increase safety by providing collision, blind spot, or do-not-pass warnings. Vehicle to infrastructure (V2I) applications can warn a driver of poor weather conditions, traffic, or parking conditions on their route. Smart truck technology can be customized to an agency's needs. This allows an agency to reduce costs by only equipping its vehicles with the necessary sensors.

Partnerships

- Applications benefit from collaboration among numerous agencies, which may include:
  - Departments of transportation (local, state, federal)
  - Federal Motor Carrier Safety Administration (FMCSA)
  - Emergency services
  - Vehicle manufacturers
  - Trucking companies

Key Components

- Communications
- Global positioning system (GPS) receiver or signpost sensors for AVL
- Infrared camera/image processing for fatigue warning systems

Examples of Implementation

- **Smart Truck Parking**

The goal of this project is to provide truck drivers with real-time information on where parking is available. This information will reduce the number of fatigued truck drivers on the road looking for a place to legally park.

- **Drowsy Driver Warning Systems**

Drowsy driving decreases reaction time and can impair judgement. Drowsy driving detection systems use cameras and other sensors to determine if a driver is drowsy. These systems will alert the driver and work to reduce the number of crashes due to fatigue.

- **Blind Spot Assistance**

Smart trucks can be equipped with a blind spot assistance sensor to detect moving objects that the driver may not be able to see (bicyclist, motorcyclist, etc.). These sensors would alert the driver if there is someone within the truck's blind spot. This would allow truck drivers to safely change lanes or make a turn.

- **Texas Two-Truck Automated Platoon Testing**

Texas Transportation Institute (TTI) in coordination with Texas Department of Transportation and the Federal Highway Administration are testing the feasibility of truck platooning. A platoon is led by a driven truck that allows the following trucks to step back from driving tasks. The trucks are equipped with radar, cameras, sensors, vehicle-to-vehicle communications, and driver-monitoring systems that allow the following trucks to safely follow the lead truck. TTI successfully completed a platooning test of two 18-wheelers, including driving a figure eight at 40 mph, increased gap distance, and left and right lane changes.

Implementation Considerations (Pro)	Implementation Considerations (Con)
•Systems can reduce human error involved with operating commercial trucks. •They decrease the number of fatigued truck operators on the road. •Vehicles can take corrective action in situations where a crash may occur. •Usage can address concerns regarding the limited number of commercial truck operators. •Truck platooning can lead to increased fuel efficiency and fuel savings.	•Drivers may feel like they are being "watched," that their privacy is being violated. •Warnings that are received while driving could be distracting. •Rural areas could have communication issues.

Opportunities for Future Expansion

- Opportunities for connected vehicle technology on heavy trucks will continue to increase in the future. Vehicle to infrastructure (V2I) systems can warn drivers of poor weather conditions, traffic, or parking conditions on their route. Smart trucks could communicate with road weather information systems (RWIS) along their route to receive alerts of poor weather conditions. Soon trucks like Samsung's "Safety Truck" (which uses a wireless camera on the front of the truck to provide motorists behind the truck a view of what's ahead), will provide motorists with a safer way to pass a commercial truck. All this technology will work to create a safer environment for large vehicles on the roadway.

Additional Resources

- *Collision Avoidance: Smart Trucks on Rural Roads,* found here: http://www.cts.umn.edu/Publications/ResearchReports/reportdetail.html?id=1298
- *Smart Fleets: The Future of the Waste and Recycling Industry,* found here: http://www.fleetmind.com/wp-content/uploads/2015/12/WA-10102015-Smart-truck.pdf
- United States Department of Transportation (USDOT), Intelligent Transportation Systems (ITS) Joint Program Office – *Truck Vehicle-to-Infrastructure,* found here: http://www.its.dot.gov/research_archives/safety/truck_v2i_progress.htm
- USDOT ITS Joint Program Office – *Truck Vehicle-to-Vehicle (V2V),* found here: http://www.its.dot.gov/research_archives/safety/truck_v2v.htm
- USDOT ITS Joint Program Office: *Supporting Freight Operations with ITS Webinar Recording*, found here: https://www.pcb.its.dot.gov/t3/s160803_Supporting_Freight_Operations_with_ITS.asp

Useful Tip

Smart trucks used for platooning can reduce fuel consumption as the vehicles in a platoon drive close together at a constant speed.

Cost Range

(Cost/financial information, where noted, is based on 2016 dollars (unless otherwise specified). Cost/financial information is estimated, and will vary based on size and scope of project, number of units, etc. In general, capital costs include initial purchase costs of hardware, software, and other required equipment. Maintenance and operations costs include staff time to operate, monitor and maintain systems; data collection; system upgrades; evaluation; etc.)

Capital Costs: The total capital cost for this tool is low (less than $50,000). The additional base vehicle price for connected vehicle technology is estimated to be $350 for 2017. The cost to add aftermarket communications to a vehicle is $200 for 2017[1]. The cost to equip a vehicle with safety systems for HAZMAT transportation ranges from $320 to $4,500 per vehicle. The cost depends on the type of system used: 1) $320 for a low-cost tracking system using a cellular phone with navigation, with the ability to shut down the vehicle on-site, 2) $4,500 for a high-end satellite communications system with an in-dash and wireless panic button with biometric scanning abilities, electronic supply chain manifest, and electronic seals, which send out an alert if a seal is broken without authorization[2]. The cost to equip a vehicle with an infrared camera and image processing system to monitor driver fatigue is $1,610 per unit[3].

Operations Costs: The operations and maintenance costs for this tool range from low (less than $50,000) to higher (above $250,000). These costs include those for the owner to upgrade/maintain the technology in the vehicle, costs to the vehicle manufacturers to continuously research and update what is offered in the vehicle, costs to the department of transportation for staff time, and costs for power and communication.

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