

Research and Technology Review

Feasibility of Implementing Automated Trucks on I-80

By Dr. Zong Tian

Automated trucks traveling at high speeds on freeways may sound like fiction. In fact, it may be a reality in the near future due to significant advances in science and technology. Dr. Zong Tian at the University of Nevada, Reno is leading a team of experts conducting a feasibility study of implementing automated trucks along the I-80 freeway between Reno and Salt Lake City. The team includes Dr. Steven Shladover, a renowned Research Engineer from the California PATH Program, and Dr. Shunfeng Song, Professor of Economics at the University of Nevada, Reno. The project is sponsored by the Nevada Department of Transportation.

Automated trucks are developed based upon automated vehicle technologies, which refer to a range of concepts for supporting or taking over portions of the driver's normal driving responsibilities. These could include warning the driver about imminent lane departures or forward collisions, aiding the driver through a combination of speed and following distance control (called adaptive cruise control) or steering assistance to avoid a lane departure, intervening automatically to try to mitigate the severity of, or to avoid an imminent crash if the driver has not responded to a warning, or completely controlling the steering, acceleration and braking of the truck automatically.

Automated vehicles are nothing new to Nevada. In fact, automated trucks were deployed in 1996 at the WesTrack facility near Fernley, Nevada for pavement testing purposes. Four driverless triple-trailer trucks were equipped with a guide-by-wire system and were moving at 40 mph for an average of 15 hours per day along an oval track. Between 1994 and 1998, the California PATH Program provided the technical leadership in the National Automated Highway System Consortium (NAHSC) on a well-known project (Demo 97) to showcase highway automation technologies.



The 3-truck platoon demonstration in the CHAUFFEUR Project by the European Commission (Source: www.itsforum.gr.jp)

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In this project, automatically controlled vehicles traveling in platoons were successfully demonstrated on a 7.6 mile segment of High Occupancy Vehicle lanes on Interstate 15 near San Diego. Major research efforts on automated trucks have also been carried out in Germany, France, and Japan. Among these projects, the most well-known is perhaps the CHAUF-FEUR Project by the European Commission, in which two or three automated trucks traveling in a platoon were successfully demonstrated.

“Implementing automated trucks in the I-80 Corridor can achieve benefits in many aspects”, said Russ Law, a long-time NDOT engineer who initiated this research idea. There are about 42,000 fatalities each year in our nation’s highway systems, among which more than 10 percent involve large trucks. The warning and control assistance systems can reduce the likelihood of a truck driver getting into a potentially dangerous pre-crash situation. The effects of human driving errors can be greatly reduced by the automated trucking technology. The average commercial heavy-duty truck travels six times more miles and consumes 27 times more fuel per year than the average passenger car. Fuel efficiency improvements are likely when an automatic speed control system can choose the most fuel efficient speed for driving and can adjust truck speeds smoothly (more smoothly than a human driver is likely to). Previous research and programs have demonstrated that there could also be up to 20 percent less fuel consumption for the following trucks and six percent less for the leading truck when they are operated in closely coupled automated platoons due to reduced aerodynamic drag force. The cost of manual driver labor is high in the trucking industry, thus there are strong economic incentives to replace that labor with automation technologies. Drivers’ workloads can be reduced with the implementation of automated trucking technology, which could change the nature of the truck driving job and could eventually lead to changes in hours of service regulations.

This feasibility study will examine all these various aspects from the benefit-cost point of view. “There are no better places than I-80 if automated trucks are to be implemented”, said Russ Law. The stretch of I-80 through Nevada is largely desolate and mountainous. After crossing Utah’s western border, I-80 crosses the desolate Bonneville Salt Flats. There is even a 37 mile stretch without exits between Wendover and Knolls. Many portions of I-80 are extremely flat and straight, causing driver fatigue and drowsiness, especially for truck drivers. There are no major cities along I-80 between Reno and Salt Lake City, and a significant number of trucks travel the entire corridor.

The research team has completed a comprehensive literature review. Data collection has been conducted to gather traffic volumes, geometry, and highway construction costs. Other on-going tasks include development of the “concept of operations” survey of the trucking industry regarding their opinions about automated trucks, and a benefit-cost analysis. The entire project will be completed by the end of 2010.



Automatically controlled vehicles traveling in a platoon in the Demo 97 project by the California PATH Program (Source: www.path.berkeley.edu/)



Typical road and traffic conditions along I-80

PRODUCT EVALUATION COMMITTEE (PEC) DECEMBER 2009 MEETING SUMMARY

The Product Evaluation Committee (PEC) met on December 1, 2009. The meeting began with a vendor presentation by Surface Pro Nevada on Sacrificial Graffiti Systems. Other topics of discussion were a new Qualified Product List (QPL) category for Pipe Lining Products, APEL Application Software System, and National Transportation Product Evaluation Program (NTPEP) activities.

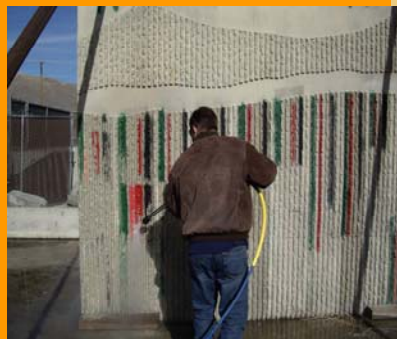
Vendor Presentation: Surface Pro Nevada

Robert Purdy, President of Surface Pro Nevada; Scott Tracey; and Benny Dickens, President of Formulators; made a presentation at the December PEC meeting on sacrificial antigraffiti systems. Currently NDOT only calls for the nonsacrificial antigraffiti system to be used on NDOT projects. Mr. Purdy successfully challenged this idea, stating that there are situations where sacrificial antigraffiti systems are more efficient and cost-effective.

Nonsacrificial antigraffiti systems are designed to be installed once every 10 years and cleaned multiple times with chemical solutions after graffiti hits without damage to the substrate, minimizing maintenance activity.

Sacrificial antigraffiti systems are designed to be installed where frequent, daily activity occurs. The surface is pre-coated, then a sacrificial layer is applied. After a graffiti hit occurs, the graffiti is removed by washing the surface (no harsh chemicals are needed) and then the surface is cleaned and the area re-treated with the sacrificial layer.

Las Vegas spends approximately \$30,000/day for graffiti abatement. NDOT has a maintenance team dedicated to address graffiti abatement in Las Vegas. In the rural areas and City of Reno, NDOT right-of-way graffiti abatement is the responsibility of NDOT maintenance. Due to the success of Surface Pro Nevada's Graffiti Deterrent System, NDOT is considering whether a contract with a vendor to maintain an area with such a system would be cost-effective where frequent graffiti abatement is needed.



ArmourGuard Barrier System

Two years ago District III purchased a portable ArmourGuard Barrier system. One use of the barrier is to detour traffic out of the Carlin Tunnel while work is completed. The system provides increased protection to the employees working on the tunnel, allows the motoring public clear traffic delineation, and has the flexibility of rolling the barrier nightly to the edge line.

One limitation is that it takes time and multiple trips to deliver and setup. It also requires strong individuals to move the system, but NDOT employees have indicated it is worth the effort.

The system is not recommended for small daily projects because of the delivery and setup time; however, for any project where a crew might work in the same area for a week or more, this system is ideal.



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Reminder !!!

Please Submit Your 2011 Research Problem Statements By February 8, 2010.



About NDOT's R&T Review

The NDOT Research Section administers the Department's research, development and technology transfer program and serves as the "clearing-house" for product evaluations.

Research and Technology Review is published quarterly by the NDOT Research Section. Its purpose is to provide the latest information on the NDOT research activities including product information and other pertinent research topics.

If you have comments or need additional information regarding any of the topics discussed in this issue, please contact the Research Section.

Edited by

Gizachew Zewdu,
Research Analyst



Heidi's Corner, a Farewell

Heidi Englund (Wood) has been one of the most charming employees of the Nevada Department of Transportation (NDOT) for the last six years. Our beloved librarian has said her goodbyes and moved to Reno, Nevada, to work for the Historical Society.

Heidi moved from Water Resources and began working for NDOT in November of 2003. The NDOT Technical Resource Library was in its infant stage, so Heidi had the dubious task of growing its resources and designing the program. Some of the programs instituted were her monthly acquisition list, training resources, and historical research. Heidi had an incredible fountain of knowledge that she could retain in her head. But Heidi was more than just her job. Heidi used to post a piece of information about the Library right at this spot, the "Library Corner." Heidi will be missed, but we wish her success with her new adventure.