

UTC Project Information	
Project Title	Human Factors Evaluation of an In-Vehicle Active Traffic and Demand Management (ATDM) System
University	Virginia Tech (Virginia Tech Transportation Institute)
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Funding Agencies	CVI-UTC (Tier 1 UTC)
Agency ID or Contract Number	451346
Project Cost	\$150,000
Start and End Dates	11/17/14 – 12/31/15
Project Duration	1 year, 1 month, 15 days
Brief Description of Research Project	<p>Active Traffic and Demand Management (ATDM) is designed to manage roadway traffic and reduce congestion while improving safety [1]. Traditionally an infrastructure-centric application, ATDM uses dynamic signs (often on overhead gantries) to provide relevant regulatory and informational content to drivers. With Connected Vehicles, the ATDM interface may instead be located inside vehicles where messages may be more ubiquitous and salient, while also decreasing infrastructure cost to road operators and road sign clutter along the roadway. However, in-vehicle devices can have negative consequences such as driver distraction, driver dependence, complacency, and annoyance.</p> <p>The following research study focuses on the development and Human Factors evaluation of an in-vehicle ATDM system deployed on the I-66 corridor in Northern Virginia. The purpose of this research is to determine if in-vehicle signage, coupled with ATDM, can successfully manage traffic while maintaining a balance between salience and annoyance of the associated message system.</p> <p>The in-vehicle ATDM features include 1) dynamic speed limits, 2) dynamic lane use/shoulder control, 3) High Occupancy Vehicle (HOV) restrictions, and 4) other traveler information through variable message signs (VMS). In addition, this system is equipped with various audio and visual alerts in order to notify the driver when relevant information has been updated. There were 40 total participants in this study where 20 participants traveled during peak hours (split evenly between AM and PM) and 20 participants traveled during non-peak hours in order to generate data on the in-vehicle system with varying traffic levels.</p>

	<p>[1] Cronin, B., & Sheehan, R. (2014, June 26). Active Transportation and Demand Management. Retrieved August 28, 2014, http://www.its.dot.gov/active_traffic.htm.</p>
<p>Describe Implementation of Research Outcomes (or why not implemented)</p> <p>Place Any Photos Here</p>	<p>The United States has recently initiated out-of-vehicle ATDM projects, with the major ones located in Minneapolis, MN and Washington State. WSDOT was the first state transportation organization to implement ATDM strategies in the United States. This new transportation system has not been employed long enough to have statistically significant effects on congestion and collisions; however, there is enough evidence to show benefits in emergency response/management throughout Washington. In addition, WSDOT has reported fewer collisions since installing the ATDM systems [2]. Due to the lack of out-of-vehicle ATDM implementation throughout the U.S., research is necessary to determine accurate benefits/dis-benefits of this new traffic control technology. The newest out-of-vehicle ATDM system is being constructed along the I-66 corridor in Northern Virginia, with expected completion in 2015.</p> <p>In-vehicle ATDM has the potential to control congestion and ensure driver safety while remaining permanently accessible. This in-vehicle system would provide the same information to drivers as the out-of-vehicle system but would be displayed inside the vehicle. By placing these ATDM elements inside the vehicle, drivers remain consistently aware of the roadway requirements, even when external signage is not visible or available. In-vehicle ATDM features will include 1) dynamic speed limits, 2) dynamic lane use/shoulder control, 3) High Occupancy Vehicle (HOV) restrictions, and 4) other traveler information through variable message signs (VMS). In addition, this study will evaluate the efficacy of an ATDM system which would not require infrastructure signage, permitting widespread use at a potentially lower cost to the associated road operator (VDOT in this instance).</p> <p>By utilizing connectivity technology, these in-vehicle signage systems will be updated and correct at all times, which is vital to improve the relevance of the information provided. In addition, various visual and/or auditory alerts will be implemented whenever the displayed information is updated to notify the driver. Despite the improved information flow between road operators and road users, in-vehicle displays can negatively affect the driver by taking their eyes off the road, adding distractions, and causing over-reliance on potentially imperfect information and false alerts. The purpose of this research is to determine if in-vehicle signage, coupled with ATDM, can successfully manage traffic while maintaining a balance between salience and annoyance of the associated message system.</p> <p>It is currently anticipated that drivers will respond positively to the in-vehicle ATDM system based on previous results from WSDOT. There may be some evidence of distraction due to the in-vehicle setup, but it is</p>

	<p>expected that the level of distraction will not be significant enough to negatively affect driver safety. The research team will also determine whether drivers find the alerts helpful, receive feedback regarding the design of the in-vehicle system, obtain any suggestions for improvement, and ascertain if drivers would like to have this technology incorporated inside their own vehicles.</p> <p>[2] Washington State Department of Transportation. (2014). Active Traffic Management. Retrieved October 21, 2014, http://www.wsdot.wa.gov/Operations/Traffic/ActiveTrafficManagement/.</p>
Impacts/Benefits of Implementation (actual, not anticipated)	<p>This study is still in progress, actual impacts and benefits of implementation will be determined in December 2015 when the study is completed. This page will be resubmitted in the next round of reporting to state these actual impacts and benefits.</p>
Web Links <ul style="list-style-type: none"> • Reports • Project Website 	http://www.cvi-utc.org/