| UTC Project Information | |
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| Project Title | Emergency Vehicle-to-Vehicle Communication |
| University | Virginia Tech |
| Principal Investigator | Pamela Murray-Tuite |
| PI Contact Information | murraytu@vt.edu |
| Funding Agencies | CVI-UTC (Tier 1 UTC) |
| Agency ID or Contract Number | 451186 |
| Project Cost | $146,380.00 |
| Start and End Dates | September 1, 2012 – August 30, 2013 |
| Project Duration | 1 year |
| Brief Description of Research Project | Vehicle-to-vehicle communication can be used to improve the safety and efficiency of emergency response. Such communication, with driver compliance to guidance, can ease driver stress associated with trying to accommodate an approaching emergency vehicle but encountering roadside obstacles or limited space to maneuver to the right or being unsure of the intended path of the emergency vehicle. The communication can also aid emergency vehicle turning movements, particularly right turns, by clearing the right lane rather than the left. Through this project, a prototype of the emergency vehicle-to-passenger vehicle communication will be developed and tested on the test bed in Northern Virginia. Prior to prototyping and testing, the research team will collect and analyze video data from both freeways and arterials, develop algorithms to determine the optimal behavior for the passenger vehicles (e.g., “move left,” “move right,” “stay where you are”) and to route the emergency vehicle through congestion, and test the algorithms with unique simulation code. The simulation and algorithms will be connected with signal pre-emption to further facilitate emergency vehicle movement and identify the effect of signal pre-emption on the optimal behavior. Emergency vehicles must often navigate through congested conditions to reach the people requesting assistance and/or to bring them to hospitals for treatment. While these vehicles may travel on shoulders, against traffic, or proceed through red-lights, these are risky situations for which the emergency vehicle driver will be held liable if a crash occurs. Other vehicles on the road are supposed to slow down and pull over to the right to facilitate the emergency vehicle's travel; however, not every driver does so. In some situations, there is little room for them to pull to the right as traffic may be gridlocked or shoulders may not be present or have obstructions. On arterials, the emergency |

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| | vehicle may need to turn right but find it difficult to do so because of the drivers on the right. Vehicle-to-vehicle communication can help alert vehicles to the presence of an emergency vehicle and with information about the emergency vehicle's desired maneuvers; the other vehicles can be better directed to accommodate the emergency vehicle. This cooperative behavior will make emergency vehicle travel safer and allow police and first responders to reach those in need faster. Further benefits may be obtained by signal pre-emption. |
| Describe Implementation of Research Outcomes (or why not implemented)<br><br>Place Any Photos Here | The goal of this study is to facilitate emergency vehicles reaching their destinations. This goal requires addressing the problem from multiple perspectives, including the emergency vehicle, passenger vehicles, and signal control. The following objectives pertain to these initial perspectives:<br>1. Determine the best behavior for passenger vehicles in order to facilitate the emergency vehicle's movement. In this initial study, passenger vehicle "behavior" is simplified to moving right, moving left, and staying where it is.<br>2. Determine the best path for the emergency vehicle through traffic. Since the maneuvering is in a small section of the network, the overall emergency vehicle path from origin to destination is considered given. With respect to this objective, the "path" pertains to the path through traffic within the localized section.<br>3. Develop a message prototype for the personal vehicles. In this initial study, the prototype will be designed for communication between an emergency vehicle and passenger vehicles.<br>4. Test the prototype. The prototype will be tested in the field on the Northern Virginia test bed.<br>5. Determine the conditions under which signal pre-emption can provide additional benefits in speeding the emergency vehicle's passage and how pre-emption affects the optimal movements of the passenger vehicles and emergency vehicle. Due to the additional complexity and heavy congestion in the Northern Virginia area, this objective will be handled in the lab in this initial study rather than in the field.<br>This project will be an initial step toward making interactions with emergency vehicles safer and more efficient. Faster emergency response may lead to lower property damage costs in fires and quicker incident clearance and hence less incident-related congestion and delay. Quicker response for ambulances will also affect the lives of trauma victims, who have the best chance of survival if they receive treatment in the first hour after the injury (the "golden hour").<br>Specific products include:<br>1. Algorithms that determine safe and proper guidance for personal vehicles in the neighborhood of an emergency vehicle. The algorithms will also guide the emergency vehicle safely and efficiently through congestion. These algorithms may be incorporated with future vehicle-to-vehicle communications.<br>2. A specialized micro-simulation tool for testing the effects of the |

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| | guidance. This tool will be important for future extensions of the algorithms as well as the current application.<br>3. A messaging prototype. This prototype can be further developed and tested for commercial applications.<br>4. Initial understanding of driver response to the messages. The live testing will help determine the best message delivery method and provide an initial study of response times and maneuver success.<br>5. An initial understanding of how the vehicle-to-vehicle communication can work synergistically with signal pre-emption. |
| Impacts/Benefits of Implementation<br>(actual, not anticipated) | This study is still in progress, actual impacts and benefits of implementation will be determined in Summer 2013 when the study is completed. This page will be resubmitted in the next round of reporting to state these actual impacts and benefits. |
| Web Links<br>• Reports<br>• Project Website | http://www.connectedvehicleinfrastructure-utc.org/?q=node/67<br><br>http://rip.trb.org/browse/dproject.asp?n=32362 |