



Exhibit F - UTCRS

UTC Project Information	
Project Title	Development of Corridor-based Traffic Signal Preemption Strategies at Signalized Intersections near Highway Railway Grade Crossings
University	University of Nebraska-Lincoln (UNL)
Principal Investigator	Laurence Rilett, Ph.D., P.E., Civil Engineering (PI)
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Funding Source(s) and Amounts Provided (by each agency or organization)	Federal Funds (USDOT UTC Program): \$65,000 Cost Share Funds (UNL): \$32,500
Total Project Cost	\$97,500
Agency ID or Contract Number	DTRT13-G-UTC59
Start and End Dates	November 2013 – December 2016
Brief Description of Research Project	Highway-rail grade crossings (HRGCs) and the intersections in their proximity are areas where potential problems in terms of safety and efficiency often arise if only simple or outdated treatments, such as normal signal timing or passive railroad warning signs, are utilized. When it comes to a corridor or a network with multiple HRGCs and heavy train traffic, the problems will be more complicated due to randomness of train arrivals and frequent abruptions of normal signal timing operation of the whole corridor. This project develops a methodology of signal timing optimization that is specially designed for such a corridor/network. Due to high time and money costs associated with testing the methodology in the field, and safety issues related to field experiments, the proposed optimization program was instead developed, used, and evaluated in a micro-simulation environment using the VISSIM simulation software

	<p>package. To replicate field conditions, real train data has been collected from the field test bed using advanced train detection technologies and input into the simulation models. Moreover, the stochastic nature of traffic has been considered in the simulation experiment by conducting multiple simulation runs with random seeds. Based on the research results, it can be concluded that the methodology can significantly improve both the safety and efficiency of the study corridor with HRGCs in both offline and online scenarios, however, at the cost of higher network delay. The effects of the prediction errors on the safety and operation of the study network are also analyzed.</p>
<p>Describe Implementation of Research Outcomes (or why not implemented)</p> <p>Place Any Photos Here</p>	<p>Before implementation is possible, hardware-in-the-loop analysis is required, which can be done by coding the TPS_DT in a controller readable programming language and incorporating it in a traffic signal controller as an extended module. Although simulation studies have shown that the proposed optimization methodology with TPS_DT can improve safety and efficiency of the corridor, field studies are necessary to test the methodology before it is considered for field implementation.</p>
<p>Impacts/Benefits of Implementation (actual, not anticipated)</p>	<p>The proposed optimization methodology has not been implemented yet. However, work on this project has resulted in one paper presentation at the Transportation Research Board 96th Annual Meeting, with the paper being accepted for publication in the Transportation Research Records.</p> <p>The information on the paper that was presented at the TRB Annual Meeting is provided hereafter:</p> <ul style="list-style-type: none"> • Chen, Y. and Rilett, L., “A Train Data Collection and Arrival Time Prediction System for Highway-Rail Grade Crossings,” Transportation Research Records, <i>Journal of the Transportation Research Board</i>, January 2017. <p>Moreover, this project has also resulted in a doctoral dissertation to be completed entitled:</p> <ul style="list-style-type: none"> • Chen, Y., “Network Traffic Optimization in Heavily Utilized Railway Corridors,” Doctoral Dissertation, Department of Civil Engineering, University of Nebraska-Lincoln, May 2015.

	<p>A detailed report summarizing all of the work performed under this project is also made available and can be downloaded from the UTCRS website at the link provided below.</p>
<p>Web Links</p> <ul style="list-style-type: none">• Reports• Project website	<p>http://www.utrgv.edu/railwaysafety/_files/documents/reports/Traffic-Signal-Preemption-Strategies-Near-HRGC_Project_Final_Report_021017.pdf</p> <p>http://www.utrgv.edu/railwaysafety/research/operations/traffic-signal-preemption-strategies-near-hrgc/index.htm</p>