QUARTERLY REPORT 10/1/2005 - 12/31/2005

CENTER FOR TRANSPORTATION STUDIES

Project Title: Toward A Multi-State Consensus on Rural Intersection Decision Support

CTS Project # 2004039 ***Contract #*** 81655 ***Work Order #*** 106 ***Authorization Date:*** 1/2/2004

Funding Source:

Mn/DOT

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Task Update

1 Project Management

Project management involves coordinating state activities (between states participating in this pooled fund study and with the national IDS program), scheduling the driver interface workshop, and disseminating research results to participating states. Travel coordination and management for the kickoff, biannual project meeting, and design workshops will be handled by Mn/DOT.

Deliverables: Coordination of research and design workshop activities, results dissemination, and periodic project reporting. Pooled fund states will be kept informed of developments and results through task summary reports

Task Budget $36,193.00

Task Due Date (calculated): 1/2/2007

Date Delivered (reported by PI):

Task Approved: No Date Approved (CTS received task approval) :

Progress: An ammendement to increase the scope and the budget for the CH2MHill Crash analysis, to handle additional states, was submitted to and approved by SPA.

A no-cost time extension will be requested for this project. This is being done for two reasons.

1. The FHWA has decided to fund the CICAS-GAP (Cooperative Intersection Collision Avoidance System - Gap Acceptance Processing) program. With CICAS-GAP comes an opportunity to collect significantly more data than ha orginally been possible. We will propose that 2 months of data, instead of the original one month, be collected in eac state. This would result in a proposed end date of May 2008.

2. The University of Minnesota particpated in the 2005 ITS World Congress in San Francisco. At the world congress the portable intersection surveillance system / prototype IDS driver interface was demonstrated to about 75 attende This demonstation took place in early November 2005.

As it turns out, Wisconsin Traffic Volumes on US 53 drop significantly between the close of hunting season and the beginning of fishing season. At the present time, traffic volumes are low enough that gap acceptance related crash are very infrequent. Personnel from WI/DOT have indicated that if good data is to be collected, data collection shoul start after 15 April 2005.

We were positioned to begin data collection in October; however, with world congress and low traffic volumes, the start date moves to April 15, 2006.

2 State Crash Analysis

Crash analysis consists of two key components: the development of a methodology by which intersection crashes can be reviewed and the development of statistical models which relate the characteristics of a rural stop-controlled intersection to that intersection's crash experience. With respect to the former, relevant crash data was used to determine which crash configurations and intersection types lead to high frequency and severity of crashes. Intersections having crash rates higher than the critical rate were identified as potential candidates for intersection research. Further analysis led to the selection of a candidate experimental intersection. This work is complete in Minnesota; the report documenting this analysis is presently in press. The statistical models relating the characteristics of a rural stop-controlled intersection to that intersection's crash experience will be used to identify intersections which are atypically dangerous or safe To also identify the characteristics associated with atypically high or low crash experiences, and ultimately to estimate the potential safety impacts of the proposed intersection decision support system. This work is still in progress. For member states analyses focused on identifying critical rural intersections using the critical crash rate and severity measure methodology will be performed by the Minnesota team. The Minnesota team will request specific crash information from the crash database in each state. The Minnesota team will then provide to each state a list of intersections with crash rates and severities above the critical level as well as a recommendation for the experimental intersection. In the even that some states lack particular data in their crash reporting/recording systems, modifications to the analysis developed for the national IDS project will be made to best compute similar statistics

Deliverables: Reports summarizing the rural intersection crash problem in each member state, a list of rural intersections with crash rates above the critical level, and a recommendation for an intersection to be instrumented and studied further.

Techniques and methodologies developed for the national IDS project will be used to analyze state crash databases

Task Budget $150,000.00

Task Due Date (calculated): 2/2/2005

Date Delivered (reported by PI):

Task Approved: No Date Approved (CTS received task approval) :

Progress: Wisconsin - DONE

Michigan - MDOT has reviewed draft memo, including the proposed intersection...they had only minor changes to the text and no problem with the selected site. MDOT now h the final memo and we're just waiting for them to "approve" the final document.

Iowa - We completed all of the data analysis and field reviews when someone at IDOT noticed a problem with the list of intersections they provided. Still need to resolve whether we are going to stay with the original list of intersections or repeat the analysis for a new set of intersections.

North Carolina - DONE

GA - We've done the initial review and are waiting for them to decide if they want us to do field visits...have been waiting on them to decide the past several months.

CA - Still waiting for data.

NV - Still waiting for data, they keepsaying we'll see something soon.

NH - Still waiting for data

3 Intersection Design Workshops

A key element of the rural IDS system is the driver-infrastructure interface, which will convey relevant intersection state data to the drive attempting to enter or cross the traffic stream. The goal of the IDS program is to develop a nationally deployable system. Design input from member states will be sought.Two interactions with the representatives from each member state are planned. The first interaction will be a design brief describing the proposed driver infrastructure interface(s). This design brief will be provided to each of the participating states; a review/critique of the proposal will be requested. Feedback provided by participants will be used to determine whic interface(s) will be replicated in the HumanFIRST driving simulator. Once the interface design set has been defined, a workshop will be held for representatives of the participating states. In this workshop, participants will have the opportunity to experience the interface in the University of Minnesota HumanFIRST driving simulator. Participants again will have the opportunity to critique the interface, and and provide design recommendations based on their experience. The final interface design will take into account the feedback produced by the design workshop. Once the design is "finalized," it will be tested under the national IDS contract in the HumanFIRST driving simulator to determine driver response and acceptance.

Deliverables: A prototype design drawing sn specification for a rural IDS driver-infrastructure interface that will satisfy national constraints with respect to deployment, maintenance, and public and Manual on Uniform Traffic Control Devices (MUTCD) acceptance points of view.

Task Budget $19,781.00

Task Due Date (calculated): 10/2/2004

Date Delivered (reported by PI):

Task Approved: No Date Approved (CTS received task approval) :

Progress: DII design work will continue with the CICAS program. At project meetings, the states will be kept abreast of developments of the DII.

As we move into the individual states for data analysis, prototype DIIs can be implemented to indicate how the syste will work once it is deployed. This should answer many of the questions which are posed about final system configuration.

4 Development of a Portable Intersection Surveillance System

The Minnesota team will develop a portable intersection surveillance system to be used to collect driver behavior data at remote, rural intersections. This system will be based on the rural intersection surveillance system developed for and operating at the intersection of US 52 and CSAH 9 in Goodhue County, MN.

The portable surveillance system will be composed of four primary subsystems:
·Radar Stations (for mainline traffic surveillance, including wireless data transmitters)
·Lidar stations (for both vehicle classification and median vehicle trajectory tracking, including wireless data transmitters)
·Main Computer Station (central control computer, Data Acquisition System, housed in a lockable trailer, and a single video camera to capture unusual events at the intersection crossroads)

·Power distribution system (including generators, transformer, auxiliary fuel tanks, cables, and automatic starting system (for battery charging), contract electrician , and an ATV to assist with system set up at each state site).

Two primary differences exist between the fixed and portable surveillance systems: power distribution and data transmission. To minimize the number of refueling trips needed by the state DOTs to keep the system running, a battery/generator system is proposed. With this system, each sensor station will be powered locally by a 12 Volt, deep cycle battery, which in turn is connected to battery charger. This battery charger is connected to a portable generator. The generator is connected to a Programmable Logic Controller (PLC) which has an internal clock. Two or three times per day, the PLC will instruct the generator to start. The generator will energize the battery chargers, which will in turn charge the batteries. After the generator runs a sufficient amount of time to charge the batteries, the PLC will shut down the generator. The process will be repeated as needed to keep the batteries sufficiently charged. A diagram of one leg of the power distribution system is shown in Figure 1 below.

Data transmission at the Minnesota test intersection is performed with a local DSL network using hardwired CAT V conductors. For the portable intersection surveillance system, wireless communication is proposed to control both the cost and the complexity of the portable system. A number of variations of 802.11a, b, and g as well as Mesh Networks will be tested at the Minnesota test intersection to identif an optimal technology for this portable surveillance system application.

Once power distribution and data transmission systems are validated, the portable surveillance system will be tested alongside the Minnesota test intersection instrumentation to validate the system performance (accuracy, reliability, data transmission robustness, etc.), fuel economy, and battery charge and discharge rates. Once the system performance and operating conditions are known, the system will likely be deployed initially in Wisconsin. The intersections identified in the Wisconsin crash analysis are on US 53, and are reasonably close to the University of Minnesota. Because of this proximity, periodic checks of this initial deployment are relatively convenient for the Minnesota team.

Deliverables: The deliverable for this task will be a portable rural intersection surveillance system which will be transported to partner states for the purpose of recording driver behavior at intersections jointly selected by each partner state and the Minnesota team.

Task Budget $195,000.00

Task Due Date (calculated): 7/2/2005

Date Delivered (reported by PI):

Task Approved: No Date Approved (CTS received task approval) :

Progress: The portable system has been fully developed, and is presently being tested at the Minnesota Test Intersection as U 52 and CSAH 9. The system will be run-in at US 52 and 9 for two weeks; once testing is complete, any changes needed will be made, and the system prepared for its first deployment in WI, beginning in April, 2006.

5 Data Collection

Data will be collected with the portable surveillance system for approximately one month at one intersection per partner state. The Minnesota team will work with each state to identify the intersection at which data will be collected. Once the intersection is known, the Minnesota team will arrange for the portable system to be shipped to a state DOT facility close to the intersection. Once the equipment arrives, Minnesota personnel will travel to the DOT facility, pick up the equipment, and bring the portable system on line. State DOT personnel will assist with this process by providing and installing sensor posts at locations determined by the Minnesota team. State DOT's will also provide a means to secure portable equipment at the intersection to discourage theft or vandalism.

The expected time to bring the system on-line and test its performance is one week. At the conclusion of the first week, the Minnesota Team will turn the portable system over to the state DOT, who will refuel generators when needed, periodically check for component the or vandalism, and in the unlikely event, reboot either the intersection controller or data acquisition computer. (The need to reboot has not been an issue with the permanent system.)

At the conclusion of the data collection process, the Minnesota team will return to the test site, take the system off-line, and prepare to ship it to its next destination. Data collected at the intersection will be archived at the University of Minnesota for subsequent analysis.

Deliverables: At least one month of driver behavior data collected in each partner state. The data will be archived and analyzed on a per state basis. Analysis includes gap acceptance statistics as functions of time of day, vehicle class, maneuver type, and speed variation along mainline roads. The results of the analysis will be summarized for each state in a letter report.

Task Budget $58,571.00

Task Due Date (calculated): 1/2/2007

Date Delivered (reported by PI):

Task Approved: No Date Approved (CTS received task approval) :

Progress: This will begin in April, 2006, in Wisconsin. Test data is presently being collected, but this just duplicates the data collected by the fixed system located as US 52 and CSAH 9.

6 Data Analysis

Deliverables:

Task Budget $38,955.00
Task Due Date (calculated):
Date Delivered (reported by PI):
Task Approved: Yes Date Approved (CTS received task approval) :

Progress: Not yet begun. Will begin with the collection of data in Wisconsin.

Future Plans: 1. Propose new timeline and longer duration data collection in each partner state.

2. Begin data collection in later April in Wisconsin.

Problems Encountered/Actions Taken: 1. Lower traffic volumes on US 53 was a bit unexpected, probably due to the fact that US 52 Traffic volumes are independent of season.