QUARTERLY REPORT 4/1/2005 - 6/30/2005

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: Held a project meeting on 20 April 2005. Presented progress on the Intersection Decision Support Project, and took the attendees to the IDS test intersection at US 52 and CSAH 9 in Goodhue County.

The meeting had 3 primary purposes:
1. Update IDS research results. Alec Gorjestani presented this.

2. Update State Crash Analysis Work. Howard Preston of CH2MHill presented his results regarding WI and NC.

3. Present new workplan based on feedback from January 2005 meeting. Lee Alexander and Craig Shankwitz presented this.

The meeting outcome was that the states are pleased with progress and crash analyses, they liked what they saw at the test intersction, and that they approved the proposed new workplan which has the U of MN develop a "portable" intersection surveillance system which will be used to collect data in each partner state.

As a result of this meeting, the University of Minnesota drafted an ammendment to the original workplan which documented the work needed to design, develop, and deploy a portable intersection surveillance system in each of the partner states. The ammendment was submitted to and approved by Mn/DOT.

We should also note that California has officially joined the state pooled fund project.

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: CH2MHill have completed the WI and NC state crash analyses, and have completed a draft of the MI report. On 22 June 2005, the Minnesota team met with MI traffic and safety engineers to review candidate test intersections in MI. Results of this field visit will be presented in the final MI crash analysis report.

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 driver 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 which 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: The HumanFIRST program has completed its initial human factors work associated with the IDS project. At the April 20 meeting, Nic presented the results of the IDS human factors work, and indicated the next steps to be taken to have an operational display in the field. The response to the presentation was very favorable, and led to a number of discussions regarding deployment issues. In general, partner states are anxious to test these system in their own states.

4 State Intersections

Facilitate the construction of a data collection system for installation at experimental intersections in those states who wish to collect data regarding the behavior of its citizens at rural intersections and who wish to participate in the anticipated FHWA sponsored Field Operational Test of this IDS program. The instrumentation of these intersections will be a joint process between Minnesota and the participating states. The Minnesota team will provide intersection design guidance and assistance in bringing the intersection online. Each state will be responsible for the purchase of the surveillance equipment to be installed at each intersection, and the construction of the infrastructure needed to support the surveillance equipment. Instrumentation of test intersections in states other than Minnesota serves a number of purposes. First, data collected from multiple states can be used to determine whether regional differences in what gaps motorists accept and how they proceed through an intersection. Results here will indicate whether a single DII design will function throughout the US, or if the system will have to be modified to accommodate regional differences. Second, by having a network of rural instrumented intersections, states are well positioned to participate in an operational test of these rural intersection decision support systems. Inclusion of these state intersections will make the operational test truly a national endeavor, and the key first step to a nationally deployable system This task consists of two phases: intersection design, and intersection build.
SUBTASK 4.1: INTERSECTION DESIGN. The Minnesota team will travel to each state which chooses to instrument an intersection. The team will create a high accuracy geospatial database of the experimental intersection. A request will also be made to the state DOT to provide design, as-built, planametric, digital terrain models (DTM), and photogrammetric data if such data is available. Once the da

Deliverables: Subtask 4.1 deliverable: A design document from which a test intersection data collection system can be built, and a parts list for the experimental intersection so necessary equipment may be purchased and subsequently installed.
Subtask 4.2 deliverable: Technical support for installation and testing of the data collection system in each state.

Task Budget $107,978.00
Task Due Date (calculated): 7/2/2005
Date Delivered (reported by PI):
Task Approved: No Date Approved (CTS received task approval) :

Progress: At the January 2005 meeting, states indicated that given present budget constraints, it was unlikely that they would each be able to provide funding for a permanent intersection surveillance system at the intersections identified in the crash analysis.

As such, the Minnesota Team presented an option: build one portable system, and take it to partner states for data collection. What was proposed was that the U of MN design and develop the system, and procure the equipment necessary to collect data at a selected intersection in each partner state. The states liked this idea, and voted to move forward in this direction.

We are now in the process of designing the portable system. The portable system will use wireless (IEEE 802.11b or g) to send data from each sensor to the main system computer. We are also designing a trailer to both transport and house equipment so it can be transferred to each locale.

The design challenge for the portable system lies with the communication system and the power system. Software developed and validated for the IDS Program will be directly used with the portable system.

5 Intersection Data Collection

Data from each of the state test intersections will be collected via a phone line from each intersection daily for subsequent analysis. To facilitate this data collection activity, a data server and data back up system must be procured and application specific software written. Provisions can be made to provide states with data from their experimental intersection. Once the system is designed, tested, and validated, data will be collected daily, archived, and backed up to assure data integrity. Data will be collected from the time an intersection is brought on-line until the project ends. On occasion as part of the data collection process, limited demographic data for the drivers making intersection entry decisions will likely be required. Each member state will be asked to collect this demographic data. The data collected will include age, gender, and time.

Deliverables: An operational remote data collection system with archival and data back-up capabilities. Data can be provided to each state if requested.

Task Budget $45,837.00
Task Due Date (calculated): 9/2/2006
Date Delivered (reported by PI):
Task Approved: No Date Approved (CTS received task approval) :

Progress: Not yet begun. Once the portable intersection surveillance system is rigged and debugged, it will be transported to Wisconsin for its first data collection effort. At the present time, it appears that the portable system will be ready for its initial deployment in September 2005.

Once the system is validated and Wisconsin data collected, the system will be moved to a partner state and set up at an intersection determined by the crash analysis of Task 2. Data will be collected for one approximately one month. At the end of the data collection period, the data will be archived in the IV Lab, where it will be subsequently analyzed. The instrumentation will be taken down, and moved to another state for additional data collection.

Traffic data will be collected in all partner states.

5 Intersection Data Analysis

Specific to this project will be the opportunity to determine whether statistically relevant regional differences exist in the gaps drivers accept and the trajectories taken to enter the mainline traffic stream. If differences are found to exist, quantification of these differences can be used to determine the degree to which the baseline rural IDS system needs to be modified to accommodate these differences. The data to be collected (and subsequently analyzed) is extensive. In addition to sensing the traffic approaching the intersection, traffic leaving the intersection will be sensed as well. By providing surveillance in this direction, collisions and near-misses will be captured, and will provide a baseline against which the IDS system can be evaluated when it is deployed. Vehicle identification systems located at each test intersection will provide macroscopic descriptions of vehicles entering the traffic streams; passenger vehicles will be distinguished from trucks, farm equipment, etc. If the resolution of the vehicle identification system is sufficient, it may be possible to distinguish large passenger vehicles from smaller vehicles, SUVs, pick-up trucks, etc. (Vehicle classification systems are under study as part of the Minnesota IDS study.) Sensors aimed at the crossroads will also record the trajectory of each vehicle as it leaves the minor road and enters the traffic stream. This information, combined with the vehicle classification data, will provide thorough behavioral models of gap acceptance and driver trajectories as a function of vehicle type.

Deliverables: A national database describing the behavior of drivers at rural expressway intersections. Analysis of the data collected at the state intersections will be used to determine whether statistically relevant regional differences exist regarding how drivers accept gaps and enter the traffic stream. If differences do exist, they will be quantified to determine which, if any, modifications to the DII and the algorithms which trigger it need to be modified to accommodate these regional differences. A report summarizing the results of the data analysis, and quantification of regional differences in driver behavior will also be provided.

Task Budget $70,713.00
Task Due Date (calculated): 1/2/2007
Date Delivered (reported by PI):
Task Approved: No Date Approved (CTS received task approval) :

Progress: Not yet undertaken. Process will begin in October 2005 with the Wisconsin data, and repeated with each subsequent partner state.

Future Plans: 1. The design, development and deployment of the portable intersection surveillance system is the primary focus of the July-September effort. If we hold our schedule, we should be ready for an initial deployment in Wisconsin in Septemer 2005. We expect a few teething problems with the initial deployment, so the Wisconsin intersection, relatively close to the U, makes an ideal first candidate.

Problems Encountered/Actions Taken: No problems at this point. Initial wireless communication tests show some range limitations, but the tests were performed with antenna mounted close to the radar sensor. Moving the wireless comm. antenna higher should alleviate the problem.