

**Cleveland State University  
Transportation Center  
Fenn College of Engineering**

**TECHNICAL REPORT  
CSUTC-TR-08-01**



**Demonstration of Innovative Techniques for Work Zone Safety  
Data Analysis  
(Quarterly Report to ODOT)**

**Stephen F. Duffy**

**OHIO DEPARTMENT OF TRANSPORTATION  
QUARTERLY RESEARCH REPORT**



For Quarter Ending December 31, 2008

Date Submitted July 6, 2009

Project Title: Demonstration of Innovative Techniques for Work Zone Safety Data Analysis  
Research Agency: Cleveland State University  
Principal Investigator(s): Stephen F. Duffy

State Job No.: 134332

Agreement No.: 21457

Pooled Fund Study No. (if applicable): \_\_\_\_\_

Project Start Date: May 1, 2007  
Contract Funds Approved: \$61,316 (\$62,683 - CSU match)  
Project Completion Date: July 1, 2009 (revised)  
Spent To Date: \$57,141.86 (\$128,005.75 - CSU match)  
% Funds Expended 93% (204% - CSU match)  
Work Done 80%  
Time Expired 81%

List the Technical Liaisons and other individuals who should receive copies of this report: Monique Evans, Jennifer Gallagher, Omar Abu-Hajar, Karen Pannell, Jill Martindale, Vicky Fout

**SUMMARY OF PROGRESS FOR QUARTER:**

**Schedule of Research Activities**

As of December 31, 2008, approximately 80% of the research has been completed. Figure 1 shows the proposed time schedule for each research task and the actual schedule of work completed on each task to date.

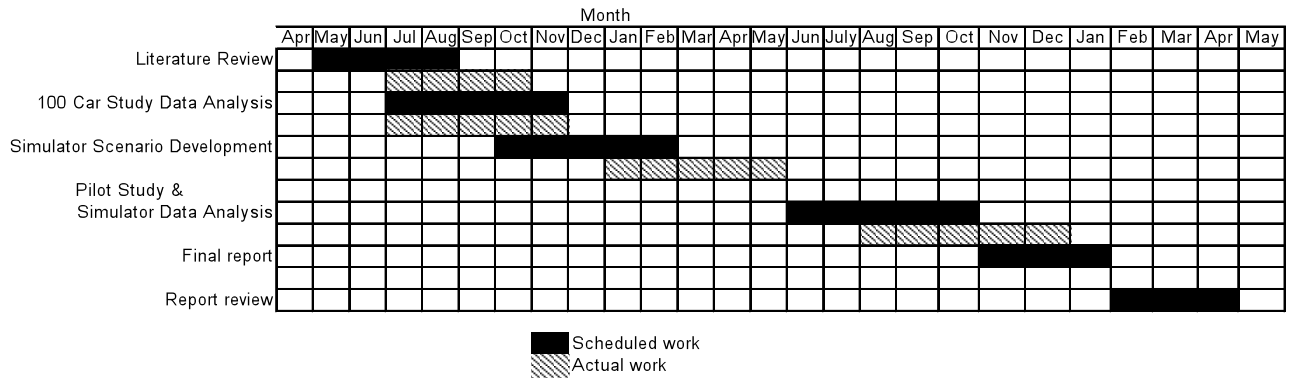


Figure 1. Schedule of research activities

During the seventh quarter the driving simulator was utilized to study work zone driving behaviors using the scenarios developed earlier. The purpose is to better understand driver-related causes of work zone crashes and provide information about the driver’s actions prior to crashes and near-crashes.

**Actual vs. Estimated Expenditures**

Figure 2 shows actual vs. estimated expenditures for work completed during the fifth quarter. As of December 31, 2008 approximately 80% of the proposed work was estimated to be completed according to the schedule shown in Figure 1 and the work time schedule provided in the original proposal.

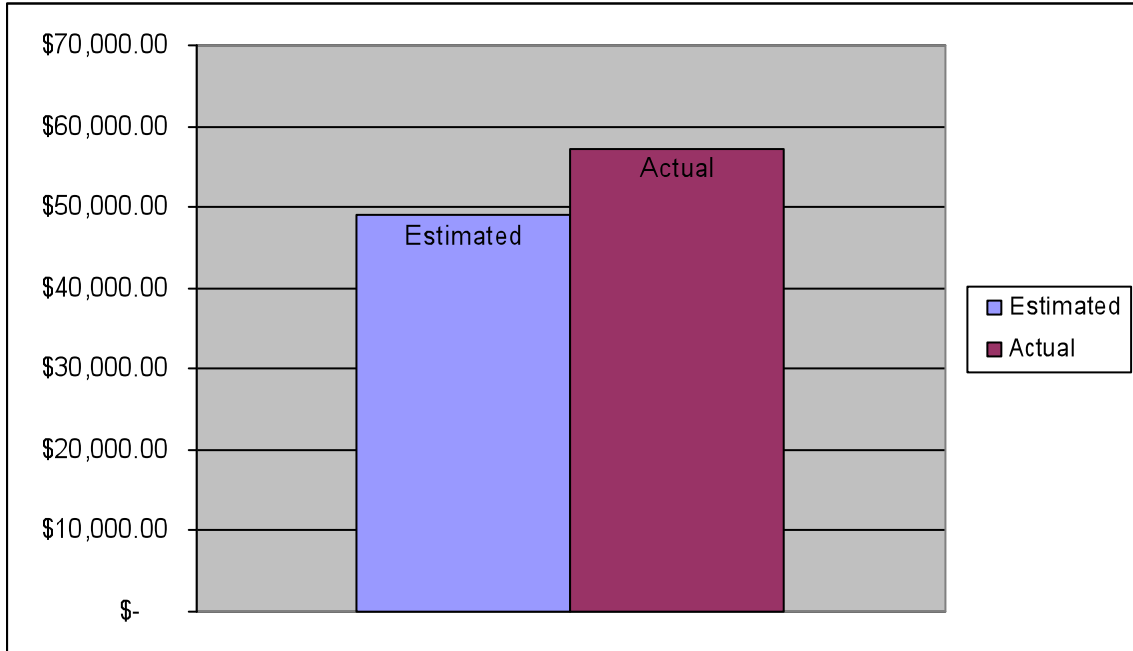


Figure 2. Estimated vs. Actual Expenditures (ODOT Funds)

Estimated expenditures of ODOT funds as of December 31 were \$49,052.80 (calculated as 80% of total budget). The actual expenditures were \$57,141.86.

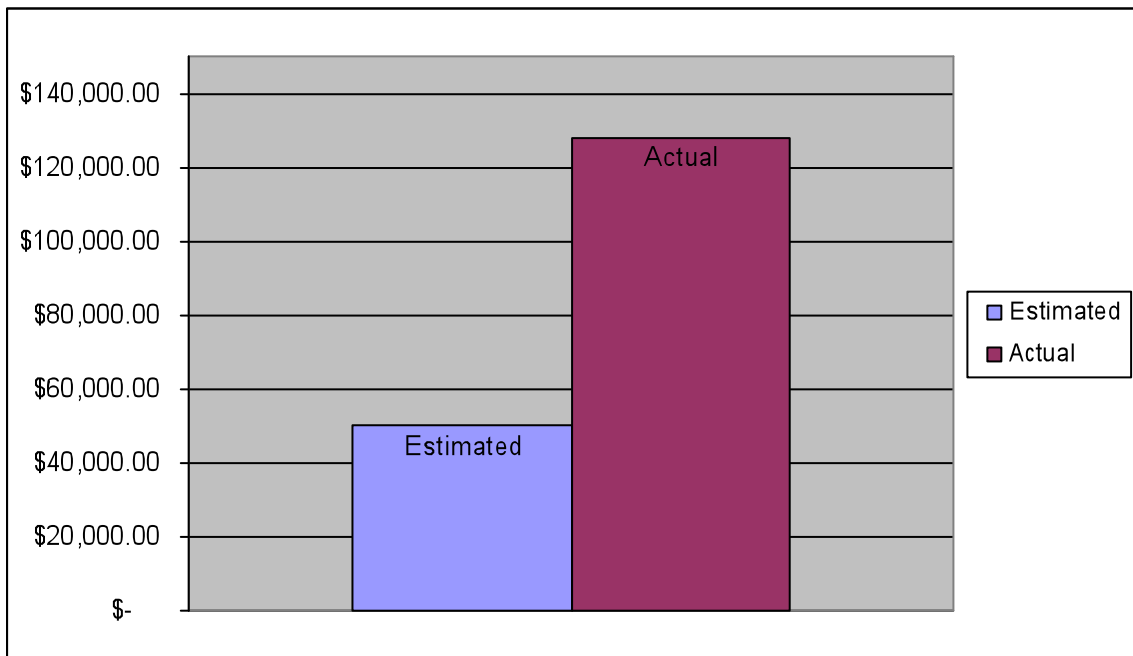


Figure 3. Estimated vs. Actual Expenditures (CSU Matching Funds)

Estimated expenditures of CSU matching funds as of December 31 were \$50,146.40 (calculated as 80% of total budget). The actual expenditures were \$128,005.75.

**Percent Completion of Research**

At the end of the fifth quarter of this grant approximately 80% of the research as been

completed.

#### *Literature Review*

The literature review has been completed and reported on in an earlier report.

#### *100 Car Study Data Analysis*

CSU received the VTTI deliverables. The data includes an excel spreadsheet representing all the relevant variables associated with all 100-Car Study crashes, near-crashes, and incidents that occurred in a work zone. In addition, CSU's analysis of Ohio work zone crash data is complete.

#### *Simulator Scenario Development*

Scenario development began in January 2008. The work zones created in the scenarios include traffic control devices and signs placed on the roadway in accordance with the Ohio MUTCD. These work zones are being used in the validation and pilot studies. Details of each of the scenarios were provided in the previous quarterly report. Work on developing the simulation scenarios is complete.

#### *Validation Study*

The validation study would have been developed and conducted based on the findings obtained from the naturalistic data analysis in comparison to data obtained from the driving simulator. A qualitative validation analysis will not be conducted. Information regarding the work zone configuration for the Virginia Tech data was never archived making the validation study impossible to conduct.

#### *Pilot Study*

A revised pilot study was developed based on collaboration with ODOT and commences at the beginning of the quarter. The pilot study was reported on in the last quarterly report. A total of 4 scenarios are being presented to study participants. Each scenario will contain 6 treatment combinations (3 on divided roads, 3 on undivided roads). The order in which treatment combinations appear in the scenario was counterbalanced to prevent confounding. The order in which scenarios are presented to each participant was also randomized. Treatment combinations were reported on in the last quarterly report.

### **PROPOSED WORK FOR NEW QUARTER:**

The pilot study is underway. Test subjects are being recruited and information regarding their behavior in each of the scenarios will continue to be collected.

### **IMPLEMENTATION (if any): N/A**

### **PROBLEMS & RECOMMENDED SOLUTIONS (if applicable):**

A contract extension of one year was requested and granted by Monique Evans on June 9, 2008. The extension was requested due to the delays associated with the IRB approval and the by the fact that the original PI, Professor Nancy Grugle has left CSU. As noted in the previous report, with the completion of the semester at CSU, obtaining subjects for the pilot study will be difficult. Therefore, the majority of the pilot study will have to be completed when school commences in the fall.

As to the departure of Professor Nancy Grugle, Professor Stephen Duffy has proposed to ODOT that he take over the grant as PI in order to finish the research. Professor Duffy reached out to Professor Deb McAvoy at Ohio University to help in completing the data analysis. A contract for Professor McAvoy's services was prepared, forwarded and

approved. This project will be finished as a joint collaboration with Ohio University.

Since the pilot study consists of subjecting each participant to a number of simulations, the length of the simulation is approximately an hour and a half. Initially we have found that the length of the simulation is a contributor to participants experiencing simulation sickness. During this quarter we have separated the scenarios for each participant into two segments. This has mitigated simulation sickness, but it is still posing problems. We are contemplating turning the motion platform off after consultations with DriveSafety, the manufacturer of the simulation equipment.

**EQUIPMENT PURCHASED (if any): N/A**

**CONTACTS & MEETINGS:**

A project meeting with ODOT personnel was held to discuss project progress on August 15, 2008. Monique Evans, Jennifer Gallagher, Dave Holstein and Reynaldo Stargell from ODOT visited CSU to meet with the project participants. A tour of the simulator was also included in the meeting.