EXHIBIT A
SCOPE OF SERVICES

SAFETY STUDY OF I-35W IMPROVEMENTS DONE UNDER UPA PROJECT

BACKGROUND

Minnesota's Urban Partnership Agreement (UPA) project consisted of a package of interventions aimed at improving travel on the I-35W corridor. Construction began in May 2009 and was essentially completed by November 2010. Problem Statement NS-329 notes that there is interest in extending some or all of these interventions to other corridors, and that an estimation of their safety effects is needed in order to assist these decisions. NS-329 also notes that the UPA intervention consisted of several different improvements, including reconstruction of the Crosstown Commons, provision of HOT lanes and priced dynamic shoulder lanes (PDSL), and changes in ramps/auxiliary lanes, and that it would be desirable to untangle the effects of the improvements. For example, crash frequencies appear to have increased where PDSL have been provided, but it is unclear if this is due to the PDSLs themselves or to changes in congestion due to removing the Crosstown bottleneck.

This research project will use an interrupted time-series approach to test for changes in crash experience before versus after the UPA project(s). In addition to looking at an overall, aggregated effect, separate analyses will be done on important individual sections of the I-35W corridor for separate times of day to allow for congestion effects, and separate crash types (rear-end, side-swipe, road departure).

OBJECTIVE

There is interest in extending the UPA innovations to other corridors, including the conversion of bus-only shoulder operation to priced dynamic shoulder lanes. The main benefit from this research will come from quantifying the safety-related effects associated with the UPA innovations, in order to support decisions regarding extension of these to other corridors.

SCOPE

The basic idea is to compare crash experience before implementation of the UPA improvements to that occurring after implementation. A naïve comparison of total crash frequencies before vs after, however, would not be persuasive because of a failure to control for possible differences in traffic volume. In addition, the need statement raises the interesting possibility that one UPA action could change traffic conditions in sections of freeway containing a second UPA action, leading to the appearance that the second action changed observed crash frequencies. Our view is that a defensible analysis would have to disaggregate data at least by day, and probably by hour, so traffic volume counts, crash counts, and traffic flow measures will be needed on an hourly basis. In addition, it will likely be necessary to conduct analyses for separate sections of I-35W. Fortunately, the I-35W corridor is well-instrumented with loop detectors for which archived traffic data at the needed level of disaggregation are available. Our general approach will be to use generalized linear models (GLM) to both estimate any change in crash rate associated with the UPA program and to control for possible trend effects, seasonal effects, and other influences that could confound our analysis. Generalized linear modeling can be viewed as a generalization of the more common linear regression analysis, which provides more appropriate tools for dealing with count data. To illustrate our intended approach, Figure 1 shows a time series plot of daily crash counts for the years 1991-1992, for a section of southbound I-35W just north of the Crosstown Commons. Figure 2 shows a time series plot of daily traffic counts from an automatic traffic recorder in that section. The overall crash rate during this period was about 0.84 crashes/million vehicles, but a test is necessary to identify if the crash rate varies on weekdays as opposed to weekends, in the winter as opposed to non-winter months, or if there is a time trend in crash rate. Estimates of GLM coefficients associated with these effects are summarized in the following table:

Effect	Coefficient	Standard Error	t-test	p-value
Weekday	0.474	0.257	1.85	0.064
Year	0.52	0.195	2.67	0.0076
Seasonal	0.206	0.195	1.06	0.289

Interestingly, there is clear evidence that, at this location, the crash rate was about 70% higher (exp(0.52)=1.699) in 1992 than in 1991, and somewhat weaker evidence for higher crash rates on weekdays as opposed to weekends. Other things equal, crash rates in the winter months appear to be roughly equal to those in non-winter months. This example shows the sort of statistical control that is possible when traffic data are available at a daily, as opposed to an annual average, level, for a single section of freeway. Rather than using total daily crash frequencies as the dependent variable it would also be possible to use crash frequencies and traffic volumes, per day, for given time periods, such as 7-9 AM, and to include measures of traffic conditions, such a lane occupancies or speeds, as control variables.

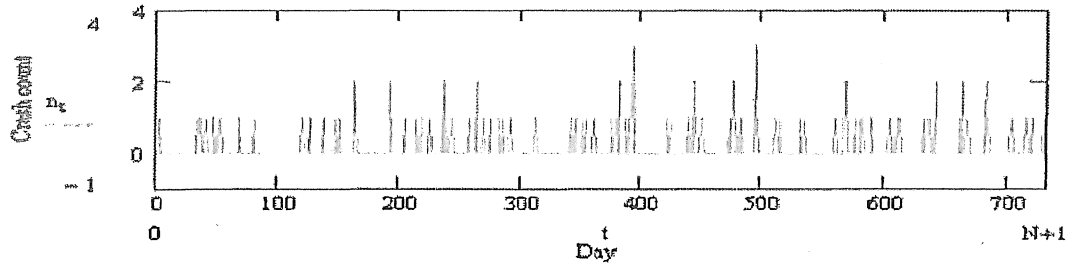

Figure 1. Daily Crash Counts on SB I-35W, North of Crosstown, 1991-1992

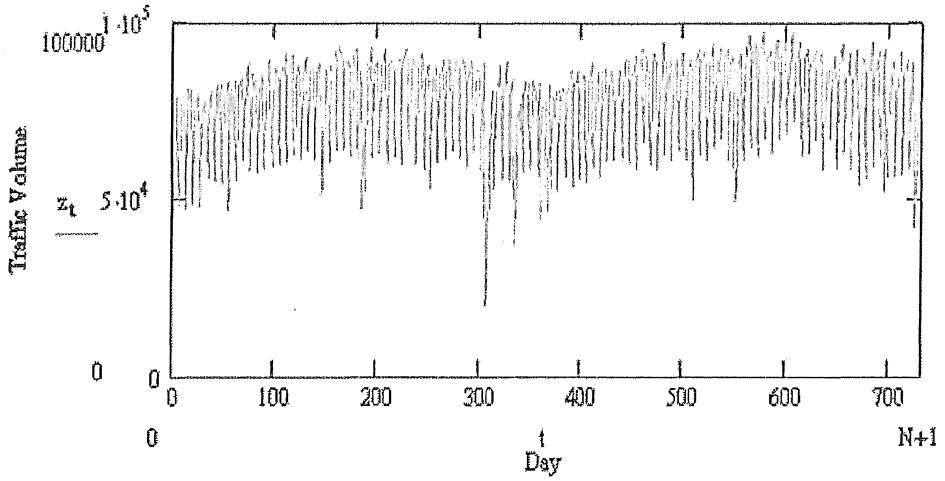

Figure 2. Daily Traffic Volumes on SB I-35W, North of Crosstown, 1991-1992

ASSISTANCE

The primary MnDOT assistance will be from the project's TAP in Task 2, where one and possibly two meeting will be needed to identify the relevant I-35W sections and times-of-day for analyses. In addition some limited assistance will be needed in getting access to crash reports in order verify that crashes are correctly located.

WORK PLAN

Task Descriptions

Task 1: Exploratory Analyses

The University will compile crash and geographic data for the UPA I-35W corridor for 3 years prior to initiation of the UPA reconstruction program and for the years 2011-2013. The University will prepare before and after collision diagram-type maps showing locations of freeway crashes. The University will also compile a detailed timeline of UPA projects.

Task 2: Determine Critical Sections/Times of Day
The University will consult with the project's TAP in order to divide the I-35W corridor into relevant, homogeneous sections. That is, sections were the freeway geometrics and traffic conditions are approximately constant. The University will also (1) identify sections and/or times of day where operations personnel suspect significant or interesting safety problems, (2) identify appropriate before and after periods for identified section.

Task 3: Compile Control Variable Data
The University will compile data on features which affect crash frequency, including traffic volumes, lane occupancy, weather conditions, for the sections and time periods identified in Task 2.

Task 4: Initial Data File Preparation and Analysis
The University will construct computer readable files, for one analysis, from the data gathered in Tasks 1-3, and test the analysis software.

Task 5: Complete Data File Preparation
The University will complete the data file preparation of all selected analyses.

Task 6: Conduct Statistical Analyses
The University will construct statistical models of crash frequencies and use these models to estimate changes before vs after the relevant UPA projects. These analyses will include aggregated (whole day) analyses for each relevant section as well as for particular times-of-day identified in Task 2.

Task 7: Compile Report, Technical Advisory Panel Review and Revisions
The University will prepare a draft report, following MnDOT's publication guidelines, to document project activities, findings and recommendations. This report will need to be reviewed by the Technical Advisory Panel (TAP), updated by the University's Principal Investigator, and then approved by the Technical Liaison before this task is considered complete. Holding a TAP meeting to discuss the draft report and review comments is strongly encouraged. TAP members may be consulted for clarification or discussion of comments.

Task 8: Final Published Report Completion
During this task, the Approved Report will be processed by MnDOT's Contract Editors. The editors will review the document to ensure the document meets the publication standard. The University's Principal Investigator will then prepare the Final Report and submit it for publication through MnDOT's publishing process.

Task Deliverables

Task:	Deliverable(s):
1:	Summary report
2:	Summary report
3:	Summary report
4:	Summary report
5:	Summary report
6:	Summary report
7:	A Draft Report and Final Report Approved for Publication
8:	Final Published Report

PROJECT SCHEDULE

Task Completion Dates

Task:	Draft Deliverable Due Date:	Final Task Approval Date:
1:	November 30, 2014	December 31, 2014
2:	January 31, 2015	February 28, 2015
3:	April 30, 2015	May 31, 2015
4:	June 1, 2015	June 30, 2015
5:	August 31, 2015	September 30, 2015
6:	January 31, 2016	February 28, 2016
7:	April 30, 2016	June 30, 2016
8:	N/A	August 31, 2016

Task Durations

	2014				2015												2016							
Months:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Task 1	X	X	X	X																				
Task 2				X	X	X																		
Task 3						X	X	X	X															
Task 4									X	X														
Task 5											X	X	X											
Task 6														X	X	X	X	X						
Task 7																			X	X	X	X		
Task 8																							X	X

Key Milestones

Key Milestones	Target Date	Description
TAP Meeting	9/15/2014	Initial meeting with project TAP
Present Results	1/31/2016	Initial results of analyses presented to TAP

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