MINNESOTA
URBAN PARTNERSHIP AGREEMENT

NATIONAL EVALUATION:
SAFETY DATA TEST PLAN

U.S. Department of Transportation
Research and Innovative Technology Administration
Federal Highway Administration
Federal Transit Administration

FINAL
November 17, 2009
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SAFETY DATA TEST PLAN

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16. Abstract

This report provides the safety data test plan for the Minnesota Urban Partnership Agreement (UPA) under the United States Department of Transportation (U.S. DOT) UPA Program. The Minnesota UPA projects focus on reducing congestion by employing strategies consisting of combinations of tolling, transit, telecommuting/TDM, and technology, also known as the 4 Ts. As outlined in the Minnesota National Evaluation Plan, the safety data test plan focuses on collecting and analyzing safety related data on the Minnesota UPA projects. The information from the safety data test plan will be used primarily in the safety analysis and the cost benefit analysis. This report presents the safety data sources, data availability, and potential risks associated with the data collection and analysis activities. The data analysis techniques, along with the schedule and responsibilities are also presented.

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LIST OF ABBREVIATIONS

4Ts	Tolling, Transit, Telecommuting, and Technology
APC	Automatic passenger counter
ATM	Active traffic management
AVL	Automatic vehicle location
BRT	Bus rapid transit
CBD	Central Business District
CBA	Cost and benefit analysis
CRD	Congestion Reduction Demonstration
CVO	Commercial vehicle operator
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HC	Hydrocarbon(s)
HOT	High-occupancy tolling
HOV	High-occupancy vehicle
ITS	Intelligent transportation systems
ITS-OTMC	Intelligent Transportation Systems-Operational Testing to Mitigate Congestion
MARQ2	Marquette and Second Avenue (downtown Minneapolis)
Mn/DOT	Minnesota Department of Transportation
MOE	Measure of effectiveness
MVTA	Minnesota Valley Transit Authority
NEF	National Evaluation Framework
NEP	National Evaluation Plan
NEPA	National Environmental Policy Act
NTOC	National Transportation Operations Coalition
O&M	Operation and maintenance
OTMC	Operational Testing to Mitigate Congestion
PDSL	Priced dynamic shoulder lane
RITA	Research and Innovative Technology Administration
ROG	Reactive organic gas(es)
ROWE	Results Only Work Environment
SOV	Single-occupant vehicle
TDM	Travel demand management
TMO	Traffic management operations
UPA	Urban Partnership Agreement
U.S. DOT	U.S. Department of Transportation
VII	Vehicle Infrastructure Integration
VMT	Vehicle miles traveled
VOC	Vehicle operating cost or Volatile organic compound
VT	Vehicle trips

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1.0 INTRODUCTION

This report presents the test plan for collecting and analyzing safety data for the National Evaluation of the Minnesota Urban Partnership Agreement (UPA) under the United States Department of Transportation (U.S. DOT) UPA program. The data will be used in examining the safety analysis contained in the Minnesota UPA National Evaluation Plan. This test plan is one of 11 test plans identified in the Minnesota UPA National Evaluation Plan.

The test plan begins with a brief overview of the Minnesota UPA projects, the safety analysis, and the relationship between the analysis areas and the test plans outlined in the Minnesota UPA National Evaluation Plan. The test plan presents the sources and availability of the safety data needed in the evaluation. Potential risks associated with the data and the data collection activities are discussed, and the data analysis techniques are described. The schedule and responsibilities for collecting, analyzing, and reporting on the safety analysis are also presented.

1.1 The Minnesota UPA

Minnesota was selected by the U.S. DOT as an Urban Partner to implement projects aimed at reducing congestion based on four complementary strategies known as the 4Ts: Tolling, Transit, Telecommuting/Travel Demand Management (TDM), and Technology. Under contract to the U.S. DOT, a national evaluation team led by Battelle is assessing the impacts of the projects in a comprehensive and systematic manner in Minnesota and other sites. The national evaluation will generate information and produce technology transfer materials to support deployment of the strategies in other metropolitan areas. The national evaluation will also generate findings for use in future federal policy and program development related to mobility, congestion, and facility pricing.

The Minnesota UPA partners include the Minnesota Department of Transportation (Mn/DOT), the Twin Cities Metropolitan Council, Metro Transit, the City of Minneapolis, Minnesota Valley Transit Authority (MVTA), and Anoka, Dakota, Ramsey, and Hennepin counties. The Center for Transportation Studies and the Hubert H. Humphrey Institute of Public affairs at the University of Minnesota are also partners in the UPA.

The Minnesota projects are focused on reducing traffic congestion in the I-35W corridor and in downtown Minneapolis. ITS technologies underlie many of the Minnesota UPA projects, including those focused on tolling, real-time traffic and transit information, transit signal priority, and guidance technologies for shoulder-running buses. Figure 1-1 highlights the general location of the various Minnesota UPA projects, which are described below.

- **High Occupancy Toll (HOT) Lanes**. The HOT lanes on I-35W represent a major component of the Minnesota UPA. This element includes expanding the existing HOV lanes to HOT lanes and constructing new HOT lanes. The HOT lanes will be dynamically priced. The existing HOV lanes on I-35W from Burnsville Parkway to I-494 will be expanded into dynamically priced HOT lanes. A new dynamically priced HOT lane will be added on I-35W from I-494 to 46th Street as part of the reconstruction of the Crosstown Commons Section.

- **Priced Dynamic Shoulder Lane (PDSL)**. The second tolling element of the Minnesota UPA is the implementation of a PDSL on I-35W in the northbound direction from 46nd Street to downtown Minneapolis. The PDSL also incorporates active lane management techniques and technologies, including speed harmonization.
- **Auxiliary Lanes**. An auxiliary lane and collector ramp is being constructed on I-35W in the northbound direction from 90th Street and I-494. An auxiliary lane is being constructed on I-35W in the southbound direction from 106th Street to Highway 13.
- **Park-and-Ride Facilities**. A total of six new or expanded park-and-ride facilities will be constructed as part of the Minnesota UPA. Two of the park-and-ride facilities are on I-35W north of downtown Minneapolis, one is on I-35W south of downtown Minneapolis, and three are on Cedar Avenue. The following describes the general facility locations and the anticipated number of parking spaces. A new 500-space parking ramp will be constructed adjacent to the existing 1,000-space parking lot at 95th Ave along I-35W North in Blaine. A new 460-space parking ramp will be constructed along I-35W North in Roseville. A new 750-space parking ramp will be constructed along I-35W south in Lakeville. A new 120-space parking lot with an enclosed passenger waiting facility will be constructed along Cedar Ave at Highway 13 in Eagan. A new 200-space parking lot will be constructed along Cedar Avenue at 180th Street in Lakeville. A new 500-space parking ramp, a 250-space surface lot, and a side platform station will be constructed along Cedar Ave at 155th Street in Apple Valley.
- **New Buses**. A total of 27 new buses will be purchased as part of the Minnesota UPA. These vehicles include a mix of standard, hybrid, and coach buses. The buses will be used to operate new and expanded express bus service.
- **Downtown Minneapolis Dual Bus Lanes on Marquette and 2nd Avenues**. Double contraflow bus lanes are being constructed on Marquette and 2nd Avenues in downtown Minneapolis. Called the MARQ2 project, the lanes replace existing single contraflow lanes on each avenue. The project also includes construction of wider sidewalks, and improved lighting, landscaping, and passenger waiting areas.
- **Transit Advantage Bus Bypass Lane**. A "Transit Advantage" bus bypass lane/ramp has been constructed to facilitate the movement of northbound buses at the Highway 77/Highway 62 intersection. A new bus-only left-turn lane has been constructed and new traffic signals have been installed to allow buses to make a left turn from Highway 77 to Highway 62.
- **Cedar Avenue Lane Guidance System**. A lane guidance system for shoulder-running buses will be developed, implemented, and operated on Cedar Avenue. The system includes lateral guidance assistance, collision avoidance, and AVL technology. Lane assistance feedback will be provided to the bus operator through a "heads up" windshield display, a vibrating seat, and an active steering wheel.

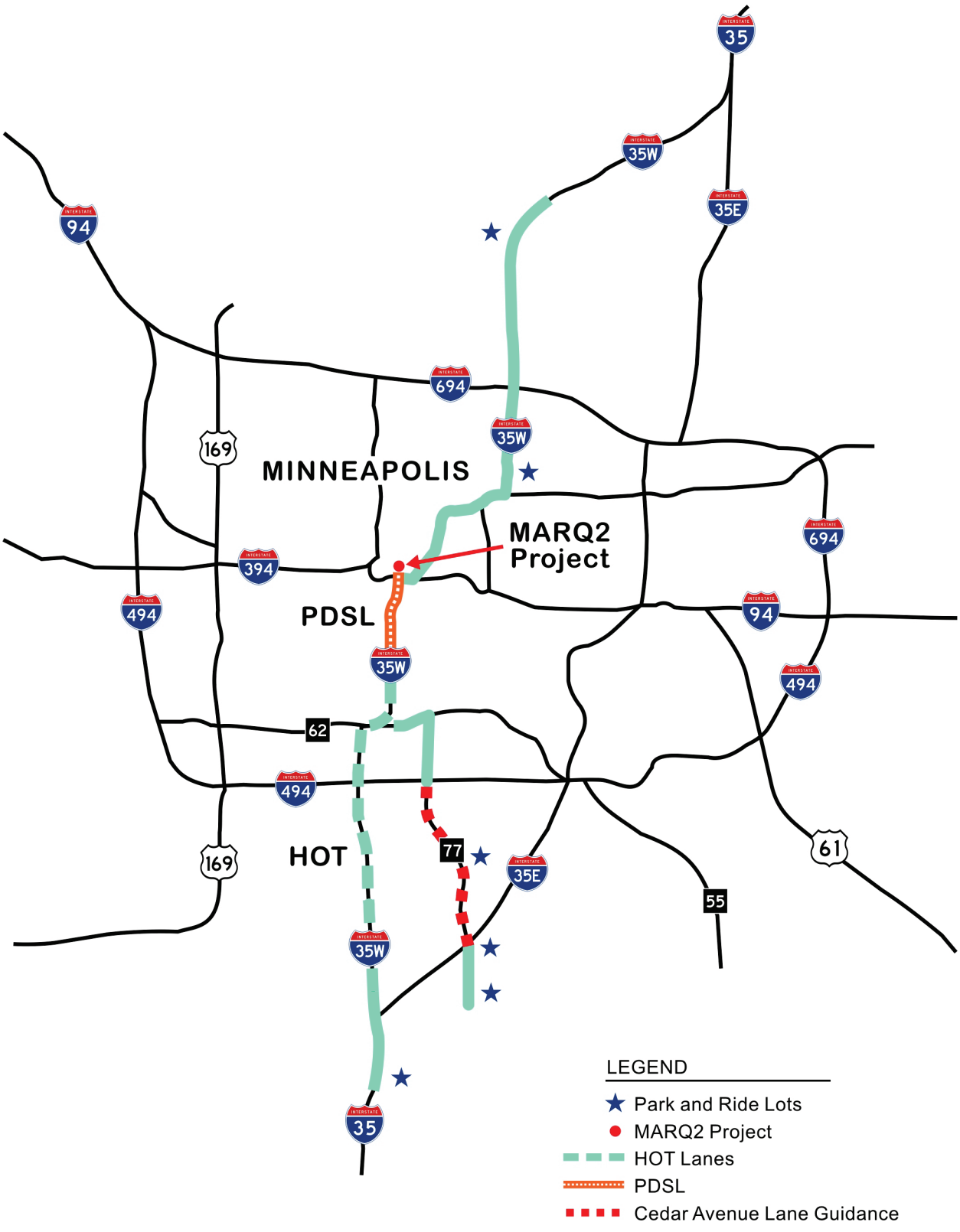

Figure 1-1. General Location of Minnesota UPA Projects

- **Real-Time Transit Information and Real-Time Traffic and Transit Information**. Real-time transit information, including next bus arrival information, will be provided along the MARQ2 lanes in downtown Minneapolis and park-and-ride facilities. Dynamic message signs along I-35W will display real-time traffic and transit travel times to downtown Minneapolis.
- **Transit Signal Priority**. Transit signal priority will be implemented along a contiguous stretch of Central Avenue north of downtown Minneapolis, and at selected locations around two park-and-ride facilities.
- **Telecommuting**. The telecommuting element of the Minnesota UPA focuses on increasing the use of Results Only Work Environment (ROWE), telecommuting, and flexible work arrangements throughout the region, including increasing the number of teleworkers and/or workers on flexible schedules in the I-35W corridor by 500 individuals. ROWE provides employees flexibility in the work location and hours by focusing on performance and results rather than presence at the office during standard work hours. ROWE is used extensively at Best Buy Corporation, headquartered in Minnesota. The UPA telecommuting component seeks to increase its use by other businesses in the region. The telecommuting element is funded entirely with state funds.

The Transit Advantage project became operational in December 2008. The majority of projects will be in operation by December 2009. The I-35W HOT lanes in the Crosstown Commons Section, the Cedar Avenue Lane Guidance System, and the Cedar Avenue Transit Station are scheduled for completion by October 2010.

1.2 Minnesota UPA National Evaluation Plan and Use of Safety Data Test Plan

The Minnesota UPA National Evaluation Plan focused on the 12 analysis areas outlined in the National Evaluation Framework (NEF)[1] and 11 test plans. Table 1-1 presents the relationships among the analysis areas and the test plans. The safety data test plan provides major input to the safety and cost benefit analyses. It also supports the technology analysis. Table 1-2 presents the safety data elements and the related measures of effectiveness and hypotheses/questions.

The remainder of this report is divided into three sections. Chapter 2.0 presents the data sources and data availability for evaluating the safety impacts of the Minnesota UPA. Potential risks associated with the safety data and data collection activities are discussed. Chapter 3.0 describes the analysis techniques for examining the safety data and assessing the measures of effectiveness. Chapter 4.0 presents the data collection schedule and responsibilities for completing the safety analysis.

[1]The document is available online at following website:
http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE//14446

Table 1-1. Relationship Among Test Plans and Evaluation Analysis

Minnesota UPA Test Plans	Evaluation Analysis											
	Congestion Analysis	Tolling Analysis	Transit Analysis	Telecommuting/ TDM Analysis	Technology Analysis	Safety Analysis	Environmental Analysis	Equity Analysis	Goods Movement Analysis	Business Impact Analysis	Non-Technical Success Factors Analysis	Cost Benefit Analysis
Traffic System Data Test Plan	●	○	○	○	●	○	○	○	●	○		●
Tolling Test Plan		●					○	○	○			●
Transit System Data Test Plan	○	○	●	○	●	○	○	○				●
Telecommuting Data Test Plan				●								
Safety Test Plan						●						●
Surveys Test Plan	●	●	●	●	●	●	●	●	●	●	●	
Transportation Modeling Test Plan												●
Environmental Data Test Plan							●	○				●
Content Analysis Test Plan											●	
Cost Benefit Analysis Test Plan												●
Exogenous Factors Test Plan	○	○	○	○	○	○	○	○	○	○	○	○

● — Major Input ○ — Supporting Input

Table 1-2. Safety Test Plan Data Elements Use in Testing Evaluation Hypotheses/Questions

Minnesota Safety Data Element	Minnesota UPA Measure of Effectiveness	Minnesota UPA Hypotheses/ Questions*
1. Mn/DOT CAD system; incident type	• Percent change in crash rate by type and severity	MNSafety-1 MNSafety-2 MNSafety-3 MNSafety-4 MNCBA-1
2. Mn/DOT CAD system; incident start time	• Percent change and change in variance in incident duration, incident frequency, and time to normal flow	MNTech-2
3. Mn/DOT CAD system; incident end time	• Percent change and change in variance in incident duration, incident frequency, and time to normal flow	MNTech-2
4. Mn/DOT CAD system; response times	• Percent change in time to clear incidents	MNSafety-1 MNSafety-2 MNSafety-3 MNSafety-4
5. Mn/DOT CAD system; incident clearance time	• Percent change in time to clear incidents	MNSafety-1 MNSafety-2 MNSafety-3 MNSafety-4
6. Mn/DOT CAD system; time to clear lanes	• Percent change in time to clear incidents	MNSafety-1 MNSafety-2 MNSafety-3 MNSafety-4
7. DPS Crash Database: severity of crash	• Percent change in crash rate by type and severity	MNSafety-1 MNSafety-2 MNSafety-3 MNSafety-4 MNCBA-1
8. DPS Crash Database: crash type	• Percent change in crash rate by type and severity	MNSafety-1 MNSafety-2 MNSafety-3 MNSafety-4 MNCBA-1
9. Traffic.com/NAVTEQ Incident and Event Database: Incident Type	• Percent change in crash rate by type and severity	MNSafety-1 MNSafety-2 MNSafety-3 MNSafety-4 MNCBA-1
10. Traffic.com/NAVTEQ Incident and Event Database: Incident Start Time	• Percent change and change in variance in incident duration, incident frequency, and time to normal flow	MNTech-2
11. Traffic.com/NAVTEQ Incident and Event Database: Incident End Time	• Percent change and change in variance in incident duration, incident frequency, and time to normal flow	MNTech-2

*Listed are acronyms corresponding to hypotheses/questions to be addressed with data from this test plan. An explanation of these acronyms can be found in Appendix A, which contains a compilation of the hypotheses/questions for all the analysis areas from the Minnesota UPA National Evaluation Plan.

2.0 DATA SOURCES, AVAILABILITY, AND RISKS

2.1 Data Sources

The safety data test plan focuses on obtaining and analyzing crash data and incident response data on I-35W, Cedar Avenue, Highway 77, County Road 23 in Dakota County, Marquette and 2nd Avenues in downtown Minneapolis, and other key locations. Similar data will be examined for the I-394 and I-94N control corridors and region-wide trends.

The safety data test plan uses three sources of data. The first two sources are the Mn/DOT Incident Logs/Computer Aided Dispatch (CAD) system and the Minnesota Department of Public Safety (DPS) Crash Database. The third source is the Traffic.com/NAVTEQ Incident and Event Database. The data from these sources is described next, along with the advantages and limitations of each database. Data from the Mn/DOT Incident Logs/CAD system is also used in the traffic data test plan.

Mn/DOT Incident Log and/or Computer-Aided Dispatch (CAD) System. The Mn/DOT Incident Log has been used historically to record freeway incidents and incident clearance times. In August 2008, Mn/DOT transitioned to the State Patrol CAD system to collect this data. The Incident Log and the CAD system include the following data:

- incident type – crash, stall, debris, etc.;
- location – direction of travel, freeway, cross-street;
- start time and end time;
- response times for state patrol and Freeway Service Patrol;
- incident clearance time and time to clear lanes; and
- lane blocking – yes or no.

There are a number of advantages to using the Incident Log and the CAD system. First, information is collected in real-time and is available immediately. Second, data on incident clearance time and response time are available. The information from the Incident Log and the CAD system can be used to provide a preliminary snapshot of the safety-related impacts of the UPA projects and to identify potential problem locations that may occur early in a UPA project.

There are limitations to use of the Incident Log and CAD system, however. Detailed information on crashes, such as type and injury severity, is not provided. The reported crash location may not be the actual location where the crash occurred. For example, a crash occurs in a general-purpose freeway lane, but the motorist moves to the nearest ramp, which is the location recorded in the log or CAD system. Only the freeways are included in the Incident Logs and the CAD system. As a result, data on I-35W and the Crosstown Commerce Section are available, but not Cedar Avenue, Marquette and Second Avenues in downtown Minneapolis, and other locations. Historical data are available only for the operating hours of Mn/DOT's Traffic Operations, which are 5:30 a.m. to 8:30 p.m., Monday through Friday, 10:00 a.m. to 6:00 p.m. on Saturday, and 11:00 a.m. to 7:00 p.m. on Sunday.

DPS Crash Database. The DPS Crash Database includes the official crash reports from the Minnesota State Patrol and local law enforcement departments. Citizen reports are also included

in the database. The list below highlights the major elements included in the DPS Crash Database:

- severity of crash – fatal, injury A, B, or C, property damage;
- crash type – struck other vehicle, struck guard rail, struck median barrier, etc.;
- crash diagram – rear-end, side-swipe, right angle, ran off road, etc.;
- location – direction, road, cross-street;
- lighting – day or night; and
- road surface – dry, rain, snow, etc.

A major advantage of the DPS Crash Database is that it includes more detailed information on the nature of the crash, including the location, than the Incident Logs or CAD System. Another advantage is that crashes are recorded 24 hours a day, 7 days a week, 365 days a year. A final advantage of the DPS Crash Database for the UPA evaluation is that Mn/DOT can request data on city and county roads, including Marquette and 2nd Avenues in downtown Minneapolis, Cedar Avenue, and County Road 23.

The major limitation of the DPS Crash Database is the lag time in data availability. It takes approximately six months for data to become available. Given the scheduled one-year of post-deployment data collection and analysis, use of the DPS Crash Database may be limited to the first six months rather than the entire year of data.

Traffic.com/NAVTEQ Incident and Event Database. As part of SHRP2 Project L03: Analytical Procedures for Determining the Impacts of Reliability Mitigation Strategies, TTI examined the use of incident and crash data available from public agencies and private vendors. The Traffic.com/NAVTEQ database, which is owned and maintained by the private sector, was one of the commercial databases included in the analysis. As part of the SHRP2 project, TTI obtained and examined 2006 and 2007 data for Minneapolis from the Traffic.com/NAVTEQ Incident and Event Database. The data includes the incident start time, the incident end time, and the type of incident. Data from 2008 is currently being processed.

One advantage of the Traffic.com/NAVTEQ Incident and Event Database is that it includes information on freeways and other roadways in the area. As a result, before-deployment data may be available for some roadways not covered in the Mn/DOT and DPS databases. Data can be requested and analyzed on a three-to-six-month basis in the post-deployment period.

2.2 Data Availability

Table 2-1 presents the data sources and availability of pre-deployment data and post-deployment data. Pre- and post-deployment data are available from the Mn/DOT Incident Log/CAD System for I-35W and Highway 77, as well as the control corridors and region-wide trends. Pre- and post-deployment data from the DPS database are also available for I-35W, Highway 77, the control corridors, and region-wide trends. Post-deployment data will be available for Cedar Avenue, County Road 23, and Marquette and 2nd Avenues. Pre- and post-deployment data on incident type, incident start time, and incident end time are available on selected segments of I-35W and other roadways of interest in the I-35W corridor from the Traffic.com/NAVTEQ Incident and Event Database.

Table 2-1. Safety Data Test Plan Data Sources and Availability

Data Source	Pre-Deployment Data	Post-Deployment Data
Mn/DOT Incident Log/CAD System		
I-35W	Yes	Yes
MARQ2	No	No
Cedar Avenue	No	No
Highway 77	Yes	Yes
County Road 23	No	No
Other Non-Freeway Locations	No	No
I-35W and I-94N Control Corridors	Yes	Yes
DPS Database		
I-35W	Yes	Yes
MARQ2	No	Yes
Cedar Avenue	No	Yes
Highway 77	Yes	Yes
County Road 23	No	Yes
Other Non-Freeway Locations	No	Yes
I-35W and I-94N Control Corridors	Yes	Yes
Traffic.com/NAVTEQ Incident and Event Database		
I-35W	Some*	Some*
MARQ2	Some*	Some*
Cedar Avenue	Some*	Some*
Highway 77	Some*	Some*
County Road 23	Some*	Some*
Other Non-Freeway Locations	Some*	Some*
I-35W and I-94N Control Corridors	No	No

*Data on incident type, incident start time, and incident end time are available for some sections of I-35W and other roadways in the corridor.

2.3 Potential Risks

There are inherent limitations and risks associated with the use of traffic crash and incident databases and safety-related analyses. First, crash and incident data are recorded by personnel at the scene. As a result, the accuracy of the data depends on individuals providing accurate and complete information. Second, even when accurate and complete information is recorded, the exact cause(s) of a crash or incident may not be apparent or known. For example, a crash in the HOT lane may be the result of driver actions in the general-purpose freeway lanes or visa-versa. Third, there is a lag time with the availability of data from some of the databases. Fourth, other factors besides the UPA projects may influence reductions or increases in crashes. Examples of these factors include traffic safety campaigns, other non-UPA improvements, and reduction in VMT due to the economic slowdown. Finally, fully examining the safety improvements of

projects takes longer than the one-year post-deployment period available for analyzing the Minnesota UPA projects.

All of these factors present limitations and potential risks for evaluating the safety-related impacts on the Minnesota UPA projects. The use of the multiple databases in this test plan, along with examining crash data from the control corridors and the overall tracking of changes in crashes in the metropolitan area, helps address some of the risks. Given budget and time considerations, there are no other cost effective approaches for addressing these risks. Mn/DOT and other participation agencies will be able to use the evaluation protocol to continue to monitor and analyze crash and incident data in the future, which will provide a longer-term perspective on the safety impacts of the UPA projects.

3.0 DATA ANALYSIS

The safety data test plan will focus on comparing pre-deployment crash and incident data with post-deployment crash and incident data. The data will be used to assess the measures of effectiveness outlined in the safety analysis and to estimate the safety cost savings from the UPA projects for the cost benefit analysis.

Members of the Battelle team will conduct a visual inspection of the data and will use automated range checks to identify any outliers or suspect data. Any data concerns identified will be checked with Mn/DOT and other agency personnel and the appropriate action will be taken.

Examples of the measures and analysis to be used in examining the safety data are highlighted below. Appropriate statistical measures, such as testing for significance, will be applied.

- Total numbers of crashes. The total number of crashes on different highways and roadways will be compared pre- and post-deployment. To the extent data are available, total crashes on I-35W South, I-35W North, Cedar Avenue, Highway 77, County Road 23, Marquette, and Second Avenues in downtown Minneapolis will be documented and compared. The total number of crashes in the control corridors and region-wide trends will also be monitored.
- Spatial configuration of crashes. The location or spatial configuration of crashes on the various facilities will also be analyzed pre- and post-deployment. This analysis will assist in determining if the UPA projects have reduced crashes in certain locations or have increased crashes in certain locations.
- Types and severity of crashes. The types and the severity of crashes will be examined pre- and post-deployment based on available data. This analysis will assess potential changes in the nature of crashes, and the resulting severity, based on the UPA projects.
- Crashes per 1,000 VMT. This analysis will compare pre- and post-deployment crashes per 1,000 VMT, based on available data from the traffic data test plan. This measure normalizes crash rates to account for either increased or decreases in VMT. Data will be examined for I-35W, Highway 77, the control corridors, the overall metropolitan area, and other facilities.
- Incident response time. The response time to incidents on I-35W will be examined pre- and post-deployment of the UPA projects.
- Incident duration time. The duration of incidents on I-35W will be compared pre- and post-deployment of the UPA projects.

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4.0 SCHEDULE AND RESPONSIBILITIES

The proposed schedule for collecting and analyzing the crash data from the four sources discussed previously is presented in Table 4-1.

Table 4-1. Safety Data Collection Schedule

Data Source	Historical Data (mid-2000 to 2008)	Pre-Deployment Data (2008/2009)	Post-Deployment Data (10/09 – 10/11)
Mn/DOT Incident Log/CAD System	08/09 – 09/09	08/09 – 09/09	10/09 – 10/11
DPS Crash Database	08/09 – 09/09	08/09 – 09/09	10/09 – 10/11
Traffic.com/NAVTEQ and Event Database	08/09 – 09/09	08/09 – 09/09	10/09 – 10/11

Historical data are available from the Mn/DOT Incident Log/CAD System, the DPS Crash Database, and the Traffic.com/NAVTEQ Incident and Event Database. Historical information from mid-2000 to 2008 will be obtained and analyzed to provide a trend line. Before-deployment data (2008 and 2009) will be obtained and analyzed. The historical and pre-deployment data collection will be initiated upon approval of this test plan by the U.S. DOT. These data collection activities are anticipated to occur in the August to September 2009 time period. Post-deployment data will be collected from October 2009 to October 2011 to allow for a full year of post-deployment data on those projects implemented in October 2010.

The responsibilities for this test plan include:

- Mn/DOT staff will provide the electronic files from the Mn/DOT Incident Logs/CAD System and the DPS Crash Database. The pre-deployment files will be provided in the August to September, 2009 time period. The Mn/DOT Incident Logs/CAD System files will be provided monthly in the post-deployment period. The DPS Crash Database files will be provided as they become available, with the realization that there is typically a six-month lag time.
- Members of the Battelle team will request the Traffic.com/NAVTEQ Incident and Event Database electronic files six-months, one year, and two years after the September, 2009 deployment of the initial UPA projects, thereby providing one full year of data on the UPA projects implemented in October 2010.
- Members of the Battelle team will check, reduce, and analyze the safety data from all sources and will complete the interim and final evaluation reports.

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APPENDIX A – COMPILATION OF HYPOTHESIS/QUESTIONS FROM THE MINNESOTA UPA NATIONAL EVALUATION PLAN

Evaluation Analysis	Hypothesis/ Question Number	Hypothesis/Question
Congestion	MNCong-1	Deployment of the UPA improvements will reduce the travel time of users in the I-35W corridor.
	MNCong-2	Deployment of the UPA improvements will improve the reliability of user trips in the I-35W corridor.
	MNCong-3	Traffic congestion on I-35W will be reduced to the extent that travelers in the corridor will experience a noticeable improvement in travel time.
	MNCong-4	Deployment of the UPA projects will not cause an increase in the extent of traffic congestion on surrounding facilities adjacent to I-35W.
	MNCong-5	Deploying the UPA improvements will result in more vehicles and persons served in the I-35W corridor during peak periods.
	MNCong-6	A majority of survey respondents will indicate a noticeable reduction in travel times after the deployment of the UPA improvements.
	MNCong-7	A majority of survey respondents will indicate a noticeable improvement in trip-time reliability after the deployment of the UPA projects.
	MNCong-8	The majority of survey respondents will indicate a noticeable reduction in the duration of congestion after deployment of the UPA projects.
	MNCong-9	A majority of survey respondents will indicate a noticeable reduction in the extent of congestion after the deployment of the UPA projects.
Tolling	MNTolling-1	Vehicle access on the HOT lanes and PDSL on I-35W will be regulated to improve operation of I-35W
	MNTolling-2	Some general-purpose lane travelers will shift to the I-35W HOT lanes and PDSL, while HOV lane travelers will remain in the HOT lane
	MNTolling-3	HOV violations will be reduced
	MNTolling-4	After ramp-up, the HOT lanes and PDSL on I-35W maintains improved operations

Evaluation Analysis	Hypothesis/ Question Number	Hypothesis/Question
Transit	MNTransit-1	The HOT lanes, PDSL, MARQ2 bus lanes, and Transit Advantage project, and shoulder running lane guidance system will increase bus travel speeds, reduce bus travel times, and improve bus trip-time reliability in the I-35W and Cedar Avenue corridors, and downtown Minneapolis
	MNTransit-2	The new park-and-ride lots and new and expanded transit services will result in ridership increases including a mode shift to transit.
	MNTransit-3	The mode shift to transit from the UPA transit strategies will reduce congestion on I-35W, downtown Minneapolis, and other roadways.
	MNTransit-4	What was the relative contribution of each of the Minnesota UPA transit strategies to mode shift to transit?
Telecommuting/ TDM	Tele/TDM-1	Use of telecommuting, ROWE, and other flexible work schedules removes trips and VMT from the I-35W corridor.
	Tele/TDM-2	Integration of telecommuting into the UPA project enhances congestion mitigation.
	Tele/TDM-3	What was the relative contribution of the telecommuting strategies to overall travel behavior changes, including secondary impacts of telecommuting
Technology	MNTech-1	Active traffic management strategies, including speed harmonization and DMS with transit and highway travel times, promoting better utilization and distribution of traffic to available capacity in the I-35W corridor.
	MNTech-2	Active traffic management strategies will reduce the number and duration of incidents that result in congestion in the I-35W corridor.
	MNTech-3	What was the relative contribution of each technology enhancement on congestion reduction in the I-35W corridors?
Safety	MNSafety-1	Active traffic management will reduce the number of primary and/or secondary crashes.
	MNSafety-2	The HOT lanes and the PDSL on I-35W South will not adversely affect highway safety.
	MNSafety-3	The MARQ2 dual bus lanes in Downtown Minneapolis will not adversely affect safety.
	MNSafety-4	The lane guidance system for shoulder running buses will not adversely affect safety.

Evaluation Analysis	Hypothesis/ Question Number	Hypothesis/Question
Equity	MNEquity-1	What are the direct social effects (tolls paid, travel times, adaptation costs) for various transportation system user groups from the I-35W HOT lanes, PDSL, transit, and other UPA strategies?
	MNEquity-2	What is the spatial distribution of aggregate out-of-pocket and inconvenience costs, and travel-time and mobility benefits?
	MNEquity-3	Are there any differential impacts on certain socio-economic groups?
	MNEquity-4	How does reinvestment of revenues from the I-35W HOT lanes and PDSL impact various transportation system users?
Environmental	MNEnv-1	What are the impacts of the Minnesota UPA strategies on air quality?
	MNEnv-2	What are the impacts on perceptions of overall environmental quality?
	MNEnv-3	What are the impacts on energy consumption?
Goods Movement	MNGoods-1	CVOs will experience reduced travel time by using the HOV lanes and PDSL on I-35W if CVO use is permitted.
	MNGoods-2	CVOs will experience reduced travel time by the overall reduction in congestion on I-35W from the UPA projects.
	MNGoods-3	CVOs hauling or delivering goods will perceive net benefit of HOT and PDSL (e.g., benefits such as faster service and greater customer satisfaction outweigh higher operating costs due to tolls). The exception may be in downtown Minneapolis, where delivery and service vehicles will not be allowed to use the dual bus lanes during the peak hours.
Business	MNBusiness-1	What is the impact of the UPA strategies on employers? e.g., employee satisfaction with commute perceived productivity impacts employee retention/hiring impacts negative impacts (increased cost of doing business)
	MNBusiness-2	How are businesses that are particularly impacted by transportation costs affected (e.g., taxis, couriers, distributors, tradesmen)?

Evaluation Analysis	Hypothesis/ Question Number	Hypothesis/Question
Non-Technical	MNNonTech-1	What role did factors related to “people” play in the success of the deployment? People (sponsors, champions, policy entrepreneurs, neutral conveners)
	MNNonTech-2	What role did factors related to “process” play in the success of the deployment? Process (forums including stakeholder outreach, meetings, alignment of policy ideas with favorable politics, and agreement on nature of the problem)
	MNNonTech-3	What role did factors related to “structures” play in the success of the deployment? Structures (networks, connections and partnerships, concentration of power and decision-making authority, conflict-management mechanisms, communications strategies, supportive rules and procedures)
	MNNonTech-4	What role did factors related to “media” play in the success of the deployment? Media (media coverage, public education)
	MNNonTech-5	What role did factors related to “competencies” play in the success of the deployment? Competencies (cutting across the preceding areas: persuasion, getting grants, doing research, technical/technological competencies; ability to be policy entrepreneurs; knowing how to use markets)
	MNNonTech-6	Does the public support the UPA/CRD strategies as effective and appropriate ways to reduce congestion?
Cost Benefit	MNCBA-1	What is the net benefit (benefits minus costs) of the UPA/CRD strategies?

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