MINNESOTA
URBAN PARTNERSHIP AGREEMENT

NATIONAL EVALUATION:
TOLLING TEST PLAN

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

FINAL
November 17, 2009
Publication No. FHWA-JPO-10-013

MINNESOTA
URBAN PARTNERSHIP AGREEMENT

NATIONAL EVALUATION:
TOLLING TEST PLAN

By

Battelle Memorial Institute
505 King Ave.
Columbus OH 43201

Prepared for

United States Department of Transportation
Federal Highway Administration (FHWA)
Office of Operations
1200 New Jersey Avenue, S.E.
Washington, DC 20590

Contract No. DTFH61-06-D-00007/ORDER 07-T-08002/WO BA07-041

FINAL
November 17, 2009

QUALITY ASSURANCE STATEMENT

The U.S. Department of Transportation provides high-quality information to serve Government, industry, and the public in a manner that promotes public understanding. Standards and policies are used to ensure and maximize the quality, objectivity, utility, and integrity of its information. U.S. DOT periodically reviews quality issues and adjusts its programs and processes to ensure continuous quality improvement.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-JPO-10-013		

4. Title and Subtitle	5. Report Date
Minnesota Urban Partnership Agreement National Evaluation: Tolling Test Plan	November 17, 2009
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Katie Turnbull, Texas Transportation Institute.	
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Battelle 505 King Avenue Columbus, OH 43201	11. Contract or Grant No. DTFH61-06-D-00007/ORDER 07-T-08002/WO BA07-041
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
U.S. Department of Transportation Research and Innovative Technology Administration Federal Highway Administration Federal Transit Administration 1200 New Jersey Avenue, S.E. Washington, DC 20590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report presents the test plan for collecting and analyzing toll data 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. The tolling projects in the Minnesota UPA include HOT lanes and a priced dynamic shoulder lane (PDSL) on I-35W South. The Tolling test plan is based on the Minnesota UPA National Evaluation. This test plan describes the tolling data sources, data availability, and possible risks associated with the data. The methods for analyzing the toll data are discussed. The schedule and responsibilities for collecting, analyzing, and reporting the toll analysis are presented.

17. Key Word	18. Distribution Statement
Urban Partnership Agreement, congestion pricing, tolling, HOT, congestion reduction, transit, bus rapid transit, telecommuting, evaluation	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
		30	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

This page intentionally left blank

ACKNOWLEDGEMENTS

A number of representatives from the Minnesota partnership agencies provided information critical to the development of the Minnesota UPA National Evaluation test plans. The assistance of Ken Buckeye, Minnesota Department of Transportation, in the development of the Tolling Test Plan is both recognized and appreciated.

TABLE OF CONTENTS

List of Appendices

List of Tables

List of Figures

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

This page intentionally left blank

1.0 INTRODUCTION

This report presents the test plan for collecting and analyzing toll 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 toll data will be used in the toll analysis and the cost benefit analysis contained in the Minnesota UPA National Evaluation Plan. The data also support the equity and goods movement analyses. This 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 relationship between the analysis areas and the test plans outlined in the Minnesota UPA National Evaluation Plan, and the use of the tolling data. The test plan presents the sources and the availability of the tolling 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 responsibility for collecting, analyzing, and reporting on the tolling 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 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.

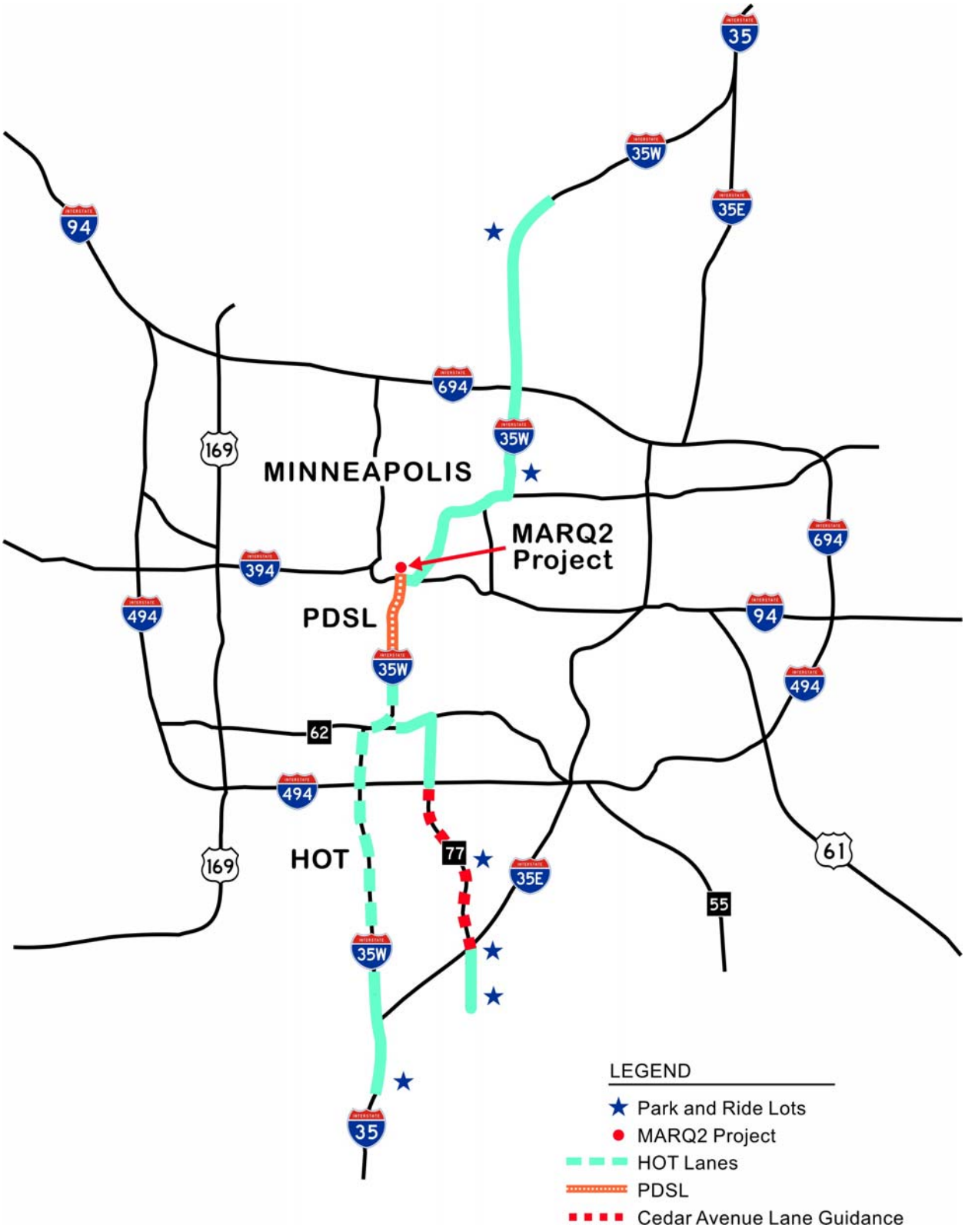

Figure 1-1. General Location of Minnesota UPA Projects

- **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 the Use of Tolling Data

The Minnesota UPA National Evaluation Plan focuses 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 tolling data test plan provides major input to the tolling and cost benefit analyses. It also supports the evaluation of the equity and goods movement analyses. Table 1-2 presents the tolling data elements and the measures of effectiveness and the hypotheses/questions the tolling data will be used to evaluate.

The remainder of this report is divided into three sections. Chapter 2.0 presents the data sources, data availability, and risks associated with evaluating the tolling elements of the Minnesota UPA. Chapter 3.0 describes the techniques that will be used to test the tolling hypotheses and assess the measures of effectiveness. Chapter 4.0 presents the schedule and responsibilities for completing the tolling 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. Tolling Test Plan Data Elements Use in Testing Evaluation Hypotheses/Questions

Minnesota Tolling Data Element	Minnesota UPA Measure of Effectiveness	Minnesota UPA Hypotheses/Questions*
1. MnPASS Database – Transponder Sales	• Use of HOT and PDSL options	MNTolling-2
2. MnPASS Database – Zip Codes of Transponder Holders	• Socio-economic and geographic distribution of benefits and impacts	MNEquity-3
3. MnPASS Database – Total Revenues	• Revenues from the HOT lanes and PDSL	MNCBA-1
4. MnPASS Database – Toll Transactions by Time-of-Day, Freeway Segment, and Direction	• Travel time reliability in HOT lanes and PDSL • Level-of-service in HOT lanes and PDSL • Use of HOT and PDSL Options • Traffic density in HOT lanes and PDSL • Number of allowed commercial vehicles using HOT lanes and PDSL	MNTolling-1 MNTolling-4 MNGoods-1
5. MN State Patrol – Citations for Toll Violations/Vehicle-Occupancy Violations	• Change in the number of violations for not meeting HOT lane vehicle-occupancy requirements	MNTolling-3

*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 tolling system used on the I-394 MnPASS project will be used on the I-35W HOT lanes and the PDSL. As a result, the tolling test plan builds on the data collection and analysis process in place on the I-394 MnPASS project. More detail on the MnPASS data is presented below. Data from the Minnesota State Patrol on violations of the MnPASS operating requirements will also be obtained and analyzed. Additional information needed for the tolling analysis will be obtained from the traffic system data test plan.

MnPASS Database. Individuals may open accounts with MnPASS on-line, over the telephone, or at the customer service center. The MnPASS system operator assigns individual transponders to account holders. The transponders are mounted via a cradle on the vehicle windshield. When the transponder is connected to the cradle, transactions may occur between the roadside toll collection systems; conversely, when the transponder is disconnected from the cradle, transactions are impeded. This approach is necessary to provide drivers with the ability to use the MnPASS HOT lanes either as a toll-paying, single-occupant vehicle or as a non-tolled high-occupancy vehicle.

For each toll transaction (with multiple transactions per trip), the following data are written by the system to the transponder for transmission to the revenue and accounts management system:

- data and time of transaction;
- transponder identification number; and
- roadside toll collection identification number.

After the system receives the data, the transactions are processed to determine the full trip (with each transaction appended to one another to reflect a corridor trip), with tolls applied based upon the established rate at the point of entry. As such, the account transaction reflects precise date, time, and toll charge for each toll segment.

Quarterly reports are provided to Mn/DOT by the system operator on the I-394 project. Table 2-1 presents the information provided in the quarterly reports. Figure 2-1 illustrates one example of how the data are presented in the quarterly reports. Daily individual transaction level data are available and will be provided to the Battelle team for the I-35W HOT lanes and the PDSL. In addition, data on MnPASS transponder purchases and returned transponders will be provided on a monthly basis. The system operator will also provide the zip codes of MnPASS transponder holders, the vehicle model, and individual registering commercial vehicles on a monthly basis. Data on the frequency of transaction use by zip code, vehicle model, and commercial vehicle will be provided on a quarterly basis.

Minnesota State Patrol. Information from the Minnesota State Patrol on the number of citations issued for violation of the HOT operating requirements will also be obtained and evaluated. Possible violations include vehicles with no MnPASS transponder, vehicles with an invalid MnPASS transponder, and vehicles illegally entering and exiting the HOT lanes and PDSL. Table 2-2 provides an example of how this data will be summarized. Information will be

requested on a monthly basis, but it is realized that there is often a lag time in receiving data from the State Patrol.

Table 2-1. MnPASS Quarterly Report Data

Type of Data
Traffic Statistics • Trips by Hour • Trips by Day of Week • Trip Comparisons – This Year versus Last Year • MnPASS Speeds
Revenue Statistics • Combined Total Revenue • Combined Average Toll • Eastbound Average Toll • Westbound Average Toll • Eastbound Toll Percentages
Accounts and Transponders • Opened and Closed Accounts • Transponder Distribution • Fee Revenue
Customer Service Center • Performance Measures and Call Activity • Transponder Distribution • Incoming E-Mail and Phone Activity
Network and Systems • Servers • System Incident Responsibilities by Percentage • Special Attention Hours per Sub-System

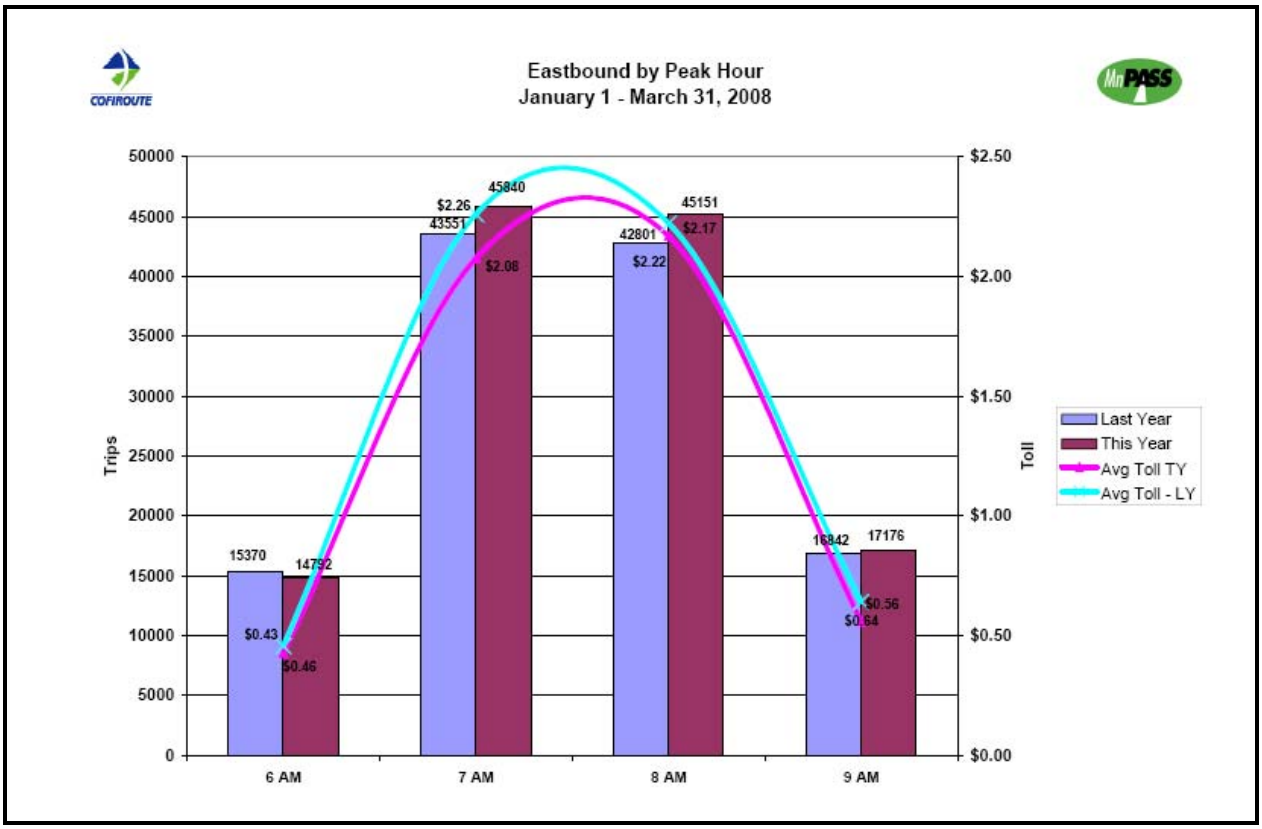

Figure 2-1. Example of Data Presented in MnPASS Quarterly Report

Table 2-2. HOT and PDSL Violation Data

Type of Violation	Number of Citations
No Transponder	
Invalid Transponder	
Illegally Entering/Exiting HOT/PDSL	

2.2 Data Availability

As noted, the toll data will be obtained from Mn/DOT and the MnPASS service provider. The needed data is currently being collected and provided on the I-394 MnPASS project. There is no pre-deployment toll data for I-35W. As discussed in Section 4.0, post-deployment data collection will be initiated after implementation of the initial HOT lane segment and the PDSL in October 2009. It is anticipated that the daily MnPASS data will be batched and transmitted to the Battelle team on a monthly basis.

2.3 Potential Risks

There do not appear to be any significant risks associated with obtaining the MnPASS data from Mn/DOT and the MnPASS service provider or the violation data from the Minnesota State Patrol. These data are currently being provided on the I-394 MnPASS project, so the procedures for collecting and maintaining these data are well established. The experience from I-394 indicates that one problem that may be encountered periodically is that the MnPASS tolling services may not receive updated traffic data from Mn/DOT's road sensors, which causes the MnPASS pricing to default to the rate tables. However, on I-394, these issues have been addressed quickly and have not caused major problems for providing the needed data. As a result, the risk that significant data for the toll analysis on I-35W will be lost is judged to be low. Thus, no special efforts to address the low risk are recommended.

3.0 DATA ANALYSIS

Experience from the I-394 MnPASS projects indicates a high level of accuracy with data available from the MnPASS database and the Minnesota State Patrol. To ensure this continued high quality, 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 representatives from the system operator, Mn/DOT, and the Minnesota State Patrol.

The data obtained from the MnPASS database and from the Minnesota State Patrol will be used to examine measures of effectiveness contained in the tolling, environmental, equity, goods movement, and cost benefit analyses. Standard statistical techniques will be applied to the measure of effectiveness calculations using the tolling data. Examples of the data analysis conducted using the tolling data are discussed below.

- MnPASS transponder purchases in the I-35W travel shed. The number of MnPASS transponders purchased by individuals in the I-35W corridor travel shed will be examined over time. Monitoring transponder purchases is important, as a valid transponder is needed to use the I-35W HOT lanes and PDSL. The number of transponders purchased provides an indication of the potential pool of users for the HOT lanes and the PDSL. This analysis will track purchases and the various marketing and outreach efforts (documented in the content analysis test plan) to identify the impact of different marketing and outreach activities on actual transponder sales. Transponder sales by different methods – including over the Internet, by telephone, and at MnPASS Service Centers – will be tracked and analyzed. The number of transponder sales over time will also be compared to the experience on I-394 to provide a benchmark. As noted later, examining the zip code of the address of record of MnPASS transponder purchases provides one method to identify possible equity concerns.
- Toll transactions on the I-35W HOT lanes and the PDSL. Examining toll transactions in the I-35W HOT lanes and the PDSL provides a basic indication of use levels. The combination of toll transaction data and level of service (LOS) from the traffic data test plan will be used to examine demand elasticities in the HOT lanes and the PDSL. It will also be used to identify changes in the composition of vehicles, including carpools and tolled vehicles, using the HOT lanes and the PDSL. Examples of how the toll transaction data will be analyzed are highlighted below.
  - Toll transaction by segment will be analyzed to identify those segments with high levels of use and those with lower levels of use. The traffic conditions in the adjacent general-purpose freeway lanes will be examined based on data from the traffic data test plan to explore possible correlations between traffic congestion in the general-purpose freeway lanes and the use of HOT lanes and PDSL.
  - Toll transactions by time-of-day will be analyzed to assess use of the HOT lanes and the PDSL during different times of the day and different directions of travel. This information will also be compared to data from the traffic data test plan to assess traffic congestion in the general-purpose freeway lanes during the time periods of high use.

  - Toll transaction data will be used in combination with data from the traffic data test plan to assess the influence of changes in toll rates on the operation of the HOT lanes and the PDSL, including managing toward LOS and travel speed targets.
  - Toll transaction data will be used in combination with the sensor data from the traffic data test plan and the number of buses from the transit data test plan to estimate the vehicle mix (tolled vehicles, carpools, and buses) using the HOT lanes and the PDSL. This analysis will compare historical and pre-deployment data on the number of carpools from the quarterly Mn/DOT I-35W HOV/HOT reports with current estimates of carpool use from the toll transaction analysis.

- Toll revenue data will be examined and analyzed. Data on the average tolls; the average toll by time period, segment, and direction; and the highest toll by time period, segment, and direction will be examined.
- Total toll revenues. Total MnPASS revenues will be used as input to the cost benefit analysis.
- Potential equity concerns. MnPASS data will be used to examine potential equity concerns related to the HOT lanes and the PDSL. Data on the zip code of record for MnPASS transponder holders will be used in this analysis. The MnPASS system can provide the zip code of record without compromising any privacy concerns. The number of transponder holders for zip codes in the I-35W catchment area will be obtained from Mn/DOT and the system operator. The zip codes will be aggregated as closely as possible to census tracts in the corridor. Census data on income, automobiles per household, households without an automobile available, ethnicity, and age will be examined to help identify characteristics of MnPASS users and potential equity concerns. Frequency of use by zip code zone of transponder holders will also be examined to the extent possible. This analysis will explore potential differences in frequency of use by individuals residing in areas with different socio-economic characteristics.
- Change in violation rates in the I-35W HOV and HOT lanes. Information from the Mn/DOT I-35W HOV/HOT lane Quarterly Reports and the citations issued by the Minnesota State Patrol will be used to assess changes in vehicle-occupancy violation rates on the I-35W HOT lanes pre- and post-deployment. Based on the experience with expansion of the I-394 HOV lanes to HOT lanes, it is anticipated that vehicle-occupancy violations will decline with the expansion of the existing I-35W HOT lanes to HOT lanes as part of the Minnesota UPA. Information on the historical and pre-deployment violation rates will be compared to those post-deployment.

4.0 SCHEDULE AND RESPONSIBILITY

Table 4-1 highlights the proposed data collection schedule for the tolling test plan. Table 4-2 provides information on the data collection schedule. The data on transponder purchases, including zip code of record, vehicle model, and commercial vehicles will be provided on a monthly basis starting in August, 2009. The data on daily individual level MnPASS transactions on the HOT lanes from Burnsville Parkway to I-494 and the PDSL will be provided on a monthly basis starting in October 2009. This schedule will enable the Battelle team to examine the data for completeness and accuracy. Data collection will continue through November 2011 to provide a full year of post-deployment data on the HOT lanes from I-494 to 46th Street, which will be operational by October 2010.

Table 4-1. MnPASS Post-Deployment Data Collection Schedule

Project Element	Implementation Date	Post-Deployment Data Collection
HOT Lanes – Burnsville Parkway to I-494	10/09	10/09 – 11/11
PDSL – 46th Street to Downtown Mpls.	10/09	1/10 – 11/11
HOT Lanes – I-494 to 46th Street	10/10	10/10 – 11/11

Table 4-2. MnPASS Data Collection Frequency

Data Element	Collection Frequency
MnPASS	
Transponder Purchases – Number – Zip Code of Record – Vehicle Model – Commercial Vehicles	Monthly
Daily Individual Level Transactions – By time, Segment, and Direction	Monthly
Aggregate Statistics on Tolling Rates, Traffic Volumes, and Violations	Monthly
Comparative Data – Transponder Use by Zip Code – Transponder Use by Commercial Vehicles	Quarterly
Minnesota State Patrol	
Violation/Citation Data	Monthly

The resource requirements for this test plan are outlined below.

- Mn/DOT will provide the MnPASS data from the system operator in electronic format to the Battelle team on a monthly basis. The MnPASS data will include the number of transponders sold and the zip code of record, vehicle model, and commercial vehicles for the purchased transponders. Daily individual transaction level data will be provided, along with summaries of toll, traffic, and violation statistics on a monthly basis. Data provided quarterly will include transponder use by zip code and commercial vehicles.
- Mn/DOT and the Minnesota State Patrol will provide violation and citation data to the Battelle team on a monthly basis.
- Battelle team members will analyze the data, conduct the analysis, and prepare the interim and final reports.

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?

U.S. DEPARTMENT OF TRANSPORTATION
ITS JOINT PROGRAM OFFICE, HOIT
1200 NEW JERSEY AVENUE, SE
WASHINGTON, DC 20590
TOLL-FREE “HELP LINE” 1-866-367-7487
WWW.ITS.DOT.GOV

EDL # 14516

U.S. DEPARTMENT OF TRANSPORTATION
RESEARCH AND INNOVATIVE TECHNOLOGY ADMINISTRATION
PUB. NO. FHWA-JPO-10-013