MINNESOTA
URBAN PARTNERSHIP AGREEMENT

NATIONAL EVALUATION:
COST BENEFIT ANALYSIS 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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16. Abstract

This report presents the cost benefit analysis 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. The test plan is based on the analysis presented in the Minnesota UPA National Evaluation Plan. The test plan identifies the data needed to conduct the cost benefit analysis of the Minnesota UPA projects. The data sources and the data availability are discussed. Potential risks associated with the data collection and analysis are discussed. The cost benefit analysis methodology is presented, along with the schedule and responsibilities.

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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 cost benefit analysis test plan for the National Evaluation of the Minnesota Urban Partnership Agreement (UPA) under the United States Department of Transportation (U.S. DOT) UPA program. 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 cost benefit 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 data sources and data availability for the cost benefit analysis. Potential risks associated with the data and data collection activities are discussed, and the data analysis techniques are described. The schedule and responsibilities for conducting the cost benefit analysis and reporting the results 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.

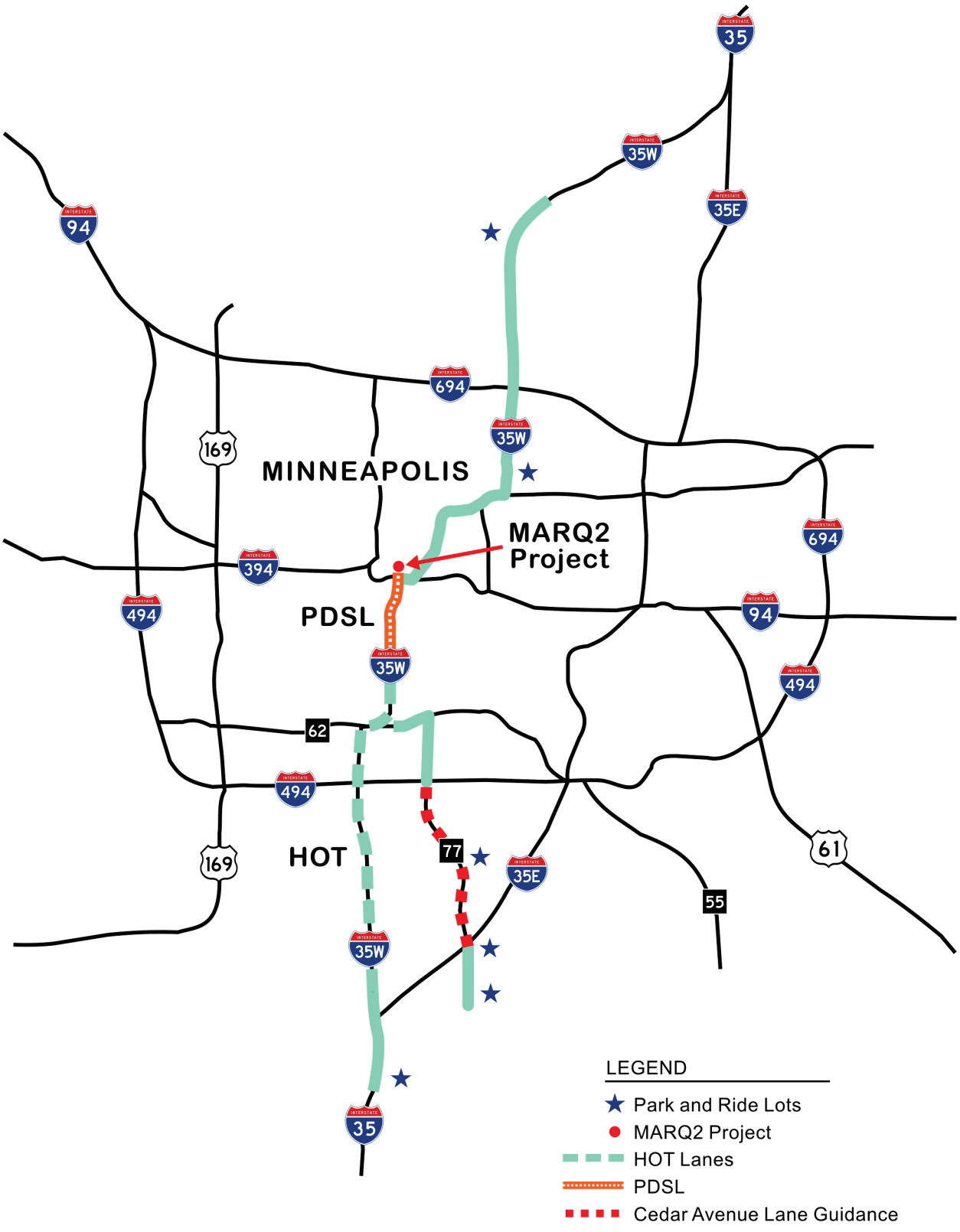

Figure 1-1. General Location of Minnesota UPA Projects

- **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 Role of Cost Benefit Data

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 cost benefit test plan is used for the cost benefit analysis. Table 1-2 presents the cost benefit analysis hypothesis/question and data from the Minnesota UPA National Evaluation Plan.

The remainder of this report is divided into three sections. Chapter 2.0 presents the data sources, data availability, and potential risks for the cost benefit analysis of the Minnesota UPA projects. Chapter 3.0 describes the cost benefit analysis methodology. Chapter 4.0 presents the schedule and responsibilities for conducting the cost benefit 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. Cost Benefit Test Plan Data Elements Use in Testing Evaluation Hypotheses/Questions

Minnesota Cost Benefit Data Element	Minnesota UPA Measure of Effectiveness	Minnesota UPA Hypotheses/Questions*
1. Mn/DOT: capital cost	• New investment in highway construction (ROW; roadway excavation; materials; etc.)	MNCBA-1
2. Mn/DOT: operational cost	• New investment in highway construction (engineer design and planning; construction labor; management; etc.)	MNCBA-1
3. Mn/DOT: capital cost	• New investment in HOT lane set-up (booths; gentries; customer service center; data center; ETC equipment; etc.)	MNCBA-1
4. Mn/DOT: operational equipment cost	• New investment in HOT lane set-up (computer hardware and software; etc.)	MNCBA-1
5. City of Minneapolis capital cost	• New investment in the MARQ2 project	MNCBA-1
6. Mn/DOT: operating and maintenance cost	• Operating and Maintenance (O&M) costs in toll lanes	MNCBA-1
7. Mn/DOT: collection and compliance costs	• O&M costs in toll lanes	MNCBA-1
8. Mn/DOT: road maintenance cost	• Road maintenance	MNCBA-1
9. Mn/DOT: replacement cost	• Reinvestment in toll lanes	MNCBA-1
10. Mn/Metro Transit: capital cost	• New purchases in transit (new bus purchases; transit information system; etc.)	MNCBA-1
11. MVTA: capital cost	• New purchases in Cedar avenue lane guidance system	MNCBA-1
12. Mn/Metro Transit: operational equipment cost	• New purchase in transit (computer hardware and software; etc.)	MNCBA-1
13. Mn/Metro Transit: operating and maintenance cost	• Transit O&M costs	MNCBA-1
14. Mn/Metro Transit: replacement cost	• Reinvestment in transit	MNCBA-1
15. State of MN: operational improvement	• Investment in telecommuting	MNCBA-1

*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 cost benefit analysis test plan will use two major sources of data. The first source is the detailed costs associated with the UPA projects. These data will be provided by Mn/DOT, Metro Transit, the City of Minneapolis, MVTA, and the Hubert H. Humphrey Institute of Public Policy at the University of Minnesota. The second source is data collected through other test plans. These data will be analyzed using the Metropolitan Council's Twin Cities Regional Travel Forecast Model described in the transportation modeling test plan.

Cost Data from Participating Agencies. Cost data will mainly be obtained from Mn/DOT, Metro Transit, the City of Minneapolis, MVTA, and the Hubert H. Humphrey Institute of Public Policy. Data include the capital costs associated with various projects, the operating and maintenance costs, and the replacement and re-investment costs. Cost data will be collected for the following cost categories.

- Capital investment costs.
  - Construction on I-35W – building new park-and-ride lots; adding new HOT lanes, the PDSL, and auxiliary lanes; and other construction projects.
  - Construction of the MARQ2 project.
  - Transit expansion – purchasing new buses.
  - MnPASS HOT lanes and PDSL – installing gantries, purchasing communication equipment, and computer software and hardware.
  - Shoulder-running bus lane guidance system and real-time traffic and transit information system.
- Operating and maintenance costs.
  - Operating and maintaining transit services.
  - Operating and Maintaining MnPASS HOT lanes and PDSL.
  - Compliance costs for enforcing the HOT lanes and PDSL.
  - Maintaining the lane guidance system and the real-time traffic and transit information system.
  - Maintaining the highway infrastructure.
  - Investment in telecommuting.
- Replacement and re-investment costs.
  - Replacing components of the MnPASS facilities.
  - Replacing and/or updating computer hardware and software for MnPASS management.
  - Replacing and/or updating communication equipment for MnPASS management.
  - Replacing and/or updating the shoulder-running bus lane guidance system and real-time traffic and transit information system.

Table 2-1 provides a cost reporting scheme with detailed cost categories by type of projects and by reporting agency.[2] The costs to be considered in the cost benefit analysis should only include those annual expenditures up to 2020 incurred as a result of implementing the UPA projects. In other words, only the differential costs should be recorded and reported as the costs of the UPA projects. For instance, suppose that Metro Transit currently operates a bus fleet on the I-35W corridor with an annual operation budget of $1 million. Further, suppose that with the investment from the UPA projects, Metro Transit's annual operational budget for the bus fleet increases to $1.5 million. For the purpose of reporting the costs for the cost benefit analysis, only the newly increased costs of $0.5 million should be reported.

Table 2-1. Cost Reporting Scheme for the UPA Projects

Project	Reporting Agency	Major Cost Category	Cost Sub-category	Year(*)					
				2008	2009	2010	2011	…	2020
New Investment in Highway Construction									
	Mn/DOT	Capital Cost	ROW; Roadway excavation; Materials (asphalts, concrete, others)						
		Operational	Engineer design and planning; Construction labor; Management						
New Investment in HOT Lane Set-up									
	Mn/DOT	Capital Cost	Booths; Gantries; Customer service center; Data center; ETC equipment						
		Operational Equipment	Computer hardware and software						
New Investment in the MARQ2 Project									
	City of Minneapolis	Capital Cost	Lane construction; Materials (asphalts, concrete, others)						
New Purchases in Transit									
	Metro Transit	Capital Cost	New bus purchases; Transit information system						
		Operational Equipment	Computer hardware and software						
New Investment in Lane Guidance System									
	MVTA	Capital Cost	Cedar avenue lane guidance system						

[2] To compute the differential costs for future years, escalation factors for various cost categories that are adopted by the State of Minnesota should be used. For the purpose of verification, Mn/DOT and Metro Transit should provide the escalation factors used in the cost calculation to the national evaluation team.

Table 2-1. Cost Reporting Scheme for the UPA Projects (Continued)

Project	Reporting Agency	Major Cost Category	Cost Sub-category	Year(*)					
				2008	2009	2010	2011	…	2020
Investment in Telecommuting									
	Humphrey Institute	Operational	Investment in telecommuting						
Differential O&M Costs in Toll Lanes: with the UPA Projects minus without the UPA Projects									
	Mn/DOT	Operating and Maintenance	Account set-up; Equipment O&M; Hardware and software maintenance; Banking; Oversight; Labor; Others						
		Collection	Account management; communication; Payment processing; Labor						
		Compliance	Enforcement; Violation processing; Dispute resolution; Labor						
Differential Costs in Road Maintenance: with the UPA Projects minus without the UPA Projects									
		Road Maintenance	Repair and maintenance; Labor						
Differential Transit O&M Costs: with the UPA Projects minus without the UPA Projects									
	Metro Transit	Operating and Maintenance	Repair and maintenance of buses and other transit equipment; Labor						
Differential Reinvestment in Toll Lanes: with the UPA Projects minus without the UPA Projects									
	Mn/DOT	Replacement	Tolling equipment and computers upgrade / replacement; Labor						
Differential Reinvestment in Transit: with the UPA Projects minus without the UPA Projects									
	Metro Transit	Replacement	Buses and other equipment upgrade / replacement						

(*) The shaded cells indicate that cost data most likely do not need to be collected for those years.

Other Minnesota UPA Test Plans. Another important source of data for the cost benefit analysis is other test plans. The data from the test plans that include both pre- and post-deployment will be used for comparative data analysis as described in Section 3.0. The data from other test plans that will be used in the cost benefit analysis include:

- Traffic Condition Data – Data will include vehicle hours-traveled (VHT), vehicle mileage-traveled (VMT), vehicle occupancy rates by personal travel trip purposes, number of vehicles, and trip volume. Data on truck trips in the corridor will also be needed. The data will be provided by the transportation modeling test plan, for forecasts post-deployment, and the traffic system data test plan, for observed data.

- Safety Condition Data – Type of incidents and crashes, number of incidents, severity of crashes, and incident clearance times from the safety test plan and the traffic system data test plan.
- Travel Time Reliability Data – Change in travel time reliability from the traffic system data test plan.
- Mode Shifting Data – Number of people changing from driving alone to riding the bus and the transit costs incurred to those people from the transportation modeling test plan, the transit system data test plan, and the survey test plan.
- Transit Travel Condition Data – Change in transit travel time from the transit system data test plan.
- Air Quality – Change in air quality from the environmental test plan.
- Telecommuting Condition Data – Reduction in travel time and travel costs and changes in productivity for telecommuting workers and changes in businesses' costs from employers from the telecommuting data test plan and the survey test plan.

2.2 Data Availability

Mn/DOT, Metro Transit, the City of Minneapolis, MVTA, and the Humphrey Institute will provide the cost data. The cost data from these agencies are available for the pre- and post-deployment time periods. The operating and maintenance costs and the replacement and re-investment costs need to cover a 10-year time period after the Minnesota UPA projects are completed. Agency staff will need to develop forecasts of these costs using their normal budgeting methods. Other data needed for the cost benefit analysis will be obtained from the other test plans.

2.3 Potential Risks

There do not appear to be any significant risks associated with obtaining information from the sources outlined previously. Potential issues may arise during the data collection process, however. Examples of possible concerns include delays in gathering data, inconsistency or duplication in the data, and cost accounting methods. In addition, the current limitations of the travel demand forecast model to account for tolling and mode sharing may influence the cost benefit analysis. As a result, the traffic forecast generated by the model may not fully capture travelers' behavior on tolling and mode shifting.

To address potential issues with obtaining cost information, Battelle team members will work with partnership agency staff to initiate the data request early in the evaluation process and follow up with any specific questions. To address the possible concerns with the travel demand forecast model, Battelle team members will work with Metropolitan Council staff to review the model runs, address any issues, and rerun the model.

3.0 DATA ANALYSIS

As noted previously, the Metropolitan Council's regional travel forecast model will be used to estimate the long-range benefits related to congestion reduction resulting from the UPA projects. Mn/DOT has used the traffic forecasts produced from the model to conduct cost benefit analysis for some UPA projects.

The Office of Management and Budget (OMB) Circular A-94 Revised on guidelines and discount rates for cost benefit analysis of Federal programs will be referenced in the Minnesota UPA cost benefit analysis. The cost benefit analysis will be performed using a 10-year time frame. This time frame includes the first year after implementation of the Minnesota UPA projects and a 10-year period after implementation of the projects. Within this evaluation time frame, the cost benefit analysis will estimate and compare annual benefits and costs between two scenarios—without implementation of the Minnesota UPA projects and with implementation of the Minnesota UPA projects.

The basic procedure for calculating the net benefit is to monetize the benefits experienced by facility users and then subtract the costs incurred by the Minnesota UPA projects. The calculation will be done for a 10-year time frame. The major components described below provide examples of how the net benefit will be calculated.

- Travel cost savings from the reduction in travel time, which is a result of improvement in traffic condition from reduced recurring congestion, experienced by drivers, transit users, and telecommuting workers. The following details the computation:
    - For freight transportation, the travel cost savings depends on the truckers' wage rate and the travel time saved. The truckers' wage rate at the historical year will be obtained from the Bureau of Labor Statistics and the forecast of the wage rate from Woods and Poole Economics, Inc. will be used for future years.
    - For personal travel, the basic calculation procedure is the same as the freight transportation but the average wage rate of Twin Cities will be used. The travel time will be adjusted according to trip purposes because non-work-related personal travels are less urgent and bound by less time constraint.
- Safety cost savings from the improvement in safety conditions—The reduction in number of incidents by incident type determines changes in the accident rates. The computation of the safety cost savings depends on the accident rates, the accident value reported by the U.S. DOT, and the miles traveled in the region.
- Vehicle operating cost savings experienced by drivers as a result of reduction in congestion – The vehicle operating cost savings include two components: fuel costs and non-fuel costs, which include "wear-and-tear" costs. The computation of fuel cost depends on fuel prices in the local area, fuel efficiencies under different driving speeds, and mileages traveled. The non-fuel costs rely on average repair and maintenance costs identified by the U.S. DOT and miles traveled.
- Consumer surplus captures the user benefits that result from reduction in travel costs and changes in vehicle volume due to the implementation of the UPA projects. The

calculation of the consumer surplus depends on the benefits, which include the cost savings from reduced travel time, safety cost savings, and vehicle operating cost savings, from the improved travel conditions and vehicle volumes with and without the UPA projects.

- Improvement in travel time reliability – The benefits realized from the improved travel time reliability depends on the average wage rate in the local area and the travel time saved from reduced non-recurring congestion, such as reduction in accident processing time or reduction in congestion caused by work-zone.
- Improvement in air quality – The benefits from the improved environment depend on emission rate per mile traveled and the dollar cost per gram of emission estimated by the Environmental Protection Agency.
- Changes in travel costs for those people who shifted from driving to riding the bus – This reflects the difference in travel cost between driving and taking the bus. The computation of the driving cost will be the same as the vehicle operating cost, while the cost of taking the bus will be bus fares to be paid by those people shifted to transit mode, plus the travel cost savings from the travel time saved.
- Changes in productivity for telecommuting workers and changes in businesses' costs from employers permitting telecommuting – This reflects potential benefits for workers and businesses that have engaged in telecommuting. The computation depends on the survey results from the telecommuting data test plan and the survey test plan.
- Capital costs, operating and maintenance costs, and replacement and re-investment costs – As presented in Table 2-1, the costs under each of the major categories will be summed for the purpose of calculating the total cost.

At the last step, the net benefit will be calculated by summing up the benefits and then subtracting costs. For the community, the benefits experienced from the improved environmental condition such as reduction in emissions will be considered.

4.0 SCHEDULE AND RESPOSIBILITIES

The schedule for conducting the cost benefit analysis is shown in Table 4-1. The schedule is based on the overall UPA project schedule. The cost benefit analysis will be initiated prior to deployment of the Minnesota UPA projects and will be completed after all the projects are in operation. Members of the Battelle team will conduct the analysis. Staff from the Metropolitan Council will run the regional travel forecast model, which is one of the main data sources for the cost benefit analysis. Cost information will be provided by the various Minnesota UPA agencies.

Table 4-1. Cost Benefit Analysis Schedule

Activities	Schedule
Initiation of the analysis	At the beginning of the MN UPA projects
Cost data	October 2011
Data from other test plans	October 2011
Obtain traffic forecasts from Metropolitan Council's regional travel forecast model	November 2011
Final Report	April 2012

The responsibility for this test plan includes:

- Mn/DOT, Metro Transit, the City of Minneapolis, MVTA, and the Humphrey Institute will provide the cost information on the Minnesota UPA projects.
- Battelle team members will provide needed data from the other test plans.
- Metro Council personnel will run the travel forecast model to estimate the cost benefit analysis of the Minnesota UPA projects. The model will be rerun if needed based on review and discussion with Battelle team members.
- Battelle team members will analyze the model results, and document the cost benefit analysis in the final Minnesota UPA national evaluation report.

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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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