APPENDIX E: ATM MODEL TECH MEMORANDUM

Metropolitan Highway System Investment Study

Evaluation of Active Traffic Management Strategies

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1. Introduction

Active Traffic Management (ATM) consists of a suite of technologies which improve the operational efficiency of highway systems by dynamically managing traffic flow and dissemination of information to the users of the system. It has also been seen that ATM helps in reducing the likelihood of accidents related to speed differentials. A brief description for some of these ATM techniques is given below:

1. **Speed Harmonization/Lane Control:** This consists of dynamically adjusting speed limits on a freeway corridor based on the level of congestion. This reduces the risk of accidents and optimizes the flow of vehicles through the corridor.
2. **Queue Warning:** This consists of displaying information about downstream traffic backups to the motorists using Variable Message Signs (VMS). This informs motorists of downstream queuing and lane closures, allowing motorists to select alternate routes or lanes and reduce queue buildup.
3. **Dynamic Re-routing:** This consists of providing information to the motorists regarding alternate routes when there is downstream congestion. Guidance is provided to the motorists to move to alternate routes.
4. **Hard Shoulder Running:** This allows for allowing motorists to use the freeway shoulder during congested periods. It helps in reducing congestion during peak periods. For implementing this strategy the shoulders should be upgraded to full depth pavements and monitored vehicle refuge areas should be constructed for disabled or stopped vehicles.

An evaluation of the various ATM techniques was to choose a technology that would best serve the needs of the Minneapolis-St. Paul region. After considering a dynamic re-routing system and a speed harmonization/ lane control system it was decided that the latter alternative would be the preferred ATM strategy for the region. Six corridors were selected for studying the deployment of the speed harmonization /lane control system. The selection of the corridors was based on the 2005-2007 freeways and major expressway crash map and the 2008 metro freeway congestion maps for the morning and evening peak periods. The corridors selected were:

- I-35 W (SB only)
- I-35 E AND I-694
- TH-36
- I-94 AND I-394
- TH-62
- I-494

This report describes the methodology used for analyzing the implementation of speed harmonization/ lane control on these corridors, the results of the analysis and some key takeaways. A comparative cost-benefit analysis approach was used to analyze the different alternatives. The analysis enabled the development of an ATM deployment strategy and helped integrate it into the long term vision for the region.

2. Methodology

In this study the different alternatives were modeled using the software tool ITS Deployment Analysis System (IDAS). IDAS is a systematic analysis tool for evaluation of the benefits and costs of Intelligent Transportation System (ITS) deployments. The modeling and analysis process involved three major tasks:

1. Modification of the IDAS software to add ATM as an ITS element under Freeway Management Systems
2. Developing the Minneapolis-St. Paul transportation network in IDAS using data from the regional travel demand model.
3. Development of various deployment alternatives and performing cost-benefit analysis.

2.1. IDAS Modification to add ATM

Off the shelf IDAS software does not have a module for ATM deployments. For the purpose of this analysis the IDAS software was modified to add two ATM components. These additions were made under the "Freeway Management System" element available in IDAS. The two ATM elements added to the software were:

1. ATM 3-Lane: This consisted of the gantry and all associated ITS equipment required for ATM implementation on a 3 lane one way freeway. The gantry is assumed to be deployed every half mile and the cost is $300K. The O&M costs are assumed to be 7.5% of capital costs annually and the life of the equipment is assumed to be 100 years. The variation in the cost is assumed to be 10%

2. ATM 4-Lane: This consisted of the gantry and all associated ITS equipment required for ATM implementation on a 4 lane one way freeway. The gantry is assumed to be deployed every half mile and the cost is $300K. The O&M costs are assumed to be 7.5% of capital costs annually and the life of the equipment is assumed to be 100 years. The variation in the cost is assumed to be 10%

Default data for the IDAS software are stored in several spreadsheets. The addition of the ATM deployments to the IDAS software required the revision of the following base spreadsheets.

1. DirectBenefits2_3.xls: This spreadsheet contains the data for the "ITS Library" in IDAS. It provides field notes for observed improvements for each of the different ITS components
2. ITSEntryDefaults2_3.xls: This spreadsheet contains the data for the impact fields; default values and drop down menus displayed when the Edit Impacts button is clicked after ITS deployments are made in IDAS.
3. Equip2_3.xls: This spreadsheet provides the description, specification and prerequisites for each ITS component. It also describes the elements used for each component, their cost values and useful life.
4. Curves2_3.xls: This spreadsheet has the default values for the Volume-delay curves. It defines the speed factor values for varying volume to capacity ratios. The data is defined for urban and suburban/rural freeways, arterials and ramps.

Each of the first three spreadsheets were updated to incorporate ATM 3-Lane and ATM 4-Lane components to the model. The "ITS Library" was updated to reflect the benefits assumed for these deployments (based on European experience). The "ITS EntryDefaults" spreadsheet was updated to add the impact values for the proposed ATM deployment. The "Equipment" spreadsheet was updated to define the components and costs of these two new ATM elements.
The default values in the "Curves" spreadsheet are based on the Bureau of Public records formula for computing speed factor. However the Minneapolis-St.Paul regional travel demand model uses conical delay functions for computing speed factors. The spreadsheet was updated to reflect the values using the conical delay functions.

The modified spreadsheets were renamed as:

1. DirectBenefits2_5.xls
2. ITSEntryDefaults2_5.xls
3. Equip2_5.xls
4. Curves2_5.xls

The modified spreadsheets were imported into the IDAS software for the ATM elements be available in the "ITS Elements" workspace.

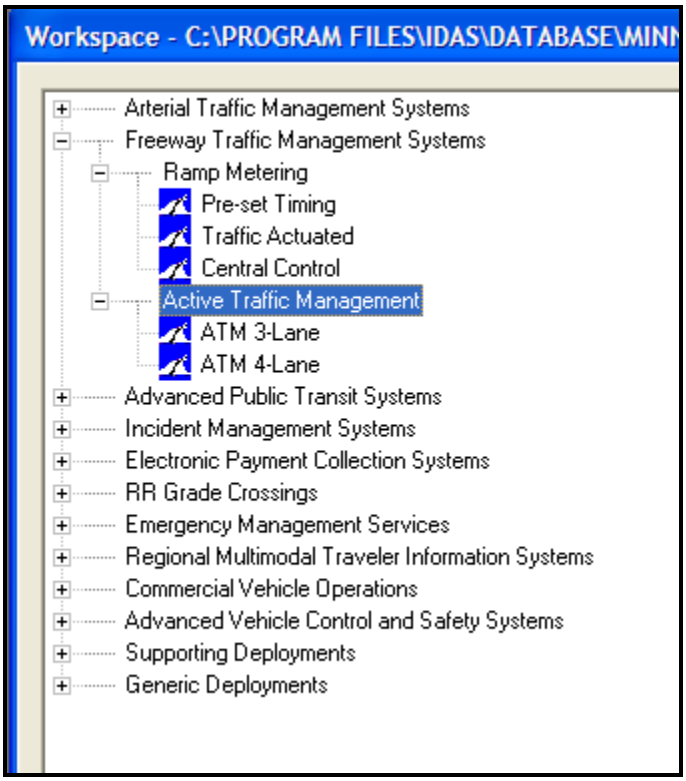


Fig 1: IDAS workspace with ATM elements.

2.2. IDAS Model

The Minneapolis-St.Paul transportation network was developed in IDAS using the data from the CUBE travel demand model (TDM) used by the Metropolitan Council. The data used for building the network included the node coordinate file, the links data file and the origin-destination matrices for each time period and market sector. Three market sectors used in the analysis are:

1. Single Occupancy Vehicles (Avg. Vehicle occupancy = 1.42)
2. High Occupancy Vehicles (Avg. Vehicle occupancy = 2.74)
3. Trucks (Avg. Vehicle occupancy = 1.58)

The alternatives were developed for two time periods using the 2030 TDM data. The periods are:

1. AM Peak Period: 6:00 a.m. – 9:00 a.m.
2. PM Peak Period: 2:30 p.m. – 5:30 p.m.

Seven alternatives were developed and evaluated for each of the two periods. Six alternatives involved deployment of ATM on the six corridors identified earlier and the seventh alternative involved deployment of ATM on all corridors.

The model assumes that ATM deployment (Speed Harmonization/Lane Control) results in reduced accident rate. These result in increased throughput for the corridor. Dynamic message signs which are part of an ATM system help in dissemination of important travel related information to the motorists. This results in improved operational efficiency for the corridor. The primary benefits value assumptions made in the model regarding the impact of deployment of a speed harmonization/lane control system are provided below:

I. Dynamic Message Sign
   - Percent Vehicles passing sign that save time = 28%
   - Percent time the sign is turned on and disseminating information=10%
   - Average amount of time savings (min.) = 11

II. Speed Harmonization/Lane Control
   1. Capacity Change: 5%
   2. Accident Rate Reductions:
      - Fatality =30%
      - Injury = 30%
      - Property Damage = 16%

A discount rate of 5% was assumed in the Costs Module.. An inflation rate of 5% was assumed in the Alternatives Comparison Module. The variation in the cost values was assumed to be +/- 10%. The annual operations and maintenance costs for the speed harmonization/ lane control system was assumed to be 7.5% of the capital costs. All results for this analysis are reported in 2010 dollars.

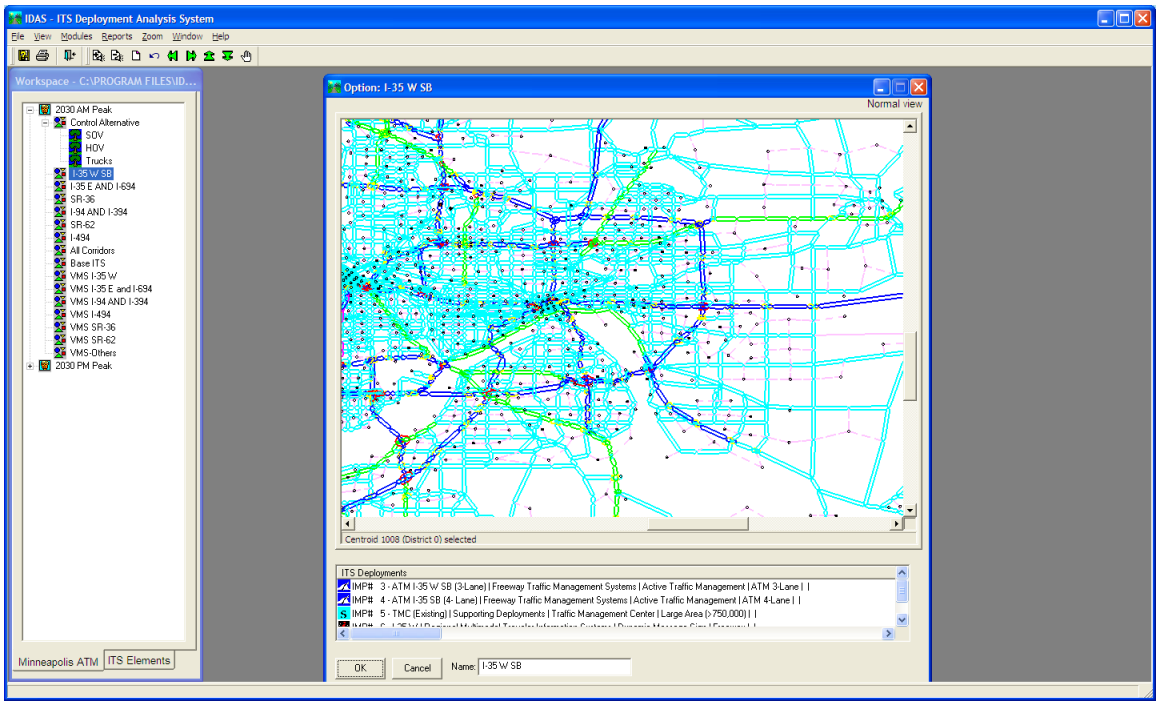


Fig 2: Screenshot of Minneapolis-St. Paul network in IDAS

2.3. Cost-Benefit Analysis

The first step in the analysis process using IDAS is to run trip assignment again for each of the alternatives. When trip assignment is done in IDAS it redistributes trips on the network based on the ITS elements deployed on the network for the alternative. Once trip assignment is run it computes the difference in values for the various measures such as vehicle miles of travel (VMT), vehicle hours of travel (VHT), average speed, number of person trips etc. Using these measures it computes the dollar value for the improvement in the performance measures of the network with the ITS improvement compared to the base case. The benefits values are annualized and total of all these benefits values is the “Total Annual Benefits”. Similarly during the analysis process the capital costs and the operations and maintenance (O& M) costs for the ITS equipment deployed are computed and annualized. This is reported as the “Total Annual Cost”. In order to compare between the various alternatives IDAS provides the values for the “Net Benefits” (Total Annual Benefits – Total Annual Costs) and the benefit to cost ratio.
It should be noted that for most analysis these measures are comparative only as they provide the relative performance of one alternative over the other. This is due to the fact that not all benefits measures are selected when running the benefits module. Again, the cost values are also highly dependent on how accurately the capital costs, the O&M costs and the life of the equipment is built into the model. The results of the AM peak analysis and PM peak analysis are provided in Table1 and Table 2 respectively.

Benefit/Cost Summary Project: Minneapolis ATM			-	-	-	-	-	-	-	-
Benefits are reported in 2010 dollars			2030 AM Peak							
Annual Benefits		**Weight**	**Control Alternative**	**I-35 W SB**	**I-35 E AND I-694**	**TH-36**	**I-94 AND I-394**	**TH-62**	**I-494**	**All Corridors**
	Change in User Mobility	1.00	$0	$35,333,095	$26,515,731	$17,535,947	$27,760,768	$17,799,622	$26,031,302	$260,833,633
	Change In User Travel Time									
	In-Vehicle Travel Time	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Out-of-Vehicle Travel Time	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Travel Time Reliability	1.00	$0	$2,148,967	$570,239	$99,040	$549,182	-$307,143	$1,885,612	$4,420,536
	Change in Costs Paid by Users									
	Fuel Costs	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Non-fuel Operating Costs	1.00	$0	-$58,072	$12,694	$44,136	-$34,396	-$2,733	-$74,352	-$3,949
	Accident Costs (Internal Only)	1.00	$0	$1,393,955	$796,582	$319,497	$2,100,570	$385,084	$1,367,085	$6,416,994
	Change in External Costs									
	Accident Costs (External Only)	1.00	$0	$245,994	$140,574	$56,382	$370,692	$67,956	$241,252	$1,132,418
	Emissions									
	HC/ROG	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	NOx	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	CO	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	PM10	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	CO2	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	SO2	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Global Warming	0.00	$0	$0	$0	$0	$0	$0	$0	$0
	Noise	1.00	$0	-$600	$176	$503	-$342	$0	-$768	$18
	Other Mileage-Based External Costs	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Other Trip-Based External Costs	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Change in Public Agencies Costs (Efficiency Induced)	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Other Calculated Benefits	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	User Defined Additional Benefits	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Total Annual Benefits		**$0**	**$39,063,339**	**$28,035,996**	**$18,055,504**	**$30,746,474**	**$17,942,786**	**$29,450,133**	**$272,799,650**
Annual Costs										
	Average Annual Private Sector Cost		$0	$0	$0	$0	$0	$0	$0	$0
	Average Annual Public Sector Cost		$0	$2,532,945	$1,818,215	$1,053,356	$4,514,078	$1,053,356	$2,194,460	$13,166,409
	Total Annual Cost		**$0**	**$2,532,945**	**$1,818,215**	**$1,053,356**	**$4,514,078**	**$1,053,356**	**$2,194,460**	**$13,166,409**
Benefit/Cost Comparison										
	Net Benefit (Annual Benefit - Annual Cost)		**$0**	**$36,530,394**	**$26,217,781**	**$17,002,149**	**$26,232,396**	**$16,889,430**	**$27,255,673**	**$259,633,241**
	B/C Ratio (Annual Benefit/Annual Cost)		**0.00**	**15.42**	**15.42**	**17.14**	**6.81**	**17.03**	**13.42**	**20.72**

Table 1: 2030 AM Peak Benefit-Cost Analysis Summary.

Benefit/Cost Summary Project: Minneapolis ATM			-	-	-	-	-	-	-	-
Benefits are reported in 2010 dollars			2030 PM Peak							
Annual Benefits		**Weight**	**Control Alternative**	**I-35 W SB**	**I-35 E AND I-694**	**TH-36**	**I-94 AND I-394**	**TH-62**	**I-494**	**All Corridors**
	Change in User Mobility	1.00	$0	$118,787,138	$95,348,403	$61,336,862	$113,706,008	$63,053,771	$91,527,922	$980,219,378
	Change In User Travel Time									
	In-Vehicle Travel Time	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Out-of-Vehicle Travel Time	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Travel Time Reliability	1.00	$0	$1,580,325	$3,837,408	$780,064	$260,424	$413,271	$1,893,631	$9,359,812
	Change in Costs Paid by Users									
	Fuel Costs	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Non-fuel Operating Costs	1.00	$0	-$51,683	$15,057	$8,604	-$33,219	$40,815	$24,838	-$155,344
	Accident Costs (Internal Only)	1.00	$0	$5,368,341	$3,563,197	$1,381,934	$8,811,806	$1,637,004	$4,725,171	$24,859,612
	Change in External Costs									
	Accident Costs (External Only)	1.00	$0	$947,361	$628,803	$243,872	$1,555,035	$288,885	$833,858	$4,387,018
	Emissions									
	HC/ROG	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	NOx	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	CO	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	PM10	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	CO2	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	SO2	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Global Warming	0.00	$0	$0	$0	$0	$0	$0	$0	$0
	Noise	1.00	$0	-$551	$168	$108	-$341	$447	$265	-$1,630
	Other Mileage-Based External Costs	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Other Trip-Based External Costs	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Change in Public Agencies Costs (Efficiency Induced)	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Other Calculated Benefits	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	User Defined Additional Benefits	1.00	$0	$0	$0	$0	$0	$0	$0	$0
	Total Annual Benefits		**$0**	**$126,630,931**	**$103,393,036**	**$63,751,444**	**$124,299,713**	**$65,434,193**	**$99,005,685**	**$1,018,668,846**
Annual Costs										
	Average Annual Private Sector Cost		$0	$0	$0	$0	$0	$0	$0	$0
	Average Annual Public Sector Cost		$0	$2,532,945	$1,818,215	$1,053,356	$4,514,078	$1,053,356	$2,194,460	$13,166,409
	Total Annual Cost		**$0**	**$2,532,945**	**$1,818,215**	**$1,053,356**	**$4,514,078**	**$1,053,356**	**$2,194,460**	**$13,166,409**
Benefit/Cost Comparison										
	Net Benefit (Annual Benefit - Annual Cost)		**$0**	**$124,097,986**	**$101,574,821**	**$62,698,088**	**$119,785,635**	**$64,380,837**	**$96,811,225**	**$1,005,502,437**
	B/C Ratio (Annual Benefit/Annual Cost)		**0.00**	**49.99**	**56.87**	**60.52**	**27.54**	**62.12**	**45.12**	**77.37**

Table 2: 2030 PM Peak Benefit-Cost Analysis Summary.

3. Results & Conclusion

Looking at the benefit cost summary for both the AM peak period and the PM peak period we see that the highest benefit to cost ratio and net benefits is for implementing speed harmonization/lane control system on all the identified corridors. This means that investment in deploying the ATM system on the corridors would yield benefits for the metropolitan highway system and help improve the operation of the system. The results of the analysis for each corridor help develop the strategy for systematic deployment on the network. If we rank order the corridors based on the benefit-cost ratio for each of the periods we get the following ranked list.

Corridor	B/C Ratio	Rank
AM Peak		
TH-36	17.14	1
TH-62	17.03	2
I-35 W SB	15.42	3
I-35 E AND I-694	15.42	4
I-494	13.42	5
I-94 AND I-394	6.81	6
PM Peak		
TH-62	62.12	1
TH-36	60.52	2
I-35 E AND I-694	56.87	3
I-35 W SB	49.99	4
I-494	45.12	5
I-94 AND I-394	27.54	6

Table 3: Corridors rank ordered by benefit cost ratio

As we see from the results the TH-36 and TH-62 corridors provide have the highest benefit-to-cost ratio and should be the first corridors in which the system should be deployed. More complex decision models can also be employed to select alternatives that are based on specific goals. Appendix B provides the values of the risk analysis performed for each alternative. The risk analysis results can also be used for developing a deployment strategy.

In a nutshell it can be said that the results of the analysis prove that ATM deployment on the corridors would provide an efficient means of managing these corridors and would prove to be an efficient and cost effective strategy. ATM also enables the agencies in the region make best use of their existing ITS infrastructure. As such ATM should be an integral part of any transportation plan for the region.

APPENDIX A
AM PEAK RESULTS BY MARKET SECTOR

ATM Deployment Scenario	By: Market Sector	SOV	HOV	Trucks	Total
	Vehicle Miles of Travel				
	Control Alternative	11,073,304	3,689	456,701	11,533,694
I-35 W SB	ITS Option	11,074,882	3,679	456,772	11,535,334
	Difference (%)	1,578(0.0%)	-9(-0.3%)	71(0.0%)	1,640(0.0%)
I-35 E AND I-694	ITS Option	11,072,781	3,673	456,734	11,533,189
	Difference (%)	-523(0.0%)	-15(-0.4%)	33(0.0%)	-505(0.0%)
TH-36	ITS Option	11,071,921	3,677	456,698	11,532,296
	Difference (%)	-1,383(0.0%)	-11(-0.3%)	-4(0.0%)	-1,398(0.0%)
I-94 AND I-394	ITS Option	11,074,186	3,678	456,758	11,534,621
	Difference (%)	882(0.0%)	-11(-0.3%)	57(0.0%)	928(0.0%)
TH-62	ITS Option	11,073,275	3,671	456,735	11,533,680
	Difference (%)	-29(0.0%)	-18(-0.5%)	33(0.0%)	-14(0.0%)
I-494	ITS Option	11,075,310	3,689	456,793	11,535,792
	Difference (%)	2,006(0.0%)	0(0.0%)	92(0.0%)	2,098(0.0%)
ALL CORRIDORS	ITS Option	11,073,174	3,671	456,769	11,533,614
	Difference (%)	-130(0.0%)	-18(-0.5%)	68(0.0%)	-80(0.0%)
	Vehicle Hours of Travel				
	Control Alternative	463,974	158	16,321	480,452
I-35 W SB	ITS Option	463,941	158	16,322	480,421
	Difference (%)	-33(0.0%)	0(0.1%)	1(0.0%)	-32(0.0%)
I-35 E AND I-694	ITS Option	463,902	158	16,317	480,377
	Difference (%)	-73(0.0%)	0(0.1%)	-3(0.0%)	-76(0.0%)
TH-36	ITS Option	463,957	158	16,322	480,436
	Difference (%)	-18(0.0%)	0(0.1%)	1(0.0%)	-17(0.0%)
I-94 AND I-394	ITS Option	464,062	158	16,323	480,543
	Difference (%)	88(0.0%)	0(0.2%)	2(0.0%)	90(0.0%)
TH-62	ITS Option	463,946	158	16,320	480,424
	Difference (%)	-28(0.0%)	0(0.1%)	-1(0.0%)	-29(0.0%)
I-494	ITS Option	464,009	158	16,322	480,489
	Difference (%)	35(0.0%)	0(0.2%)	1(0.0%)	37(0.0%)
ALL CORRIDORS	ITS Option	463,740	158	16,311	480,208
	Difference (%)	-234(-0.1%)	0(0.2%)	-10(-0.1%)	-244(-0.1%)
	Average Speed				
	Control Alternative	23.9	23.4	28.0	24.0
I-35 W	ITS Option	23.9	23.3	28.0	24.0

SB	Difference (%)	0(0.0%)	0(-0.4%)	0(0.0%)	0(0.0%)
I-35 E AND I-694	ITS Option	24	23	28	24
	Difference (%)	0(0.0%)	0(-0.5%)	0(0.0%)	0(0.0%)
TH-36	ITS Option	24	23	28	24
	Difference (%)	0(0.0%)	0(-0.4%)	0(0.0%)	0(0.0%)
I-94 AND I-394	ITS Option	24	23	28	24
	Difference (%)	0(0.0%)	0(-0.5%)	0(0.0%)	0(0.0%)
TH-62	ITS Option	24	23	28	24
	Difference (%)	0(0.0%)	0(-0.6%)	0(0.0%)	0(0.0%)
I-494	ITS Option	24	23	28	24
	Difference (%)	0(0.0%)	0(-0.2%)	0(0.0%)	0(0.0%)
ALL CORRIDORS	ITS Option	24	23	28	24
	Difference (%)	0(0.0%)	0(-0.7%)	0(0.1%)	0(0.0%)
	Person Hours of Travel				
	Control Alternative	463,974	158	16,321	480,452
I-35 W SB	ITS Option	658,796	432	25,788	685,017
	Difference (%)	-47(0.0%)	1(0.1%)	2(0.0%)	-44(0.0%)
I-35 E AND I-694	ITS Option	658,740	432	25,782	684,954
	Difference (%)	-103(0.0%)	0(0.1%)	-5(0.0%)	-108(0.0%)
TH-36	ITS Option	658,818	432	25,788	685,039
	Difference (%)	-25(0.0%)	1(0.1%)	1(0.0%)	-23(0.0%)
I-94 AND I-394	ITS Option	658,968	432	25,790	685,191
	Difference (%)	125(0.0%)	1(0.2%)	3(0.0%)	129(0.0%)
TH-62	ITS Option	658,803	432	25,786	685,021
	Difference (%)	-40(0.0%)	0(0.1%)	-1(0.0%)	-41(0.0%)
I-494	ITS Option	658,893	432	25,789	685,114
	Difference (%)	50(0.0%)	1(0.2%)	2(0.0%)	53(0.0%)
ALL CORRIDORS	ITS Option	658,510	432	25,771	684,714
	Difference (%)	-333(-0.1%)	1(0.2%)	-16(-0.1%)	-348(-0.1%)
	Number of Person Trips				
	Control Alternative	1,993,774	444	113,536	2,107,754
I-35 W SB	ITS Option	1,993,774	444	113,536	2,107,754
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
I-35 E AND I-694	ITS Option	1,993,774	444	113,536	2,107,754
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
TH-36	ITS Option	1,993,774	444	113,536	2,107,754
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
I-94 AND I-394	ITS Option	1,993,774	444	113,536	2,107,754
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
TH-62	ITS Option	1,993,774	444	113,536	2,107,754
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
I-494	ITS Option	1,993,774	444	113,536	2,107,754
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)

ALL CORRIDORS	ITS Option	1,993,774	444	113,536	2,107,754
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
	Number of Fatality Accidents				
	Control Alternative	1.3234E-01	2.6652E-05	5.3117E-03	1.3768E-01
I-35 W SB	ITS Option	1.1882E-01	2.4199E-05	4.7709E-03	1.2362E-01
	Difference (%)	-3.974E-04(-0.3%)	-2.004E-07(-0.8%)	-2.554E-05(-0.5%)	-4.231E-04(-0.3%)
I-35 E AND I-694	ITS Option	1.1898E-01	2.4171E-05	4.7818E-03	1.2379E-01
	Difference (%)	-2.336E-04(-0.2%)	-2.292E-07(-0.9%)	-1.466E-05(-0.3%)	-2.485E-04(-0.2%)
TH-36	ITS Option	1.1913E-01	2.4178E-05	4.7868E-03	1.2394E-01
	Difference (%)	-8.603E-05(-0.1%)	-2.215E-07(-0.9%)	-9.725E-06(-0.2%)	-9.598E-05(-0.1%)
I-94 AND I-394	ITS Option	1.1860E-01	2.4241E-05	4.7507E-03	1.2338E-01
	Difference (%)	-6.159E-04(-0.5%)	-1.593E-07(-0.7%)	-4.576E-05(-1.0%)	-6.618E-04(-0.5%)
TH-62	ITS Option	1.1911E-01	2.4114E-05	4.7853E-03	1.2392E-01
	Difference (%)	-1.094E-04(-0.1%)	-2.859E-07(-1.2%)	-1.116E-05(-0.2%)	-1.209E-04(-0.1%)
I-494	ITS Option	1.1882E-01	2.4120E-05	4.7751E-03	1.2361E-01
	Difference (%)	-4.031E-04(-0.3%)	-2.799E-07(-1.1%)	-2.141E-05(-0.4%)	-4.248E-04(-0.3%)
ALL CORRIDORS	ITS Option	1.1736E-01	2.3897E-05	4.6665E-03	1.2205E-01
	Difference (%)	-1.858E-03(-1.6%)	-5.031E-07(-2.1%)	-1.3E-04(-2.7%)	-1.989E-03(-1.6%)
	Number of Injury Accidents				
	Control Alternative	1.2277E+01	2.4198E-03	4.9164E-01	1.2771E+01
I-35 W SB	ITS Option	1.0874E+01	2.1728E-03	4.3480E-01	1.1311E+01
	Difference (%)	-3.093E-02(-0.3%)	-1.778E-05(-0.8%)	-1.967E-03(-0.5%)	-3.291E-02(-0.3%)
I-35 E AND I-694	ITS Option	1.0888E+01	2.1696E-03	4.3569E-01	1.1326E+01
	Difference (%)	-1.738E-02(-0.2%)	-2.096E-05(-1.0%)	-1.078E-03(-0.2%)	-1.848E-02(-0.2%)
TH-36	ITS Option	1.0898E+01	2.1716E-03	4.3605E-01	1.1337E+01
	Difference (%)	-6.754E-03(-0.1%)	-1.9E-05(-0.9%)	-7.201E-04(-0.2%)	-7.493E-03(-0.1%)
I-94 AND I-394	ITS Option	1.0860E+01	2.1761E-03	4.3342E-01	1.1296E+01
	Difference (%)	-4.521E-02(-0.4%)	-1.448E-05(-0.7%)	-3.351E-03(-0.8%)	-4.858E-02(-0.4%)
TH-62	ITS Option	1.0897E+01	2.1660E-03	4.3595E-01	1.1335E+01
	Difference (%)	-8.039E-03(-0.1%)	-2.454E-05(-1.1%)	-8.211E-04(-0.2%)	-8.885E-03(-0.1%)
I-494	ITS Option	1.0875E+01	2.1692E-03	4.3521E-01	1.1312E+01
	Difference (%)	-3.03E-02(-0.3%)	-2.135E-05(-1.0%)	-1.556E-03(-0.4%)	-3.187E-02(-0.3%)
ALL CORRIDORS	ITS Option	1.0765E+01	2.1477E-03	4.2703E-01	1.1195E+01
	Difference (%)	-1.398E-01(-1.3%)	-4.284E-05(-2.0%)	-9.737E-03(-2.2%)	-1.495E-01(-1.3%)
	Number of PDO Accidents				
	Control Alternative	1.7613E+01	3.3948E-03	7.0371E-01	1.8320E+01
I-35 W SB	ITS Option	1.5498E+01	3.0204E-03	6.1881E-01	1.6120E+01
	Difference (%)	-2.108E-02(-0.1%)	-2.373E-05(-0.8%)	-1.317E-03(-0.2%)	-2.242E-02(-0.1%)
I-35 E	ITS Option	1.5507E+01	3.0143E-03	6.1943E-01	1.6129E+01

AND I-694	Difference (%)	-1.248E-02(-0.1%)	-2.983E-05(-1.0%)	-6.977E-04(-0.1%)	-1.321E-02(-0.1%)
TH-36	ITS Option	1.5513E+01	3.0162E-03	6.1963E-01	1.6135E+01
	Difference (%)	-6.353E-03(0.0%)	-2.799E-05(-0.9%)	-5.007E-04(-0.1%)	-6.882E-03(0.0%)
I-94 AND I-394	ITS Option	1.5489E+01	3.0253E-03	6.1795E-01	1.6110E+01
	Difference (%)	-3.014E-02(-0.2%)	-1.883E-05(-0.6%)	-2.18E-03(-0.4%)	-3.234E-02(-0.2%)
TH-62	ITS Option	1.5513E+01	3.0100E-03	6.1956E-01	1.6136E+01
	Difference (%)	-6.044E-03(0.0%)	-3.412E-05(-1.1%)	-5.704E-04(-0.1%)	-6.649E-03(0.0%)
I-494	ITS Option	1.5499E+01	3.0254E-03	6.1910E-01	1.6121E+01
	Difference (%)	-2.02E-02(-0.1%)	-1.872E-05(-0.6%)	-1.03E-03(-0.2%)	-2.125E-02(-0.1%)
ALL CORRIDORS	ITS Option	1.5420E+01	2.9979E-03	6.1346E-01	1.6037E+01
	Difference (%)	-9.868E-02(-0.6%)	-4.629E-05(-1.5%)	-6.665E-03(-1.1%)	-1.054E-01(-0.7%)
	Travel Time Reliability (hours of unexpected delay)				
	Control Alternative	6,383.87	8.04	122.69	6,514.60
I-35 W SB	ITS Option	13,539.31	10.89	270.10	13,820.29
	Difference (%)	-140.01(-1.0%)	-0.12(-1.1%)	-2.66(-1.0%)	-142.79(-1.0%)
I-35 E AND I-694	ITS Option	13,643.00	10.98	271.58	13,925.55
	Difference (%)	-36.31(-0.3%)	-0.03(-0.3%)	-1.18(-0.4%)	-37.53(-0.3%)
TH-36	ITS Option	13,672.84	11.10	272.59	13,956.53
	Difference (%)	-6.47(0.0%)	0.10(0.9%)	-0.17(-0.1%)	-6.55(0.0%)
I-94 AND I-394	ITS Option	13,643.79	10.93	271.96	13,926.68
	Difference (%)	-35.52(-0.3%)	-0.08(-0.7%)	-0.80(-0.3%)	-36.40(-0.3%)
TH-62	ITS Option	13,699.86	11.05	272.82	13,983.73
	Difference (%)	20.55(0.2%)	0.05(0.4%)	0.06(0.0%)	20.65(0.1%)
I-494	ITS Option	13,558.30	10.90	269.38	13,838.59
	Difference (%)	-121.01(-0.9%)	-0.11(-1.0%)	-3.38(-1.2%)	-124.49(-0.9%)
ALL CORRIDORS	ITS Option	13,394.41	10.78	265.52	13,670.71
	Difference (%)	-284.91(-2.1%)	-0.22(-2.0%)	-7.24(-2.7%)	-292.37(-2.1%)

APPENDIX B
PM PEAK RESULTS BY MARKET SECTOR

ATM Deployment Scenario	By: Market Sector	SOV	HOV	Trucks	Total
	Vehicle Miles of Travel				
	Control Alternative	28,499,674	5,209	654,578	29,159,461
I-35 W SB	ITS Option	28,501,146	5,209	654,622	29,160,977
	Difference (%)	1,472(0.0%)	1(0.0%)	44(0.0%)	1,517(0.0%)
I-35 E AND I-694	ITS Option	28,499,220	5,206	654,572	29,158,998
	Difference (%)	-454(0.0%)	-3(-0.1%)	-6(0.0%)	-463(0.0%)
TH-36	ITS Option	28,499,362	5,209	654,587	29,159,158
	Difference (%)	-312(0.0%)	0(0.0%)	9(0.0%)	-303(0.0%)
I-94 AND I-394	ITS Option	28,500,566	5,206	654,621	29,160,392
	Difference (%)	892(0.0%)	-3(-0.1%)	43(0.0%)	932(0.0%)
TH-62	ITS Option	28,498,466	5,207	654,555	29,158,228
	Difference (%)	-1,208(0.0%)	-2(0.0%)	-23(0.0%)	-1,233(0.0%)
I-494	ITS Option	28,498,966	5,209	654,557	29,158,732
	Difference (%)	-708(0.0%)	0(0.0%)	-21(0.0%)	-729(0.0%)
ALL CORRIDORS	ITS Option	28,503,974	5,211	654,742	29,163,927
	Difference (%)	4,300(0.0%)	3(0.1%)	164(0.0%)	4,466(0.0%)
	Vehicle Hours of Travel				
	Control Alternative	774,267	136	20,145	794,548
I-35 W SB	ITS Option	774,119	136	20,140	794,395
	Difference (%)	-148(0.0%)	0(0.0%)	-5(0.0%)	-153(0.0%)
I-35 E AND I-694	ITS Option	774,014	136	20,138	794,289
	Difference (%)	-253(0.0%)	0(-0.1%)	-7(0.0%)	-259(0.0%)
TH-36	ITS Option	774,125	136	20,140	794,401
	Difference (%)	-142(0.0%)	0(0.0%)	-5(0.0%)	-147(0.0%)
I-94 AND I-394	ITS Option	774,154	136	20,143	794,433
	Difference (%)	-113(0.0%)	0(0.0%)	-3(0.0%)	-115(0.0%)
TH-62	ITS Option	774,062	136	20,139	794,337
	Difference (%)	-204(0.0%)	0(0.0%)	-7(0.0%)	-211(0.0%)
I-494	ITS Option	773,982	136	20,138	794,255
	Difference (%)	-285(0.0%)	0(0.0%)	-7(0.0%)	-293(0.0%)
ALL CORRIDORS	ITS Option	773,455	136	20,123	793,714
	Difference (%)	-812(-0.1%)	0(-0.1%)	-22(-0.1%)	-834(-0.1%)
	Average Speed				
	Control Alternative	36.8	38.3	32.5	36.7
I-35 W	ITS Option	36.8	38.3	32.5	36.7

SB	Difference (%)	0(0.0%)	0(0.1%)	0(0.0%)	0(0.0%)
I-35 E AND I-694	ITS Option	36.8	38.3	32.5	36.7
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
TH-36	ITS Option	36.8	38.3	32.5	36.7
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
I-94 AND I-394	ITS Option	36.8	38.3	32.5	36.7
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
TH-62	ITS Option	36.8	38.3	32.5	36.7
	Difference (%)	0(0.0%)	0(-0.1%)	0(0.0%)	0(0.0%)
I-494	ITS Option	36.8	38.3	32.5	36.7
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
ALL CORRIDORS	ITS Option	36.9	38.4	32.5	36.7
	Difference (%)	0(0.1%)	0(0.1%)	0(0.1%)	0(0.0%)
	Person Hours of Travel				
	Control Alternative	1,099,459	372	31,829	1,131,661
I-35 W SB	ITS Option	1,099,248	372	31,822	1,131,442
	Difference (%)	-211(0.0%)	0(0.0%)	-8(0.0%)	-218(0.0%)
I-35 E AND I-694	ITS Option	1,099,100	372	31,819	1,131,291
	Difference (%)	-359(0.0%)	0(-0.1%)	-11(0.0%)	-370(0.0%)
TH-36	ITS Option	1,099,257	372	31,821	1,131,451
	Difference (%)	-202(0.0%)	0(0.0%)	-8(0.0%)	-210(0.0%)
I-94 AND I-394	ITS Option	1,099,299	372	31,825	1,131,497
	Difference (%)	-160(0.0%)	0(0.0%)	-4(0.0%)	-164(0.0%)
TH-62	ITS Option	1,099,169	372	31,819	1,131,360
	Difference (%)	-290(0.0%)	0(0.0%)	-10(0.0%)	-301(0.0%)
I-494	ITS Option	1,099,054	372	31,817	1,131,244
	Difference (%)	-405(0.0%)	0(0.0%)	-12(0.0%)	-417(0.0%)
ALL CORRIDORS	ITS Option	1,098,306	372	31,795	1,130,473
	Difference (%)	-1,153(-0.1%)	0(-0.1%)	-35(-0.1%)	-1,188(-0.1%)
	Number of Person Trips				
	Control Alternative	4,574,629	775	172,127	4,747,531
I-35 W SB	ITS Option	4,574,629	775	172,127	4,747,531
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
I-35 E AND I-694	ITS Option	4,574,629	775	172,127	4,747,531
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
TH-36	ITS Option	4,574,629	775	172,127	4,747,531
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
I-94 AND I-394	ITS Option	4,574,629	775	172,127	4,747,531
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
TH-62	ITS Option	4,574,629	775	172,127	4,747,531
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
I-494	ITS Option	4,574,629	775	172,127	4,747,531
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)

ALL CORRIDORS	ITS Option	4,574,629	775	172,127	4,747,531
	Difference (%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)
	Number of Fatality Accidents				
	Control Alternative	2.9392E-01	4.0276E-05	6.9436E-03	3.0091E-01
I-35 W SB	ITS Option	2.9228E-01	3.8071E-05	6.9039E-03	2.9923E-01
	Difference (%)	-1.64E-03(-0.6%)	-2.205E-06(-5.5%)	-3.972E-05(-0.6%)	-1.682E-03(-0.6%)
I-35 E AND I-694	ITS Option	2.9286E-01	4.0244E-05	6.9213E-03	2.9982E-01
	Difference (%)	-1.067E-03(-0.4%)	-3.273E-08(-0.1%)	-2.232E-05(-0.3%)	-1.09E-03(-0.4%)
TH-36	ITS Option	2.9352E-01	4.0250E-05	6.9284E-03	3.0048E-01
	Difference (%)	-4.091E-04(-0.1%)	-2.65E-08(-0.1%)	-1.52E-05(-0.2%)	-4.244E-04(-0.1%)
I-94 AND I-394	ITS Option	2.9121E-01	4.0172E-05	6.8756E-03	2.9812E-01
	Difference (%)	-2.719E-03(-0.9%)	-1.043E-07(-0.3%)	-6.806E-05(-1.0%)	-2.787E-03(-0.9%)
TH-62	ITS Option	2.9343E-01	4.0051E-05	6.9273E-03	3.0040E-01
	Difference (%)	-4.91E-04(-0.2%)	-2.253E-07(-0.6%)	-1.637E-05(-0.2%)	-5.076E-04(-0.2%)
I-494	ITS Option	2.9250E-01	3.9220E-05	6.9093E-03	2.9945E-01
	Difference (%)	-1.428E-03(-0.5%)	-1.057E-06(-2.6%)	-3.43E-05(-0.5%)	-1.463E-03(-0.5%)
ALL CORRIDORS	ITS Option	2.8632E-01	3.6852E-05	6.7491E-03	2.9310E-01
	Difference (%)	-7.607E-03(-2.6%)	-3.424E-06(-8.5%)	-1.945E-04(-2.8%)	-7.805E-03(-2.6%)
	Number of Injury Accidents				
	Control Alternative	2.6162E+01	3.3475E-03	6.2588E-01	2.6791E+01
I-35 W SB	ITS Option	2.6041E+01	3.1872E-03	6.2297E-01	2.6667E+01
	Difference (%)	-1.212E-01(-0.5%)	-1.603E-04(-4.8%)	-2.911E-03(-0.5%)	-1.243E-01(-0.5%)
I-35 E AND I-694	ITS Option	2.6080E+01	3.3433E-03	6.2417E-01	2.6708E+01
	Difference (%)	-8.179E-02(-0.3%)	-4.171E-06(-0.1%)	-1.706E-03(-0.3%)	-8.35E-02(-0.3%)
TH-36	ITS Option	2.6131E+01	3.3444E-03	6.2474E-01	2.6759E+01
	Difference (%)	-3.11E-02(-0.1%)	-3.057E-06(-0.1%)	-1.14E-03(-0.2%)	-3.225E-02(-0.1%)
I-94 AND I-394	ITS Option	2.5964E+01	3.3386E-03	6.2091E-01	2.6588E+01
	Difference (%)	-1.98E-01(-0.8%)	-8.863E-06(-0.3%)	-4.963E-03(-0.8%)	-2.03E-01(-0.8%)
TH-62	ITS Option	2.6125E+01	3.3284E-03	6.2467E-01	2.6753E+01
	Difference (%)	-3.677E-02(-0.1%)	-1.905E-05(-0.6%)	-1.209E-03(-0.2%)	-3.8E-02(-0.1%)
I-494	ITS Option	2.6055E+01	3.2661E-03	6.2333E-01	2.6682E+01
	Difference (%)	-1.073E-01(-0.4%)	-8.134E-05(-2.4%)	-2.544E-03(-0.4%)	-1.099E-01(-0.4%)
ALL CORRIDORS	ITS Option	2.5602E+01	3.0947E-03	6.1156E-01	2.6217E+01
	Difference (%)	-5.602E-01(-2.1%)	-2.527E-04(-7.5%)	-1.431E-02(-2.3%)	-5.748E-01(-2.1%)
	Number of PDO Accidents				
	Control Alternative	3.7053E+01	4.6138E-03	8.9069E-01	3.7948E+01
I-35 W SB	ITS Option	3.6967E+01	4.5029E-03	8.8867E-01	3.7861E+01
	Difference (%)	-8.533E-02(-0.2%)	-1.109E-04(-2.4%)	-2.022E-03(-0.2%)	-8.746E-02(-0.2%)
I-35 E AND I-	ITS Option	3.6992E+01	4.6073E-03	8.8940E-01	3.7886E+01
	Difference (%)	-6.097E-	-6.483E-	-1.289E-	-6.227E-

694		02(-0.2%)	06(-0.1%)	03(-0.1%)	02(-0.2%)
TH-36	ITS Option	3.7028E+01	4.6092E-03	8.8985E-01	3.7923E+01
	Difference (%)	-2.43E-02(-0.1%)	-4.589E-06(-0.1%)	-8.416E-04(-0.1%)	-2.514E-02(-0.1%)
I-94 AND I-394	ITS Option	3.6915E+01	4.6054E-03	8.8723E-01	3.7807E+01
	Difference (%)	-1.379E-01(-0.4%)	-8.458E-06(-0.2%)	-3.459E-03(-0.4%)	-1.414E-01(-0.4%)
TH-62	ITS Option	3.7024E+01	4.5943E-03	8.8981E-01	3.7919E+01
	Difference (%)	-2.844E-02(-0.1%)	-1.955E-05(-0.4%)	-8.801E-04(-0.1%)	-2.934E-02(-0.1%)
I-494	ITS Option	3.6972E+01	4.5453E-03	8.8882E-01	3.7865E+01
	Difference (%)	-8.064E-02(-0.2%)	-6.849E-05(-1.5%)	-1.875E-03(-0.2%)	-8.259E-02(-0.2%)
ALL CORRIDORS	ITS Option	3.6656E+01	4.4308E-03	8.8055E-01	3.7541E+01
	Difference (%)	-3.965E-01(-1.1%)	-1.83E-04(-4.0%)	-1.014E-02(-1.1%)	-4.069E-01(-1.1%)
	Travel Time Reliability (hours of unexpected delay)				
	Control Alternative	7,732.28	2.00	143.97	7,878.25
I-35 W SB	ITS Option	7,629.71	1.97	141.76	7,773.44
	Difference (%)	-102.57(-1.3%)	-0.03(-1.4%)	-2.21(-1.5%)	-104.81(-1.3%)
I-35 E AND I-694	ITS Option	7,482.87	1.98	138.76	7,623.62
	Difference (%)	-249.41(-3.2%)	-0.02(-0.8%)	-5.20(-3.6%)	-254.63(-3.2%)
TH-36	ITS Option	7,682.18	1.98	142.58	7,826.74
	Difference (%)	-50.10(-0.6%)	-0.02(-0.8%)	-1.39(-1.0%)	-51.51(-0.7%)
I-94 AND I-394	ITS Option	7,715.42	1.98	143.59	7,860.98
	Difference (%)	-16.86(-0.2%)	-0.02(-1.1%)	-0.38(-0.3%)	-17.26(-0.2%)
TH-62	ITS Option	7,706.33	1.96	142.91	7,851.20
	Difference (%)	-25.95(-0.3%)	-0.03(-1.7%)	-1.06(-0.7%)	-27.05(-0.3%)
I-494	ITS Option	7,609.75	1.92	141.13	7,752.80
	Difference (%)	-122.53(-1.6%)	-0.08(-4.0%)	-2.84(-2.0%)	-125.44(-1.6%)
ALL CORRIDORS	ITS Option	7,126.24	1.88	130.02	7,258.14
	Difference (%)	-606.04(-7.8%)	-0.11(-5.7%)	-13.95(-9.7%)	-620.11(-7.9%)

APPENDIX C
RISK ANALYSIS

I-35 W SB (AM Peak)

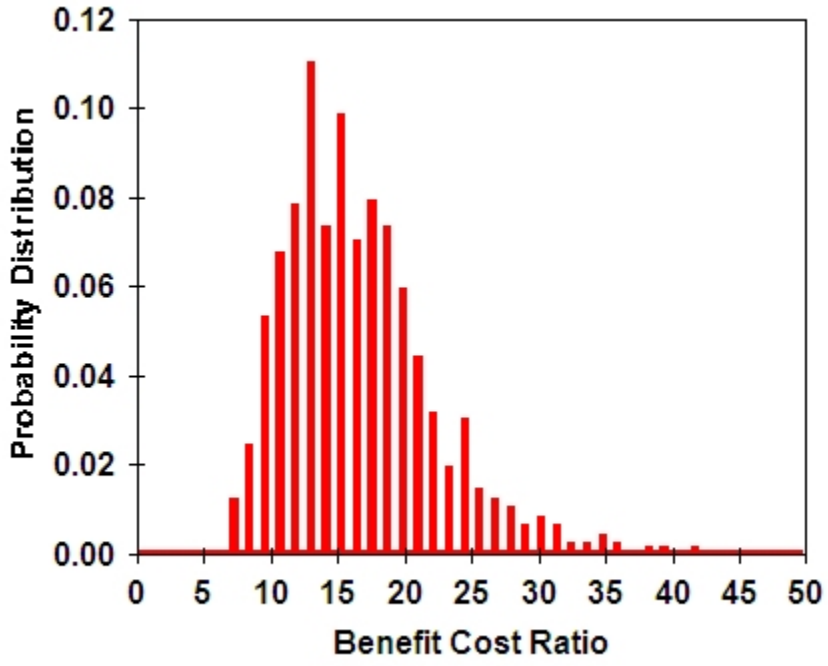


Fig 3: Histogram for B/C ratio for I-35 W SB (AM Peak)

- Mean B/C Ratio = 16.98
- Median B/C Ratio = 16.2
- Cost-Benefit Analysis B/C Ratio = 15.42
- Confidence level that value will be greater than or equal to the Analysis Value = 60%

I-35 E And I-694 (AM Peak)

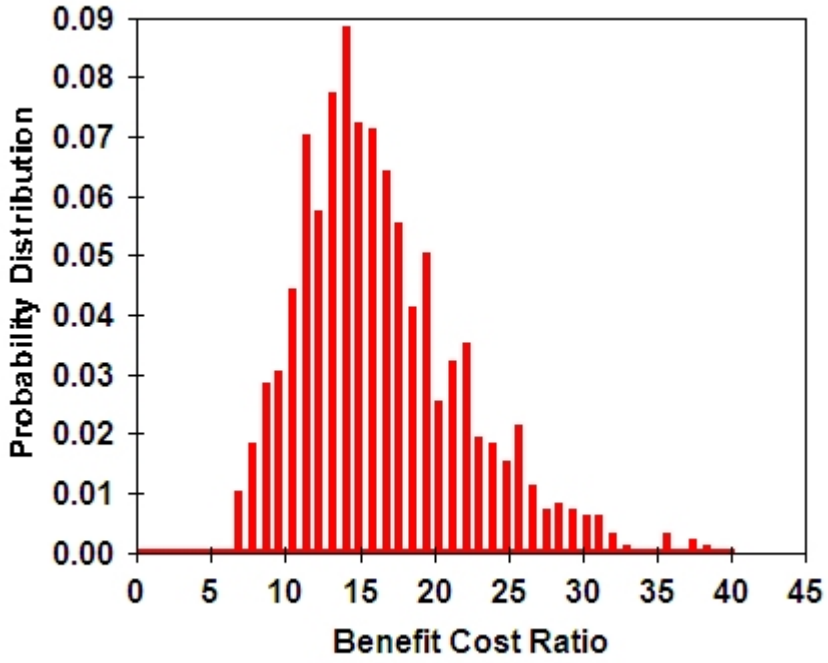


Fig 4: Histogram for B/C ratio for I-35E And I-694 (AM Peak)

- Mean B/C Ratio = 16.83
- Median B/C Ratio = 15.9
- Cost-Benefit Analysis B/C Ratio = 15.42
- Confidence level that value will be greater than or equal to the Analysis Value = 60%

TH-36 (AM Peak)

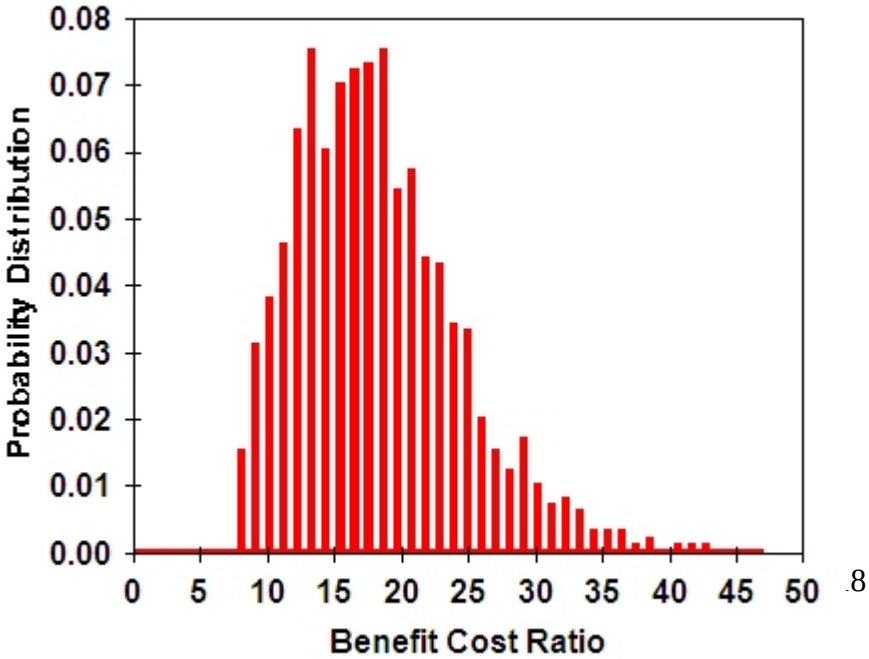


Fig 5: Histogram for B/C ratio for I-35E And I-694 (AM Peak)

- Mean B/C Ratio = 18.63
- Median B/C Ratio = 17.97
- Cost-Benefit Analysis B/C Ratio = 17.14
- Confidence level that value will be greater than or equal to the Analysis Value = 60%

I-94 And I-394 (AM Peak)

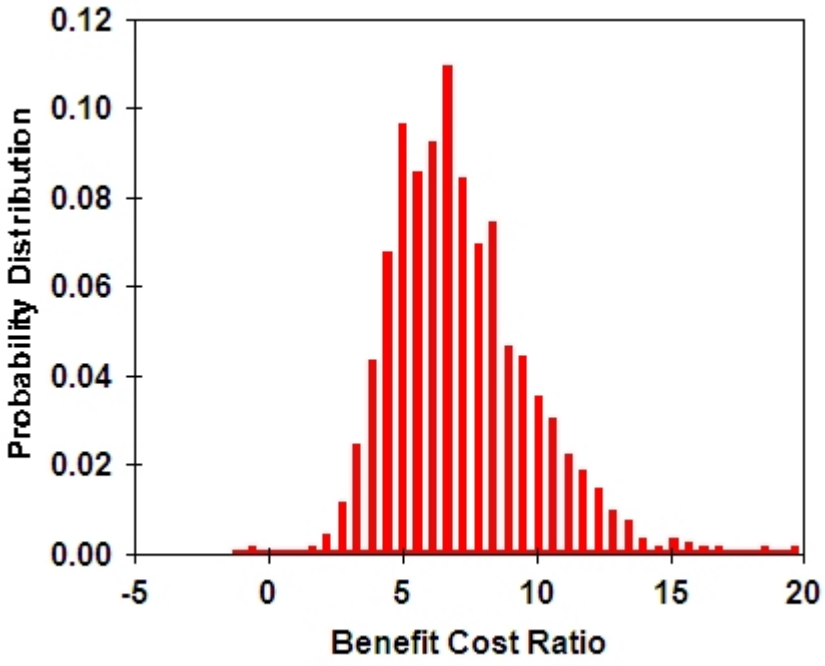


Fig 6: Histogram for B/C ratio for I-94 and I-394 (AM Peak)

- Mean B/C Ratio = 7.45
- Median B/C Ratio = 7.06
- Cost-Benefit Analysis B/C Ratio = 6.81
- Confidence level that value will be greater than or equal to the Analysis Value = 60%

TH-62 (AM Peak)

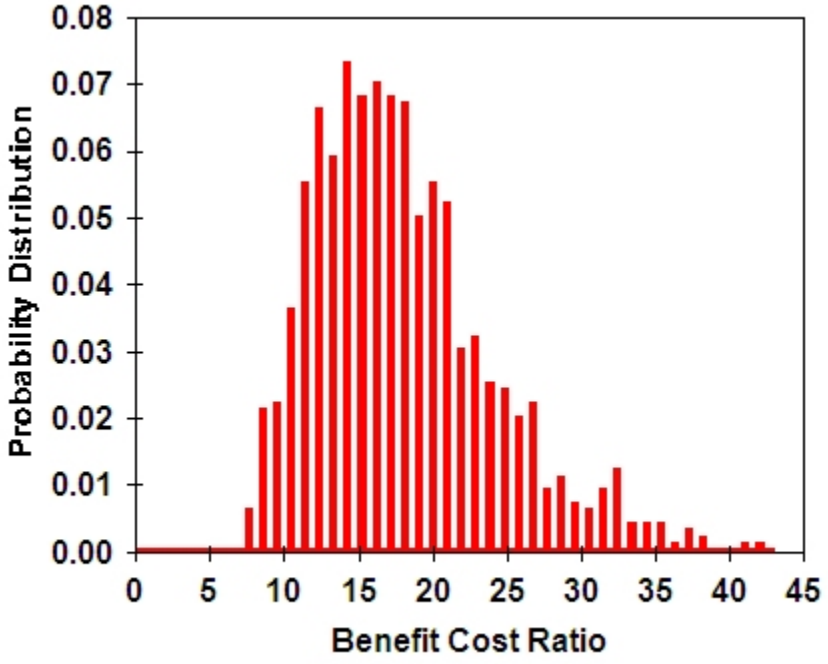


Fig 7: Histogram for B/C ratio for TH-62 (AM Peak)

- Mean B/C Ratio = 18.41

- Median B/C Ratio = 17.41
- Cost-Benefit Analysis B/C Ratio = 17.03
- Confidence level that value will be greater than or equal to the Analysis Value = 60%

I-494 (AM Peak)

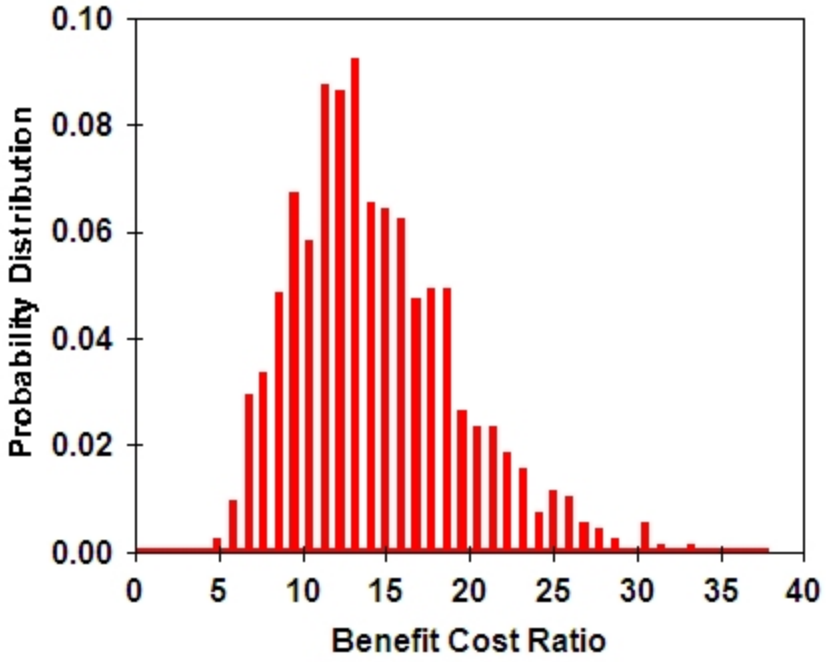
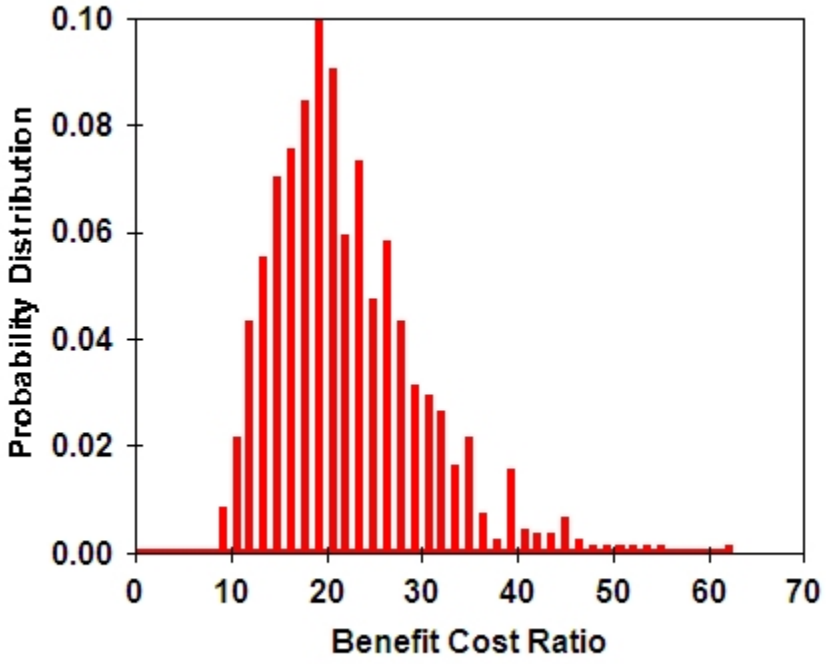


Figure 8: Histogram for B/C ratio for I-494 (AM Peak)

- Mean B/C Ratio = 14.79
- Median B/C Ratio = 13.95

- Cost-Benefit Analysis B/C Ratio = 13.42
- Confidence level that value will be greater than or equal to the Analysis Value = 60%

All



Corridors (AM Peak)

Fig 9: Histogram for B/C ratio for All Corridors(AM Peak)

- Mean B/C Ratio = 22.76
- Median B/C Ratio = 21.41
- Cost-Benefit Analysis B/C Ratio = 20.72
- Confidence level that value will be greater than or equal to the Analysis Value = 60%

I-35 W SB (PM Peak)

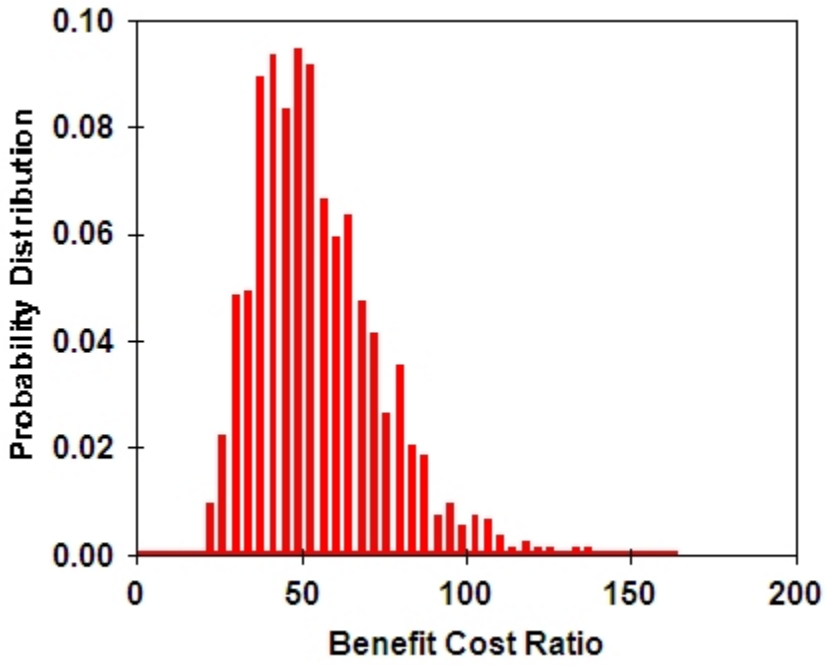


Fig 10: Histogram for B/C ratio for I-35 W SB (PM Peak)

- Mean B/C Ratio = 56.54
- Median B/C Ratio = 53.61
- Cost-Benefit Analysis B/C Ratio = 49.99
- Confidence level that value will be greater than or equal to the Analysis Value = 60%

I-35 E And I-694 (PM Peak)

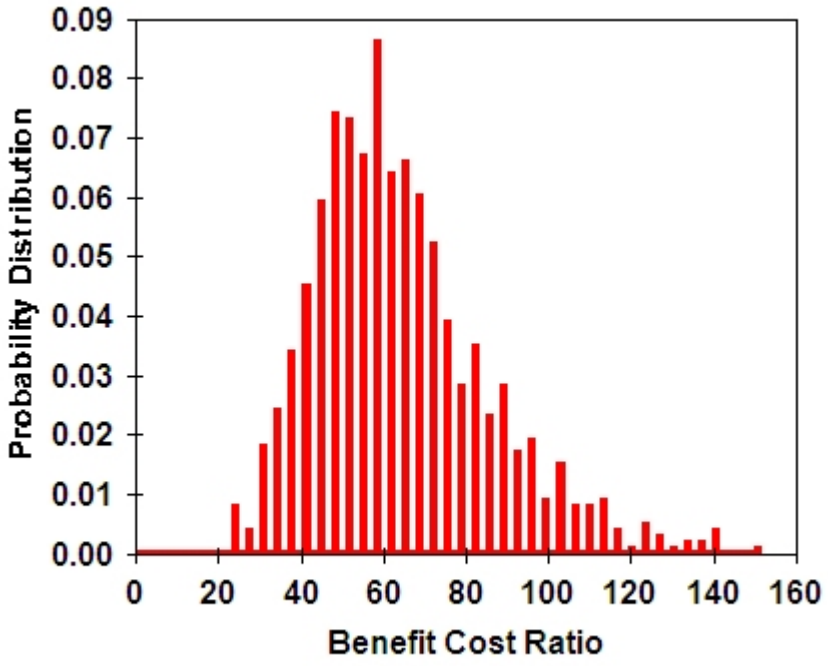


Fig 11: Histogram for I-35E And I-694 (PM Peak) B/C ratio

- Mean B/C Ratio = 65.91
- Median B/C Ratio = 62.14
- Cost-Benefit Analysis B/C Ratio = 56.87

- Confidence level that value will be greater than or equal to the Analysis Value = 60%

TH-36 (PM Peak)

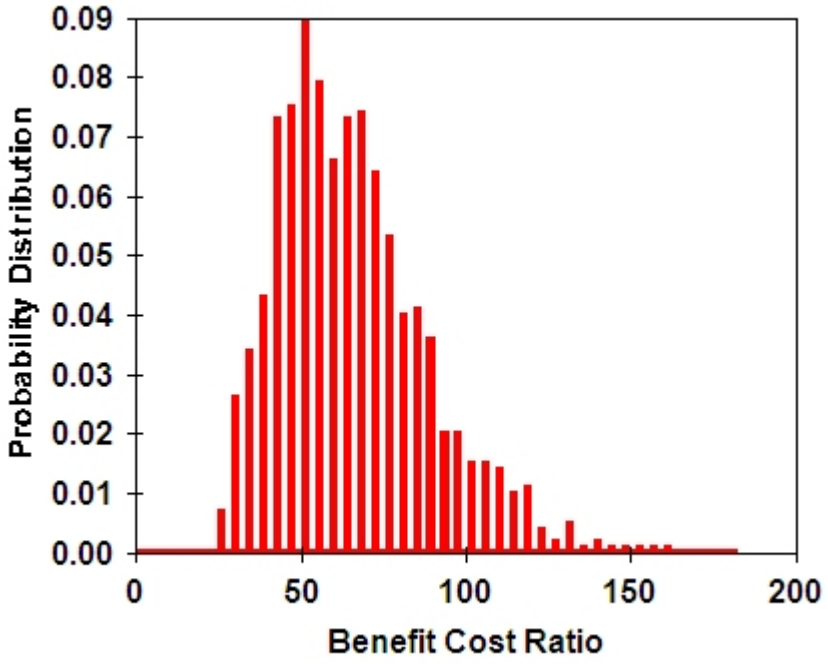


Fig 12: Histogram for B/C ratio for TH-36 (PM Peak)

- Mean B/C Ratio = 67.72
- Median B/C Ratio = 64.57
- Cost-Benefit Analysis B/C Ratio = 60.52
- Confidence level that value will be greater than or equal to the Analysis Value = 59%

I-94 And I-394 (PM Peak)

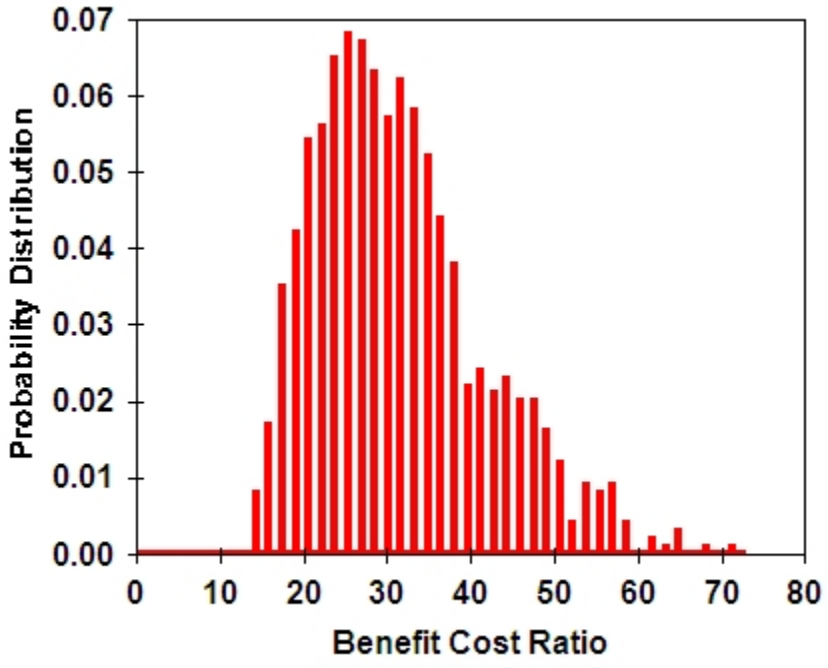


Fig 13: Histogram for I-94 and I-394 (PM Peak) B/C ratio

- Mean B/C Ratio = 32.08
- Median B/C Ratio = 30.61
- Cost-Benefit Analysis B/C Ratio = 27.54
- Confidence level that value will be greater than or equal to the Analysis Value = 70%

TH-62 (PM Peak)

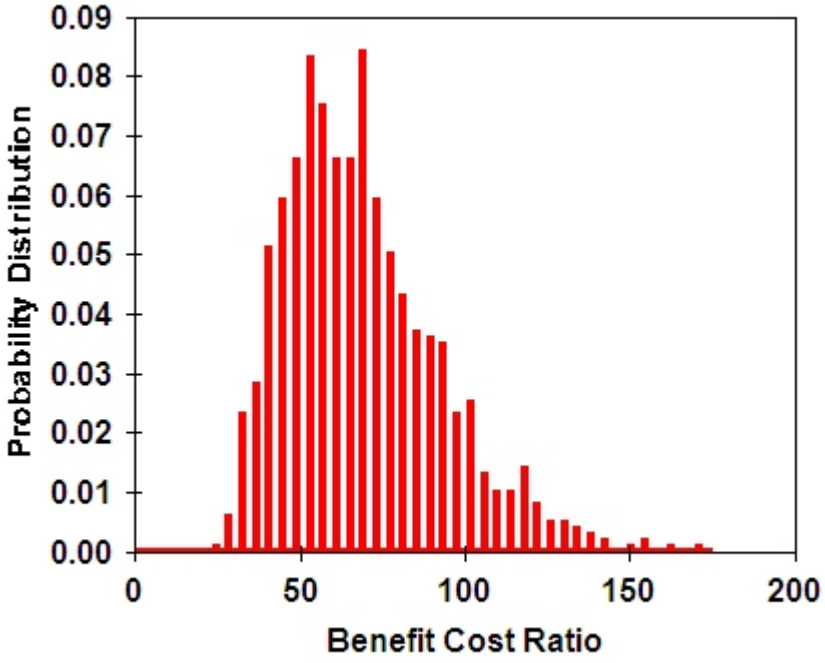


Fig 14: Histogram for B/C ratio for TH-62 (PM Peak)

- Mean B/C Ratio = 70.77
- Median B/C Ratio = 66.99
- Cost-Benefit Analysis B/C Ratio = 62.12
- Confidence level that value will be greater than or equal to the Analysis Value = 57%

I-494 (PM Peak)

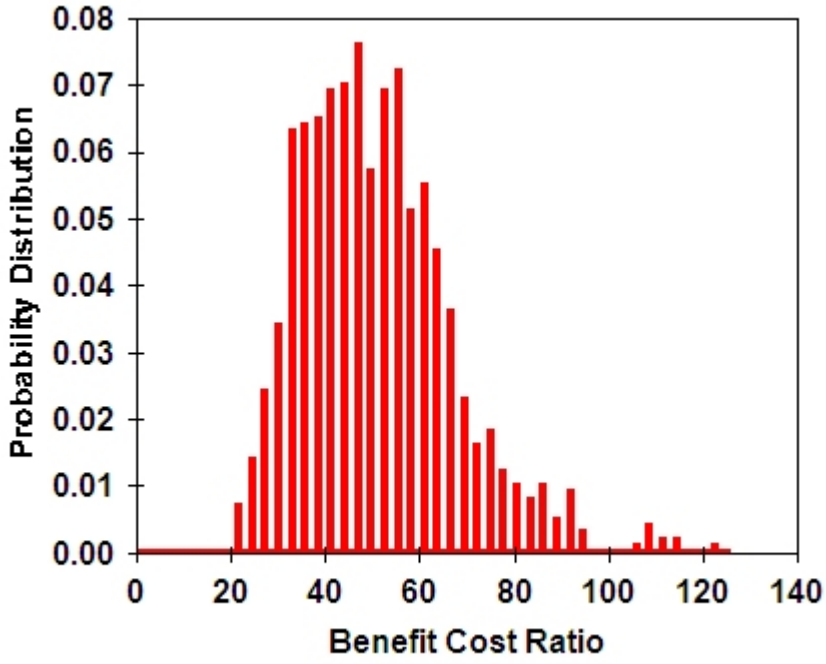


Fig 15: Histogram for B/C ratio for I-494 (PM Peak)

- Mean B/C Ratio = 52.23
- Median B/C Ratio = 50.25
- Cost-Benefit Analysis B/C Ratio = 45.12
- Confidence level that value will be greater than or equal to the Analysis Value = 70%

All Corridors (PM Peak)

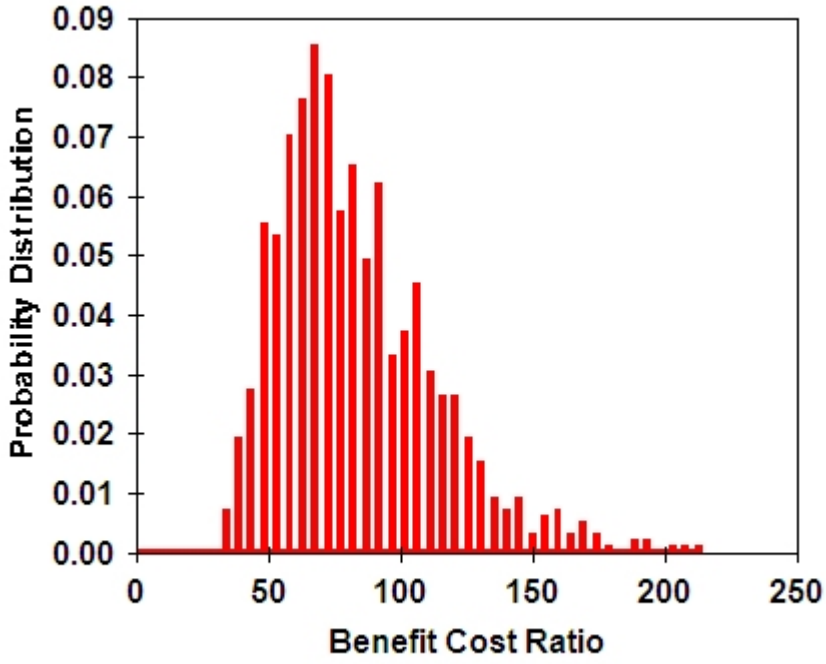


Fig 16: Histogram for B/C ratio for All Corridors (PM Peak)

- Mean B/C Ratio = 85.41
- Median B/C Ratio = 79.75
- Cost-Benefit Analysis B/C Ratio = 77.37
- Confidence level that value will be greater than or equal to the Analysis Value = 58%