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MEMORANDUM

TO: James Grube, Hennepin County

FROM: Graham Johnson, PE

DATE: May 28, 2015

RE: I-35W and Lake Street Transit Access Project - Benefit Cost Analysis
SEH No. HENNC 113114

This memorandum documents the methodology and results of the benefit-cost analysis for the preferred build alternative, developed as part of the I-35W and Lake Street Transit Access Project. The project includes three separate projects combined into one proposed preferred build alternative.

The first project includes replacement of two major bridges in the project area based on the requirements of the Chapter 152 Bridge Replacement Program (2008). These include the southbound I-35W bridge over northbound TH 65 near 24th Street, and the northbound I-35W/TH 65 flyover bridge to westbound I-94. The next project is the Lake Street transit station reconstruction and access changes at Lake Street and 28th Street. The transit station will be reconstructed in the center of mainline I-35W and exit ramps will be included for southbound I-35W to Lake Street and northbound I-35W to 28th Street.

With the reconstruction of I-35W between downtown and 32nd Street, a southbound MnPASS lane will be constructed through this area. Therefore the last of the three project is the “gap” project which will reconfigure I-35W between 42nd Street to 32nd Street to accommodate MnPASS lanes. Both northbound and southbound I-35W MnPASS lanes will be developed; currently southbound does not have a MnPASS facility in this area and northbound has an existing priced dynamic shoulder.

The new freeway access, auxiliary lanes, and MnPASS lanes have a major impact on both the local and regional roadway system. The access changes provide a more direct route into a large portion of South Minneapolis that currently has very limited access. The southbound MnPASS facility connects an incomplete HOV facility that serves the downtown area users.

PURPOSE

The purpose of a benefit-cost analysis is to express the effects of an investment (or closure) into a common measure (dollars). This allows for the fact that the benefit or costs of a project are often accrued over a long period of time, while the initial investment is incurred during the initial years of the project.

In this analysis approach, any quantified benefits that are greater than or equal to the quantified costs (benefit-to-cost ratio greater than one) represents an economically viable project.

BENEFIT-COST METHODOLOGY

The monetary benefit for the project is quantified in terms of reduced vehicle miles traveled (VMT), vehicle hours traveled (VHT), and estimated crashes over the analysis period between the No-Build and the Build option. The costs typically include construction, bridges and structures, right-of-way, and

engineering/project delivery costs. Remaining capital values of these roadway features at the end of the analysis period are subtracted from the total cost of the project.

The results of the analysis provide input for evaluating the overall benefit of the proposed improvements to the corridor. Due to the planning level of detail in the calculations, the magnitude of the value is not as important as the value being greater or less than one.

General Assumptions

- All monetary values are discounted to the 2015 analysis year. Inflation is not included.
- The 20-year benefit period is based on a 2018 day-of-opening through 2038
- Yearly Build and No-Build benefits are calculated based on linear interpolation over the 20-year analysis period.
- The number of days per year used in the analysis was 260; this is based on I-35W being a heavy commuter route.
- Longer travel times and rerouting of trips during construction years are not included.
- Preliminary costs estimates were provided by MnDOT and completed using current methodology. The cost estimates are based on documented construction costs. The cost estimates include all roadway sections including local street connections due to access changes.
- Operating and Maintenance (O&M) values were estimated based on MnDOT guidance from the Office of Transportation System Management.
 - MnPASS operating and maintenance costs are equal between the No Build and Build condition.
 - The existing northbound PDSL lane has additional costs associated with it when compared to a full MnPASS lane. Removing the PDSL will also allow MnDOT to remove some existing devices along the corridor as well as daily maintenance of debris removal on the existing shoulder lane.
 - The new southbound MnPASS lane will add a few devices, but the lane will tie into an existing MnPASS corridor so the operation costs are very minor.

Specific Assumptions

The values in the table below are from the MnDOT Office of Transportation Management. These values are typically adjusted on a yearly basis; however these are the most current values as of May 2015.

Table 1. Specific Assumptions (Mn/DOT)

Fatal Type K	\$10,300,000
Injury Type A	\$550,000
Injury Type B	\$160,000
Injury Type C	\$81,000
Property Damage Only	\$7,400
<i>Operating Costs (Vehicle Miles Traveled)</i>	
Automobile (per mile)	\$0.31
Heavy Vehicle (per mile)	\$0.96
<i>Time Costs (Vehicle Hours Traveled)</i>	
Automobile (per occupant)	\$16.00
Heavy Commercial (per occupant)	\$27.30
<i>Vehicle Occupancy Rates</i>	
Automobile (passengers per vehicle)	1.30
Heavy Commercial (passengers per vehicle)	1.02
<i>Capital Cost Estimate – see Preliminary Cost Estimate Table A2</i>	
<i>Component Service Life (years)</i>	
Program Development and Delivery	0
Right-of-way, per acre	100
Major Structure	60
Grading and Drainage	50
Sub-base and Base	40
Surface	25
<i>Analysis Period for Roadway projects (years)</i>	20
<i>Discount Rate (annual)</i>	2.0%

Source: Mn/DOT Office of Transportation System Management, May 2015

Traffic Assumptions

As part of the I-35W Transit Access Project, traffic forecasts for all roadways in the project area were developed for a forecast year of 2038 and year of opening 2018 based on the Twin Cities Travel Demand Model (TCTDM). The forecasts were developed to determine operational and safety benefits of the preferred alternative compared to the No-Build alternative. Below are the traffic assumptions used in the VMT, VHT, and crash calculations for the preferred build:

- Daily VMT and VHT for the four scenarios (2018 & 2038 No-Build, and 2018 & 2038 Build) were calculated from the TCTDM model results for the entire metro area network. The TCTDM modeled years were 2009 and 2030, this information was extrapolated out to the 2018 and 2038 year of opening and design years.
- Transit User benefits are not directly included in this analysis. However the TCTDM does include a mode split with additional transit riders in the future condition.
- There are major changes to the regional roadway network that have great potential to change traffic patterns for a large portion of south Minneapolis. The regional changes include the following:
 - A new MnPASS lane for southbound I-35W between Downtown Minneapolis and the existing MnPASS lane at 42nd Street.
 - This facility connects the high density downtown commercial district with an existing MnPASS facility that extends south of the Minnesota River.

- The facility will be MnPASS during peak periods but be open to general purpose traffic during off-peak hours.
 - An upgraded MnPASS facility for northbound I-35W between 42nd Street and Downtown Minneapolis from a priced dynamic shoulder lane to a full MnPASS facility.
 - A new southbound I-35W exit ramp to Lake Street
 - This new exit ramp gives much better access to a large portion of South Minneapolis that is on the west side of I-35W, south of I-94. This ramp removes traffic from the existing, congested 35th Street ramp as well as traffic on the local road system.
 - A new northbound I-35W exit ramp to 28th Street
 - This new exit ramp gives much better access to a large portion of South Minneapolis that is on the east side of I-35W, south of I-94. This ramp removes traffic from the existing, congested 31st Street ramp as well as traffic on the local road system.
- Due to the major shifting of traffic patterns in the project area on both the arterial and freeway roadway network, a typical, confined crash analysis would not represent the benefit the additional freeway access points and MnPASS lanes have on the local roadway network as more traffic is drawn towards the freeway system.
 - 2011 MnDOT section crash data, for the previous 3-years, was analyzed to determine an average freeway and arterial statewide crash and severity rate.
 - Yearly crashes on both the arterial roadway system and freeway system, for both the no build and build, were calculated based on the same crash rates for each scenario. The TCTDM VMT data was separated out based on roadway facility type.
- Heavy Vehicle percentage estimated at 5.3% based on MnDOT HCAADT/AADT Traffic Maps for 2012.

The TCTDM is the most effective tool for a project of this type that includes freeway access changes and capacity improvements that can change travel patterns throughout a large area. The forecasting process goes through a series of reasonableness check to ensure the methodology results in a realistic forecast.

The ensuing VHT benefits result in a major benefit to the roadway network. The benefit stems partially from the access changes, but a high proportion is from the new capacity from the southbound I-35W MnPASS lane. The MnPASS lane provides peak period capacity and operates as a general purpose lane during off-peak periods. The additional 2.3 miles of capacity improvement through an existing congested area pulls more trips to the freeway system, both reducing travel time and travel distance.

Table 2 represents the resulting VMT and VHT values for both alternatives for the year of opening, the design year.

Table 2. Yearly VMT and VHT

Year	No-Build	Build
2018 VMT	30,519,150,055	30,364,547,035
2038 VMT	36,272,105,283	35,791,372,730
2018 VHT	1,067,778,790	1,046,656,382
2038 VHT	1,403,469,838	1,341,192,521

BENEFIT-COST ANALYSIS RESULTS

Table 3, below, summarizes the results of the benefit-cost analysis for the preferred build of the I-35W and Lake Street Transit Access Project.

Table 3. Summary of Benefit-Cost Analysis

Scenario	Preferred Build
VMT & VHT Benefit	\$ 10,798,614,003.60
Crashes Benefit	\$ 416,008,684.53
Operating/Maintenance	\$ (839,445.32)
Total Benefit	\$ 11,213,783,242.81
Total Construction Costs (PV)	\$ 317,412,884.24
Remaining Capital Value (RCV)	\$ 69,717,192.70
Total Cost minus RCV	\$ 247,695,691.54
BC RATIO	45.27

The preliminary analysis indicates that the build alternative has a benefit cost ratio greater than 1.0. Meaning, the VMT, VHT and crash reduction benefits of the project are estimated to be greater than the costs associated with the construction of the project.

At this level of analysis, the magnitude of the benefit-cost ratio is not as important as the overall finding that the ratio is greater than one. Further refinements to the VMT and VHT values are possible using different traffic models and methods. However, this basic analysis indicates that the proposed build alternative is economically valuable.

See attached Appendix A tables for more detail on the Benefit Cost calculations.

gtj
Appendix Tables A1 through A10

- c: Scott Pedersen, MnDOT
- April Crockett, MnDOT
- Ron Rauchle, MnDOT
- John Wilson, MnDOT
- Jenifer Hager, Minneapolis
- Mark Dierling, SEH
- Mike Kotila, SEH
- Sam Turrentine, SEH

Benefit Cost

Table A1

Summary

ITEM	Preferred Build
Operating Benefit (VMT)	\$ 1,190,002,232
Travel Time Benefit (VHT)	\$ 9,608,611,772
Crash Benefit	\$ 416,008,685
Operating and Maintenance Benefit	\$ (839,445)
TOTAL BENEFIT	\$ 11,213,783,243
MAJOR STRUCTURES	\$ 99,624,711
SURFACING	\$ 54,267,378
SUBBASE/BASE	\$ 16,979,792
GRADING/DRAINAGE	\$ 6,399,750
MISCELLANEOUS	\$ 46,617,537
OTHER	\$ 10,491,281
RIGHT OF WAY	\$ 3,780,000
UTILITIES	\$ 5,250,000
ENGINEERING (12%)	\$ 28,125,654
RISK (17%)	\$ 45,876,783
TOTAL CONSTRUCTION COST ESTIMATES	\$ 317,412,884
Project Remaining Capital Value	\$ 69,717,193
TOTAL COST - REMAINING CAPITAL VALUE	\$ 247,695,692
Benefit-Cost Ratio	45.27

Benefit Cost

Table A2

Itemized Costs (2015)

Construction Cost Estimate Totals:

ITEM	Preferred Build
MAJOR STRUCTURES	\$ 99,624,711.00
SURFACING	\$ 54,267,377.60
SUBBASE/BASE	\$ 16,979,791.75
GRADING/DRAINAGE	\$ 6,399,750.00
MISCELLANEOUS	\$ 46,617,536.70
OTHER	\$ 10,491,280.51
RIGHT OF WAY	\$ 3,780,000.00
UTILITIES	\$ 5,250,000.00
ENGINEERING (12%)	\$ 28,125,653.71
RISK (17%)	\$ 45,876,782.98
TOTAL COST	\$317,412,884

NOTES: 2014 Cost Estimate provided by MnDOT and inflated to 2015 dollars

Benefit Cost

Table A3

Assumptions Used in the Benefit-Cost Study

Alternatives

Base Condition	No Build
Build Alternative	Preferred Build

Analysis Timeframe

Existing Year	2015
Duration of Benefit Cost Analysis (years)	20
Year of Opening	2018
Design Year	2038
Days Per Year	260.00

Crash Costs

Estimating change in crashes	Fatal Type K	\$ 10,300,000
Mn/DOT Standard Values ⁽¹⁾	Injury Type A	\$ 550,000
	Injury B	\$ 160,000
	Injury C	\$ 81,000
	Property Damage Only	\$ 7,400

Operating Costs

Estimating change in travel costs (Vehicle Miles of Travel)		
	Automobile (per mile) ⁽¹⁾	\$ 0.31
	Heavy Vehicle (per mile) ⁽¹⁾	\$ 0.96

Time Costs

Estimating change in time costs (Vehicle Hours of Travel)		
	Automobile (per occupant use vehicle occupancy to adjust) ⁽¹⁾	\$ 16.00
	Heavy Commercial (per hour, assume avg occupancy = 1.0) ⁽¹⁾	\$ 27.30

Vehicle Occupancy

	Auto Occupancy Rate (Seven-County Metro) ⁽³⁾	1.30
	Truck Occupancy Rate (State-wide Average) ⁽²⁾	1.02
	Percent automobiles ⁽⁴⁾	94.72%
	Percent heavy vehicles ⁽⁴⁾	5.28%

Capital Cost Estimate (See Costs)

(2015 Dollars)

Annualized Life-Cycle Operations and Management Cost

Estimated Annual cost per Lane Mile ⁽⁵⁾	\$ 12,000.00
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Component Service Life (years)⁽¹⁾

Engineering	0
Right-of-Way	100
Bridge	60
Mass Grading and Drainage	50
Base	40
Surface	25
Signal System	20

Depreciation Method

Discount Rate (annual)

Sinking Fund	2.0%
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NOTES:

- (1) MnDOT Office of Transportation System Management recommended value (as of May 2015)
- (2) 2009 National Household Travel Survey (NHTS)
- (3) 2010 Metropolitan Council Travel Behavior Inventory (TBI) Home Interview Study
- (4) MnDOT Traffic Mapping Application Data; 2012 AADT and HCAADT Data
- (5) MnDOT Average estimated Life-Cycle Operations and Maintenance

Benefit Cost

Table A4

Remaining Capital Values

Service Life	Remaining Capital Value Factor	Item (2015 Dollars)	Preferred Build
50	71.0%	Grading and Drainage	\$ 6,399,750
40	60.0%	Subbase/Base	\$ 16,979,792
25	24.0%	Surfacing	\$ 54,267,378
		Construction SV	\$ 27,755,868
60	79.0%	Major Structures	\$ 99,624,711
		Major Structures	\$ 78,703,522
100	92.0%	Right of Way	\$ 3,780,000
		R/W SV	\$ 3,477,600
		Other Costs	\$ 136,361,254
		TOTAL COST	\$ 317,412,884
		TOTAL SV yr 2038	\$ 109,936,990
		REMAINING CAPITAL VALUE 2015	\$ 69,717,193

Benefit Cost

Table A5

VMT / VHT

Daily VMT and VHT Twin Cities Regional Model ⁽¹⁾

	No Build			Preferred Build		
	Freeway Network	Arterial Network	Total Roadway Network	Freeway Network	Arterial Network	Total Roadway Network
2018 VMT	37,498,660	46,058,219	83,556,879	37,423,616	45,709,983	83,133,599
2038 VMT	42,332,430	56,975,182	99,307,612	41,991,390	56,000,048	97,991,438
2018 VHT	1,003,092	1,920,327	2,923,419	991,599	1,873,990	2,865,589
2038 VHT	1,223,949	2,618,542	3,842,491	1,188,886	2,483,099	3,671,985

Calculated Yearly VMT and VHT

	No Build			Preferred Build		
	Freeway Network	Arterial Network	Total Roadway Network	Freeway Network	Arterial Network	Total Roadway Network
2018 VMT	9749651600	11975136940	21,724,788,540	9,730,140,160	11,884,595,580	21,614,735,740
2038 VMT	11006431800	14813547320	25,819,979,120	10,917,761,400	14,560,012,480	25,477,773,880
2018 VHT	260803920	499285020	760,088,940	257,815,740	487,237,400	745,053,140
2038 VHT	318226740	680820920	999,047,660	309,110,360	645,605,740	954,716,100

Notes: (1)VMT and VHT based on Twin Cities Regional Travel Demand Model

260 Days per year was used based on the high commuter route and MnPASS lane only operating on weekdays

Benefit Cost

Table A6

Operating Benefits

Year	Vehicle Miles Traveled (VMT)		Annual Operating Cost		Operating Benefit		Present Value Operating Benefit (2015 dollars)	
	No Build	Preferred Build	No Build	Preferred Build	No Build	Preferred Build	No Build	Preferred Build
2018	21,724,788,540	21,614,735,740						
2019	21,929,548,069	21,807,887,647	\$ 7,550,465,231	\$ 7,508,576,872	\$ -	\$ 41,888,359	\$ -	\$ 38,698,369
2020	22,134,307,598	22,001,039,554	\$ 7,620,965,074	\$ 7,575,080,146	\$ -	\$ 45,884,928	\$ -	\$ 41,559,393
2021	22,339,067,127	22,194,191,461	\$ 7,691,464,918	\$ 7,641,583,421	\$ -	\$ 49,881,497	\$ -	\$ 44,293,342
2022	22,543,826,656	22,387,343,368	\$ 7,761,964,761	\$ 7,708,086,696	\$ -	\$ 53,878,065	\$ -	\$ 46,904,098
2023	22,748,586,185	22,580,495,275	\$ 7,832,464,605	\$ 7,774,589,970	\$ -	\$ 57,874,634	\$ -	\$ 49,395,443
2024	22,953,345,714	22,773,647,182	\$ 7,902,964,448	\$ 7,841,093,245	\$ -	\$ 61,871,203	\$ -	\$ 51,771,055
2025	23,158,105,243	22,966,799,089	\$ 7,973,464,291	\$ 7,907,596,520	\$ -	\$ 65,867,772	\$ -	\$ 54,034,514
2026	23,362,864,772	23,159,950,996	\$ 8,043,964,135	\$ 7,974,099,794	\$ -	\$ 69,864,340	\$ -	\$ 56,189,307
2027	23,567,624,301	23,353,102,903	\$ 8,114,463,978	\$ 8,040,603,069	\$ -	\$ 73,860,909	\$ -	\$ 58,238,823
2028	23,772,383,830	23,546,254,810	\$ 8,184,963,821	\$ 8,107,106,344	\$ -	\$ 77,857,478	\$ -	\$ 60,186,363
2029	23,977,143,359	23,739,406,717	\$ 8,255,463,665	\$ 8,173,609,618	\$ -	\$ 81,854,047	\$ -	\$ 62,035,138
2030	24,181,902,888	23,932,558,624	\$ 8,325,963,508	\$ 8,240,112,893	\$ -	\$ 85,850,615	\$ -	\$ 63,788,272
2031	24,386,662,417	24,125,710,531	\$ 8,396,463,352	\$ 8,306,616,168	\$ -	\$ 89,847,184	\$ -	\$ 65,448,805
2032	24,591,421,946	24,318,862,438	\$ 8,466,963,195	\$ 8,373,119,442	\$ -	\$ 93,843,753	\$ -	\$ 67,019,695
2033	24,796,181,475	24,512,014,345	\$ 8,537,463,038	\$ 8,439,622,717	\$ -	\$ 97,840,322	\$ -	\$ 68,503,818
2034	25,000,941,004	24,705,166,252	\$ 8,607,962,882	\$ 8,506,125,991	\$ -	\$ 101,836,890	\$ -	\$ 69,903,974
2035	25,205,700,533	24,898,318,159	\$ 8,678,462,725	\$ 8,572,629,266	\$ -	\$ 105,833,459	\$ -	\$ 71,222,884
2036	25,410,460,062	25,091,470,066	\$ 8,748,962,569	\$ 8,639,132,541	\$ -	\$ 109,830,028	\$ -	\$ 72,463,196
2037	25,615,219,591	25,284,621,973	\$ 8,819,462,412	\$ 8,705,635,815	\$ -	\$ 113,826,597	\$ -	\$ 73,627,486
2038	25,819,979,120	25,477,773,880	\$ 8,889,962,255	\$ 8,772,139,090	\$ -	\$ 117,823,165	\$ -	\$ 74,718,257
					\$ -	\$ 1,597,115,245	\$ -	\$ 1,190,002,232

Benefit Cost

Table A6

Operating Benefits

Year	Vehicle Hours Traveled (VHT)		Annual Time Cost		Travel Time Benefit		Present Value Travel Time Benefit (2015 dollars)	
	No Build	Preferred Build	No Build	Preferred Build	No Build	Preferred Build	No Build	Preferred Build
2018	760,088,940	745,053,140						
2019	772,036,876	755,536,288	\$ 16,345,466,090	\$ 15,996,117,749	\$ -	\$ 349,348,341	\$ -	\$ 322,743,867
2020	783,984,812	766,019,436	\$ 16,598,426,264	\$ 16,218,065,619	\$ -	\$ 380,360,645	\$ -	\$ 344,504,355
2021	795,932,748	776,502,584	\$ 16,851,386,438	\$ 16,440,013,489	\$ -	\$ 411,372,949	\$ -	\$ 365,287,407
2022	807,880,684	786,985,732	\$ 17,104,346,612	\$ 16,661,961,359	\$ -	\$ 442,385,254	\$ -	\$ 385,122,986
2023	819,828,620	797,468,880	\$ 17,357,306,787	\$ 16,883,909,229	\$ -	\$ 473,397,558	\$ -	\$ 404,040,258
2024	831,776,556	807,952,028	\$ 17,610,266,961	\$ 17,105,857,099	\$ -	\$ 504,409,863	\$ -	\$ 422,067,609
2025	843,724,492	818,435,176	\$ 17,863,227,135	\$ 17,327,804,968	\$ -	\$ 535,422,167	\$ -	\$ 439,232,664
2026	855,672,428	828,918,324	\$ 18,116,187,310	\$ 17,549,752,838	\$ -	\$ 566,434,471	\$ -	\$ 455,562,309
2027	867,620,364	839,401,472	\$ 18,369,147,484	\$ 17,771,700,708	\$ -	\$ 597,446,776	\$ -	\$ 471,082,705
2028	879,568,300	849,884,620	\$ 18,622,107,658	\$ 17,993,648,578	\$ -	\$ 628,459,080	\$ -	\$ 485,819,310
2029	891,516,236	860,367,768	\$ 18,875,067,833	\$ 18,215,596,448	\$ -	\$ 659,471,384	\$ -	\$ 499,796,892
2030	903,464,172	870,850,916	\$ 19,128,028,007	\$ 18,437,544,318	\$ -	\$ 690,483,689	\$ -	\$ 513,039,552
2031	915,412,108	881,334,064	\$ 19,380,988,181	\$ 18,659,492,188	\$ -	\$ 721,495,993	\$ -	\$ 525,570,736
2032	927,360,044	891,817,212	\$ 19,633,948,356	\$ 18,881,440,058	\$ -	\$ 752,508,298	\$ -	\$ 537,413,254
2033	939,307,980	902,300,360	\$ 19,886,908,530	\$ 19,103,387,928	\$ -	\$ 783,520,602	\$ -	\$ 548,589,295
2034	951,255,916	912,783,508	\$ 20,139,868,704	\$ 19,325,335,798	\$ -	\$ 814,532,906	\$ -	\$ 559,120,442
2035	963,203,852	923,266,656	\$ 20,392,828,878	\$ 19,547,283,668	\$ -	\$ 845,545,211	\$ -	\$ 569,027,688
2036	975,151,788	933,749,804	\$ 20,645,789,053	\$ 19,769,231,538	\$ -	\$ 876,557,515	\$ -	\$ 578,331,450
2037	987,099,724	944,232,952	\$ 20,898,749,227	\$ 19,991,179,408	\$ -	\$ 907,569,819	\$ -	\$ 587,051,587
2038	999,047,660	954,716,100	\$ 21,151,709,401	\$ 20,213,127,278	\$ -	\$ 938,582,124	\$ -	\$ 595,207,408
					\$ -	\$ 12,879,304,645	\$ -	\$ 9,608,611,772

Benefit Cost

Table A8a

Crash Rates, Severity Rates and Annual Crash Cost

2018 Annual Crash Costs

Time Frame	Scenario	Classification	Severity	Proportion of Crashes	Crash Rates	MVMT (2018)	Avg. Crashes/year	Cost/Crash	Cost/Year
2018	No Build	Metro Urban Freeway & Metro Urban Arterial	K	0.2%		Freeway	86.5	10,300,000	\$ 890,753,799.28
			A	0.9%	Freeway	9,749,651,600	296.4	550,000	\$ 163,017,993.87
			B	6.9%	1.10	Arterial	2382.0	160,000	\$ 381,118,221.25
			C	22.1%	Arterial	11,975,136,940	7658.0	81,000	\$ 620,298,309.12
			N	69.9%	2.00	Total	24252.0	7,400	\$ 179,464,952.71
			Total	100%		21,724,788,540	34674.9	-	\$ 2,234,653,276.24
2018	Preferred Build	Metro Urban Freeway & Metro Urban Arterial	K	0.2%		Freeway	85.9	10,300,000	\$ 885,099,958.26
			A	0.9%	Freeway	9,730,140,160	294.4	550,000	\$ 161,927,532.63
			B	6.9%	1.10	Arterial	2367.6	160,000	\$ 378,821,143.29
			C	22.1%	Arterial	11,884,595,580	7611.9	81,000	\$ 616,562,409.32
			N	69.9%	2.00	Total	24112.5	7,400	\$ 178,432,395.39
			Total	100%		21,614,735,740	34472.3	-	\$ 2,220,843,438.88

2038 Annual Crash Costs

Time Frame	Scenario	Classification	Severity	Proportion of Crashes	Crash Rates	MVMT (2018)	Avg. Crashes/year	Cost/Crash	Cost/Year
2038	No Build	Metro Urban Freeway & Metro Urban Arterial	K	0.3%		Freeway	104.9	10,300,000	\$ 1,080,862,963.50
			A	0.9%	Freeway	11,006,431,800	361.6	550,000	\$ 198,894,219.10
			B	6.9%	1.10	Arterial	2875.5	160,000	\$ 460,086,232.53
			C	22.1%	Arterial	14,813,547,320	9244.1	81,000	\$ 748,770,844.67
			N	69.8%	2.00	Total	29148.0	7,400	\$ 215,695,067.98
			Total	100%		25,819,979,120	41734.2	-	\$ 2,704,309,327.78
2038	Preferred Build	Metro Urban Freeway & Metro Urban Arterial	K	0.3%		Freeway	103.3	10,300,000	\$ 1,064,352,293.30
			A	0.9%	Freeway	10,917,761,400	355.9	550,000	\$ 195,751,485.60
			B	6.9%	1.10	Arterial	2833.0	160,000	\$ 453,286,942.37
			C	22.1%	Arterial	14,560,012,480	9107.5	81,000	\$ 737,710,501.35
			N	69.9%	2.00	Total	28729.7	7,400	\$ 212,600,039.67
			Total	100%		25,477,773,880	41129.6	-	\$ 2,663,701,262.30

NOTES: Crash Cost from MnDOT Office of Transportation System Management (July 2014)
 Crash Rates and Severity from MnDOT Traffic. Rates are for Urban Freeway section (all crashes) and a combination of arterial rates.
 Crash Rates and Severity from MnDOT Traffic
 VMT data from Twin Cities Regional Model including roadway split between Freeway and Arteria

Table A8b
CRASH CALCULATIONS FOR BENEFIT COST

Calculated YEARLY VMT (Table A5)

Scenario	2018			2038		
	Freeway	Arterial	Total	Freeway	Arterial	Total
S0: No Build	9,749,651,600	11,975,136,940	21,724,788,540	11,006,431,800	14,813,547,320	25,819,979,120
S6A: SB & 28th St Exits	9,730,140,160	11,884,595,580	21,614,735,740	10,917,761,400	14,560,012,480	25,477,773,880
Difference	-19,511,440	-90,541,360	-110,052,800	-88,670,400	-253,534,840	-342,205,240

Crash Rate	All Urban Freeway	Arterial
		1.1
Fatal	0.2%	0.3%
Severity A	0.4%	1.0%
Severity B	6.1%	7.2%
Severity C	19.8%	23.1%
Property Damage	73.5%	68.3%
Total	100.0%	100.0%

Based on MnDOT Metro average crashes 2009-2011

"Arterial" is a combination of all "Urban" classifications

Total YEARLY Crashes

Scenario	2018			2038		
	Freeway	Arterial	Total	Freeway	Arterial	Total
S0: No Build	10,725	23,950	34,675	12,107	29,627	41,734
S6A: SB & 28th St Exits	10,703	23,769	34,472	12,010	29,120	41,130
Difference	-21	-181	-203	-98	-507	-605

YEARLY Crash Splits	2018			2038		
	S0: No Build	S6A: SB & 28th St Exits	Difference	S0: No Build	S6A: SB & 28th St Exits	Difference
Freeway	10,725	10,703	-21	12,107	12,010	-98
Arterial	23,950	23,769	-181	29,627	29,120	-507
Fatal	86	86	-1	105	103	-2
Severity A	296	294	-2	362	356	-6
Severity B	2,382	2,368	-14	2,876	2,833	-42
Severity C	7,658	7,612	-46	9,244	9,108	-137
Property Damage	24,252	24,112	-140	29,148	28,730	-418
Total	34,675	34,472	-203	41,734	41,130	-605

Benefit Cost

Table A9

Crash Benefits

Year	Annual Crash Cost		Crash Benefit		Present Value Crash Benefit (2015 dollars)	
	No Build	Preferred Build	No Build	Preferred Build	No Build	Preferred Build
2018	\$ 2,234,653,276	\$ 2,220,843,439				
2019	\$ 2,258,136,079	\$ 2,242,986,330	\$ -	\$ 15,149,749	\$ -	\$ 13,996,026
2020	\$ 2,281,618,881	\$ 2,265,129,221	\$ -	\$ 16,489,660	\$ -	\$ 14,935,193
2021	\$ 2,305,101,684	\$ 2,287,272,112	\$ -	\$ 17,829,572	\$ -	\$ 15,832,149
2022	\$ 2,328,584,487	\$ 2,309,415,004	\$ -	\$ 19,169,483	\$ -	\$ 16,688,189
2023	\$ 2,352,067,289	\$ 2,331,557,895	\$ -	\$ 20,509,394	\$ -	\$ 17,504,571
2024	\$ 2,375,550,092	\$ 2,353,700,786	\$ -	\$ 21,849,306	\$ -	\$ 18,282,522
2025	\$ 2,399,032,894	\$ 2,375,843,677	\$ -	\$ 23,189,217	\$ -	\$ 19,023,235
2026	\$ 2,422,515,697	\$ 2,397,986,568	\$ -	\$ 24,529,129	\$ -	\$ 19,727,872
2027	\$ 2,445,998,499	\$ 2,420,129,459	\$ -	\$ 25,869,040	\$ -	\$ 20,397,562
2028	\$ 2,469,481,302	\$ 2,442,272,351	\$ -	\$ 27,208,951	\$ -	\$ 21,033,404
2029	\$ 2,492,964,105	\$ 2,464,415,242	\$ -	\$ 28,548,863	\$ -	\$ 21,636,470
2030	\$ 2,516,446,907	\$ 2,486,558,133	\$ -	\$ 29,888,774	\$ -	\$ 22,207,800
2031	\$ 2,539,929,710	\$ 2,508,701,024	\$ -	\$ 31,228,686	\$ -	\$ 22,748,405
2032	\$ 2,563,412,512	\$ 2,530,843,915	\$ -	\$ 32,568,597	\$ -	\$ 23,259,273
2033	\$ 2,586,895,315	\$ 2,552,986,806	\$ -	\$ 33,908,508	\$ -	\$ 23,741,360
2034	\$ 2,610,378,117	\$ 2,575,129,698	\$ -	\$ 35,248,420	\$ -	\$ 24,195,600
2035	\$ 2,633,860,920	\$ 2,597,272,589	\$ -	\$ 36,588,331	\$ -	\$ 24,622,898
2036	\$ 2,657,343,723	\$ 2,619,415,480	\$ -	\$ 37,928,243	\$ -	\$ 25,024,137
2037	\$ 2,680,826,525	\$ 2,641,558,371	\$ -	\$ 39,268,154	\$ -	\$ 25,400,175
2038	\$ 2,704,309,328	\$ 2,663,701,262	\$ -	\$ 40,608,065	\$ -	\$ 25,751,845
Total			\$ -	\$ 557,578,142	\$ -	\$ 416,008,685

Benefit Cost
Table A10
Operating & Maintenance Benefits

Year	Operating & Maintenance Costs		Operating & Maintenance Benefit		Present Value Operating and Maintenance Benefit (2015 dollars)	
	No Build	Preferred Build	No Build	Preferred Build	No Build	Preferred Build
2018	\$ -	\$ 54,480				
2019	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (50,331)
2020	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (49,344)
2021	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (48,377)
2022	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (47,428)
2023	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (46,498)
2024	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (45,586)
2025	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (44,693)
2026	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (43,816)
2027	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (42,957)
2028	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (42,115)
2029	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (41,289)
2030	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (40,479)
2031	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (39,686)
2032	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (38,908)
2033	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (38,145)
2034	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (37,397)
2035	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (36,663)
2036	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (35,945)
2037	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (35,240)
2038	\$ -	\$ 54,480	\$ -	\$ (54,480)	\$ -	\$ (34,549)
		Total	\$ -	\$ (1,089,600)	\$ -	\$ (839,445)

NOTES: -Both alternatives have the same I-35W mainline roadway network
-The No Build and Build alternatives have essentially the same lane miles with the exception of 3 new lane facilities in the preferred Build condition. The southbound I-35W Lake Street Exit and Auxiliary lane add approximately 1.68 miles of lane; the southbound I-35W MnPASS lane adds approximately 2.31 miles; and the northbound I-35W 28th Street Exit and Auxiliary lane add approximately 0.55 miles.
-Therefore, only the additional 4.54 miles of new lane miles is included in the yearly maintenance.
-Operating costs on the new southbound MnPASS facility are offset by the improved northbound MnPASS lane.