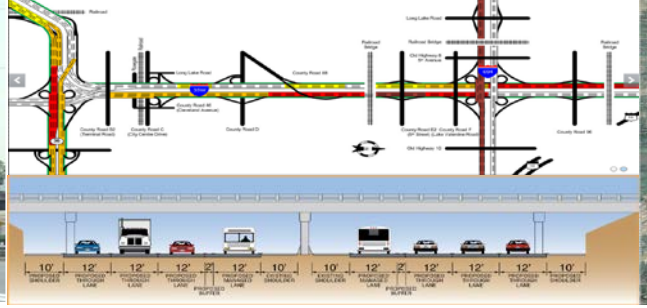


Enhancing Return on Investment for MnPASS

CTS Research Conference
November 2, 2017

Minnesota Department of Transportation

Western Transportation Institute | Montana State University

SRF Consulting Group, Inc.

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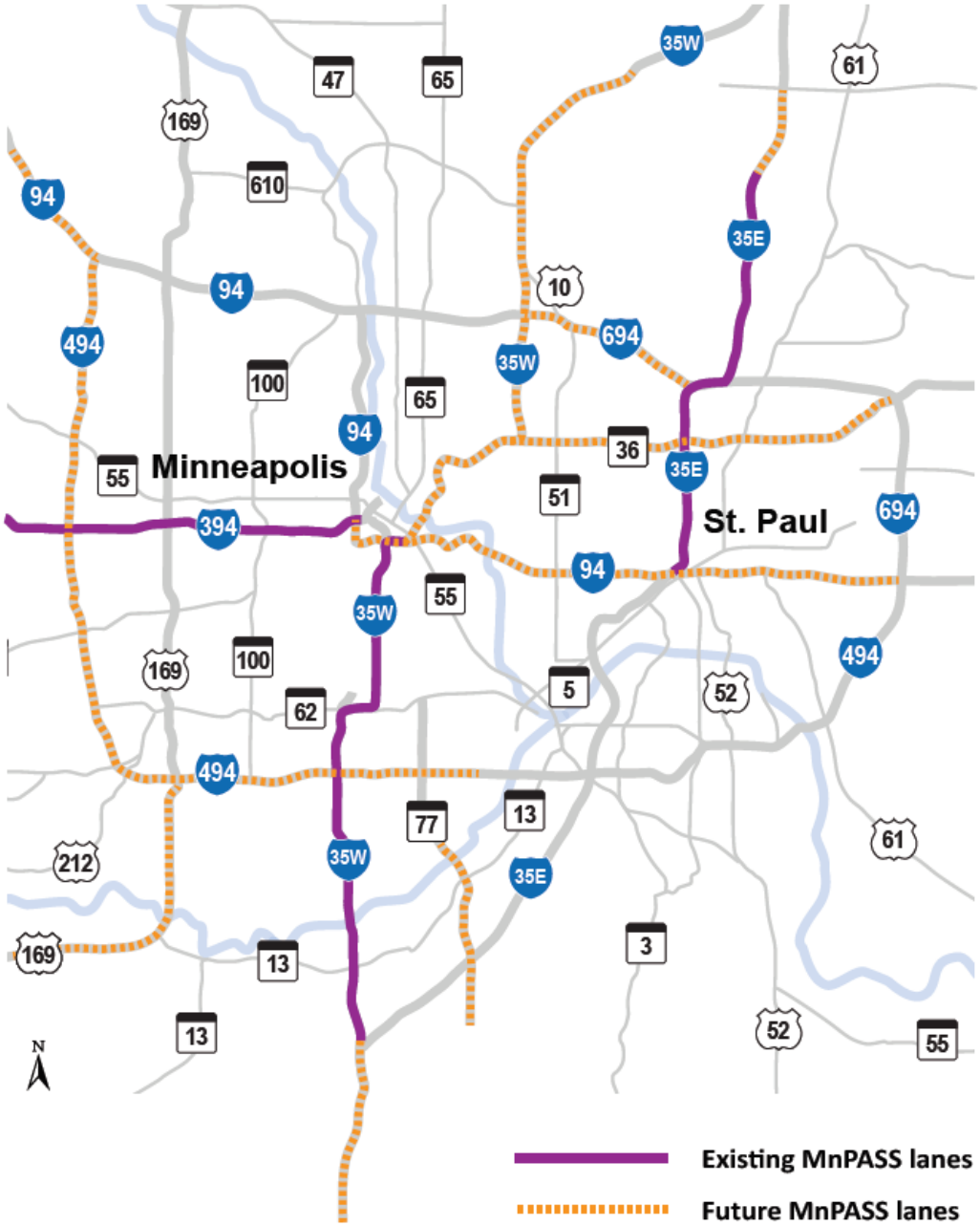
MnPASS System

MnPASS tolling lane projects have proven effective:

- Relieve traffic congestion
- Manage increased travel demand
- Maximize benefit of public investments



The Problem…

<u>Traditional benefit-cost approaches:</u>

- Move more cars
- Increase speeds
- Reduce congestion

≠

<u>MnPASS lanes are designed to:</u>

- Move more *people*
- Provide a *choice*
- Improve *reliability*

Research conducted to improve methods and tools for estimating return on investment…

Agency Staff Interviews

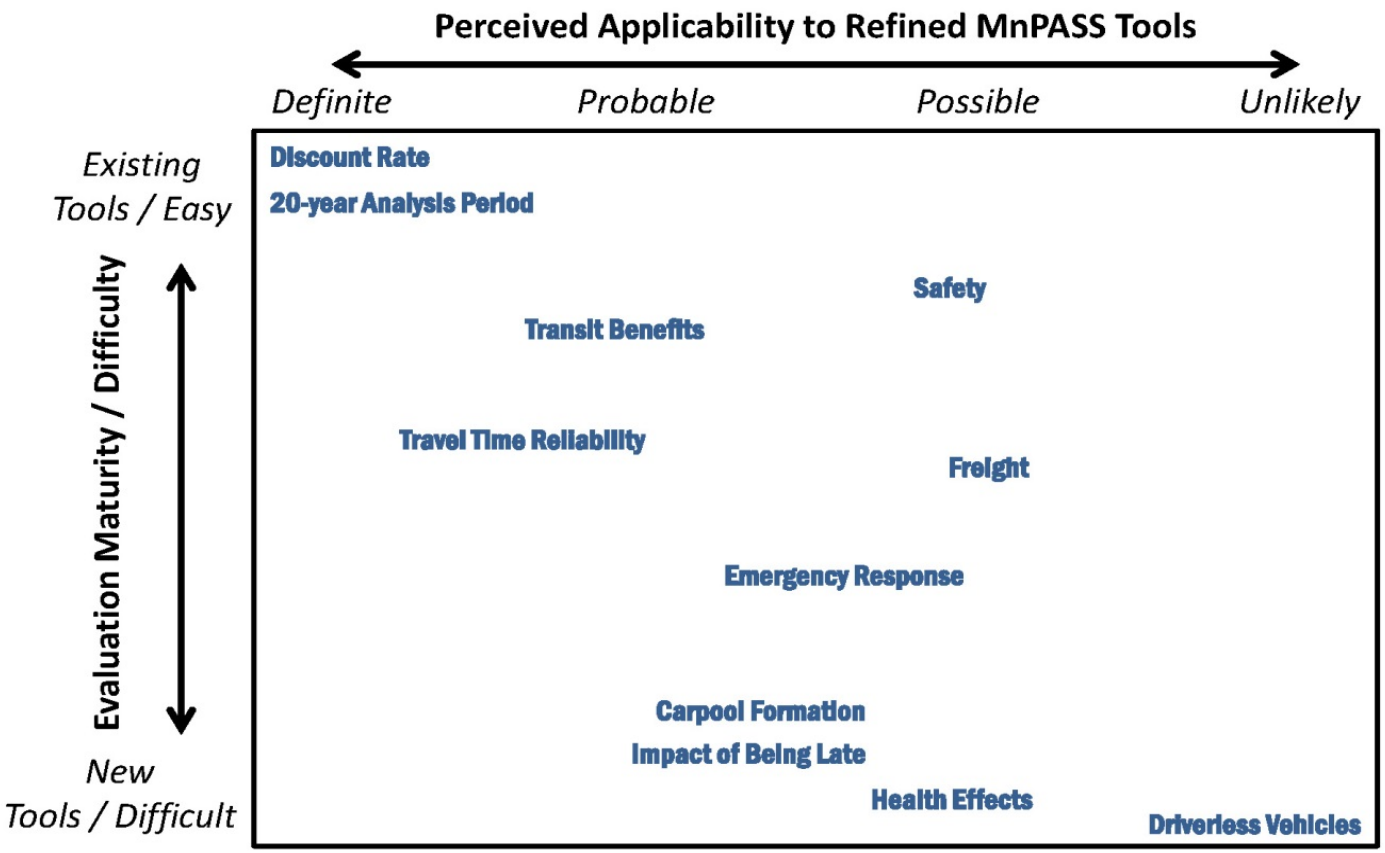
Participants

- MnDOT Metro District
- MnDOT Central Office
- Metropolitan Council
- RTMC

Discussion Questions

- Existing shortcomings
- Expectations for refined methodology
- Specific elements to be included
- Other economic factors
- Unique aspects of MnPASS

Managed Lanes ROI Inclusion Importance vs. Component Maturity



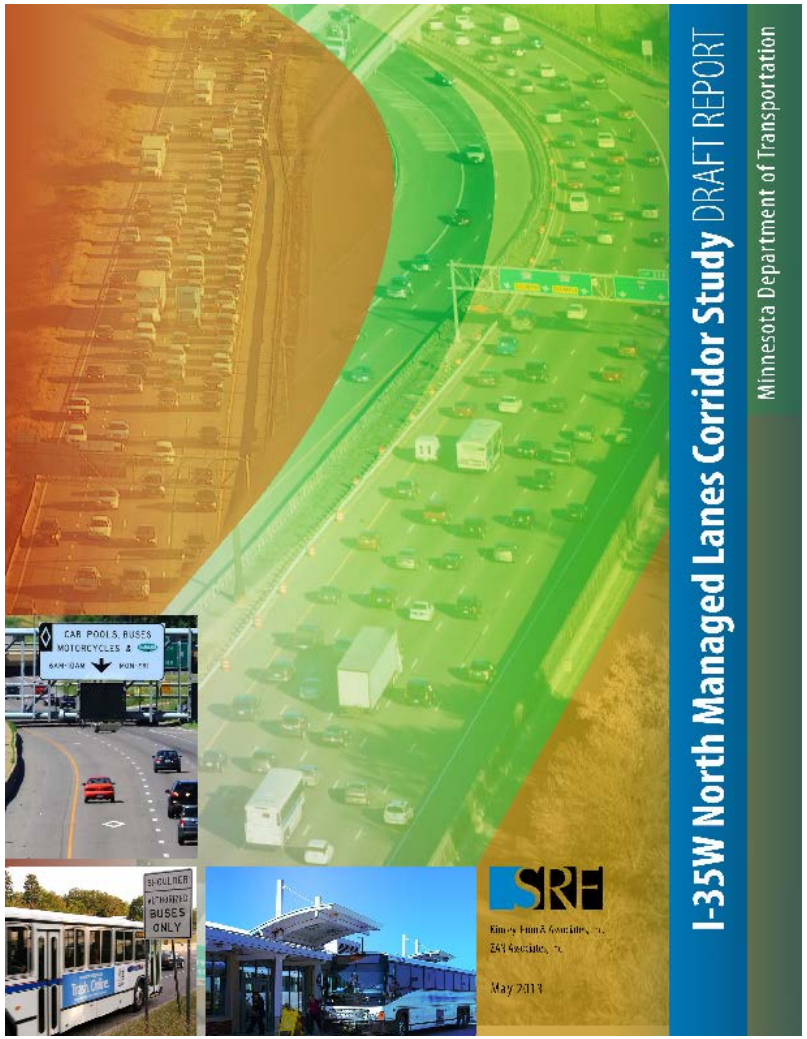
ROI Benefit Categories

Following Steps

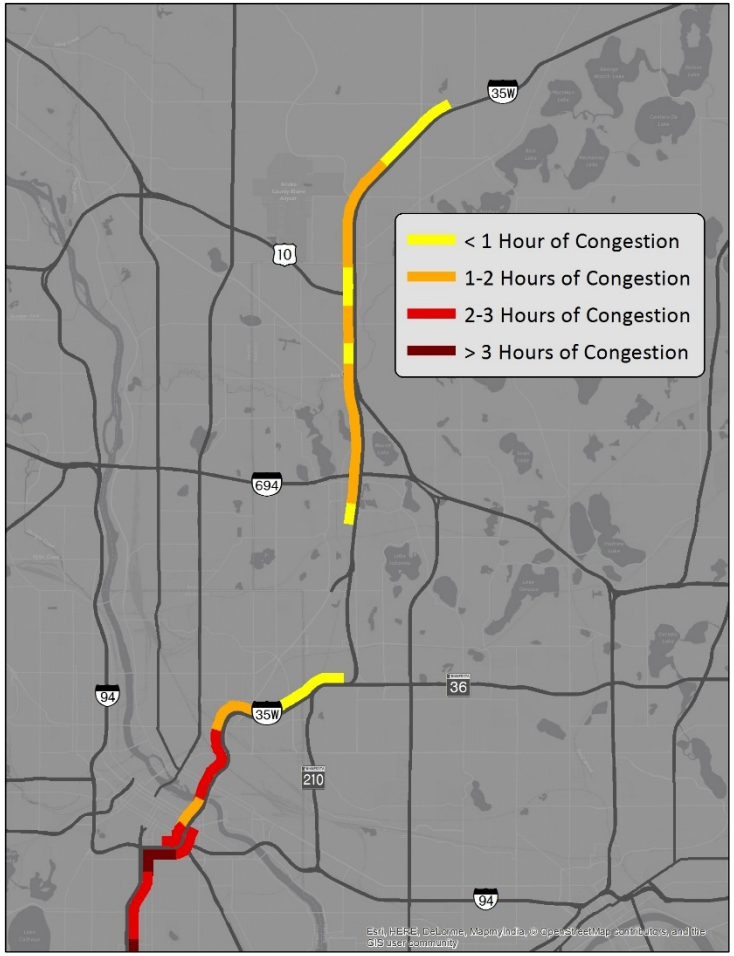
- Literature Search
- Individual Component Review
- Model and Data Availability Assessment
- Framework Refinement

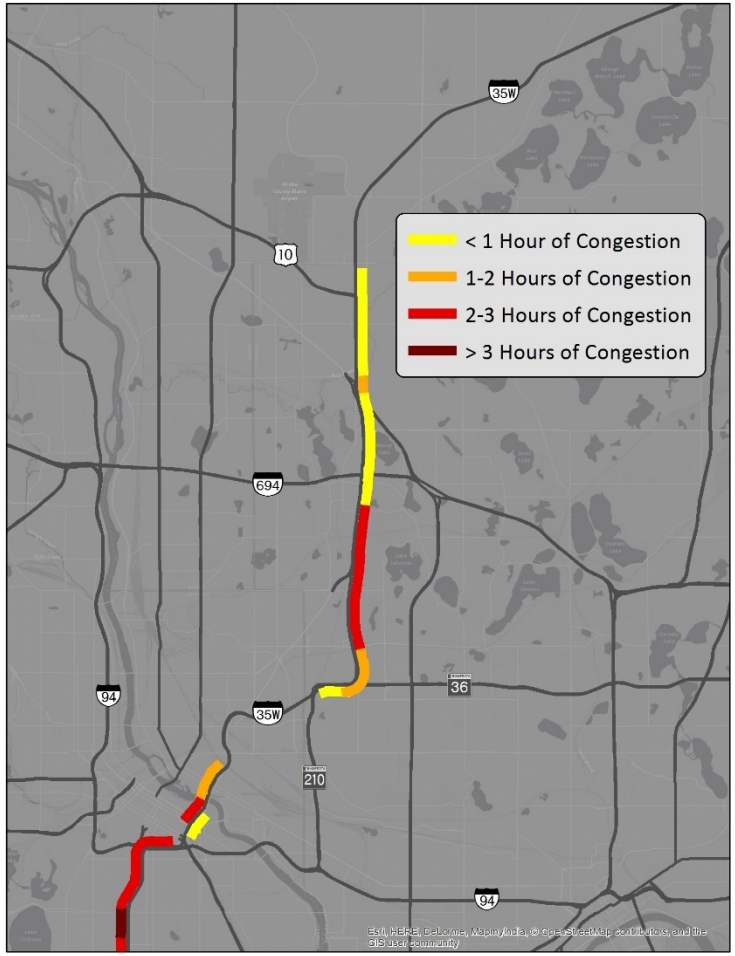
- Travel Time Savings
- Vehicle Operating Cost Savings
- Crash Cost Savings
- Travel Time Reliability
- Transit Benefit
- Emergency Response
- Induced Traffic
- Emission Impact
- Noise Impact

Demonstration Project



Existing Conditions





Background Information

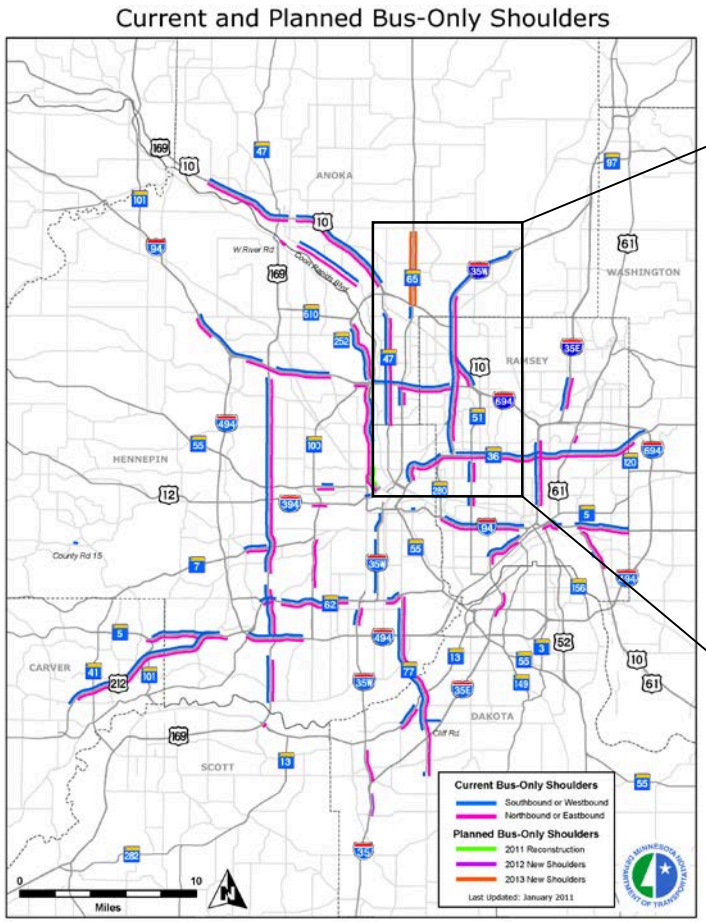
- The BCA was conducted to capture the forecasted changes of both base year 2010 and forecasting year 2040

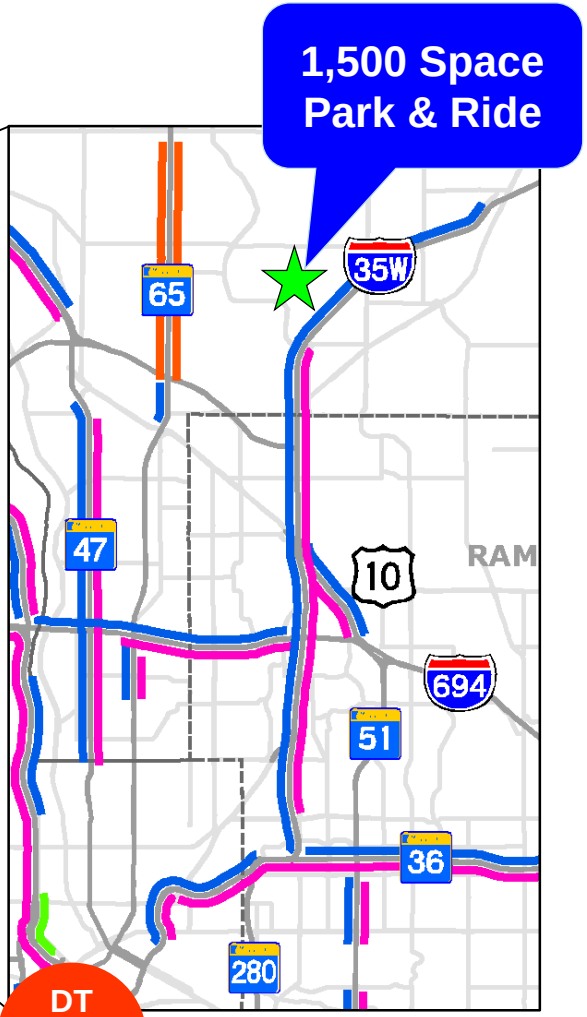
Benefit Definition	Cost Estimation
• Travel time savings • Vehicle operating cost savings • Safety improvement	• Capital costs • Operation and maintenance costs • Remaining capital value

- The preferred Build alternative was found to have a benefit-cost ratio of **2.11** from this analysis

Transit Benefits

Express Bus Service





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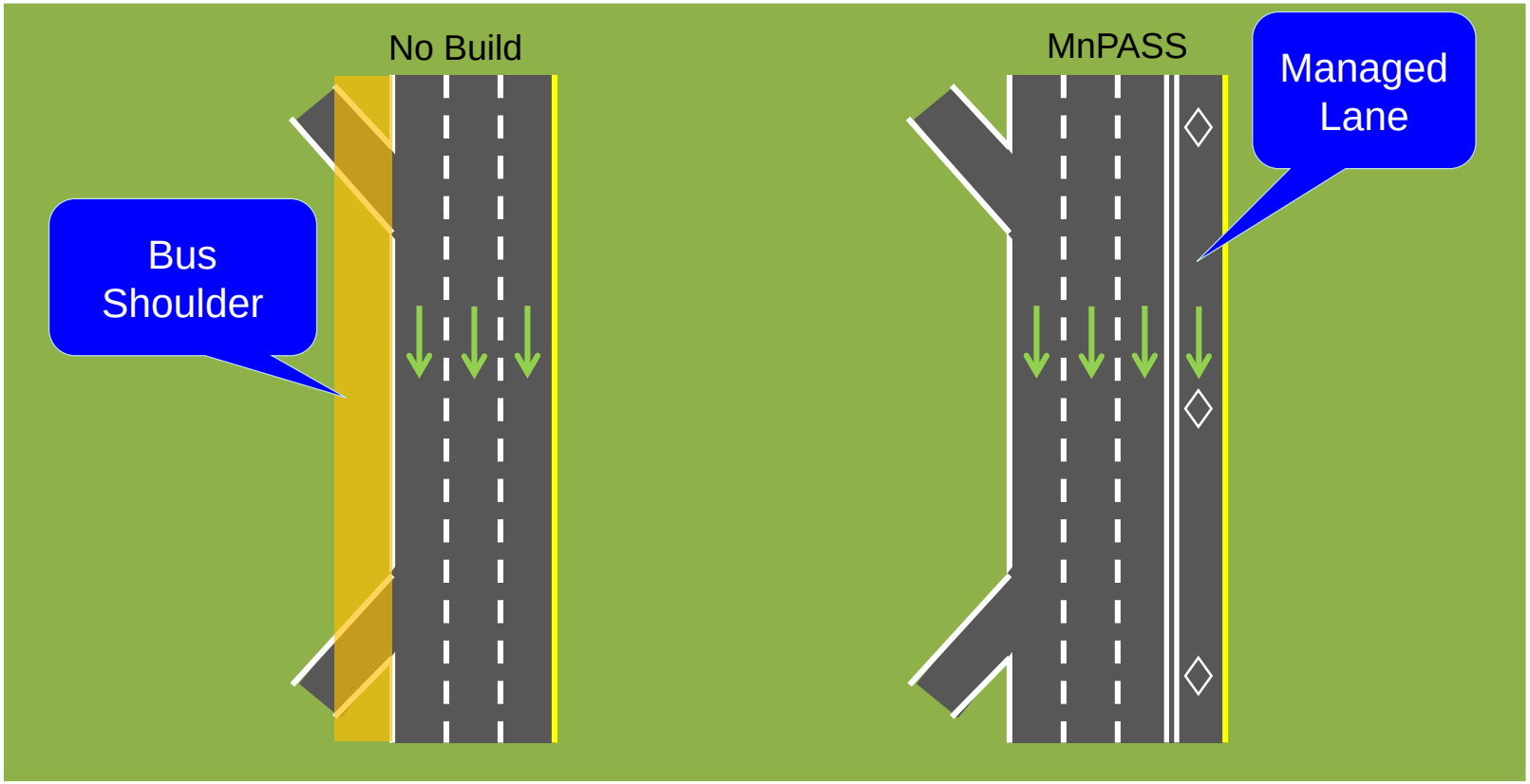
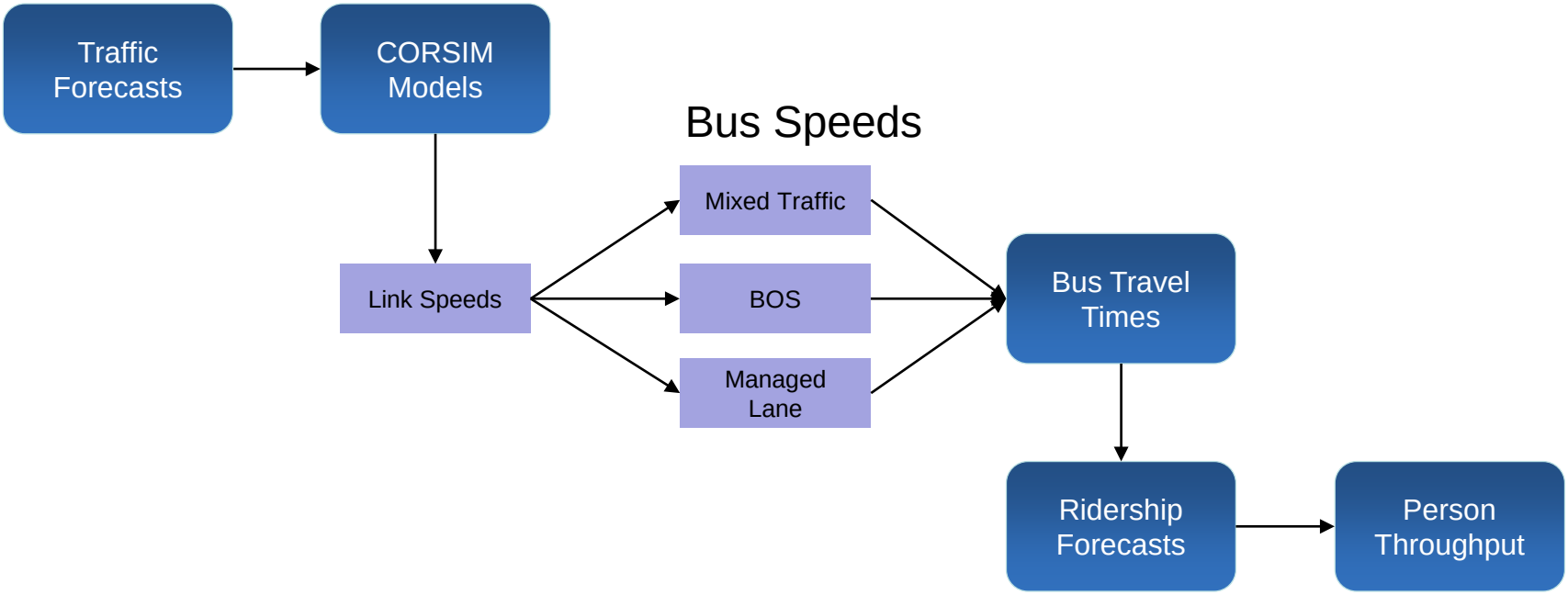
Transit Advantages



Transit Forecasts



Existing Bus Shoulder Use

Bus Shoulder	General Purpose		Intersection	General Purpose	Bus Shoulder
	67	0	NB I-35W Mainline	65	
	67	0		65	
	66	0	CSAH 23	64	
	66	0		66	
66	66	1		65	65
62	62	1		60	60
64	64	1		64	64
64	64	1		64	64
64	64	1		64	64
64	64	1		64	64
64	64	1		64	64
64	64	1		64	64
62	62	1	Lexington Ave	63	63
65	65	1		65	65
63	63	1		64	64
55	55	1		55	55
61	61	1		61	61
62	62	1		61	61
58	58	1	95th Ave	59	59
48	48	1		63	63
35	34	1		55	55
35	30	1		61	61
35	28	1		60	60
35	32	1	Lake Dr	57	57
36	36	1	CR J	50	50
43	43	1		51	51
53	53	1	EB TH 10	54	54
57	57	1		63	63
60	60	1	CR I	47	47
52	52	1		35	35
46	46	1		31	35
43	43	1	CR H	34	35
47	47	1		44	44
53	53	1	CR 10	62	62
46	46	1		62	62
38	38	1		57	57
35	34	1	CR 96	51	51
35	28	1		61	61
35	26	1		61	61
35	32	1		55	55
48	48	1	WB I-694	36	36
56	56	1		35	35
47	47	1	EB I-694	29	35
35	35	1		31	35
39	39	1	CR E2	27	35
57	57	1		20	35
56	56	1		23	35
59	59	1		21	35
57	57	1	CR 88	20	35
62	62	1		19	34
61	61	1	CR D	19	34
59	59	1		26	35
52	52	1	CR C	28	35
	56	0		34	
	61	0		39	
	57	0	NB Cleveland Ave	49	
	53	0		64	
	49	0		65	
	59	0	EB TH 36	64	
	63	0		49	
	52	0		54	
	56	0	TH 280	62	
60	60	1		64	64
61	61	1		62	62
60	60	1		30	35
63	63	1	Industrial Blvd	29	35
63	63	1		34	35
62	62	1		56	56
64	64	1	Stinson Blvd	64	64
64	64	1		66	66
64	64	1	Stinson Blvd HOV	66	66
58	58	1		65	65
56	56	1		65	65
59	59	1	Stinson/Johnson	64	64
61	61	1		55	55
61	61	1		61	61
60	60	1		59	59
	60	0	4th St	46	
	62	0		60	
	62	0	University Ave	63	
	63	0		59	
	65	0		65	

SB: 95th Ave to CR E2

NB: CR E2 to TH 10

NB: Stinson to TH 280

* GP speeds were estimated from COSSIM model.

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2040 No Build Bus Shoulder Use

SB: CSAH 23 to CR 10

NB: CR C to TH 10

NB: Stinson to TH 280

Bus Shoulder	General Purpose		Intersection	General Purpose	Bus Shoulder
	55	0	NB I-35W Mainline	0 55	
	63	0		0 65	
	53	0	CSAH 23	0 64	
	43	0		0 66	
36	35	1		1 65	65
36	31	1		1 60	60
37	31	1		1 64	64
36	29	1		1 64	64
35	27	1		1 64	64
33	24	1		1 64	64
32	23	1		1 64	64
32	22	1		1 64	64
32	21	1	Lexington Ave	1 62	62
28	16	1		1 65	66
28	15	1		1 65	65
32	20	1		1 54	54
34	22	1		1 59	60
34	22	1		1 61	61
34	23	1	95th Ave	1 58	58
30	15	1		1 63	63
29	14	1		1 52	53
33	19	1		1 59	59
34	20	1		1 60	60
35	25	1	Lake Dr	1 57	57
35	31	1	CR J	1 49	49
36	35	1		1 48	47
41	40	1	EB TH 10	1 51	51
34	24	1		1 61	61
31	20	1	CR I	1 33	36
32	20	1		1 31	36
33	21	1		1 29	36
35	25	1	CR H	1 24	34
36	35	1		1 23	33
60	60	1	CR 10	1 29	36
62	62	1		1 34	39
55	55	1		1 40	43
59	59	1	CR 96	1 38	42
61	61	1		1 42	44
52	53	1		1 46	47
44	44	1		1 47	44
55	55	1	WB I-694	1 29	35
61	61	1		1 24	34
52	54	1	EB I-694	1 22	33
43	45	1		1 23	33
43	43	1	CR E2	1 19	32
60	60	1		1 15	29
58	59	1		1 17	31
61	61	1		1 18	29
59	59	1	CR 88	1 14	28
63	63	1		1 17	27
62	62	1	CR D	1 13	28
60	60	1		1 16	31
53	53	1	CR C	1 12	27
	57	0		0 11	
	62	0		0 12	
	57	0	NB Cleveland Ave	0 8	
	56	0		0 5	
	51	0		0 8	
	61	0	EB TH 36	0 8	
	64	0		0 13	
	49	0		0 13	
	57	0	TH 280	0 5	
60	61	1		1 17	27
61	61	1		1 19	27
60	61	1		1 18	32
63	63	1	Industrial Blvd	1 16	30
63	63	1		1 17	31
63	63	1		1 21	31
65	65	1	Stinson Blvd	1 33	36
65	65	1		1 48	47
63	63	1	Stinson Blvd HOV	1 57	53
52	54	1		1 62	60
52	53	1		1 65	65
57	57	1	Stinson/Johnson	1 64	64
60	61	1		1 54	54
60	61	1		1 61	61
58	58	1		1 64	64
	58	0	4th St	0 59	
	61	0		0 65	
	62	0	University Ave	0 52	
	62	0		0 49	
	63	0		0 61	

* GP speeds were estimated from COSSIM model.

2040 Managed Lane Bus Shoulder Use

Buses use managed lanes

Bus Shoulder	General Purpose	Managed Lane		Intersection	Managed Lane	General Purpose	Bus Shoulder
	65		0	NB I-35W Mainline	0	65	
	66		0		0	65	
	65		0	CSAH 23	0	63	
	65		0		0	65	
62	62		1		1	65	65
56	56		1		1	59	59
62	62		1		1	64	64
63	63		1		1	64	64
63	63		1		1	64	64
63	63		1		1	64	64
63	63		1		1	64	64
60	60		1		1	64	64
55	55		1	Lexington Ave	1	62	62
52	52		1		1	65	65
48	48		1		1	64	64
40	40	57	1		1	59	59
42	42	67	1		1	64	64
38	38	67	1		1	64	64
35	31	63	1	95th Ave	1	67	60	65
33	18	40	1		1	66	63	63
29	14	40	1		1	55	54	54
31	16	42	1		1	65	58	58
32	17	65	1		1	64	59	59
33	18	59	1	Lake Dr	1	64	56	56
35	21	33	1	CR J	1	62	55	55
35	21	35	1		1	63	55	55
35	21	62	1	EB TH 10	1	62	57	57
35	24	65	1		1	64	62	62
35	21	63	1	CR I	1	64	39	39
34	19	44	1		1	65	42	42
35	31	52	1		1	65	44	44
47	47	65	1	CR H	1	65	38	38
52	52	67	1		1	62	22	35
60	60	66	1	CR 10	1	41	16	31
60	60	65	1		1	41	15	30
54	54	61	1		1	55	19	34
56	56	61	1	CR 96	1	65	18	33
55	55	61	1		1	65	19	34
56	56	66	1		1	61	22	35
52	52	67	1		1	44	27	35
56	56	66	1	WB I-694	1	59	26	35
60	60	66	1		1	65	24	35
54	54	65	1	EB I-694	1	64	22	35
59	59	65	1		1	64	24	35
53	53	63	1	CR E2	1	65	21	35
60	60	63	1		1	62	19	34
58	58	62	1		1	42	17	32
59	59	62	1		1	54	15	30
58	58	63	1	CR BB	1	63	14	29
51	51	63	1		1	62	13	28
41	41	60	1	CR D	1	62	12	27
37	37	66	1		1	37	21	35
35	34		1	CR C	1	42	23	35
	42		0		0		31	
	49		0		0		30	
	46		0	NB Cleveland Ave	0		28	
	47		0		0		30	
	46		0		0		29	
	58		0	EB TH 36	0		28	
	62		0		0		15	
	51		0		0		16	
	57		0	TH 280	0		31	
60	60		1		1		33	35
60	60		1		1		33	35
60	60		1		1		18	33
63	63		1	Industrial Blvd	1		16	31
63	63		1		1		15	30
63	63		1		1		14	29
65	65		1	Stinson Blvd	1		14	29
64	64		1		1		15	30
60	60		1	Stinson Blvd HOV	1		21	35
51	51		1		1		26	35
51	51		1		1		30	35
56	56		1	Stinson/Johnson	1		33	35
60	60		1		1		36	36
60	60		1		1		41	41
58	58		1		1		46	46
	58		0	4th St	0		46	
	60		0		0		53	
	61		0	University Ave	0		57	
	62		0		0		47	
	64		0		0		59	

Buses use managed lanes

NB: 4th St to TH 280

* GP speeds were estimated from COSSIM model.

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Bus Travel Time

CSAH 23 to Mississippi River

Travel Time Three-hour peak period (min)	AM		PM		Round Trip		
	SB I-35W		NB I-35W		Total Travel Time		Total Savings
	Bus	GP*	Bus	GP*	Bus	GP*	Two-Way
2040 No-Build	26	33	33	42	59	75	**16**
2040 MnPASS Build	20	28	24	39	44	67	**23**

*GP = General Purpose Lanes

Ridership Forecasts

Alternative	Route 250	Route 252	Route 288	*Total*
2040 No-Build	3,400	200	700	***4,300***
2040 Build MnPASS	3,700	200	700	***4,600***

The Annual Transit Benefit Estimation
- Year 2040

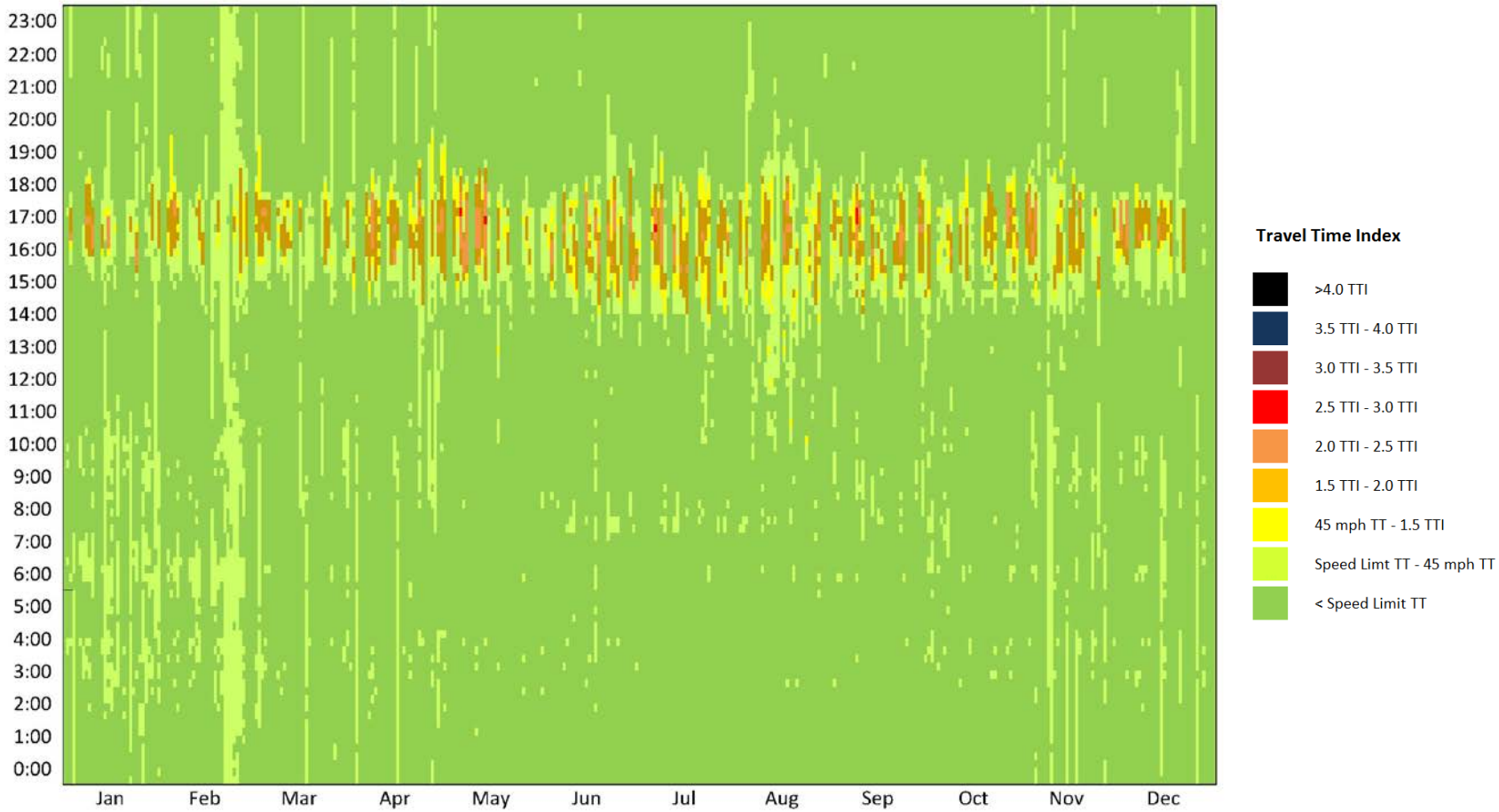
Measures	2040 No-Build	2040 Build
Round Trip Transit Travel Time (hr)	0.98	0.73
Round Trip Auto Travel Time (hr)	1.25	1.12
Ridership	4,300	4,600
Auto (if no MnPASS)	300	-
Total Travel Time (hr)	4,603	3,373
Value of Time ($/hr)	$ 17.65	$ 17.65
Total Cost ($)	$ 81,249	$ 59,539
Benefit ($)	-	$ 21,710
Annual Benefit ($)	-	$ 5,644,600

Travel Time Reliability

Reliability Evaluation Method

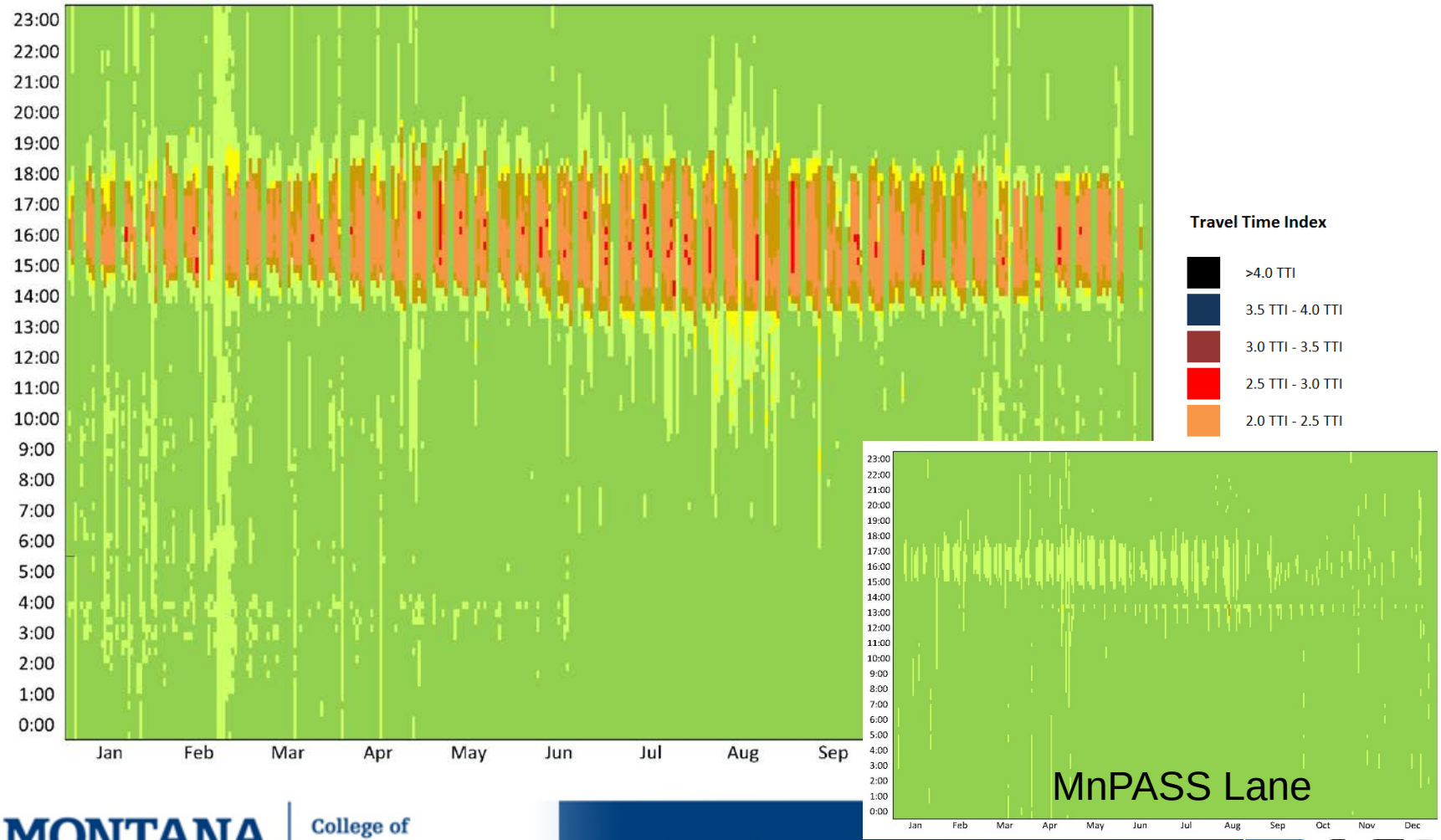
1. Collect 1 year of travel time data along project corridor
2. Obtain and integrate weather and crash data
3. Collect 1 year of travel time data in GP and MnPASS lanes along I-394 and I-35W South
   - Capture relationship between GP and MnPASS lanes
   - Project travel time savings for I-35W North MnPASS

Northbound - Existing



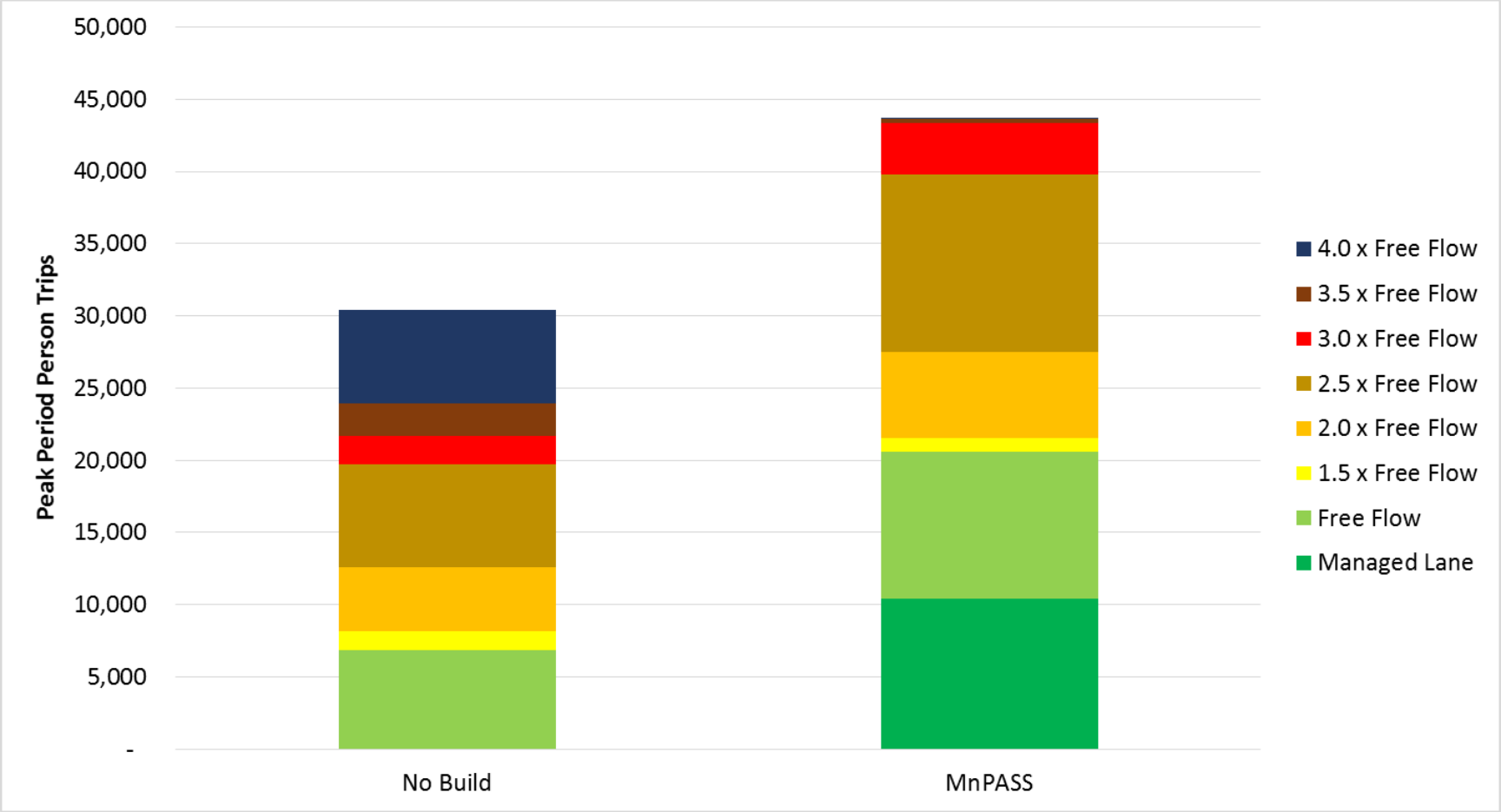
Northbound – 2040 No Build

Northbound – 2040 MnPASS

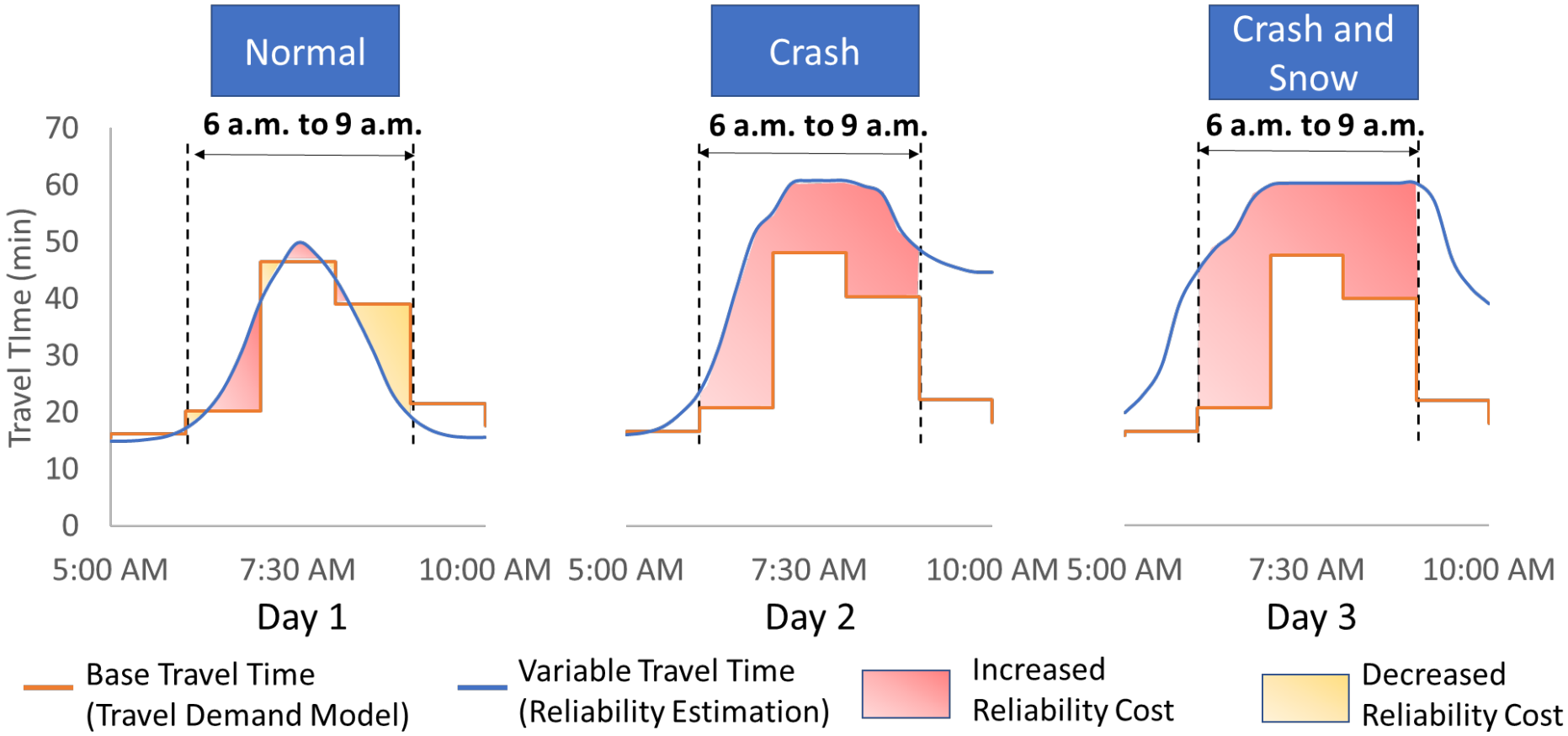


Reliability by Person Trips

Peak Period/Peak Direction



Travel Time Reliability Measurement Methodology

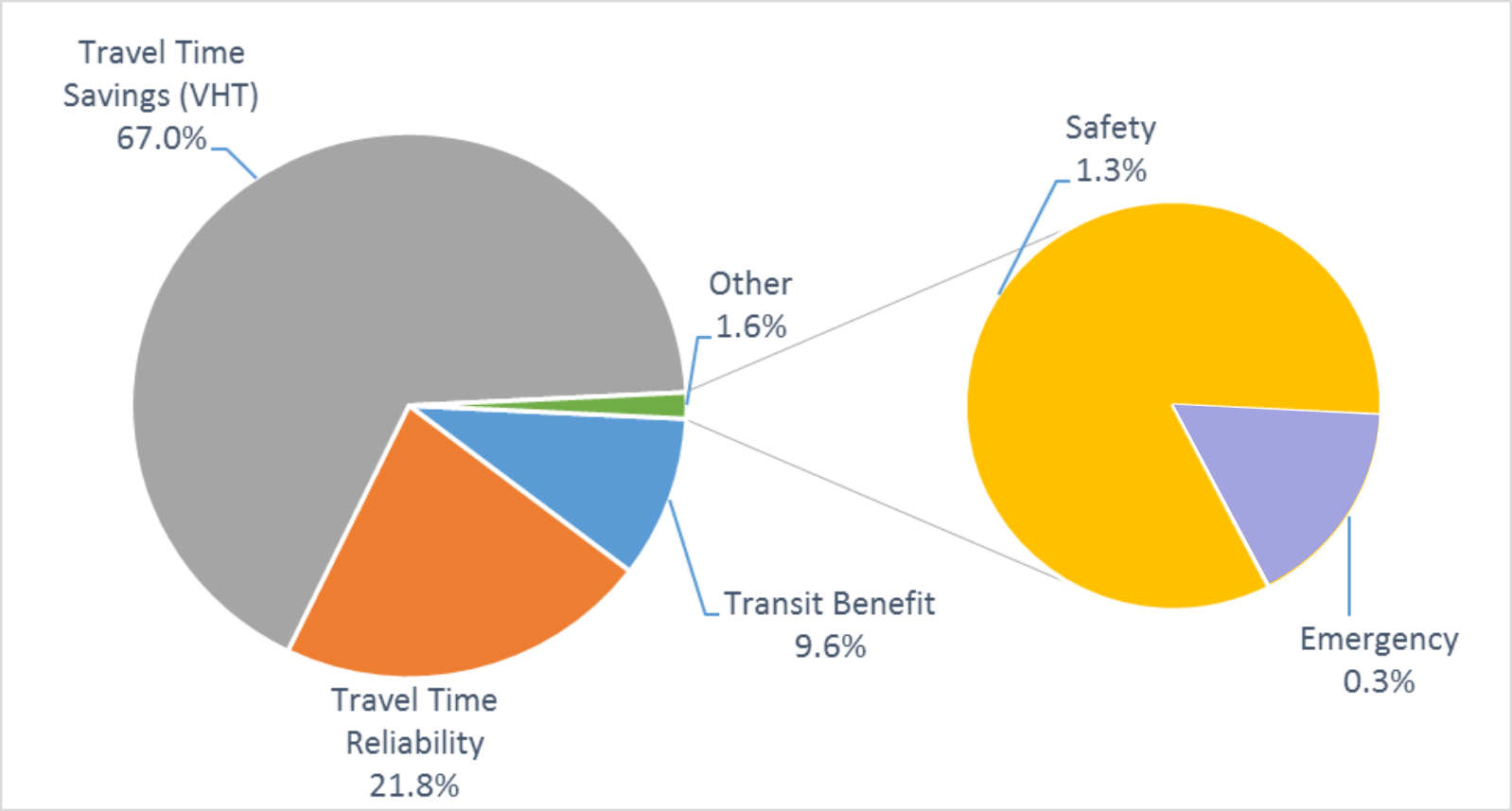


Travel Time Reliability Calculation Results

	2040 No-Build		2040 MnPASS Build			
			General Purpose Lane		MnPASS	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
Reliability (Veh-Hr)	1,529,636	1,349,944	1,549,131	811,477	2,884	3,473
Time Value ($/Hr/Veh)	$22.48	$22.48	$22.48	$22.48	$22.48	$22.48
Value of Reliability VHT ($)	$34,386,225	$30,346,732	$34,824,470	$18,242,003	$64,841	$78,073
Subtotal User Cost ($)	$64,732,958		$53,209,387			
Annual Benefit			$11,523,570			

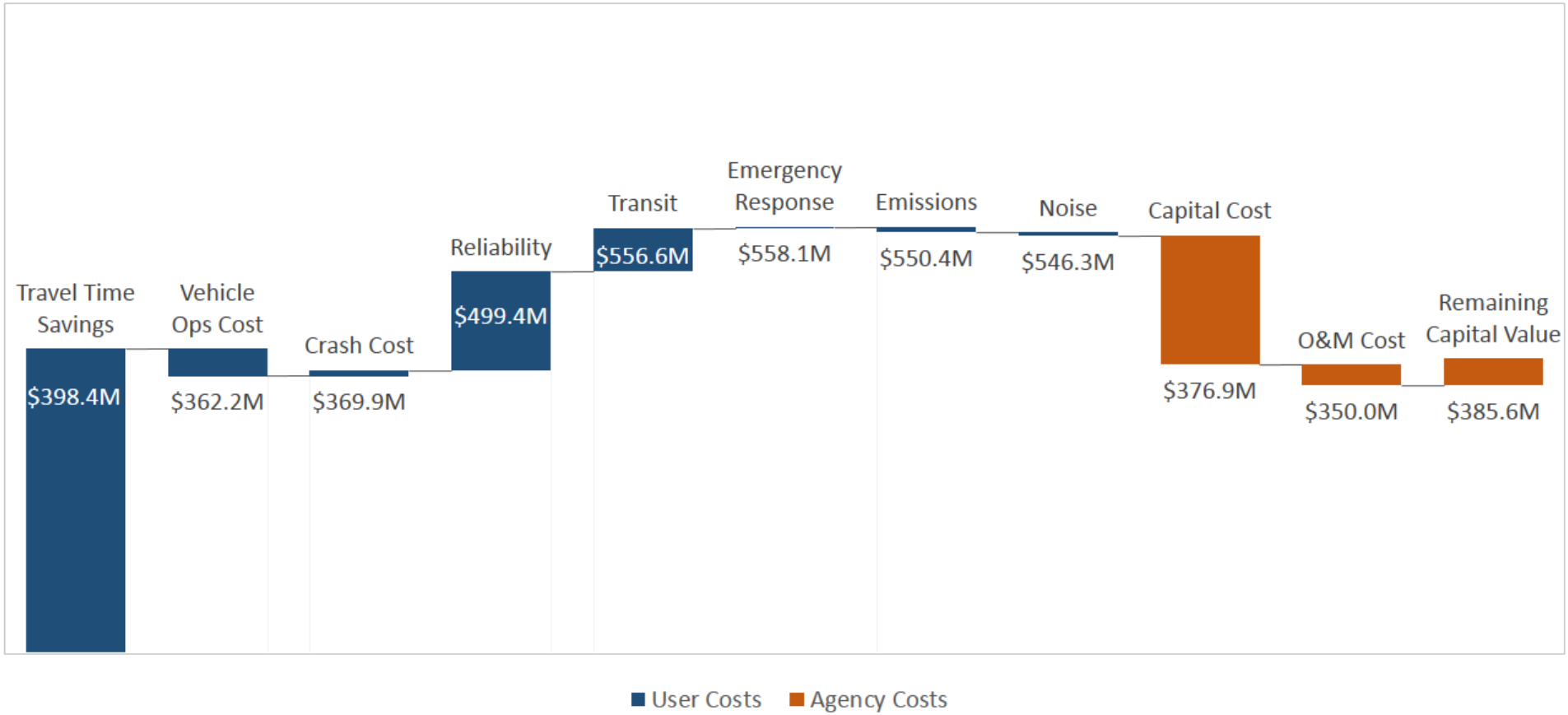
Benefit-Cost Analysis Results

Benefit-Cost Analysis Results



Positive Benefits by Category

Benefit-Cost Analysis Results



Comparison Analysis and Conclusion

	Category	Original Framework	Refined Framework
Cost Component	Capital Cost	$169,466,823	$169,466,823
	Operation and Maintenance Cost	$20,848,172	$26,838,533
	Remaining Capital Value	-$35,522,760	-$35,522,760
	Total Cost (2015$)	***$154,792,236***	**$160,782,596**
Benefit Component	Travel Time Savings (VHT)	$368,122,531	$398,386,602*
	Vehicle Operating Cost (VMT)	-$49,037,258	-$36,154,055*
	Crash Cost/Safety	$6,766,596	$7,624,153*
	Travel Time Reliability		$129,588,931
	Transit Benefit		$57,120,143
	Induced Travel		-
	Emergency Response		$1,521,542
	Emission Impact		-$7,715,881
	Noise Impact		-$4,024,296
	Total Benefit/Net Present Value (2015$)	**$325,851,870**	**$546,347,139**
	Benefit-Cost Ratio	**2.11**	**3.40**

Comparison Analysis and Conclusion

- Capture a wider range of project impacts in the alternative evaluation
- Improve the accuracy of the current MnPASS ROI methodology
- Improve the ability to verify the financial desirability of MnPASS alternatives
- Make project/alternative comparisons more comprehensive and consistent
- Provide better recommendations for practical investments

Questions?

Thank you!

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