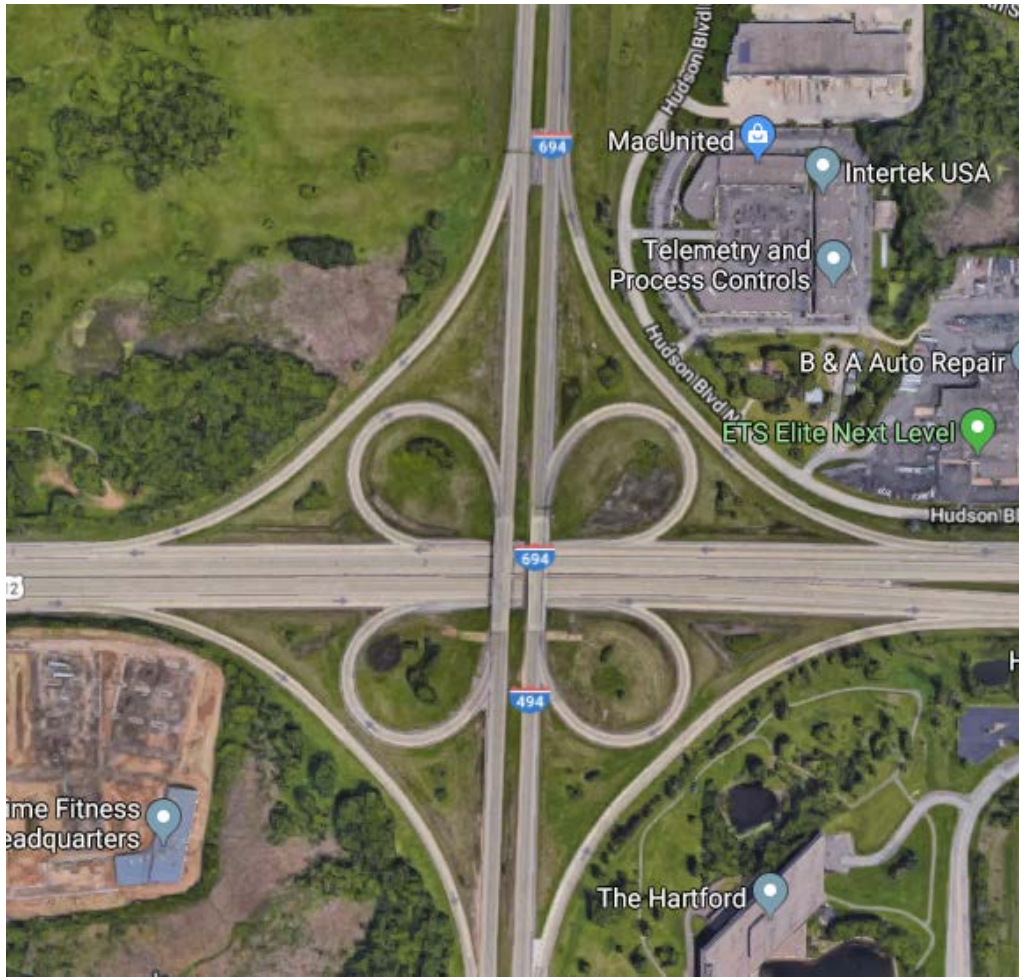
MnDOT/Met Council: Freeway System Interchange Study

TAC Planning

March 12, 2020

Background

- Investment prioritization study
- System interchanges connect two freeways
- Locations have been evaluated independently
- Interchange Issues:
  - Congestion
  - Crashes
- Systemwide numerous identified needs



Source: Google

Purpose

- Systematically discover and prioritize opportunities across region
- Reduce delay and crashes
- Consider needs of freight and transit
- Right-size investments

Source: SRF Consulting Group

Example of recent investment: I-494/I-35W in Bloomington/Richfield

- North to west directional ramp
- Corridors of Commerce awarded $70 million to begin in 2021
- Includes directional ramp and bridge braids

Source: City of Bloomington

Stakeholder Engagement

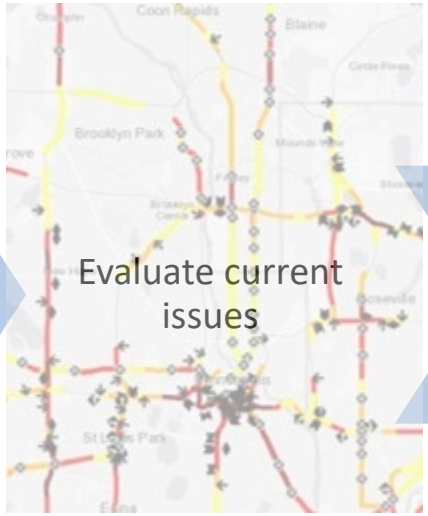
Study Leadership	Agency Outreach
Technical Advisory Committee • Seven-county Metro Area counties • Wright and Sherburne counties • Local governments • Federal Highway Administration • MnDOT • Metropolitan Council	• Minnesota Fright Advisory Committee • Transportation Advisory Board - Technical Advisory Committees • Congestion Management Process • State's Capital Improvements Committee • Met Council Transportation Committee

Study Process

System Interchanges

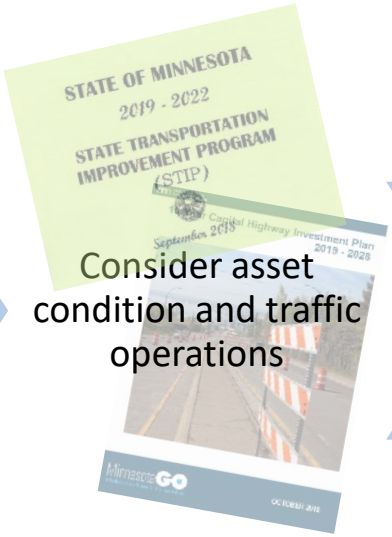
Determine locations to be studied

Study interchanges



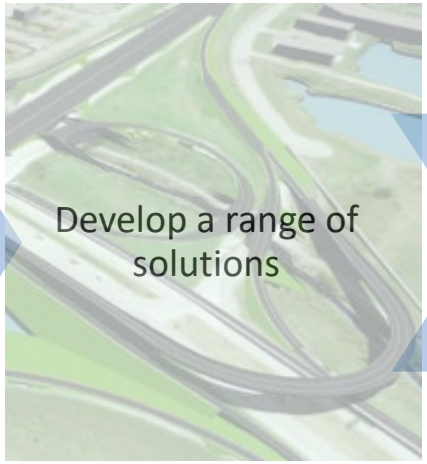
Identify critical problem magnitudes

Focus locations



Consider recent investments and bottleneck causes

Solution locations



Estimate return on investment

Right-sized solutions

Identify improvement opportunities

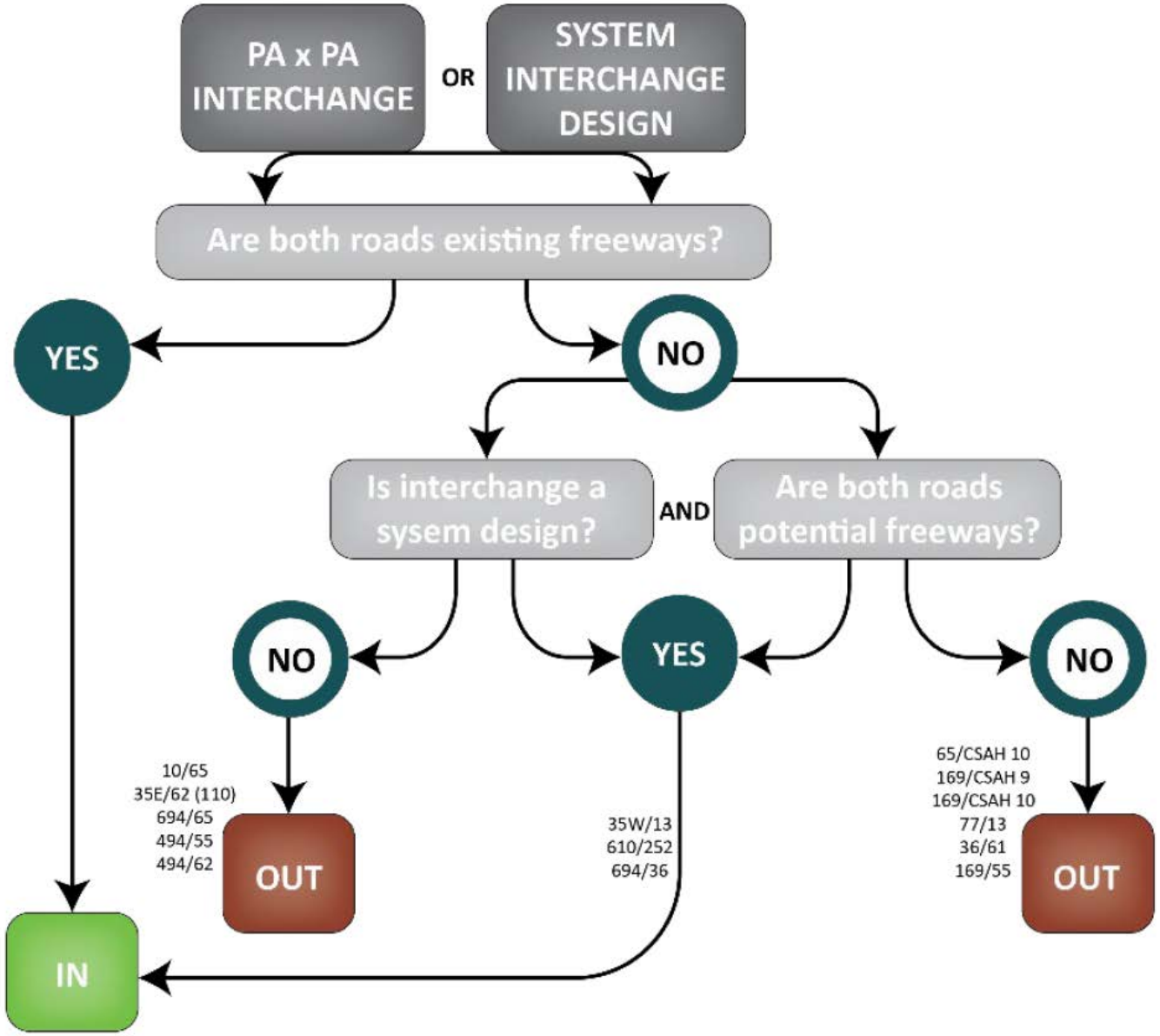
Document observations for future investments

Regional opportunities

Phase 1: Study Interchanges

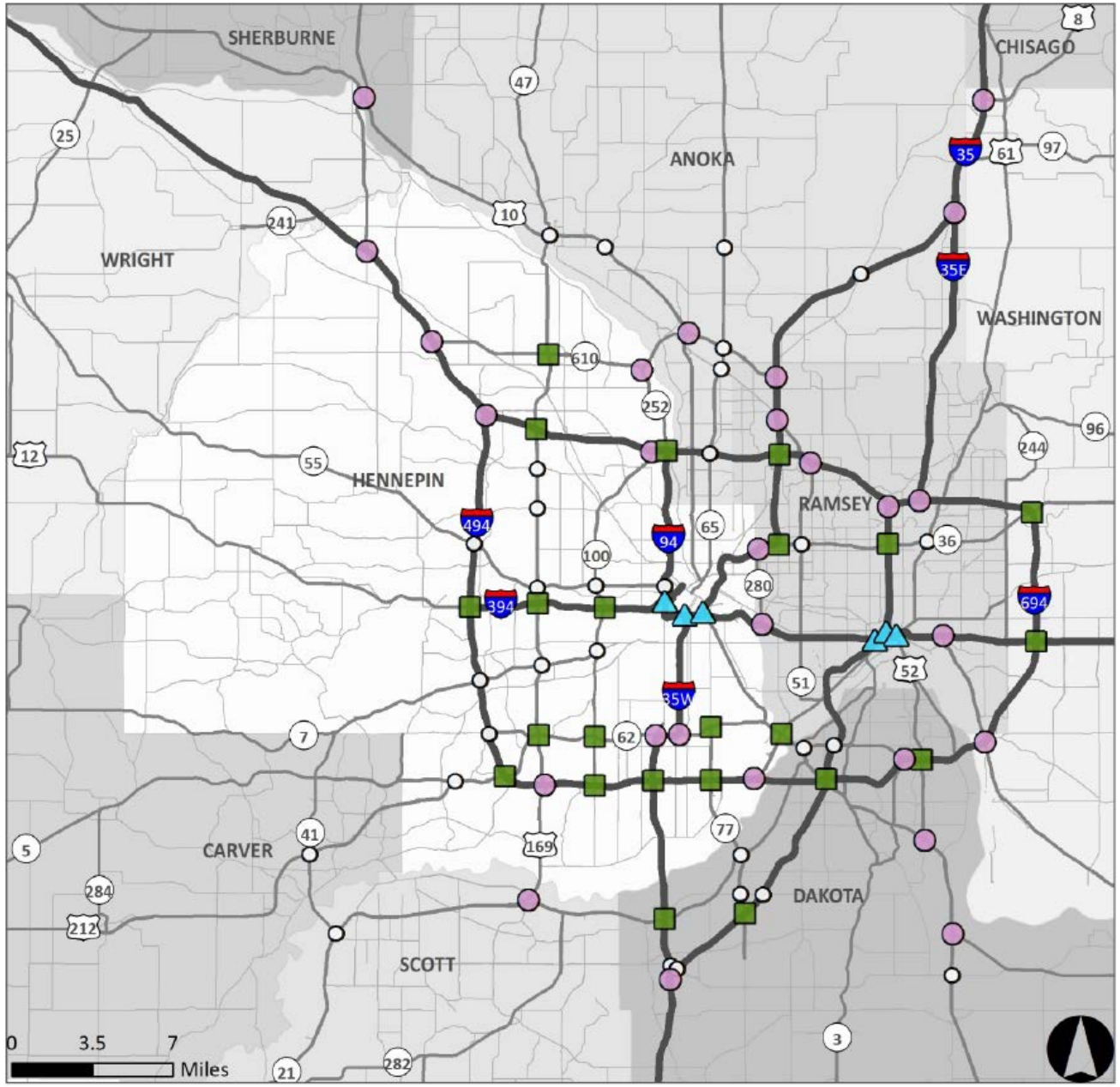
Study Interchanges

- Principal Arterial Interchange
  - Through movements are grade separated
  - Access via ramps
- System Interchange Design
  - All movements provided are uninterrupted flow
- Freeway
  - Controlled access
  - Uninterrupted flow
  - Minimum 3 legs
- Potential Freeway
  - Programmed, planned, or undergoing conversion study



Study Interchanges

- 56 interchanges
  - Cloverleaf – 23
  - Downtown commons – 6
  - Other interchange types - 27



Phase 2: Focus Locations

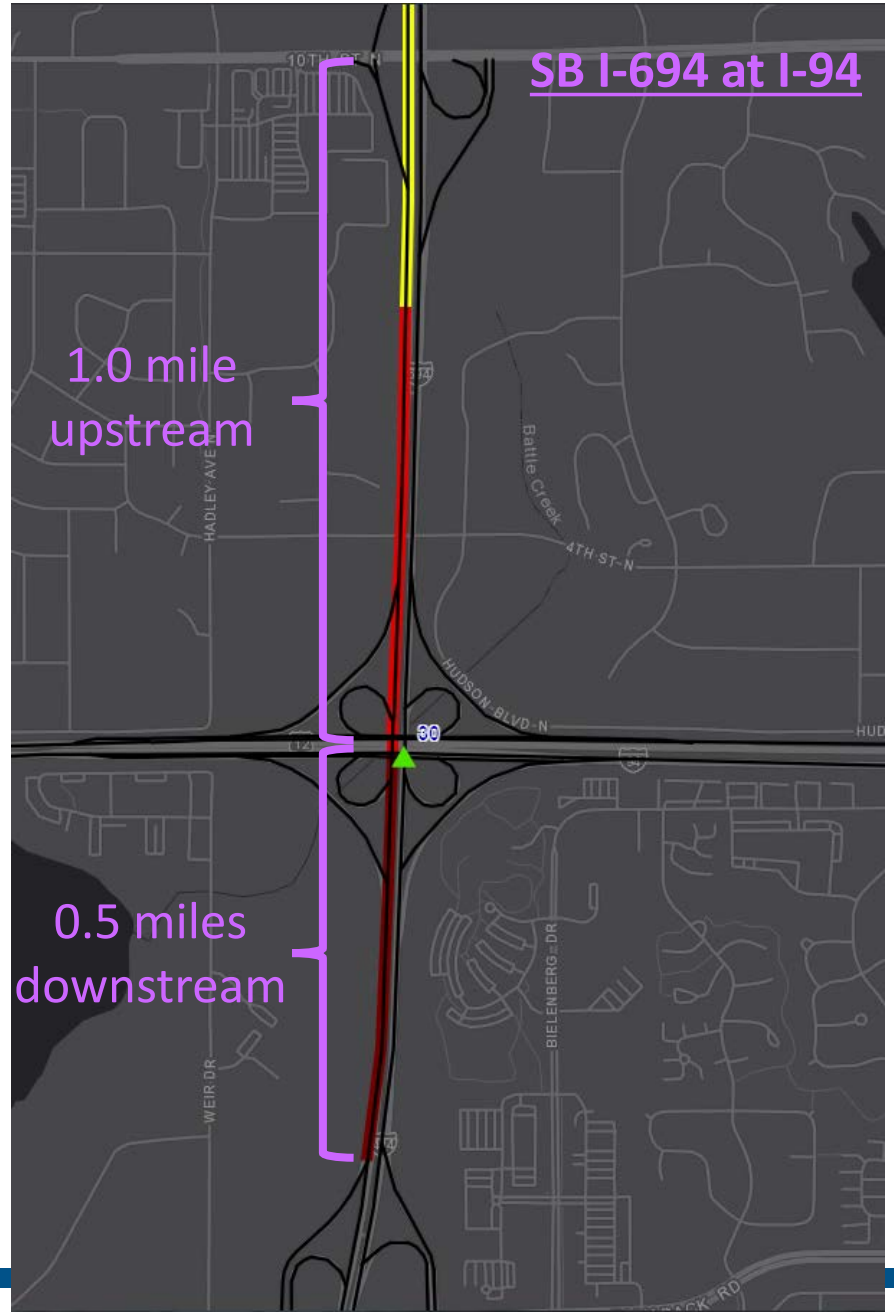
Performance Measures

Metric Category	Performance Measure(s)	Units	Source
Mobility	Travel time delay	Vehicle-hours of delay (VHD)	Loop detectors, NPMRDS/INRIX data
Reliability	Variability of congestion	Standard deviation (minutes)	Loop detectors, NPMRDS/INRIX data
Safety	Cost of crashes	Dollars	MN DPS crash data
Freight	Freight volume	HCAADT	ATR/VC counts
Transit	Transit ridership	Persons	Met Council

Planned improvements and MnPASS: to be inventoried for each interchange approach and referenced for project implementation purposes

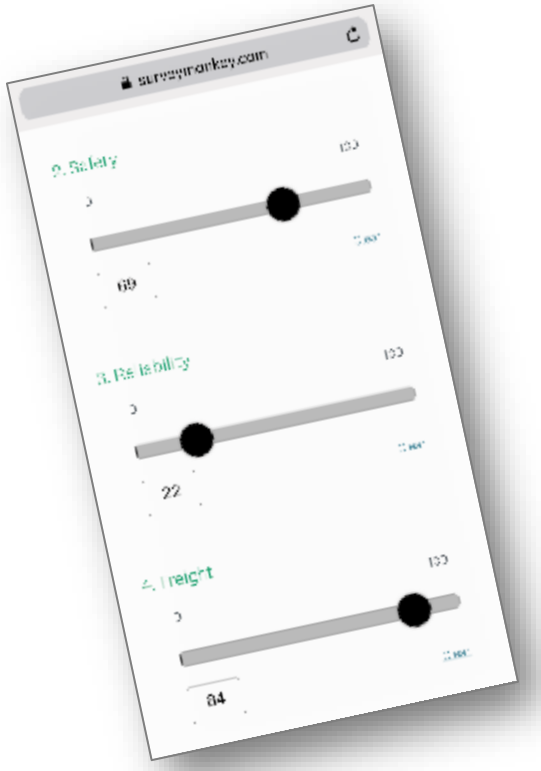
Analysis Procedure – Spatial

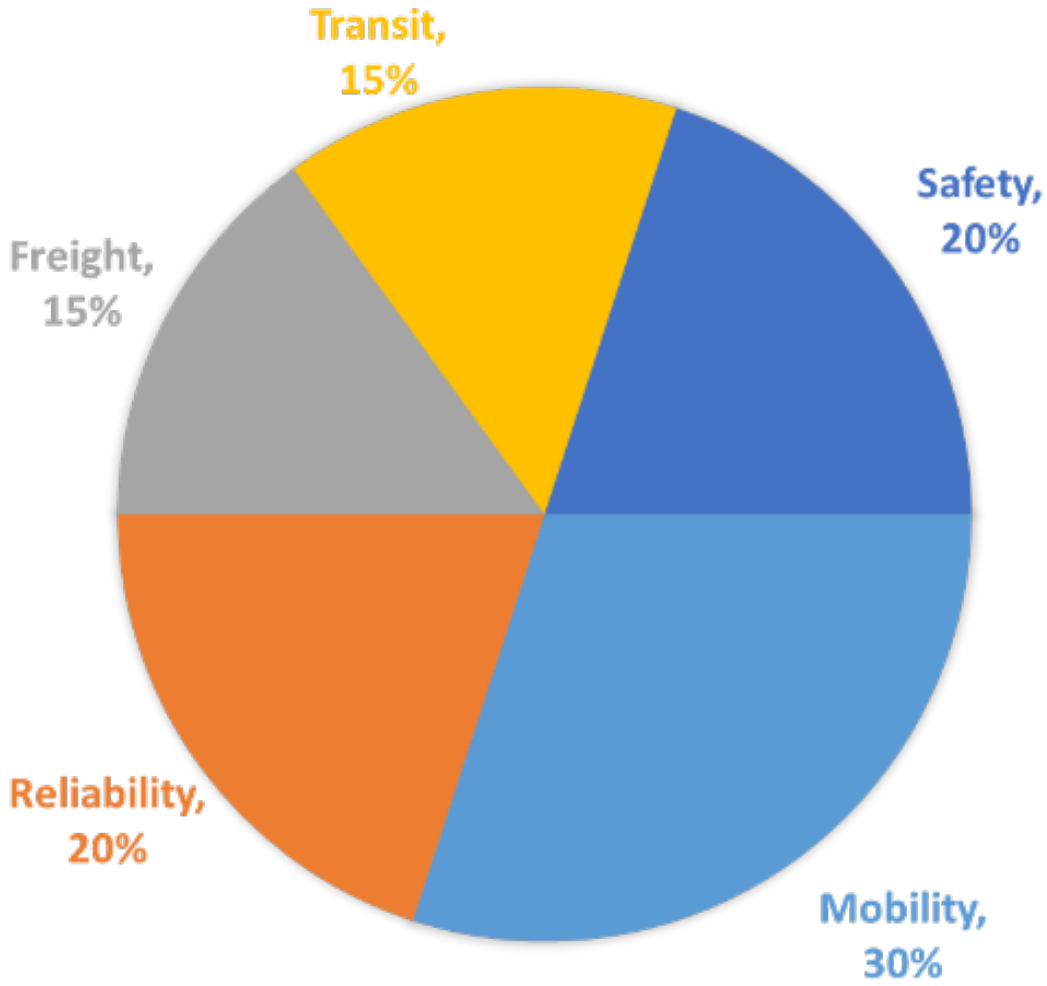
- Influence area
  - Used for mobility, reliability, and safety analyses
  - For each interchange approach, capture:
    - 1.0 mile upstream
    - 0.5 miles downstream
- Transit and Freight
  - Total ridership and HCAADT volume on directional segments through interchange
  - Perform sensitivity analyses using heavy commercial vehicle percentage and transit advantages



Weighting

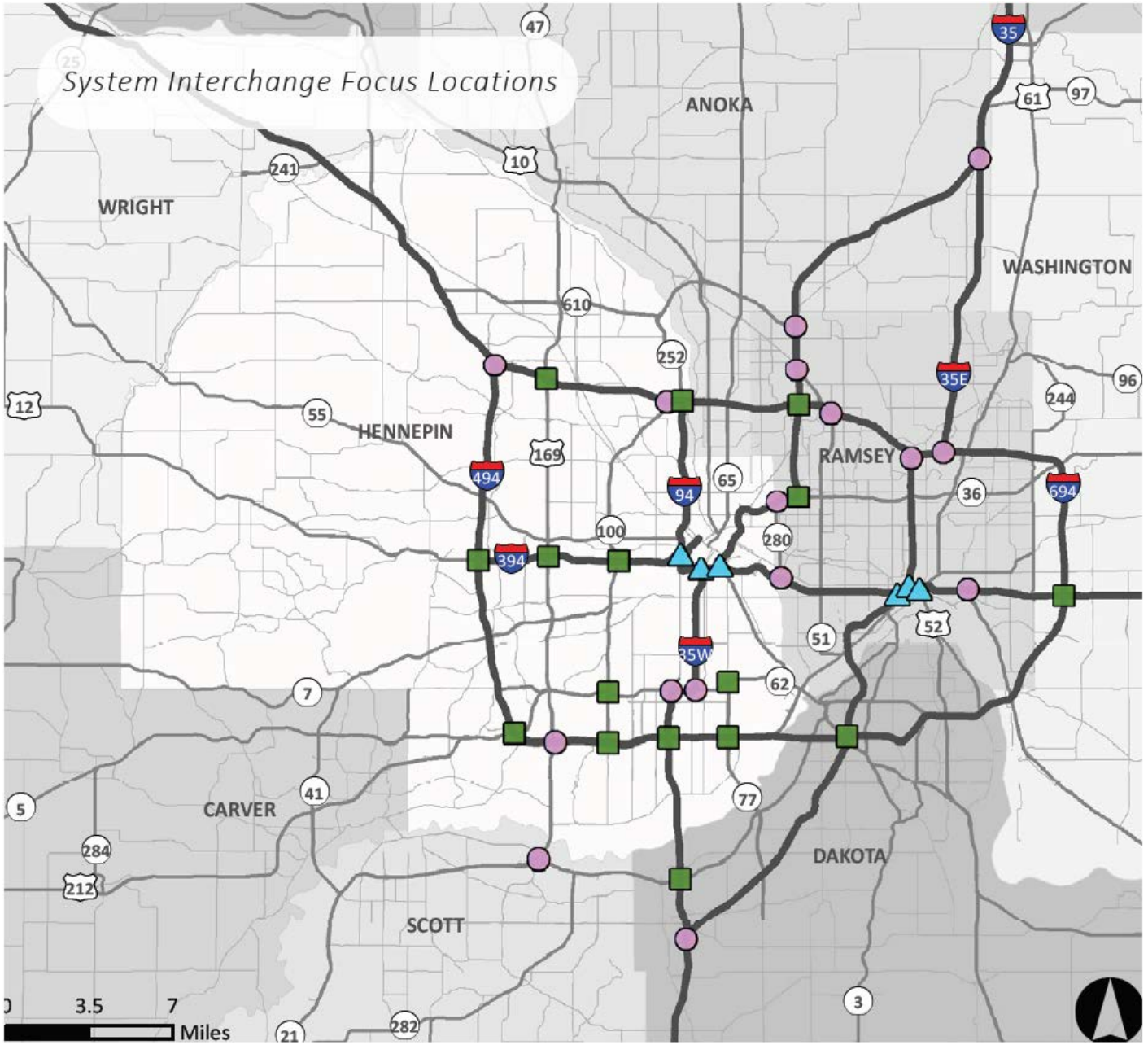
- Technical scoring process based on performance measures and weights





Focus Locations

- **37** system interchanges with **94** focus locations
  - Top 63 approaches
  - 31 add'l Interstate-to-Interstate



Phase 3: Solution Locations

Recent System Interchange Investments

Location	Condition/Project	Jurisdiction	Result
I-694/35E west junction	full build complete	IS x IS	Carry forward
I-694/35E east junction	full build complete	IS x IS	Carry forward
I-494/US 169	full build complete	IS x non-IS	Remove
I-35W/TH 62 east junction	full build complete	IS x non-IS	Remove
I-35W/TH 62 west junction	full build complete	IS x non-IS	Remove
I-694/US 10/TH 51 (Snelling Ave)	full build complete	IS x non-IS	Remove
I-35W/US 10 North Junction	project underway (I-35W North MnPASS)	IS x non-IS	Remove
I-35W/US 10 South Junction	project underway (I-35W North MnPASS)	IS x non-IS	Remove

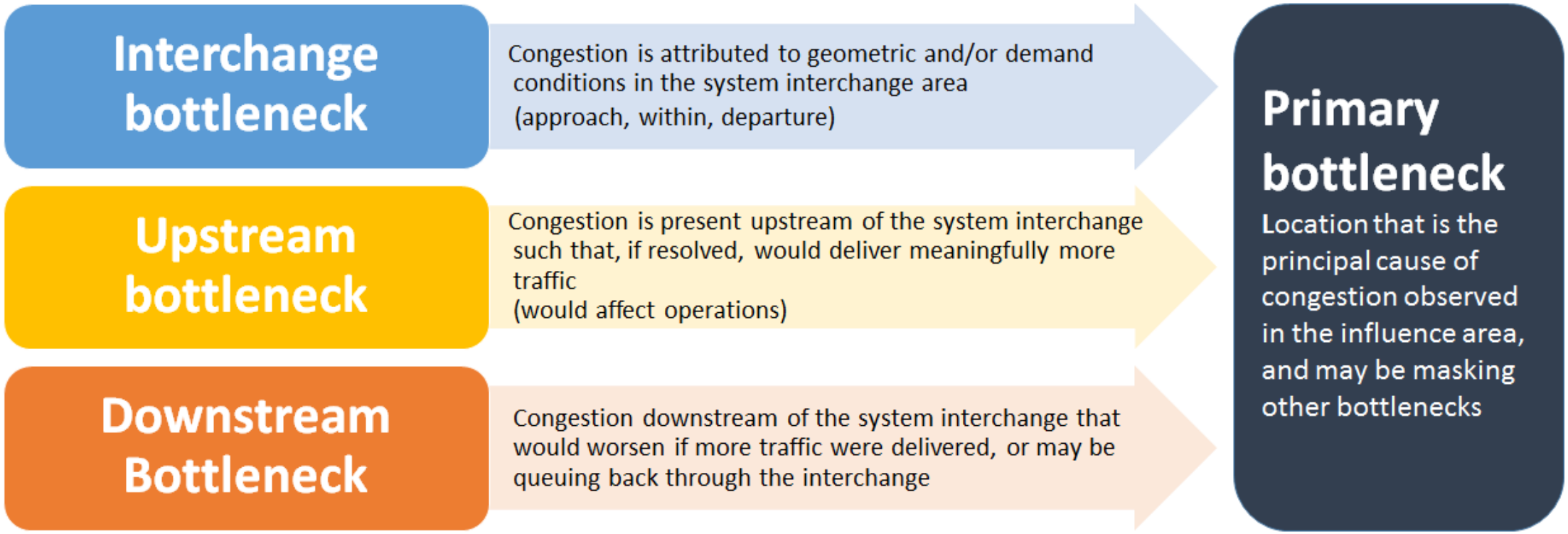
Current Projects Under Development

- Several locations have environmental documentation underway
- FSIS should not introduce “solutions” outside of environmental process
- Avoids pre-empting Purpose & Need by introducing “Alternatives”
- Avoids confusion with alternatives developed through project studies

The Plan: Incorporate solutions developed through projects into FSIS scoring when environmental process nears completion

System Interchange Locations
I-94 & TH 280
I-35W & I-494
I-94 & I-494/694 (Oakdale/Woodbury)
I-35W & TH 36

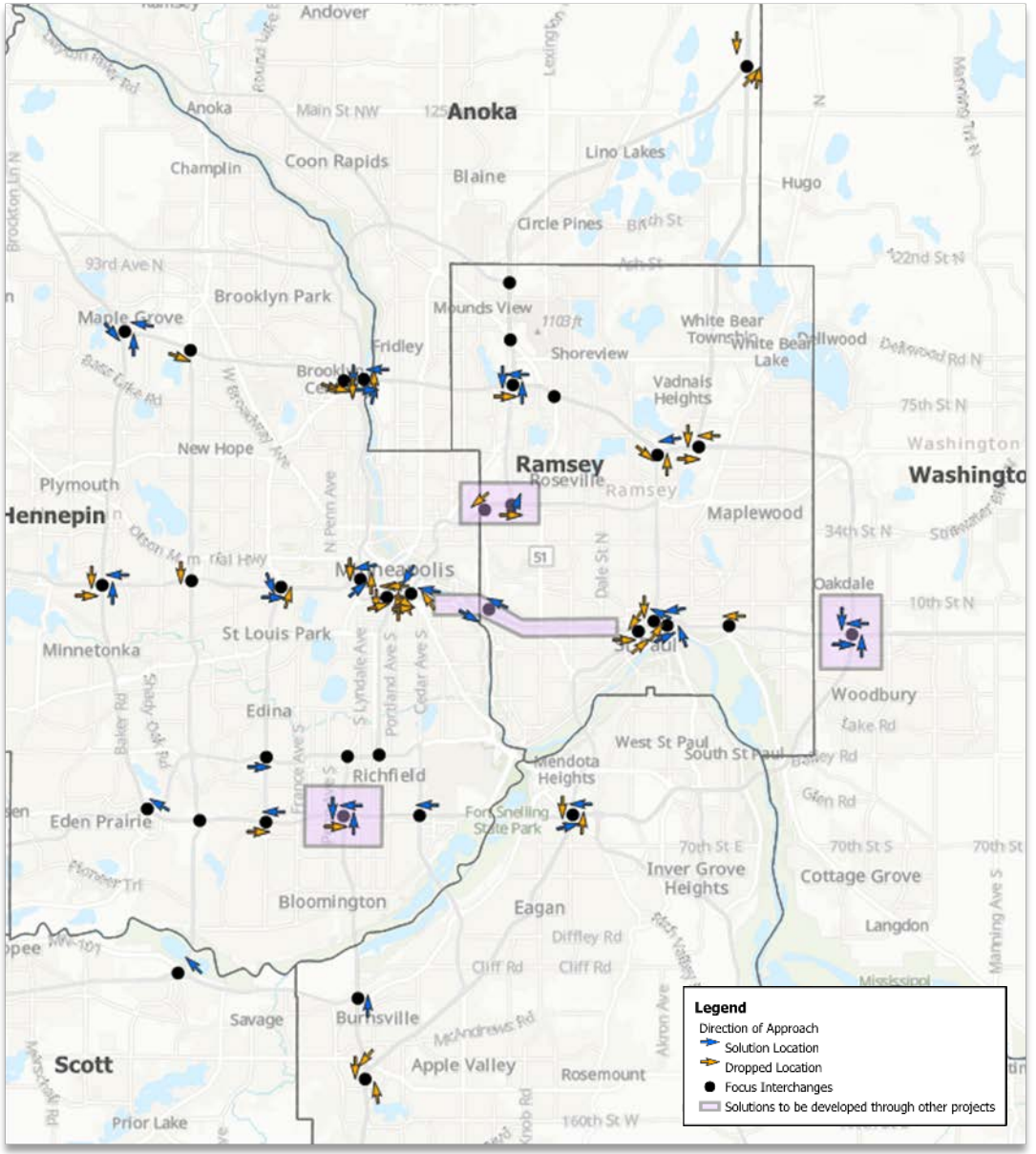
Bottleneck Definitions



Outcome: Carry approaches forward to **Solution Locations** when **Interchange** bottleneck = **Primary** bottleneck

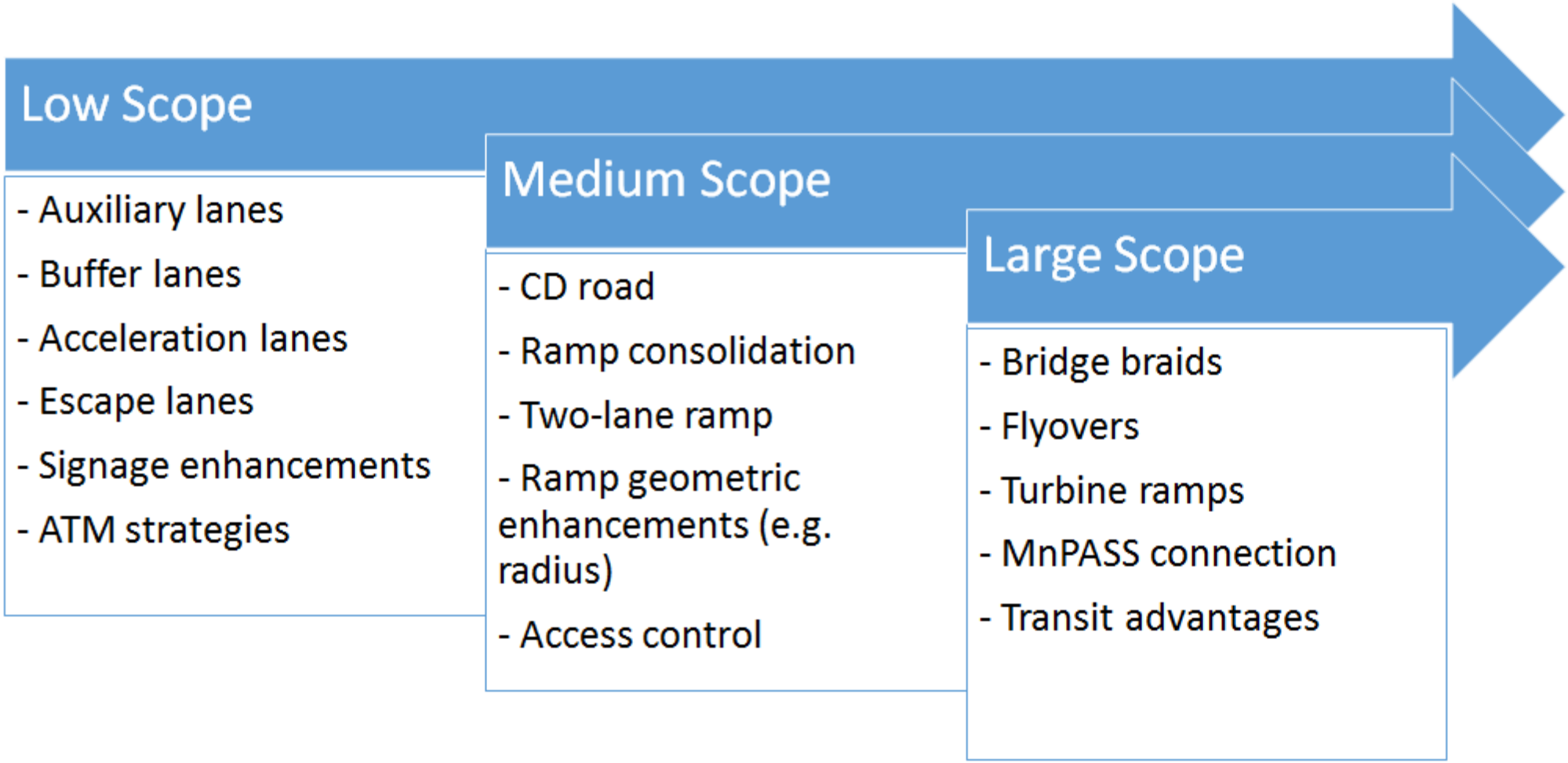
Solution Locations

- Problems attributed to system interchange
- Recently reconstructed interchanges removed from consideration
- **42** approaches carried forward across **22** system interchanges
- Number of approaches carried forward by interchange type:
  - Cloverleaf: 27
  - Downtown commons: 8
  - Other interchange types: 7



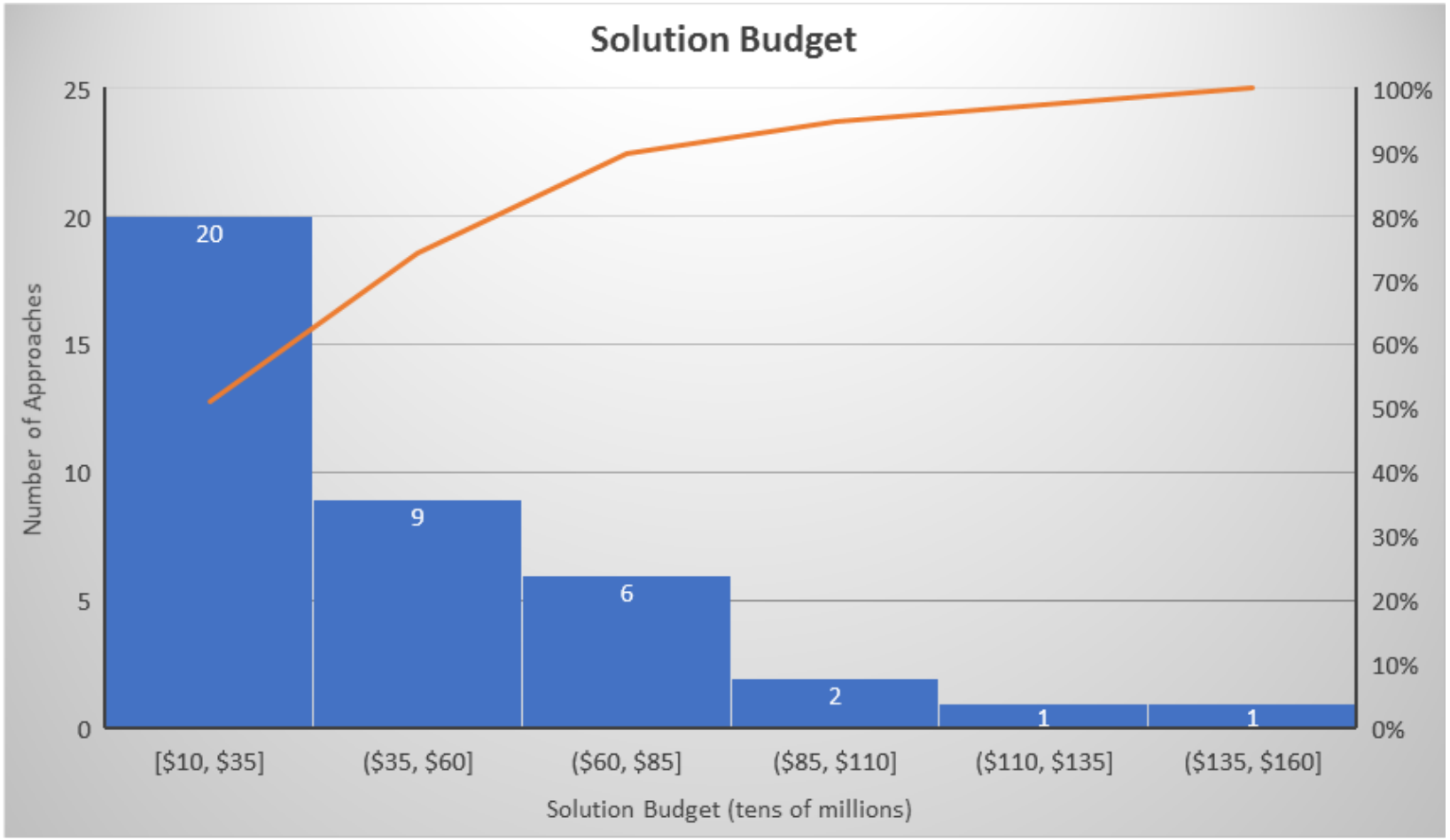
Phase 4: Right-Sized Solutions

Solution Development



Solution Development

- Solution "budget"
- Estimate maximum value of improvements to be 10x problem cost (congestion + crashes)

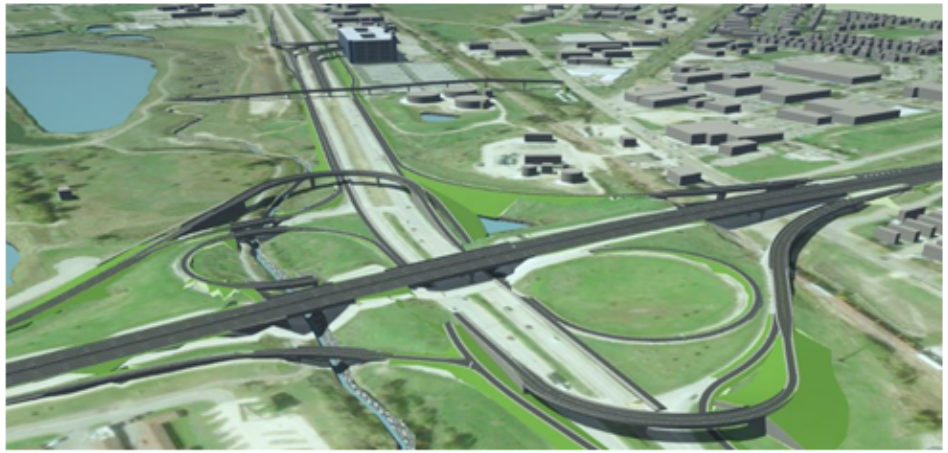


Solution Development

- Bottom-up design approach
  - Assess if lower-cost solutions can address operational issues before moving to higher-cost solutions

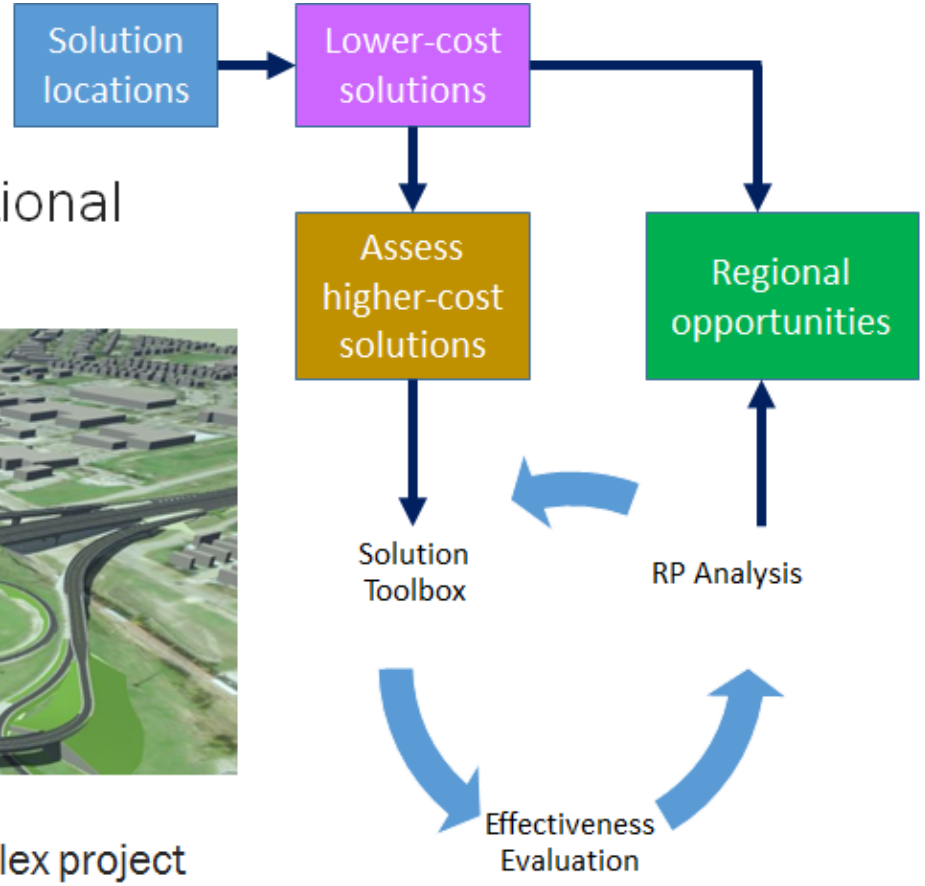
Low Scope Solutions

- Planning-level concept sketches
- Assess severity of pavement and grading, right-of-way impacts, etc.



High Scope Solutions

- Detailed design intended for complex project alternatives
- Assess vertical and horizontal clearance, quantify itemized construction elements, etc.



Cost Estimates

MnDOT bid prices applied to key quantities:

- Pavement
- Bridge area
- Earthwork (embankments and excavation)
- Retaining walls
- Curb & gutter
- Concrete median barrier
- Removals

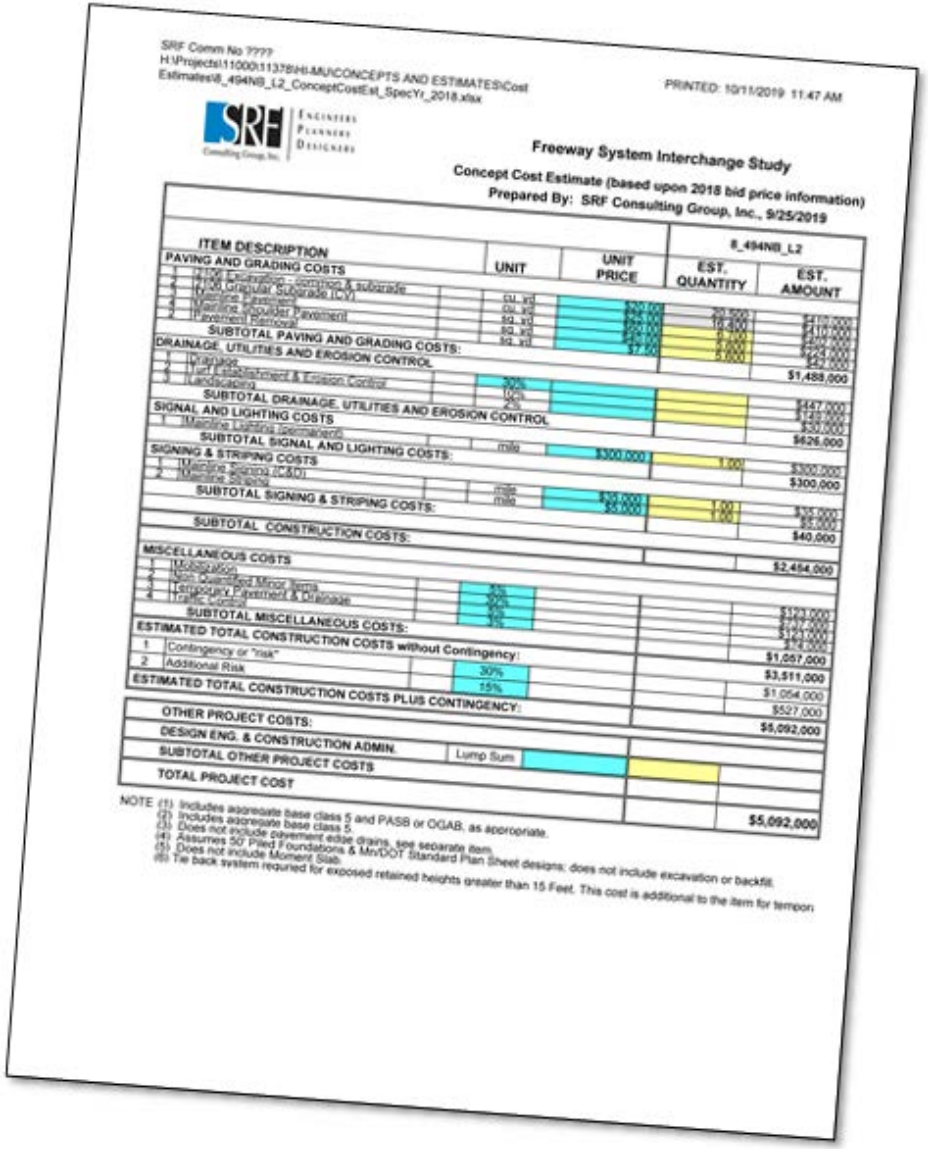
Contingency / Risk Factors

Percentages applied to account for additional factors:

- Drainage = 30%
- Traffic Control = 5%
- Mobilization = 5%

Non-Quantified Contingency Allowance

- <$10M = 15%
- $10-40M = 30%
- >$40M = 50%



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SRF Consulting Group, Inc. — Engineers, Planners, Designers

Freeway System Interchange Study

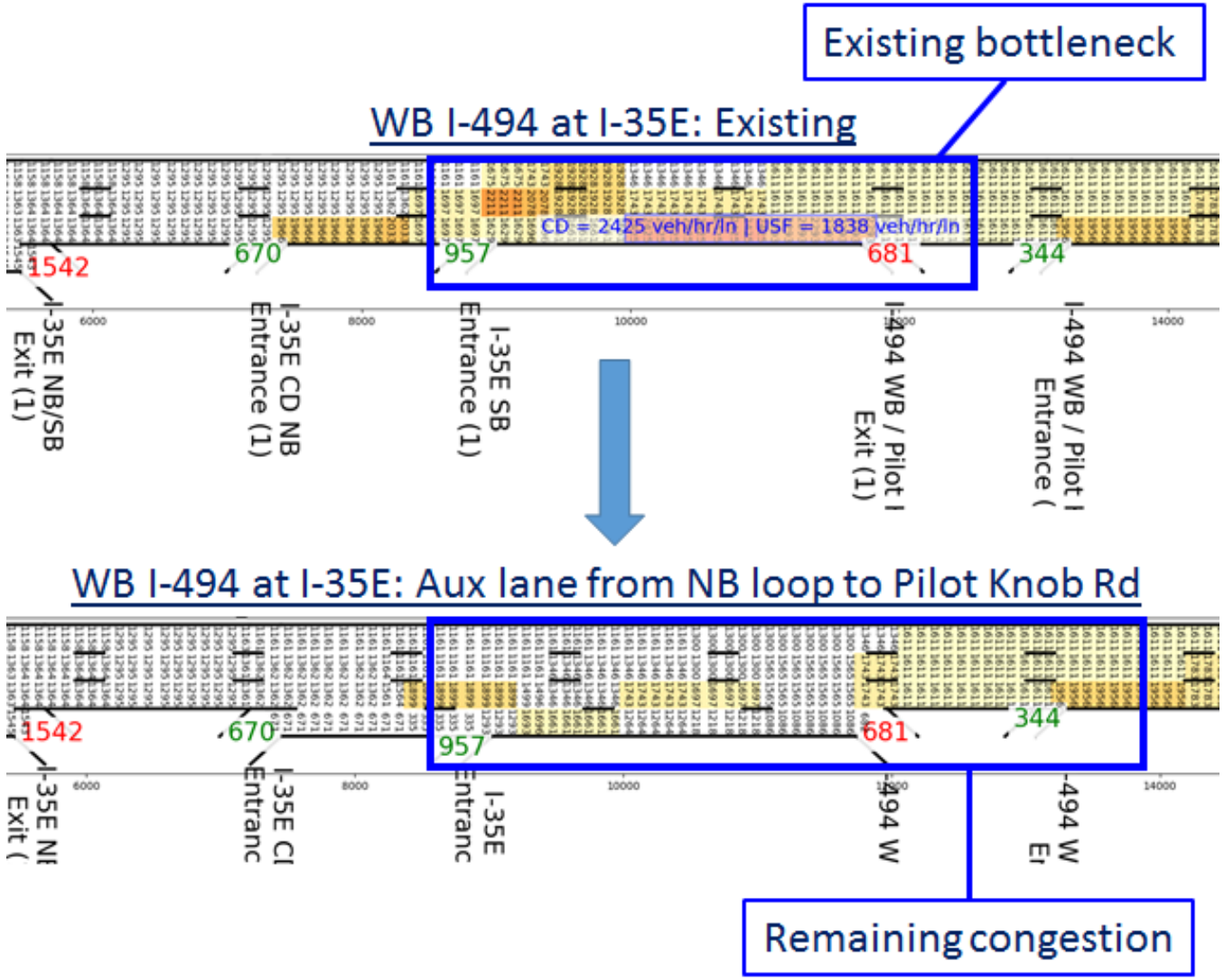
Concept Cost Estimate (based upon 2018 bid price information)
Prepared By: SRF Consulting Group, Inc., 9/25/2019

ITEM	DESCRIPTION	UNIT	UNIT PRICE	8_494NB_L2 EST. QUANTITY	8_494NB_L2 EST. AMOUNT
	PAVING AND GRADING COSTS				
1	Pavement Removal	SY	$20.00	20,500	$410,000
2	Mill & Overlay Pavement	SY	$20.00	18,000	$360,000
3	Pavement Removal	SY	$20.00	0	$0
4	Pavement Removal	SY	$20.00	5,000	$100,000
	SUBTOTAL PAVING AND GRADING COSTS:				$870,000
	DRAINAGE, UTILITIES AND EROSION CONTROL				
1	Drainage				$1,488,000
2	Turf Establishment & Erosion Control	30%			$447,000
3	Landscaping	10%			$149,000
	SUBTOTAL DRAINAGE, UTILITIES AND EROSION CONTROL	2%			$30,000
	SIGNAL AND LIGHTING COSTS				$626,000
1	Temporary Lighting (permanent)	mile	$300,000	1.00	$300,000
	SUBTOTAL SIGNAL AND LIGHTING COSTS:				$300,000
	SIGNING & STRIPING COSTS				
1	Permanent Signing (C&G)	mile	$40,000	1.00	$40,000
2	Permanent Striping	mile	$40,000	1.00	$40,000
	SUBTOTAL SIGNING & STRIPING COSTS:				$80,000
	SUBTOTAL CONSTRUCTION COSTS:				$2,464,000
	MISCELLANEOUS COSTS				
1	Mobilization	5%			$123,000
2	Non-Specified Minor Items	5%			$123,000
3	Temporary Pavement & Drainage	5%			$123,000
4	Traffic Control	5%			$123,000
	SUBTOTAL MISCELLANEOUS COSTS:				$492,000
	ESTIMATED TOTAL CONSTRUCTION COSTS without Contingency:				$2,956,000
1	Contingency or "risk"	30%			$1,067,000
2	Additional Risk	15%			$3,511,000
	ESTIMATED TOTAL CONSTRUCTION COSTS PLUS CONTINGENCY:				$1,054,000
					$527,000
	OTHER PROJECT COSTS:				$5,092,000
	DESIGN ENG. & CONSTRUCTION ADMIN.	Lump Sum			
	SUBTOTAL OTHER PROJECT COSTS				
	TOTAL PROJECT COST				$5,092,000

NOTE (1) Includes aggregate base class 5 and PASB or OGAB, as appropriate.
(2) Includes aggregate base class 5.
(3) Does not include pavement edge drains, see separate item.
(4) Assumes 50' Piled Foundations & MnDOT Standard Plan Sheet designs; does not include excavation or backfill.
(5) Does not include Moment Slab.
(6) Tie back system required for exposed retained heights greater than 15 Feet. This cost is additional to the item for temporo

Traffic Evaluation

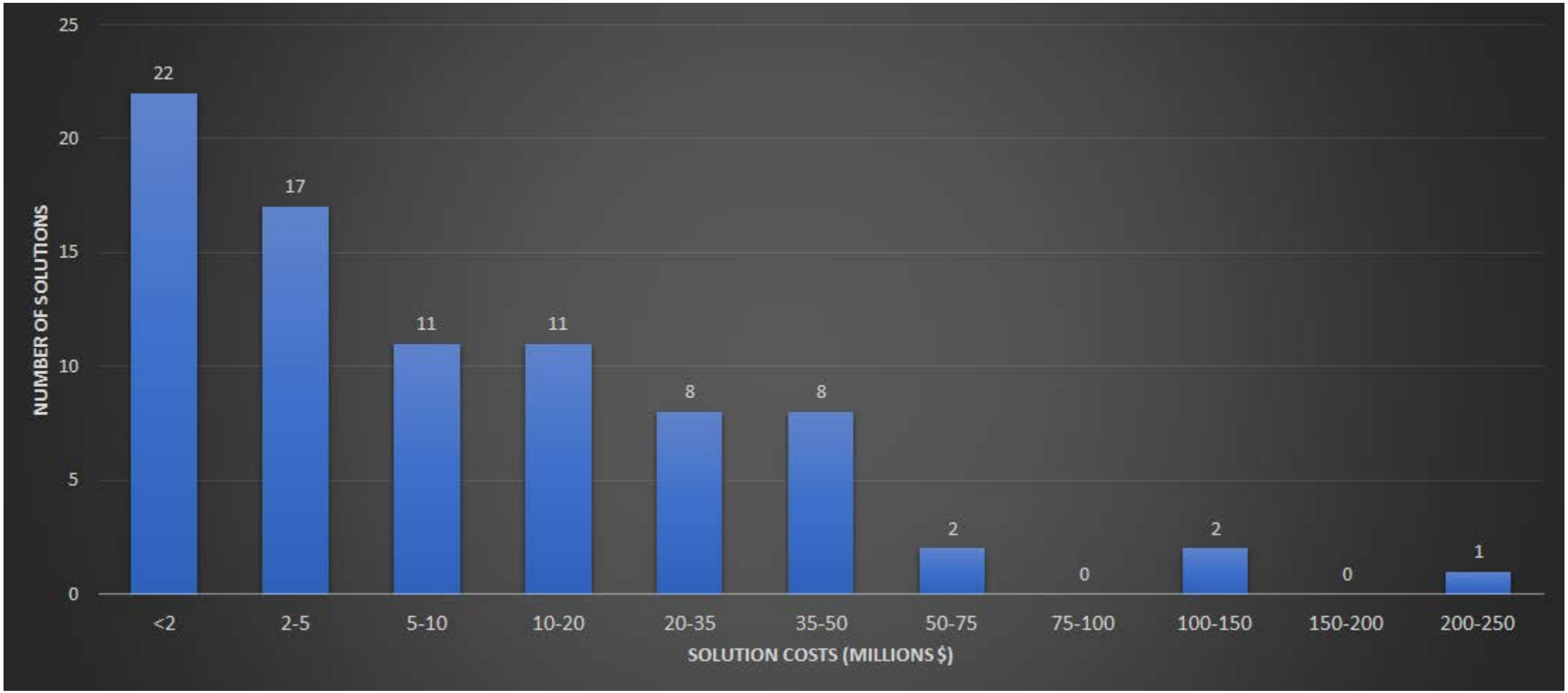
- Benefit evaluation considerations:
  - Upstream and downstream congestion
  - Additional approaches effected by solution
- Delay reduction estimation:
  - Compare congestion severity to determine solution effectiveness



Return on Investment

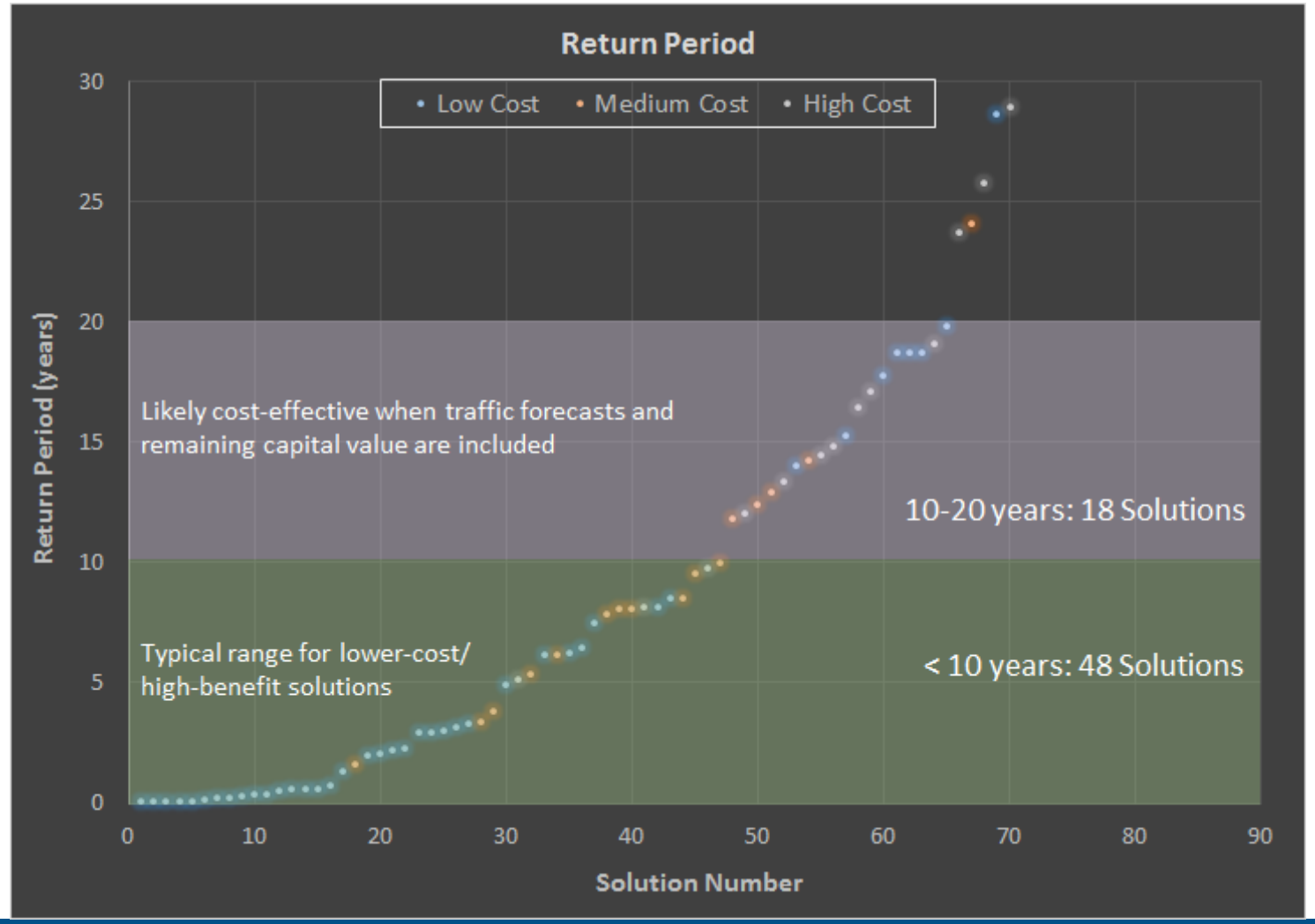
- Reduction in congestion applied to annual delay cost
- Congestion reduction applied to congestion-related crashes
  - AM and PM peak period crashes from 2013-2017
- Return period = Construction Cost / Annual Benefit
  - Estimated number of years to repay investment

Solution Cost Distribution

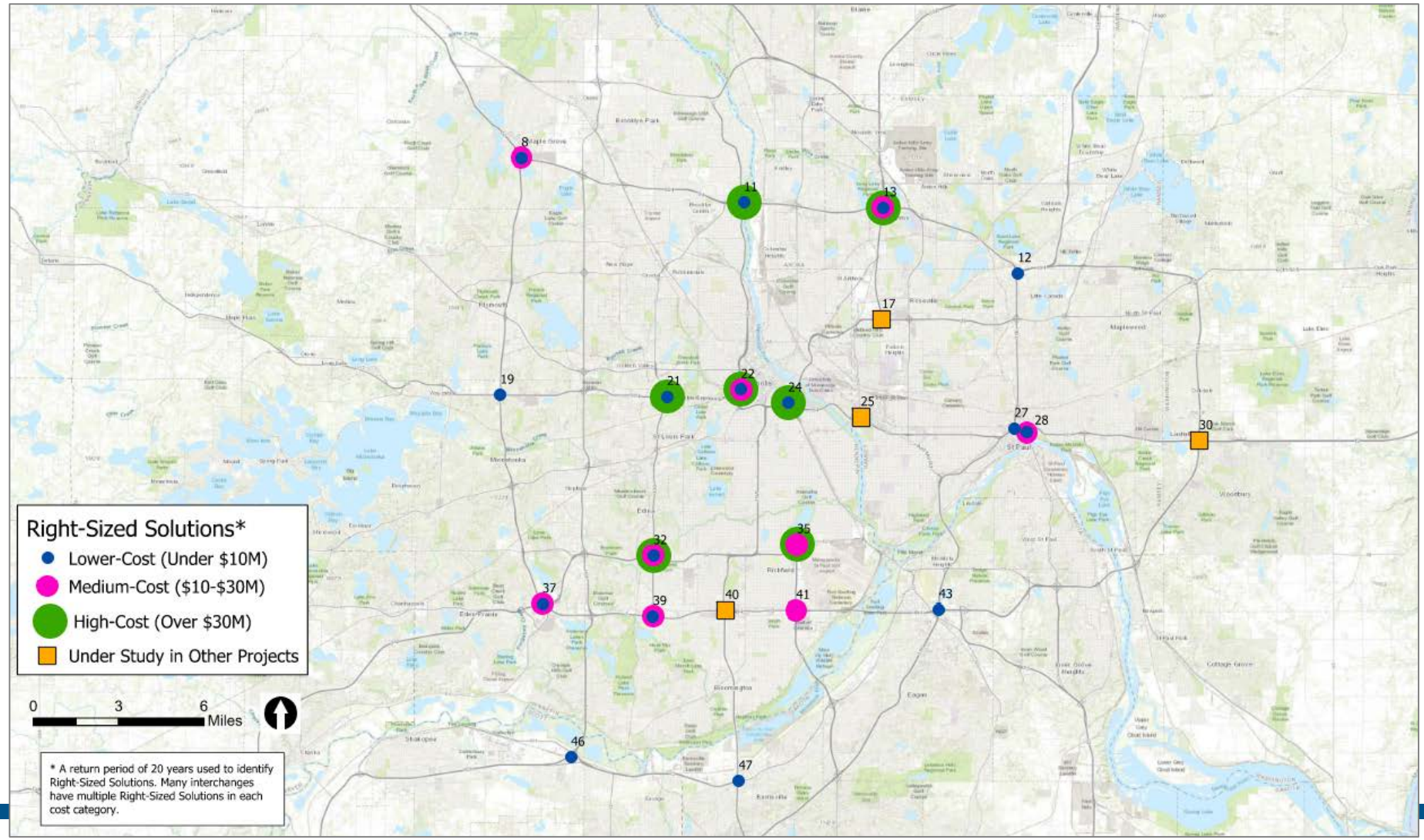


Return Period Threshold

- Identify natural break points for cost-effective solutions
- 80 solutions evaluated
  - 66 cost-effective
  - 14 not cost-effective



Right-Sized Solution Locations

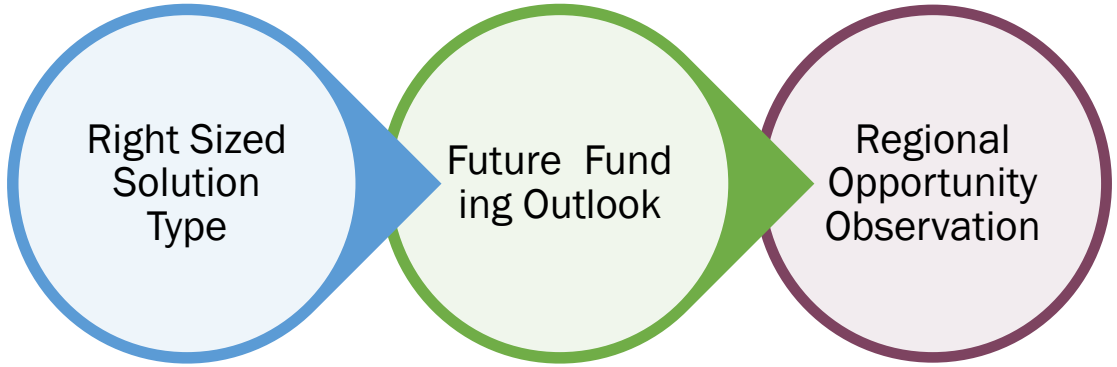


Phase 5: Regional Opportunities

Regional Opportunities Overview

Add context to the “Right-Sized Solutions” by reviewing the future funding outlook at those locations:

- STIP (0-4 years)
- CHIP (5-10 years)
- BRIM (25 year bridge needs)
- TPP projects (MnPASS, Strategic Capacity, CMSP)
- Safety and freight addressed through STIP, TPP, and evaluation methodology



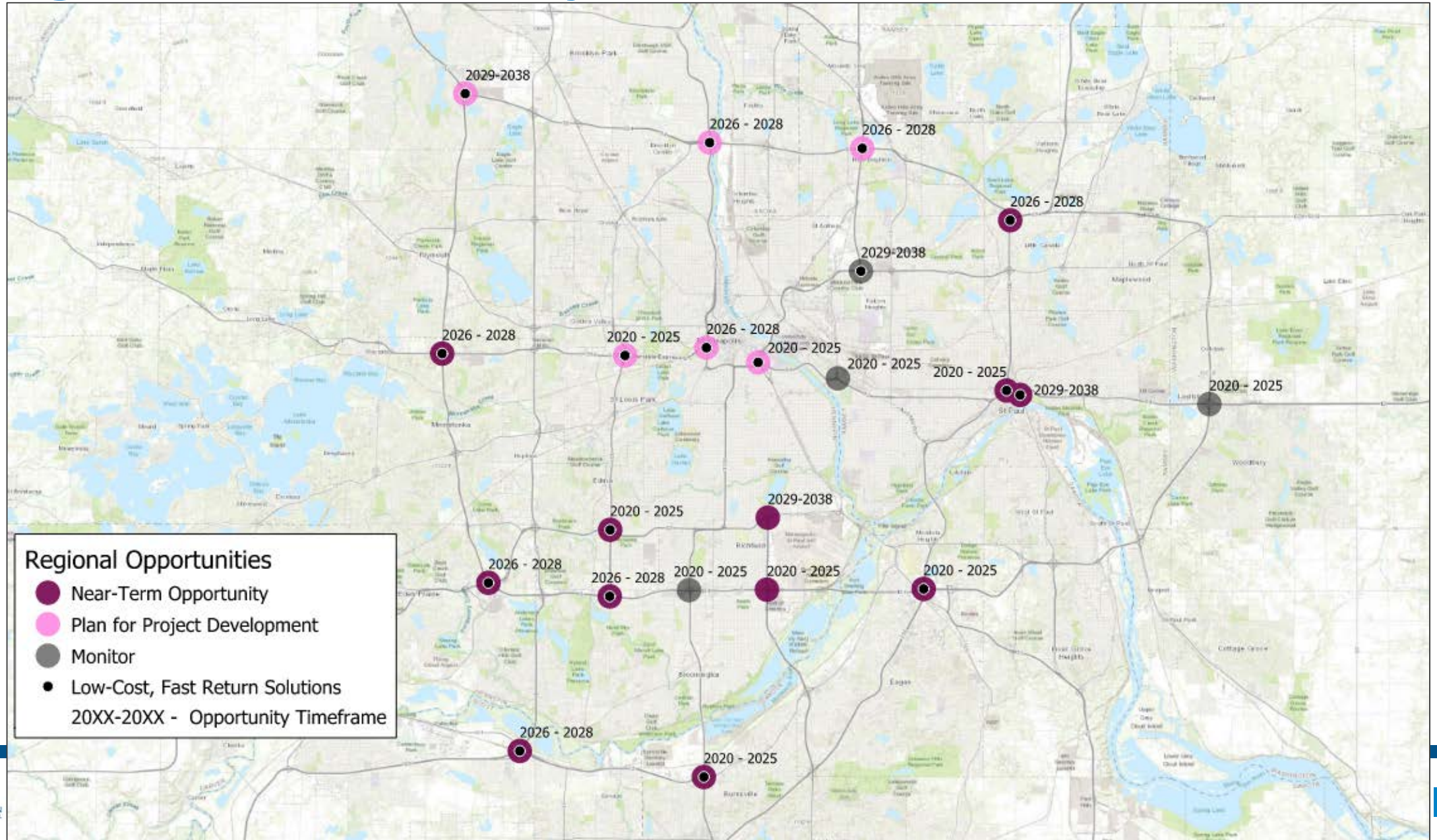
Freeway System Interchange Investment Approach

- Preservation projects should be used as a catalyst to address other identified safety, mobility, freight, bicycle, and pedestrian needs
- Integrating with preservation projects:
  - Minimizes costs
  - Reduces inconvenience to travelers
  - Addresses multiple policy objectives
- Where mobility needs are identified, investments should be made in lower cost projects that produce high benefits and avoid exceeding the point of diminishing returns

The "Regional Opportunity" categories are intended to inform project scoping and future funding decisions

Funding plans, funding decisions, and project priorities will be proposed by MnDOT and the Metropolitan Council separate from this study process

Regional Opportunity Observations



Regional Opportunities Summary

Phase		Outcome	No. of System Interchanges	No. of Approaches
1	Determine Freeway System Interchanges to be Studied	Study Interchanges	56	222
2	Screen System Interchanges to Focus Locations	Focus Locations	37	94
3	Establish Solution Locations	Solution Locations	22	42
4	Develop Range of Solutions	Right-Sized Solutions	22*	42*
5	Identify Improvement Opportunities	Regional Opportunities	22**	-

*Four (4) interchanges (10 approaches) are under evaluation in other studies

**Ten (10) opportunities in the near-term and 12 opportunities in later years

Implementing the Observations

- *All of the solution locations have opportunities for meaningful improvements!*
- These findings are intended to inform project scoping and programming decisions along with key highway investment principles
  - Preservation projects should be used as a catalyst for mobility projects
  - Mobility investments should be made in lower cost projects that produce high benefits and avoid exceeding the point of diminishing returns
- Funding plans, funding decisions, and project priorities will be proposed by MnDOT and the Metropolitan Council separate from this study process

Thank you!

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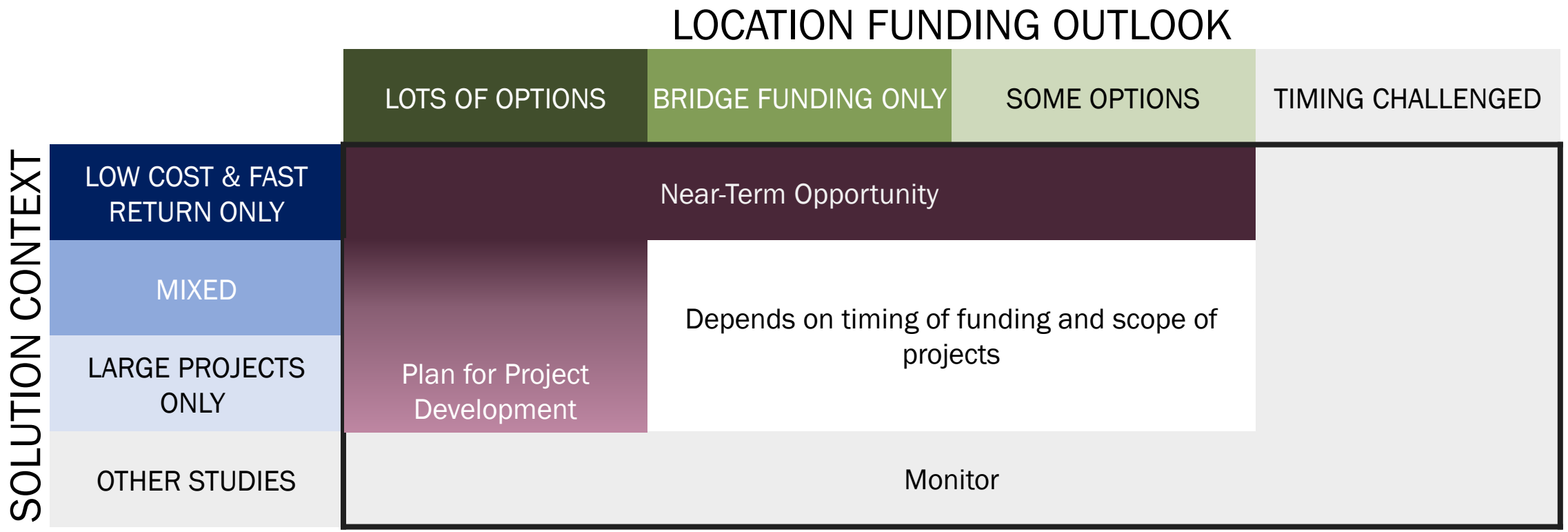
Right-Sized Solution Context

Low Cost & Fast Return Only	Only low cost & fast return projects identified
Mixed	A mixture of low, medium, and high cost projects identified
Large Projects Only	Only high cost projects identified
Other Studies	Solutions being developed in other studies
Solved elsewhere	Issue resolved by a solution in another approach

Location Funding Outlook

Lots of Options	Has a bridge (BRIM) project planned in the current revenue scenario and something else (pavement (CHIP), TPP, and/or STIP).
Bridge Funding Only	Has a bridge (BRIM) project planned in the current revenue scenario but no pavement work planned.
Some Options	Has a pavement (CHIP), TPP, and/or STIP, but no bridge work planned.
Timing Challenged	Has STIP/TIP project but no future planned project in the current revenue scenario.

Right Sized Solution Context & Location Funding Outlook are related



Regional Opportunity Observations

Near-Term Opportunity	Location with near-term programming and low cost solution(s) with quick returns. A project here could be considered separately from or combined with known programming.
Plan for Project Development	Locations where the number (and/or scale) of solutions and funding opportunities necessitate a more detailed planning and programming effort.
Monitor	Locations with solutions being developed in other studies.