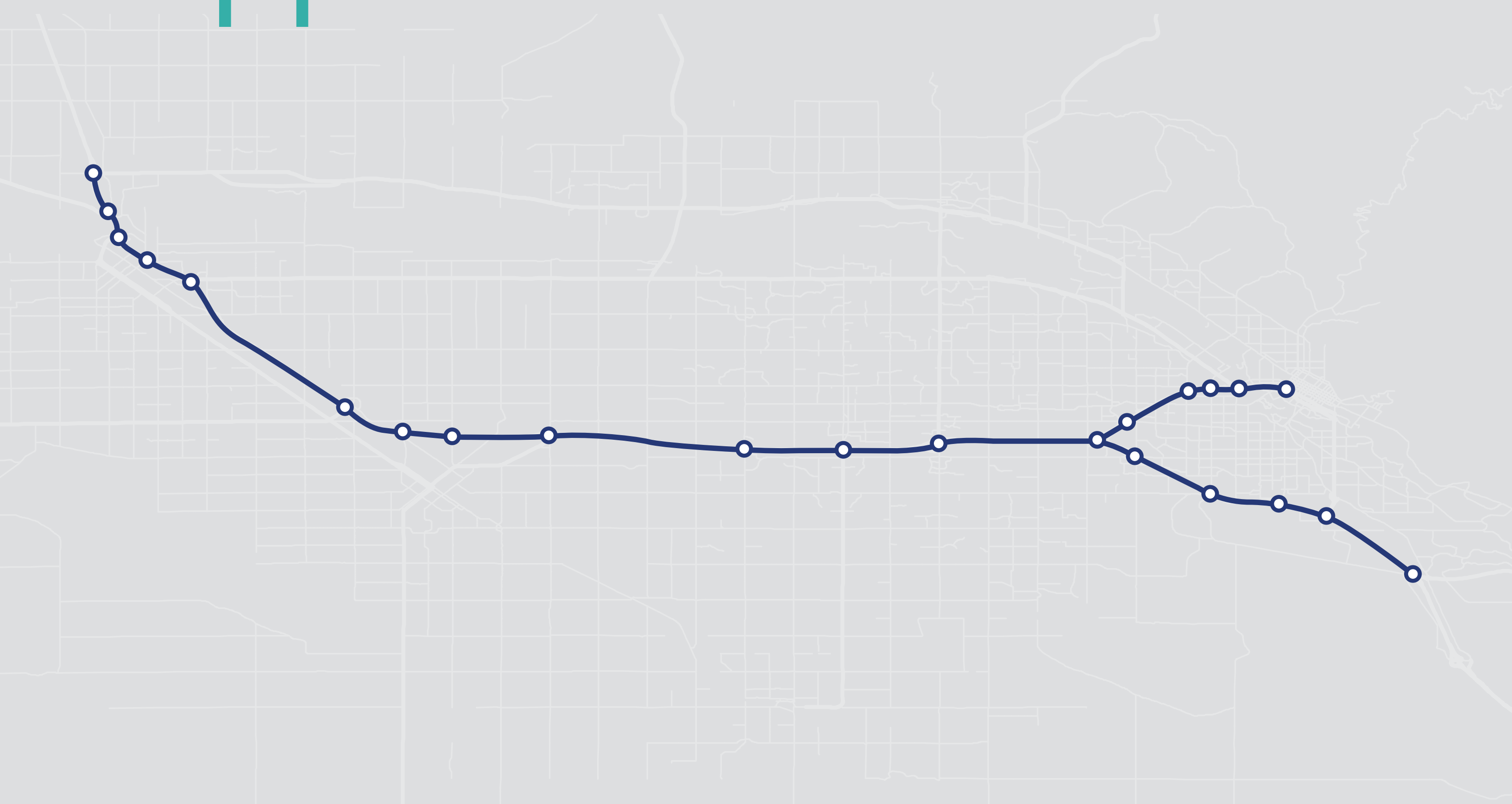
I-84 Corridor Operations Plan Appendix



COMPASS
COMMUNITY PLANNING ASSOCIATION
of Southwest Idaho

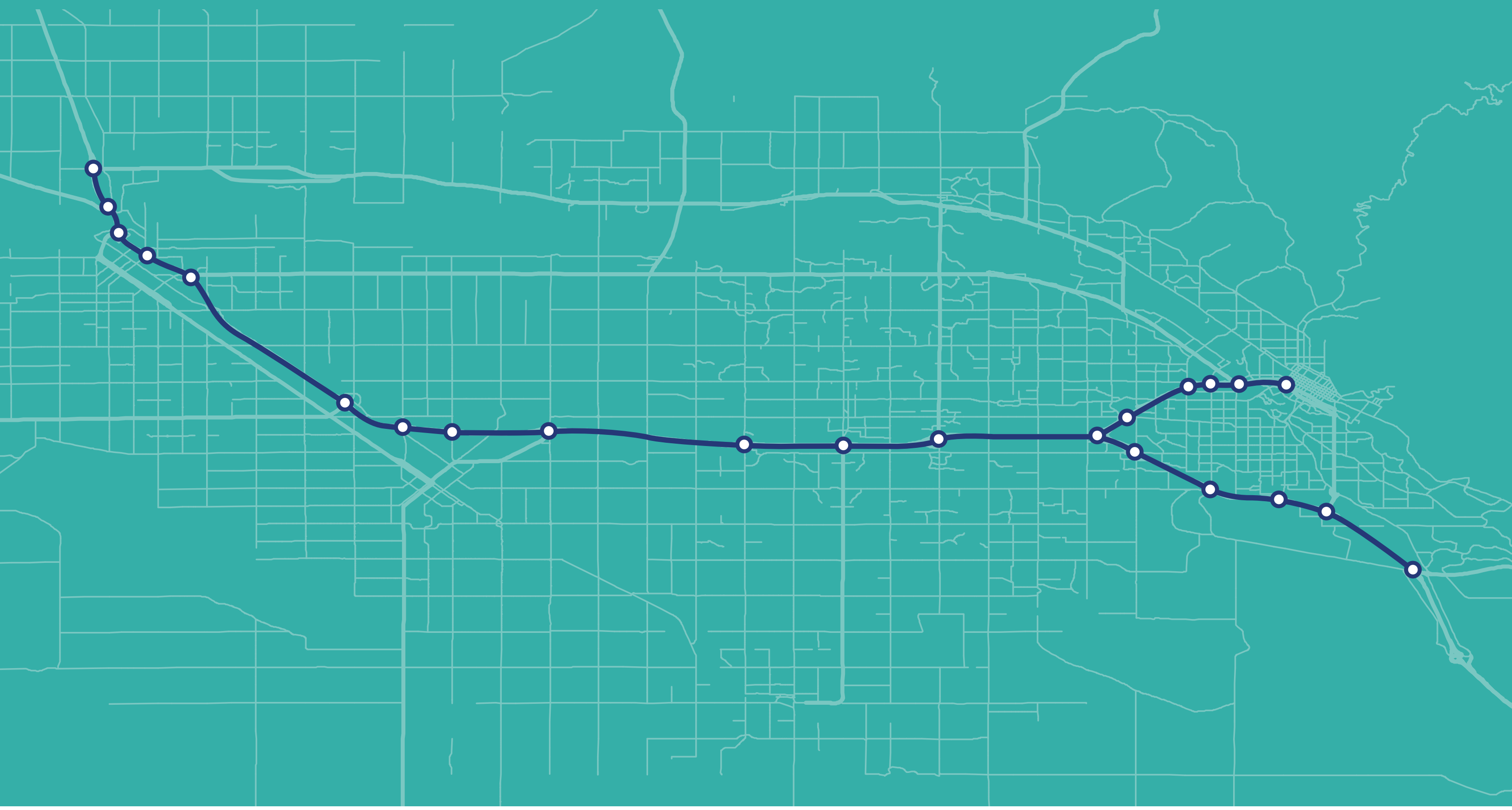
IDAHO TRANSPORTATION DEPARTMENT

DKS

IN ASSOCIATION WITH

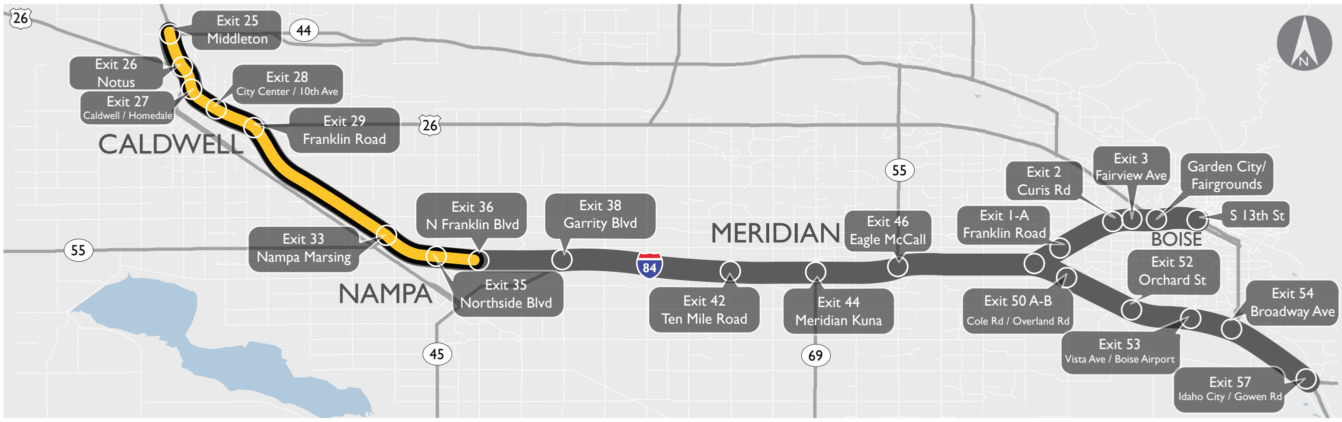
IBI

Existing Conditions Cut Sheets



SEGMENT A: EXIT 25 TO EXIT 36 ALONG I-84

MIDDLETON (HIGHWAY 44) TO NORTH FRANKLIN BOULEVARD



KEY FINDINGS

This segment experiences the highest heavy vehicle percentages along the corridor in both directions.

Between 2015 to 2019, this segent experienced the highest number of crashes that resulted in a serious injury. Of the total 717 mainline (non-ramp) crashes, 46% of the crashes were rear-end related and 15% were within a workzone area.

This segment has the second highest total of incidents from the State Comm records along the study corridor.

Common stakeholder comments along this segment include significant construction (particularly between Exit 33 and 38) that are causing delays and concerns regarding high speed vehicles merging with slower traffic.

CHALLENGES

Construction projects in this segment impact capacity, speed and safety concerns:

> Franklin Rd Exit 29 to Karcher/Midland Exit 33: widening an additional travel lane in each direction resulted in reducing speed limit to 55 mph and traffic reduced to 1 lane overnight.

>Northside Blvd Interchange project: bridge improvements will results in nighttime closures.

The Karcher Road Interchange area (MP 33) has a high number of incidents and is also the location of some the longest duration bottlenecks during both peaks, indicating that these incidents are related to congestion.

DATA

SEGMENT A

11 miles in length
8 interchanges
2 - 3 Lanes
65 Posted Speed Limit

EASTBOUND

AADT (2019): 32,500
Heavy Vehicles: 18%

Average Speed (2018-2020)
59 mph AM Peak
63 mph PM Peak

WESTBOUND

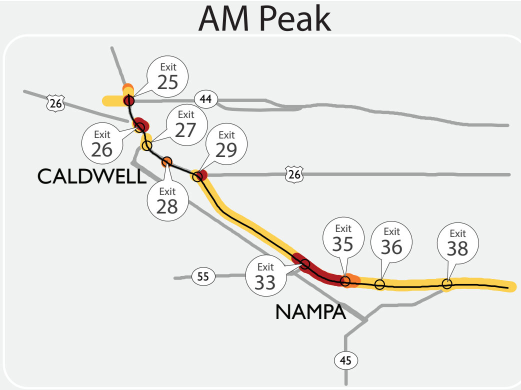
AADT (2019): 30,900
Heavy Vehicles: 16%

Average Speed (2018 -2020)
65 mph AM Peak
62 mph PM Peak

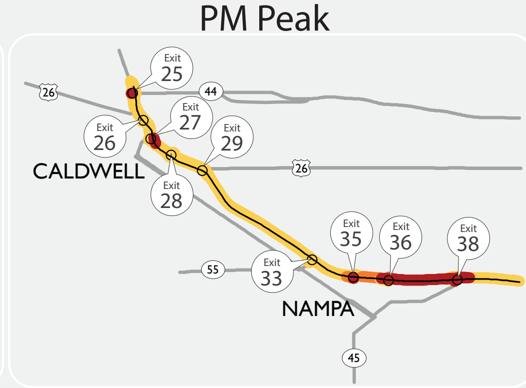
CONGESTION

Level of Congestion (2019)
- High
- Medium
- Low
- Ramp Location
- Study Corridor

AM Peak



PM Peak



SEGMENT A: SAFETY DATA

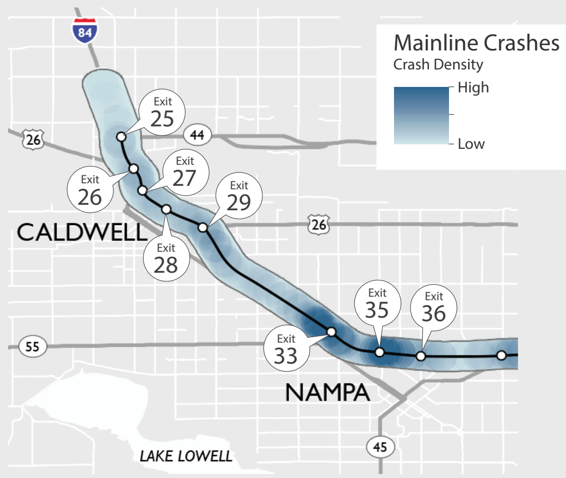
EASTBOUND

Crash Data (2015-2019)

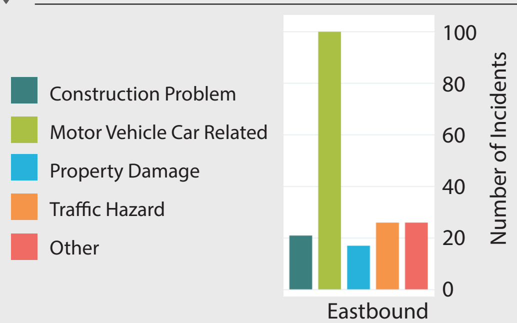
Total Mainline (non-ramp) **416**

3	Fatal
38	Serious Injury (A Injury)
52	Non-Incapacitating Injury (B Injury)
168	Possible Injury (C Injury)
155	Property Damage Only

Heat Map Mainline Crashes Eastbound



Incidents/ Hazards Log (2018-2020)



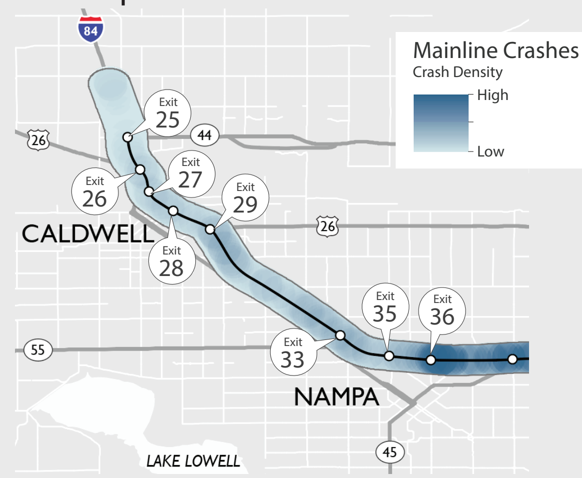
WESTBOUND

Crash Data (2015-2019)

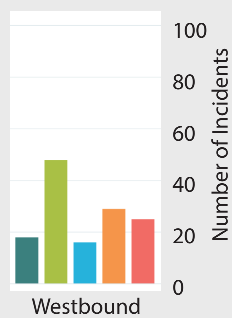
Total Mainline (non-ramp) **301**

9	Fatal
15	Serious Injury (A Injury)
42	Non-Incapacitating Injury (B Injury)
91	Possible Injury (C Injury)
144	Property Damage Only

Heat Map Mainline Crashes Westbound

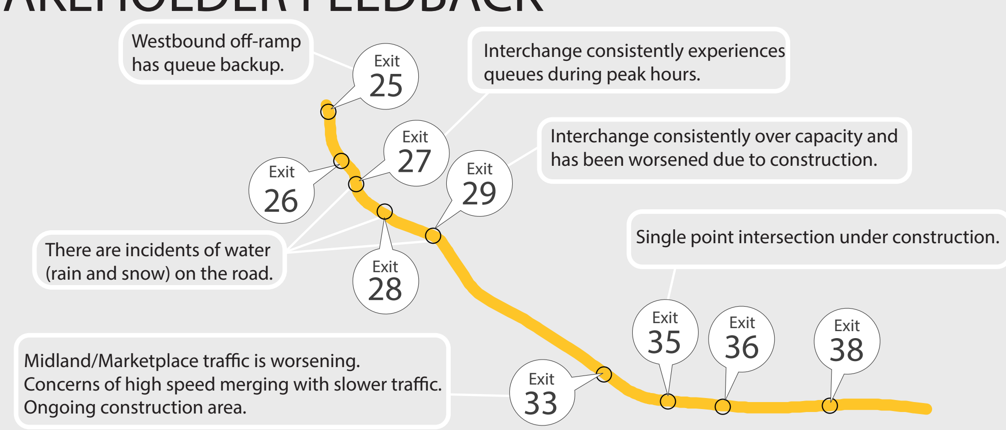


Incidents/ Hazards Log (2018-2020)



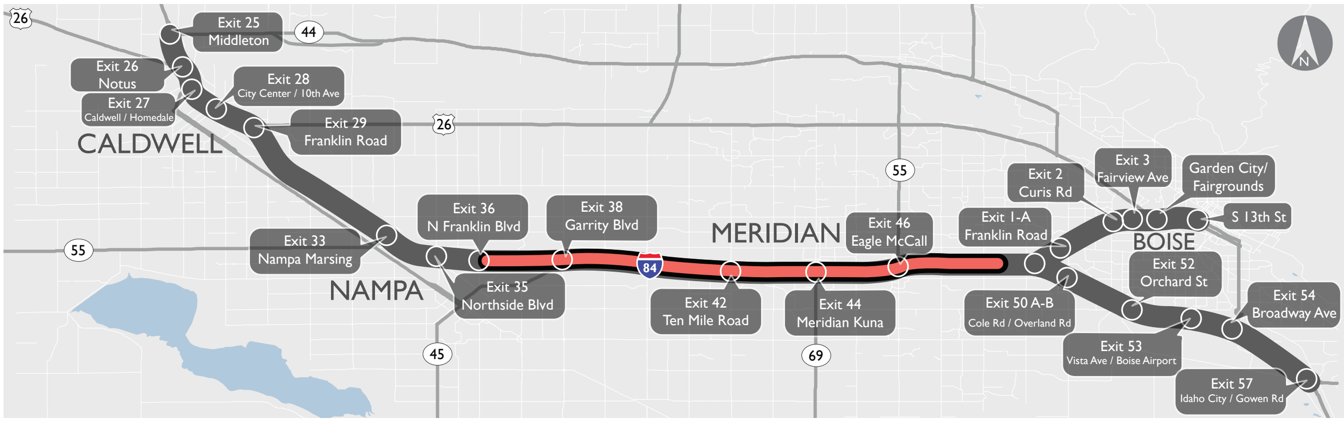
The highest non-collision and non-traffic hazard incident is "Construction Problem", likely indicating recurring issues with the current construction in this segment.

STAKEHOLDER FEEDBACK



SEGMENT B: EXIT 36 TO MILEPOST 48.4 ALONG I-84

NORTH FRANKLIN BOULEVARD TO MILEPOST 48.4 (END OF WESTBOUND DROP LANE)



KEY FINDINGS

This segment experiences the highest average annual daily traffic along the corridor in both directions.

Between 2015 to 2019, this segment experienced the highest number of crashes. Of the total 1,304 mainline (non-ramp) crashes, 56% of the crashes were rear-end related and 13% were within a workzone area.

This segment has the second highest total of incidents from the State Comm records along the study corridor.

Common stakeholder comments along this segment include traffic concerns caused by the Amazon facility near the Garrity Exit 38 and the morning congestion eastbound that is causing queues that spillback on to the interstate (Exit 42 and 46). Transit also experiences congestion along this corridor that sometimes forces them to use surface streets.

CHALLENGES

Construction projects in this segment impact capacity, speed and safety concerns:

> Karcher Rd/ Midland Exit 33 to Franklin Exit 36

This segment experienced a high number of incidents at interchange areas, in particular at Franklin Blvd (Exit 36), Garrity Rd (Exit 38), Ten Mile Road (Exit 42) and Eagle Road (Exit 46).

DATA

SEGMENT B

12.4 miles in length

5 interchanges

3-4 Lanes

65 Posted Speed Limit

EASTBOUND

AADT (2019)

63,900 — Heavy Vehicles 10%

Average Speed (2018-2020)

60 mph AM Peak

67 mph PM Peak

WESTBOUND

AADT (2019)

63,800 — Heavy Vehicles 12%

Average Speed (2018-2020)

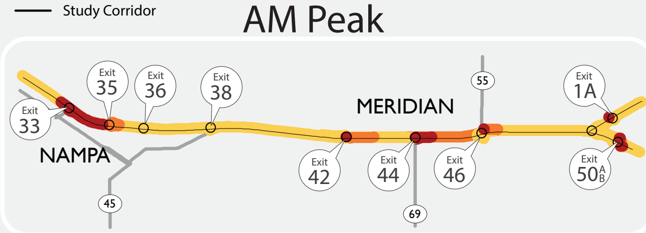
67 mph AM Peak

54 mph PM Peak

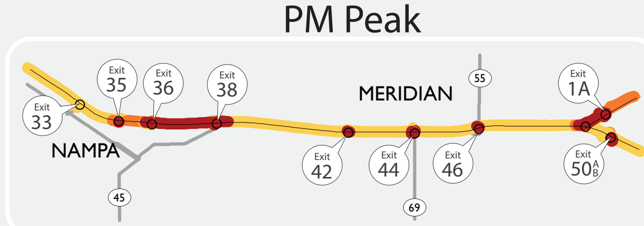
CONGESTION

Level of Congestion (2019)
- High
- Medium
- Low
- Ramp Location
- Study Corridor

AM Peak



PM Peak



SEGMENT B: SAFETY DATA

EASTBOUND

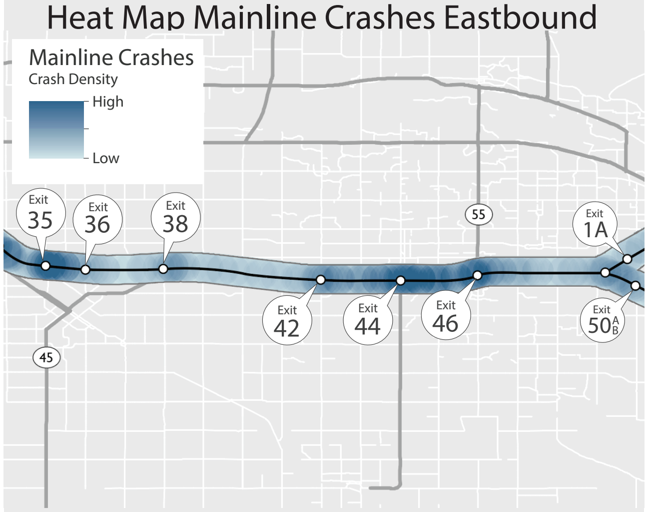
Crash Data (2015-2019)

Total Mainline (non-ramp)

526

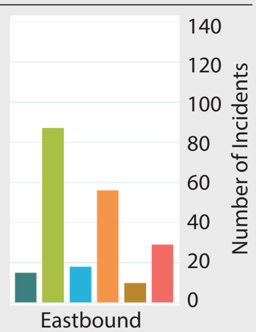
- 5 Fatal
- 18 Serious Injury (A Injury)
- 76 Non-Incapacitating Injury (B Injury)
- 227 Possible Injury (C Injury)
- 200 Property Damage Only

Heat Map Mainline Crashes Eastbound



Incidents/ Hazards Log (2018-2020)

- Construction Problem
- Motor Vehicle Car Related
- Property Damage
- Traffic Hazard
- Water Over the Road
- Other



WESTBOUND

Crash Data (2015-2019)

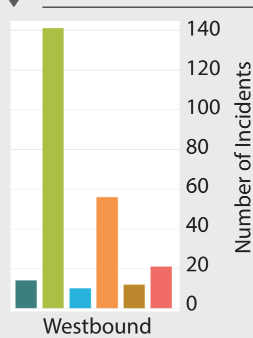
Total Mainline (non-ramp)

778

- 3 Fatal
- 33 Serious Injury (A Injury)
- 113 Non-Incapacitating Injury (B Injury)
- 337 Possible Injury (C Injury)
- 292 Property Damage Only

Heat Map Mainline Crashes Westbound

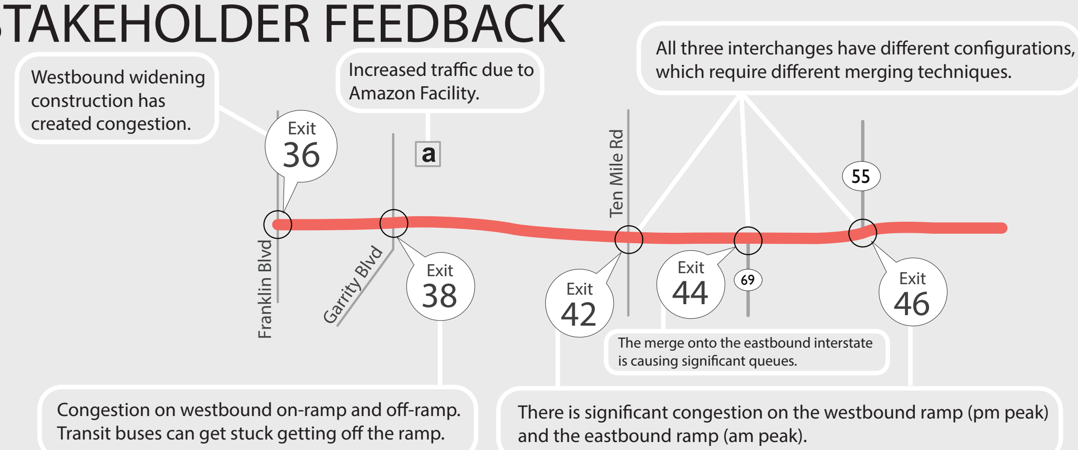
Incidents/ Hazards Log (2018-2020)



This segment contains a number of high incident interchange areas, indicating that weaving and merging actions contribute to the operations issues. The highest incident interchange locations include:

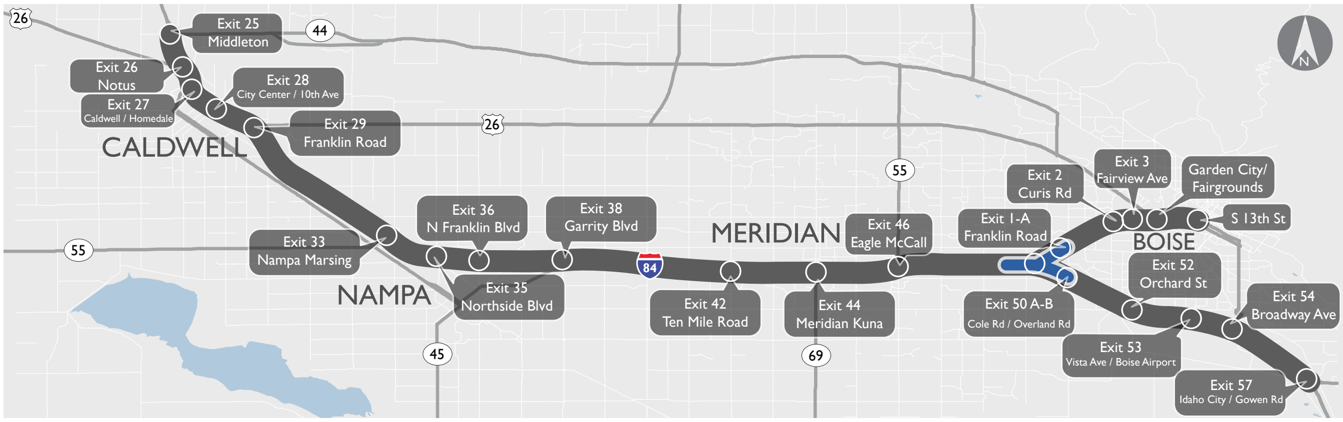
- Franklin Blvd (Exit 36)
- Garrity Road (Exit 38)
- Ten Mile Road (Exit 42)
- Eagle Road (Exit 46)

STAKEHOLDER FEEDBACK



SEGMENT C: WYE INTERCHANGE

I-84 MILEPOST 48.4 (END OF WESTBOUND DROP LANE) TO COLE ROAD INTERCHANGE AND I-184 FRANKLIN INTERCHANGE



KEY FINDINGS

Between 2015 to 2019, this segment experienced a total of 296 mainline (non-ramp) crashes. Of the total, 53% of the crashes were rear-end related and 20% were side-swipe related. The top contributing factors were reported following too close (41%) and improper lane change (14%).

Stakeholders from Valley Regional Transit expressed significant transit service concerns regarding delays while travelling through this segment. In particular, there are concerns of congestion at the Franklin Road merge to I-184 and Exit 50 A-B that are forcing transit to use surface streets.

CHALLENGES

There is a high number of merging and diverting areas in this segment as travelers exit I-84 to I-184 and also exiting 1-184 westbound to both east and westbound I-84.

Transit service needs to efficiently travel through the Wye interchange.

DATA

SEGMENT C

2.5 miles in length
3 interchanges
3-4 Lanes
65 Posted Speed Limit

EASTBOUND

AADT (2019): 58,700
Heavy Vehicles: 14%

Average Speed (2018-2020)
62 mph AM Peak
62 mph PM Peak

WESTBOUND

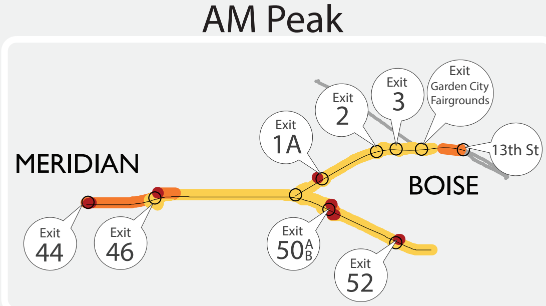
AADT (2019): 42,800
Heavy Vehicles: 13%

Average Speed (2018-2020)
61 mph AM Peak
47 mph PM Peak

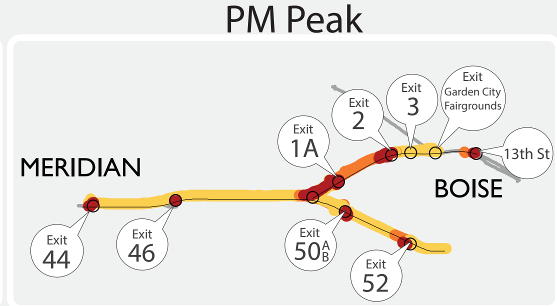
CONGESTION

Level of Congestion (2019)
- High
- Medium
- Low
- Ramp Location
- Study Corridor

AM Peak



PM Peak



SEGMENT C: SAFETY DATA

EASTBOUND

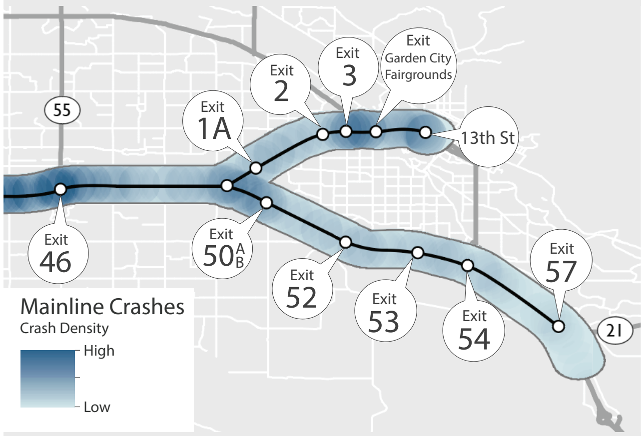
Crash Data (2015-2019)

Total Mainline (non-ramp)

80

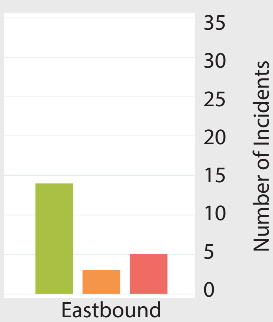
- 0 Fatal
- 5 Serious Injury (A Injury)
- 13 Non-Incapacitating Injury (B Injury)
- 22 Possible Injury (C Injury)
- 40 Property Damage Only

Heat Map Crashes Eastbound



Incidents/ Hazards Log (2018-2020)

- Motor Vehicle Car Related
- Traffic Hazard
- Other



WESTBOUND

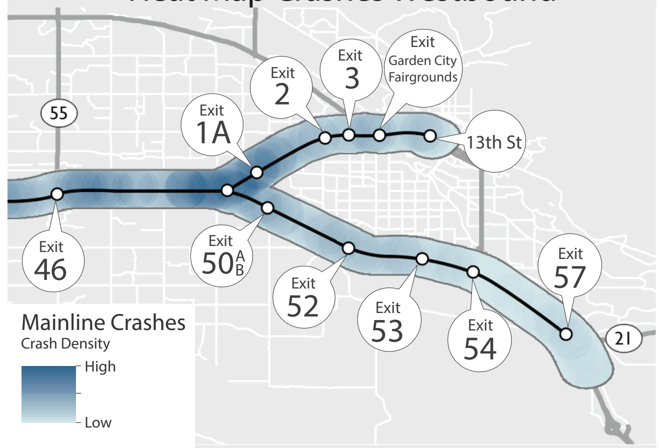
Crash Data (2015-2019)

Total Mainline (non-ramp)

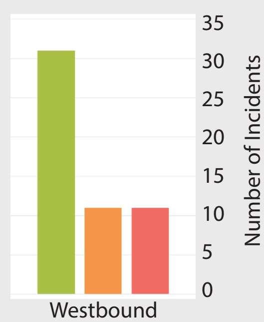
216

- 0 Fatal
- 10 Serious Injury (A Injury)
- 27 Non-Incapacitating Injury (B Injury)
- 86 Possible Injury (C Injury)
- 93 Property Damage Only

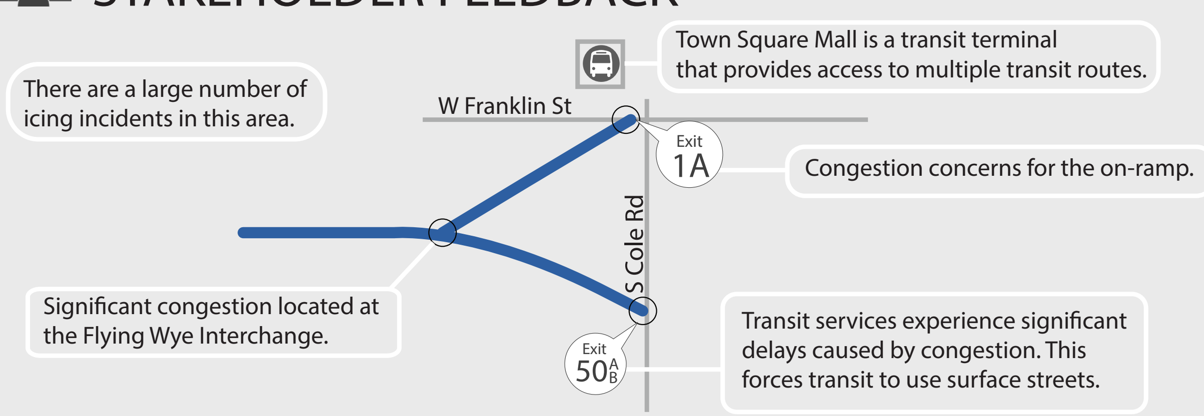
Heat Map Crashes Westbound



Incidents/ Hazards Log (2018-2020)

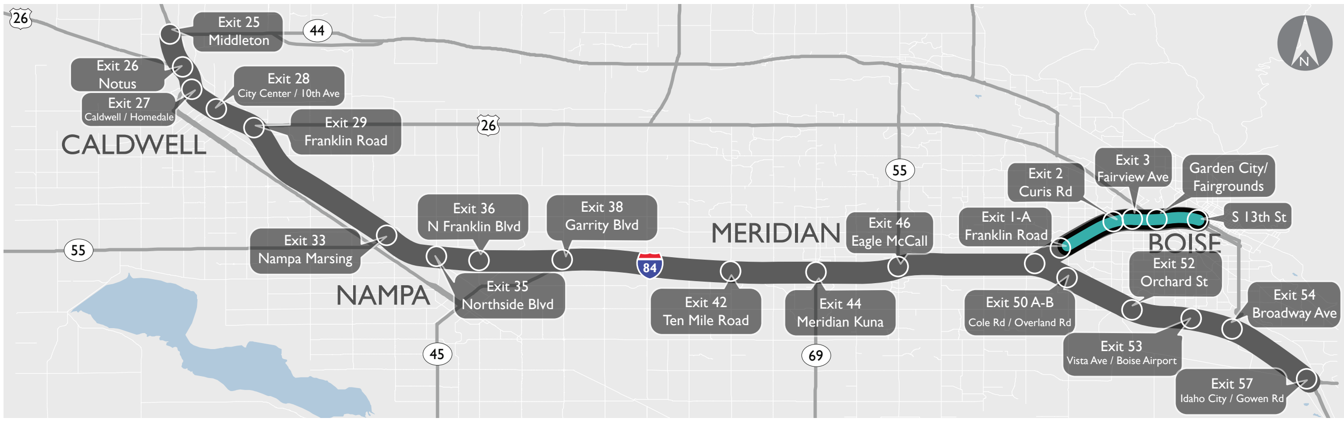


STAKEHOLDER FEEDBACK



SEGMENT D: EXIT 1-A TO SOUTH 13TH STREET ALONG I-184

FRANKLIN INTERCHANGE TO SOUTH 13TH STREET ALONG I-184



KEY FINDINGS

There is a gradual posted speed limit decrease from I-84 to downtown Boise (Exit at 13th St) along this segment.

Between 2015 to 2019, this segment experienced a total of 291 mainline (non-ramp) crashes. 54% of the crashes were rear-end related and 20% involved a vehicle hitting a concrete traffic barrier. One in five crashes were reported on road surface conditions that were non-dry (i.e. snow, water, ice etc.).

This segment reported a significant amount of "water over the road" incidents that could potentially indicate geometric issues contributing to traffic operations during weather events.

Stakeholders often mentioned that they would avoid travelling on this section to avoid Boise traffic.

CHALLENGES

- Based on 2018-2019 data, there is significant congestion causing delay in the PM peak period along this segment. In particular, there is a significant bottleneck at Franklin Road (Exit 1-A). The Franklin Road (Exit 1-A) is the main exit to reach Town Square Mall, which is also a transit terminal.

DATA

SEGMENT D

3.7 miles in length

3* interchanges
*(multiple ramp locations)

3 Lanes

35-65 Posted Speed Limit

EASTBOUND

AADT (2019)

46,000 — Heavy Vehicles 4%

Average Speed (2018-2020)

59 mph AM Peak
63 mph PM Peak

WESTBOUND

AADT (2019)

47,600 — Heavy Vehicles 5%

Average Speed (2018-2020)

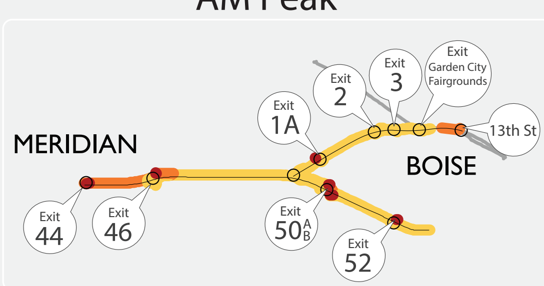
65 mph AM Peak
62 mph PM Peak

CONGESTION

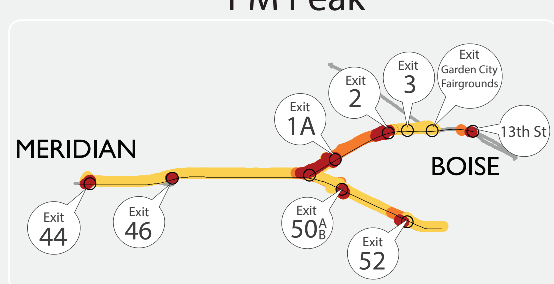
Level of Congestion (2019)

- High
- Medium
- Low
- Ramp Location
- Study Corridor

AM Peak



PM Peak



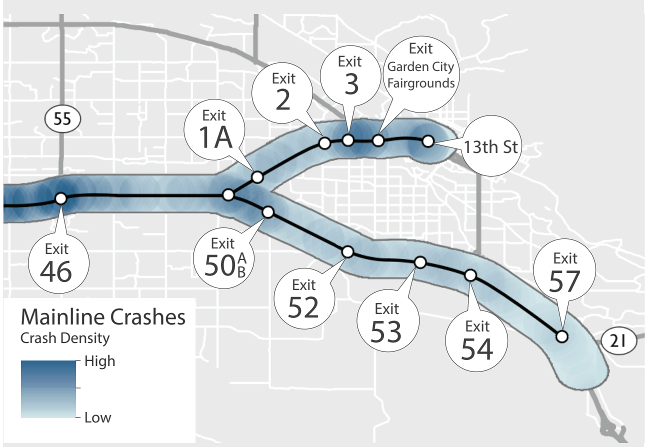
SEGMENT D: SAFETY DATA

EASTBOUND
Crash Data (2015-2019)

Total Mainline (non-ramp)
140

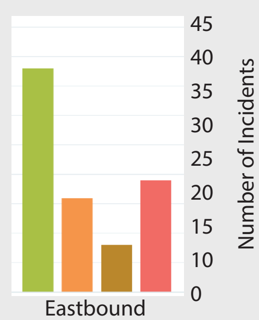
- 1 Fatal
- 5 Serious Injury (A Injury)
- 18 Non-Incapacitating Injury (B Injury)
- 54 Possible Injury (C Injury)
- 62 Property Damage Only

Heat Map Crashes Eastbound



Incidents/ Hazards Log (2018-2020)

- Motor Vehicle Car Related
- Traffic Hazard
- Water Over the Road
- Other

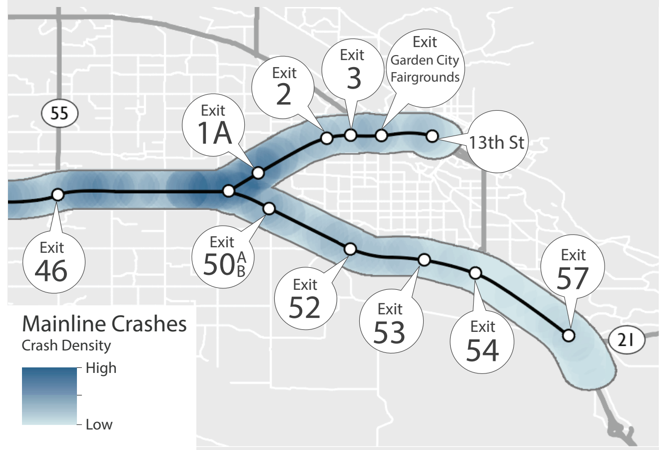


WESTBOUND
Crash Data (2015-2019)

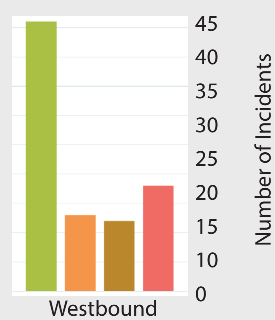
Total Mainline (non-ramp)
151

- 1 Fatal
- 9 Serious Injury (A Injury)
- 22 Non-Incapacitating Injury (B Injury)
- 57 Possible Injury (C Injury)
- 62 Property Damage Only

Heat Map Crashes Westbound



Incidents/ Hazards Log (2018-2020)



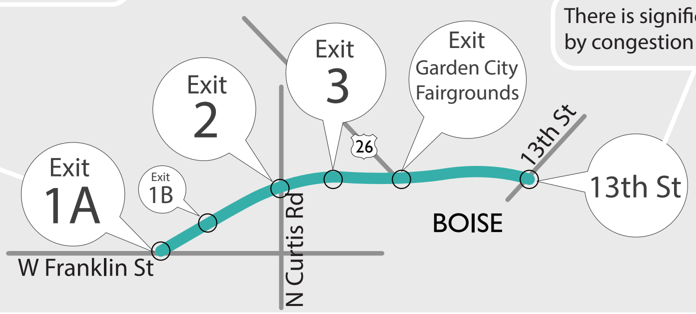
Along Segment D the only significant reported incident from the State Comm logs (other than motor vehicle collision or traffic hazard) is "Water over the Road." This indicates that geometric issues could be contributing to traffic operations during extreme weather events.

STAKEHOLDER FEEDBACK

During special events, there is congestion along arterial streets leading up to the interchange areas.

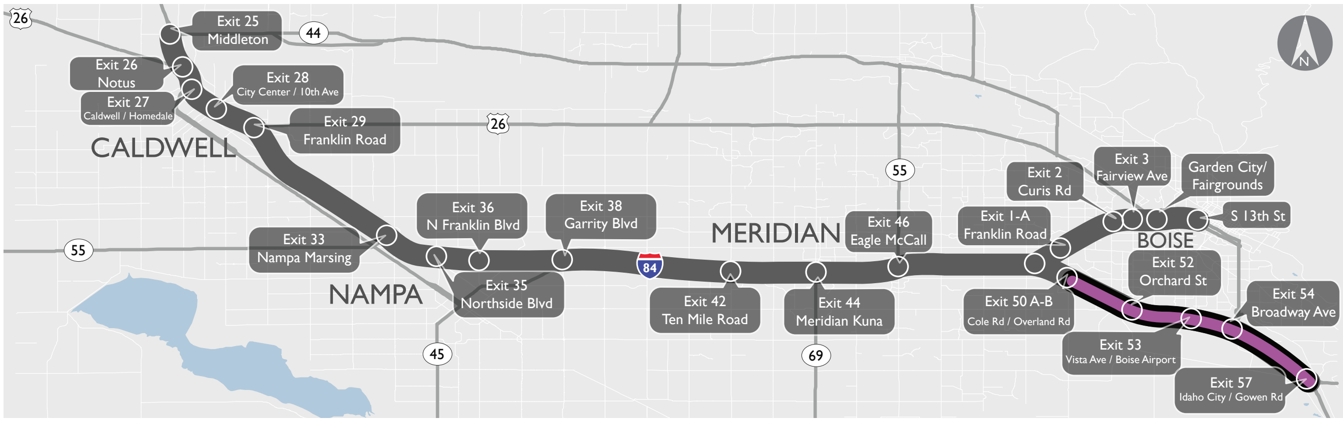
There is significant delays caused by congestion in downtown Boise.

There are concerns regarding the westbound evening congestion. There is only one lane used to exit 1-A.



SEGMENT E: EXIT 50 TO EXIT 57 ALONG I-84

COLE ROAD INTERCHANGE TO GOWEN ROAD INTERCHANGE



KEY FINDINGS

Between 2015 to 2019, this segment experienced a total of 230 mainline (non-ramp) crashes. 30% of the crashes were rear-end related and 20% involved a vehicle hitting a concrete traffic barrier. The most common contributing circumstance for all mainline crashes was reported 'failed to maintain lane' (19%).

Stakeholders have commented that Exit 50 experiences significant congestion that has an impact on transit operations. There is a need to improve transit travelling through Exit 50 and the Wye Interchange.

CHALLENGES

- Based on 2018-2019 travel time data, travellers along this segment experience congestion near the interchange locations.
  In particular, transit operations have been significantly impacted by delays near Exit 50.

DATA

SEGMENT E

- 6.8 miles in length
- 5 interchanges
- 3-4 Lanes
- 65 Posted Speed Limit

EASTBOUND

AADT (2019)

40,900 — Heavy Vehicles 13%

Average Speed (2018-2020)

59 mph AM Peak
63 mph PM Peak

WESTBOUND

AADT (2019)

42,700 — Heavy Vehicles 13%

Average Speed (2018-2020)

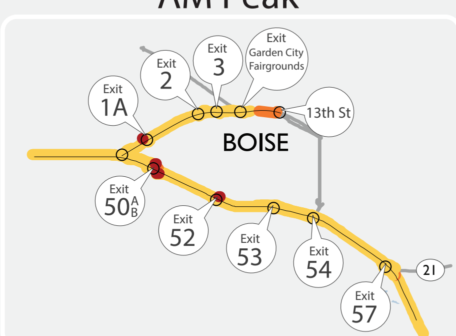
65 mph AM Peak
62 mph PM Peak

CONGESTION

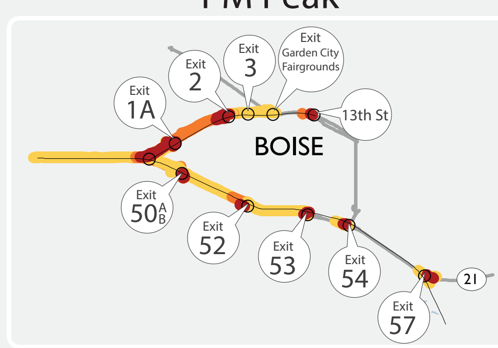
Level of Congestion (2019)

- High
- Medium
- Low
- Ramp Location
- Study Corridor

AM Peak



PM Peak



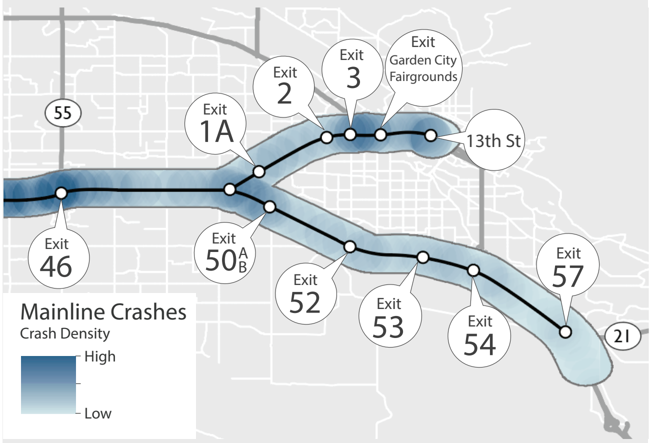
SEGMENT E: SAFETY DATA

EASTBOUND
Crash Data (2015-2019)

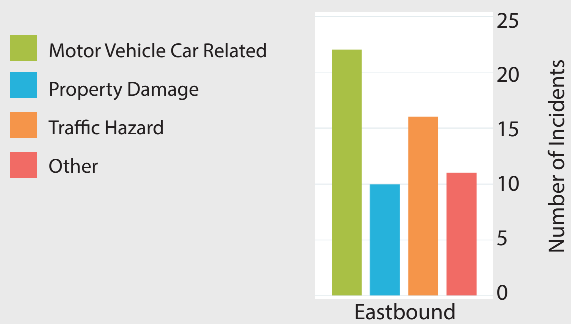
Total Mainline (non-ramp)
103

- 0 Fatal
- 8 Serious Injury (A Injury)
- 21 Non-Incapacitating Injury (B Injury)
- 29 Possible Injury (C Injury)
- 45 Property Damage Only

Heat Map Crashes Eastbound



Incidents/ Hazards Log (2018-2020)

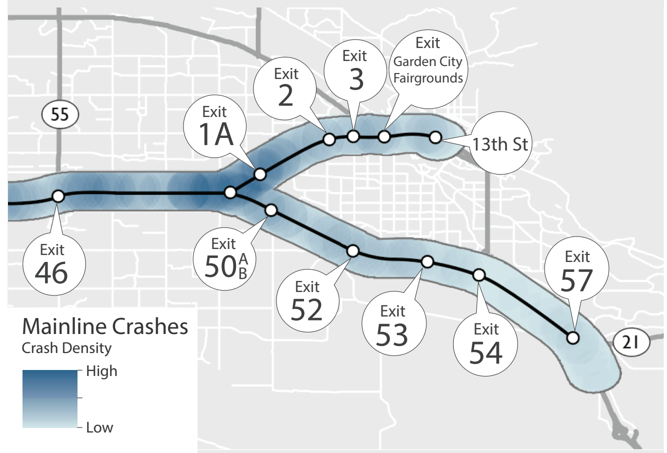


WESTBOUND
Crash Data (2015-2019)

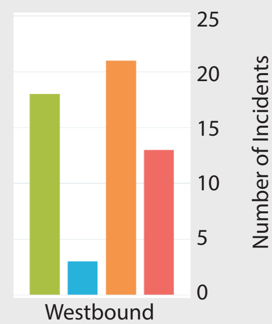
Total Mainline (non-ramp)
127

- 2 Fatal
- 14 Serious Injury (A Injury)
- 19 Non-Incapacitating Injury (B Injury)
- 37 Possible Injury (C Injury)
- 55 Property Damage Only

Heat Map Crashes Westbound

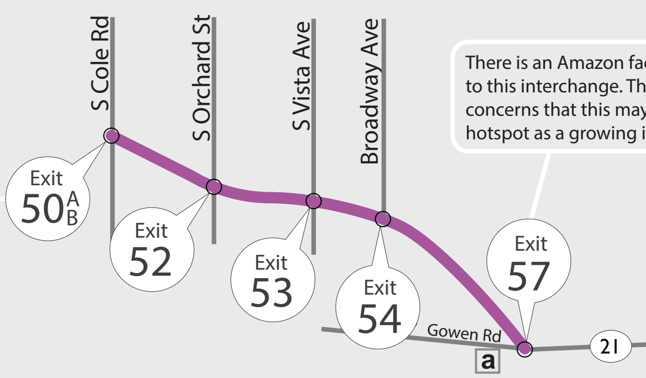


Incidents/ Hazards Log (2018-2020)



STAKEHOLDER FEEDBACK

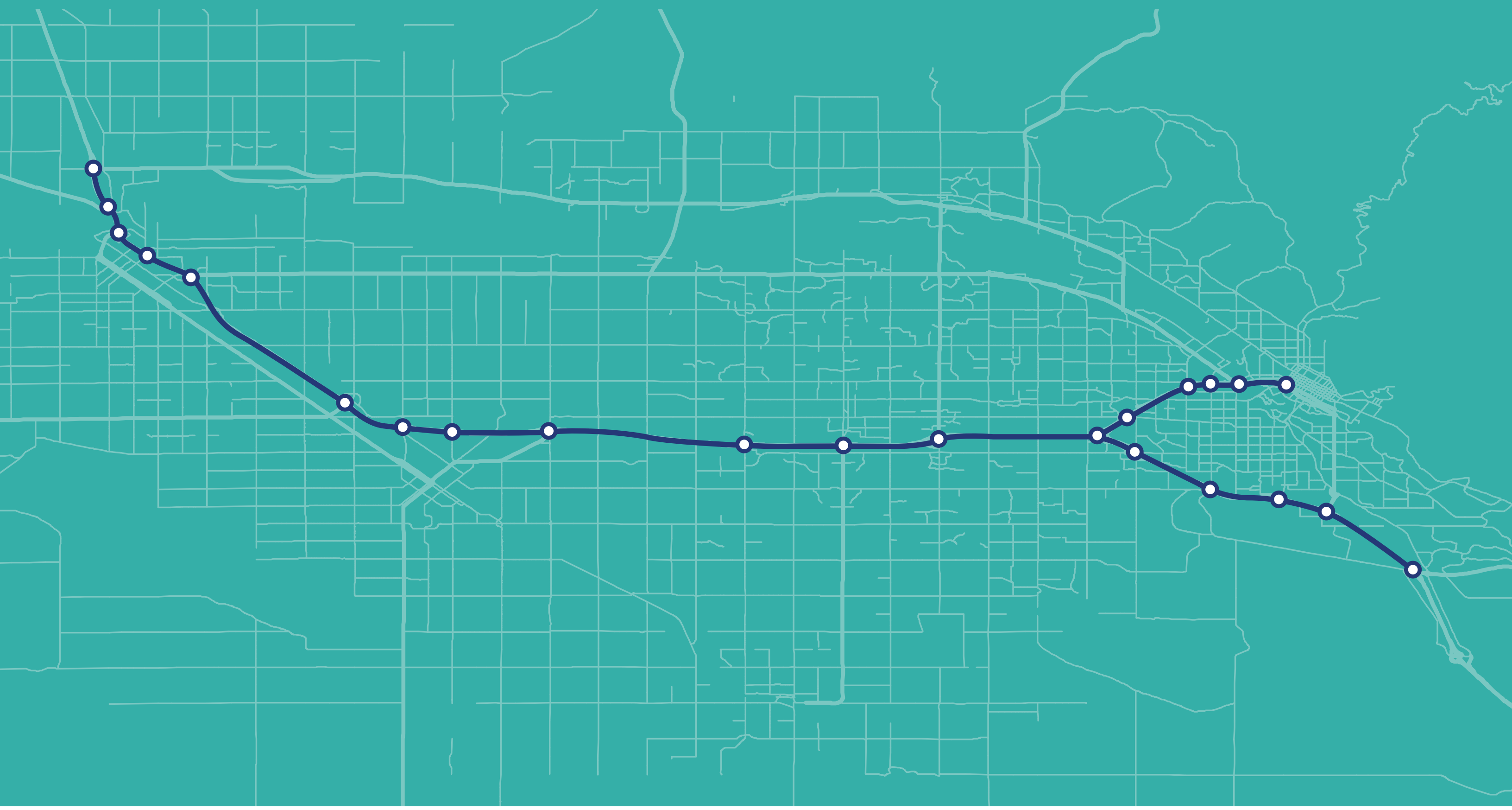
There is a need to improve transit reliability and reduce congestion between Exit 50 and the Wye Interchange.
Perhaps consider traffic responsive signals to help flush the ramp congestion.



There is an Amazon facility next to this interchange. There are future concerns that this may become a hotspot as a growing industrial area.

Consider ways to communicate to travelers that there may be congestion ahead, which will allow them to take a break before they reach the area.

First Level Screening Methodology



I-84 CORRIDOR OPERATIONS PLAN – FIRST LEVEL SCREENING METHODOLOGY

AUGUST 4TH, 2021

COMPASS
COMMUNITY PLANNING ASSOCIATION
of Southwest Idaho

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INTRODUCTION

This memorandum documents the methodology used for the first level screening process to select approximately ten strategies from the initial toolbox of strategies. The initial toolbox of strategies consisted of 39 strategies, and they were presented to the stakeholders for their feedback at a June 2021 stakeholder meeting.

The project team developed a methodology to score each strategy based on the project goals and stakeholder feedback. This memorandum outlines the steps taken to determine which strategies will advance to the next phase of the study and evaluation.

METHODOLOGY

All 39 toolbox strategies were evaluated based on the existing needs of the I-84 corridor, how well they met project goals, related improvements on similar facilities in other parts of the country, and professional experience with the strategies. Based on those references, unweighted scores were assigned to each strategy.

Once the unweighted scores were assigned to strategies, several weightings were applied based on stakeholder feedback. In the June 2021 stakeholder meeting, stakeholders voted for strategies that they thought would most benefit the region. Stakeholders also distributed 100 points among the three goals to the I-84 Corridor Operations Plan. Those goals include:

- Goal 1: Improve safety of the I-84/I-184 Corridor
- Goal 2: Respond to regional growth by maximizing capacity and reliability of I-84/I-184 for travelers and freight.
- Goal 3: Manage I-84/I-184 as part of an integrated transportation system, including state highways, arterials, and transit.

The following sections go into greater detail on the unweighted scores, goal utility, weighting of regionally preferred strategies, and adjustment of raw scores with weighting included. Figure 1 provides an overview of first level screening process.

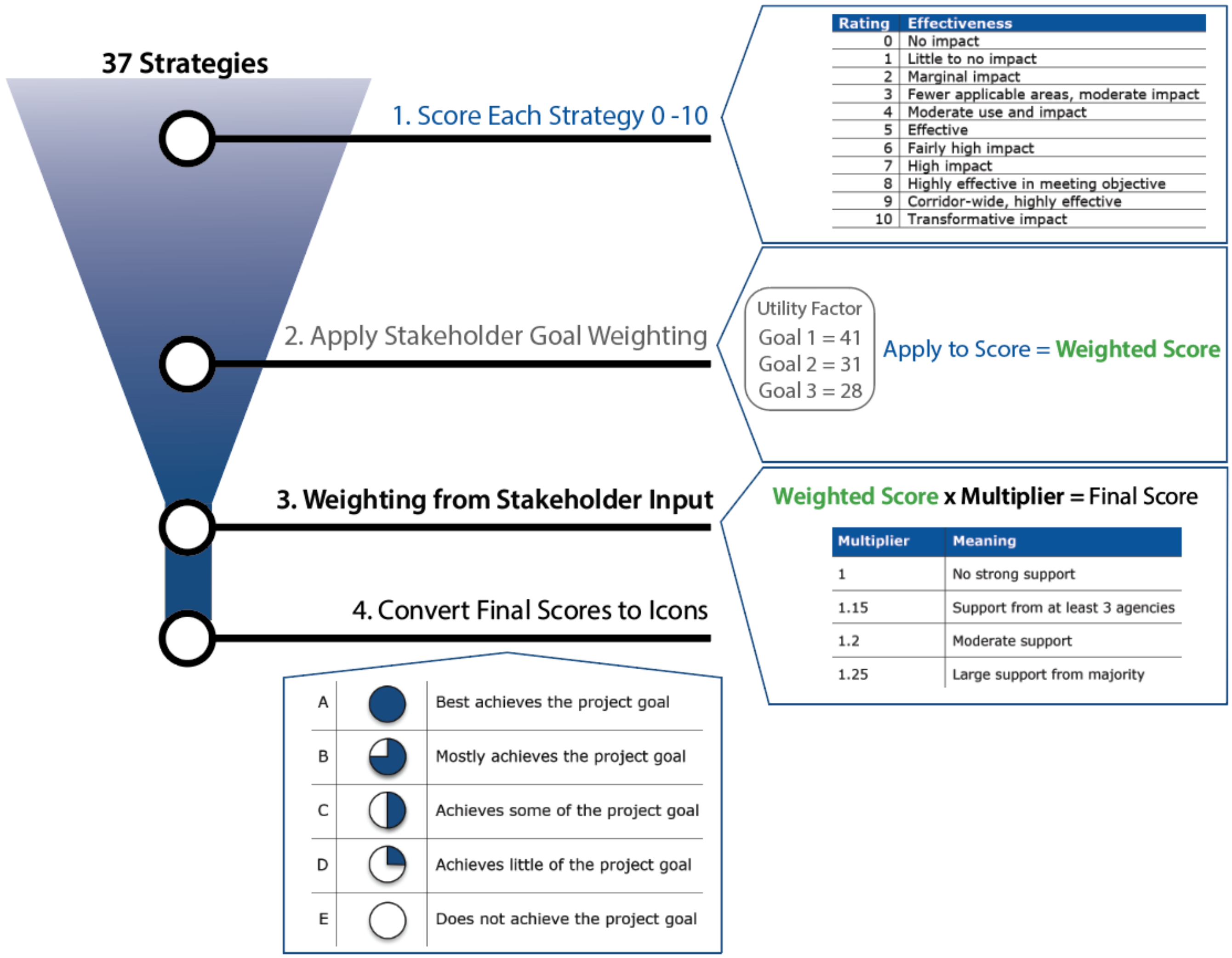


Figure 1: Overview of First Level Screening Process

SCORING STRATEGIES BASED ON OBJECTIVES

Each strategy was ranked 0 through 10 based on how adequately it met each objective, as described in Table 1. The initial ratings were supported by existing knowledge of its benefits and findings from studies across the nation supported by the Federal Highway Administration (FHWA) and State Departments of Transportation (DOTs). The strategies' range of applicability was considered when analyzing their performance and impact as a corridor-wide strategy. Strategies localized to specific locations or areas of non-recurring traffic, such as emergency evacuations (via contraflow), winter weather management, and work zone tools, were ranked lower due to their narrow impact. Indirect impacts were also gauged during the rankings and typically fell within the 1 through 4 scoring range, for example, decreased frequency of collisions due to heightened situational awareness.

Table 1: Rating Scale

Rating	Effectiveness
0	No impact
1	Little to no impact
2	Marginal impact
3	Fewer applicable areas, moderate impact
4	Moderate use and impact
5	Effective
6	Fairly high impact
7	High impact
8	Highly effective in meeting objective
9	Corridor-wide, highly effective
10	Transformative impact

APPLYING STAKEHOLDER GOAL WEIGHTING

The utility of the goals was determined by the Phase 2 (Goals/Objectives & Strategies) Mural exercise (Mural is an online interactive meeting software) when stakeholders were asked to distribute 100 points among the three goals based on how important they were to the individual. The average for each goal was added as a factor to create the utility scores that encompassed the value of each goal.

Table 2: Goal Weighting Values

Goals	Utility Factor
Goal 1: Improved safety of the I-84/I-184 Corridor	41
Goal 2: Maximize capacity and reliability for all users of I-84/I-184	31
Goal 3: Manage I-84/I-184 as part of an integrated transportation system	28

WEIGHTING FROM STAKEHOLDER INPUT

Strategies with strong support from the Phase 1 (Current Conditions and Challenges) interviews and the Phase 2 Mural exercise were assigned incremental multipliers ranging from 1 to 1.25. The multipliers from the Mural exercise could receive up to a value of 1.25. Strategies supported highly during the interviews but not equally during the Mural exercise received multipliers at a maximum of 1.15. These factors were applied to the utility scores to create the weighted utility

Table 3: Stakeholder Support Multipliers

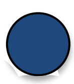
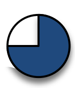
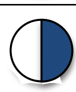
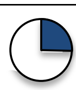
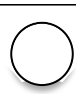
Multiplier	Meaning
1	No strong support
1.15	Support from at least 3 agencies
1.2	Moderate support
1.25	Large support from majority and in Mural

CONVERTING SCORES TO ICONS

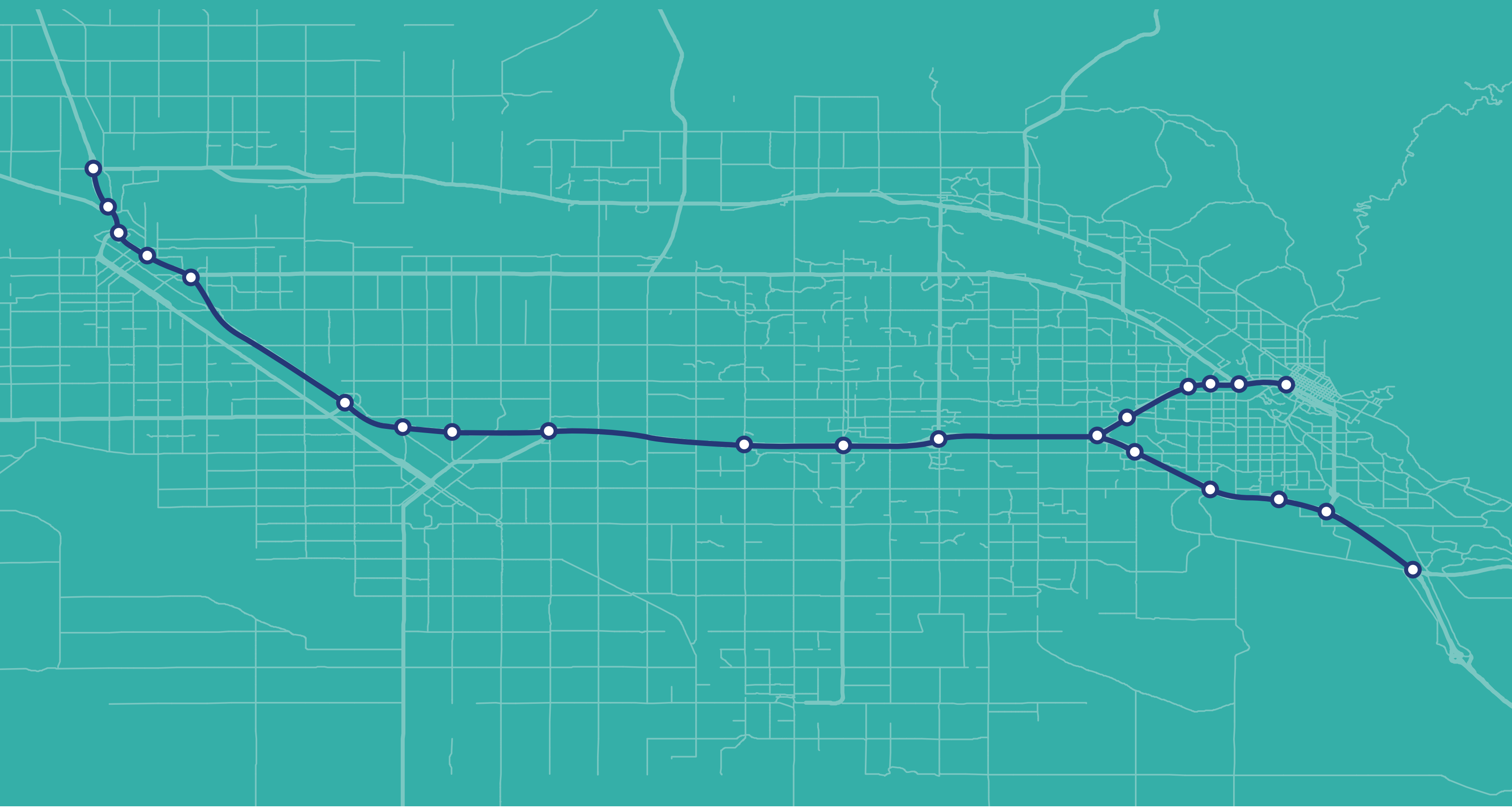
Visual scoring icons (shown below) will be used to convey the overall scores. Scores in each goal helped to confirm if overall scores reflected the beneficial use of strategies. Other considerations to better inform decision-making for the next level of screening includes relevant locations to deploy strategies and the current usage of strategies (existing and widely used, existing with room for improvement, or not used at all).

NEXT STEPS

Once the scores are finalized, the scores will be translated to Harvey Balls, which are round icons that can be used for visual communication. Each strategy will be presented to stakeholders via these icons to achieve buyoff on strategies to move forward to a more detailed second screening.

Score	Icon	Meaning
A		Best achieves the project goal
B		Mostly achieves the project goal
C		Achieves some of the project goal
D		Achieves little of the project goal
E		Does not achieve the project goal

First Level Screening



I-84 CORRIDOR OPERATIONS PLAN – TOOLBOX OF STRATEGIES INITIAL SCORING

AUGUST 20, 2021

COMPASS
COMMUNITY PLANNING ASSOCIATION
of Southwest Idaho

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IDAHO
TRANSPORTATION DEPARTMENT

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INTRODUCTION

The project team assembled an initial TSMO toolbox of strategies with the potential to meet the I-84 project goals along the corridor. The TSMO strategies toolbox includes 37 tactics, organized into six strategies:

- Traffic Management
- Incident and Emergency Management
- Road Weather Management
- Public Transportation
- Performance Measurement
- Work Zone Management

The screening process will allow the project team to narrow a full-range of TSMO tactics, to those that best meet the identified goals and needs for the I-84 corridor study area. The screening levels and applied criteria for each level are shown in the diagram below:

First Level Screening

Narrow to Approximately 10 Tactics from Initial Toolbox

Criteria: I-84 corridor goals

Second Level Screening

Narrow to 5 Tactics

Criteria: Operational benefits, feasibility, initial cost and on-going maintenance cost

Implementation Plan

-Advance recommended strategies to the Implementation Plan

DESIRED OUTCOMES

The purpose of this memo and the August stakeholder meeting is to present stakeholders with all 37 tactics and preliminary ratings for each tactic. The August meeting will narrow the 37 tactics to approximately 10 tactics. The selected tactics will move forward to the Second Level Screening Process, which involves more in-depth analysis and evaluation criteria.

In the June 2021 stakeholder meeting, stakeholders voted for tactics that they thought would most benefit the region and achieve the three goals to the I-84 Corridor Operations Plan. Those goals include:

Goal 1: Improve safety of the I-84/ I-184 Corridor.

Goal 2: Respond to regional growth by maximizing capacity and reliability of I-84/I-184 for travelers and freight.

Goal 3: Manage I-84/I-184 as part of an integrated transportation system, including state highways, arterials, and transit.

Following the stakeholder meeting, all 37 tactics were evaluated based on the existing needs of the I-84 corridor, how well they met project goals, how well similar improvements performed on similar facilities in other parts of the country, stakeholder feedback, and professional experience. Based on those references, each tactic was scored based on the following rating scale:

Color	Meaning
●	Best achieves the project goal
◕	Mostly achieves the project goal
◑	Achieves some of the project goal
◔	Achieves little of the project goal
○	Does not achieve the project goal

PRELIMINARY SCORING BASED ON PROJECT GOALS

The following tables present the 37 potential tactics, organized by the six strategies. Each tactic has a brief description and a rating for how well the tactic meets each goal. These preliminary ratings are all up for discussion in the upcoming stakeholder meeting.

Table 1. Traffic Management Strategy

Tactic No.	Tactic [location to be applied]	Description	How well does this tactic meet each goal			Overall Rating
			1	2	3	
	TRAFFIC MANAGEMENT					
1	Active Traffic Management (ATM) [Locations: I-184 and I-84 west of the Flying Wye]	Active traffic management improves the efficiency and safety of the transportation system through the use of technology. The technology detects road conditions and responds automatically by communicating with drivers using variable speed system, or traveler information systems.	◕	◔	○	◔
2	Active Traffic Management (Dynamic Lane Control) [Locations: I-184 and I-84 west of the Flying Wye]	Dynamic lane control (DLC) involves closing or opening individual traffic lanes, using DLC signs to provide advance notice, to safely merge traffic into adjoining lanes. Using DLC signs can incrementally direct drivers to reduce speeds and change lanes as necessary to ease congestion.	◕	◔	○	◔
3	Ramp Metering [Locations: exit 36 N Franklin Blvd, exit 38 Garrity Blvd, exit 42 Ten Mile Rd, exit 46 Eagle/McCall, and exit 44 Meridian/Kuna on-ramps]	Traffic signals on freeway ramps alternate between red and green to control the flow of vehicles entering the freeway. Metering rates can be altered based on freeway and on-ramp traffic conditions.	●	●	○	●
4	Expanding Traffic Surveillance (Cameras and Detection) [Locations: I-84 and I-184]	Monitor traffic operations in real-time using video cameras along the corridor that are controlled from a traffic management center (TMC). This tactic could be used in conjunction with providing real time information for both traveler information and incident management.	●	◕	●	●

Tactic No.	Tactic [location to be applied]	Description	How well does this tactic meet each goal			Overall Rating
			1	2	3	
5	Regional video and data sharing (monitoring and control) [Locations: I-84 and I-184]	This tactic aims to improve the collective understanding of the operation of the freeway system by sharing information between local system managers.	●	●	●	●
6	Roadside Traveler Information (Dynamic Message Signs) [Locations: I-84 and I-184	Dynamic Message Signs can warn drivers of approaching hazards on the roadway. Some examples of the types of warnings these systems can provide are road surface conditions, traffic conditions including queues, and obstacles or hazards.	◕	◕	◑	◕
7	Roadside Traveler Information (Dynamic Message Signs Travel Time Estimates) [Locations: Queue warning near exit 44 Meridian/Kuna and exit 38 Garrity Blvd]	Dynamic Message Signs can also be used as an effective way to provide traveler information that experience traffic congestion or traffic unreliability. Time-based messages allow drivers to make choices to help people know of potential delays, decide when to take alternative routes and provide a level of comfort while travelling.	◑	●	●	●
8	Dynamic Roadway Warning [Locations: I-184]	Dynamic Warning signs can warn drivers of approaching hazards on the roadway such as water over the roadway. Some examples of the types of warnings these systems can detect hazardous roadway conditions and automatically warn drivers about poor road surface conditions, traffic conditions including queues, and obstacles or hazards.	●	◑	◔	◕
9	Traffic Signal Management and Operations (coordination and signal performance measures) [Locations: I-84 and I-184]	This tactic can benefit a freeway corridor by utilizing planned event or incident timing plans that synchronize groups of signals and prioritize certain traffic flows.	◔	●	◕	◕
10	HOV [Locations: I-84 between the exit 38 Garrity Blvd interchange and the Flying Wye]	Manage access to freeway lanes to allow only high occupancy vehicle (HOV) types. These lanes allow vehicles with multiple occupants (at a minimum, and usually, two people) to use an additional freeway lane to bypass congestion points along a corridor.	◔	◑	○	◔

Tactic No.	Tactic [location to be applied]	Description	How well does this tactic meet each goal			Overall Rating
			1	2	3	
11	Connected and Automated Vehicle Readiness [Locations: I-84 and I-184]	Deliver real-time roadway information to connected vehicles. Ensure that roadway related communications systems are connected vehicle ready.	◑	◔	◕	◑
12	Regional Traveler Information (websites and mobile applications) [Locations: I-84 and I-184]	Advanced communications have improved the dissemination of information to the traveling public. Motorists are now able to receive relevant information on location-specific traffic conditions in a number of ways, including dynamic message signs (DMS), onboard GPS devices, and 3rd party apps such as Inrix, HERE or WAZE. May include 511 systems. Provide predictive travel times using algorithms that combine existing data with future weather/event information.	◑	◕	◔	◑
13	Event Management [Locations: Ford Idaho Center (exit 38 Garrity Blvd) and Boise State University Events]	Event transportation management systems can help control the impact of congestion at stadiums or convention centers (specifically at Ford Idaho Center and Albertsons Stadium). In areas with frequent events, large changeable destination signs or other lane control equipment can be installed. In areas with occasional or one-time events, portable equipment can help smooth traffic flow.	○	◕	◔	◔
14	Automated Decision-Support System (ATMS Software) [Locations: I-84 and I-184]	Implement a Decision-support system that supports integrated corridor management capabilities. Monitor congestion, crashes, travel times, work zones, weather, transit and provide response plans to manage traffic and incident management strategies.	◕	◔	◕	◑
15	On-ramp Configuration and Auxiliary Lanes [Locations: exit 42 Ten Mile Rd, exit 44 Meridian/Kuna, and exit 46 Eagle/McCall interchanges]	Construct targeted roadway improvements to meet current standards for acceleration and merge areas.	◔	◑	○	◔

Tactic No.	Tactic [location to be applied]	Description	How well does this tactic meet each goal			Overall Rating
			1	2	3	
16	Availability of Truck Parking [Locations: West and East ends of the I-84 study area]	Provide available parking information at public and/or monitored rest areas to truck drivers. This information assists drivers in making decisions about staging, mandatory breaks, rest, and other needs.	◔	◕	◔	◔

Table 2. Incident and Emergency Management Strategy

Tactic No.	Tactic [location to be applied]	Description	How well does this tactic meet the goal?			Overall Rating
			1	2	3	
INCIDENT AND EMERGENCY MANAGEMENT						
17	Corridor Operations Team [Locations: I-84 and I-184]	The Corridor Operations Team is a standing committee of traffic management and emergency response agencies to conduct pre- and post-incident and event coordination, with the goal of improving effectiveness of coordinated incident response.	◑	◕	◔	◑
18	Emergency Management - contra flow on I-84/I-184 for evacuations (ITS solutions) [Locations: I-184]	In the case of an evacuation, contraflow lane reversal will alter the direction of travel. The goal is for a rapid clearance time while ensuring safety through interagency personnel and technology coordination.	○	○	◔	○
19	Enhanced Detour Plans [Locations: I-84 and I-184]	Establishing an enhanced detour plan in the case of an emergency will lessen the impacts on drivers and freight mobility.	◕	●	◑	●
20	Interoperable communications procedures/operations Playbook (SOP) [Locations: I-84 and I-184]	This tactic develops and maintains a set of standardized operating procedures for response to common Interstate and incident management scenarios, clarifying roles/responsibilities, decisions, and actions.	◑	◕	●	◕
21	Interoperable communications (voice and radio) [Locations: I-84 and I-184]	A voice and radio system allows communication and coordination between responding agencies. Choice of headsets, earpieces, hands-free speaker microphone can assure safe mobility while communicating.	◑	◑	◕	◑
22	Regional Alert System (Incident Queue/ Situational Awareness) [Locations: I-84 and I-184]	Disperses urgent public safety messages to the public on missing persons, emergency evacuations, major traffic impacts, policy activity, etc. Broadcast of information can assist in redirecting traffic.	◕	◕	◕	◕

Tactic No.	Tactic [location to be applied]	Description	How well does this tactic meet the goal?			Overall Rating
			1	2	3	
23	Roadway Service Patrols [Locations: I-84 and I-184]	Assists in minor incidents, clearing roadways, and assistant stranded vehicles. Roadway service patrols help in reducing the risk of secondary collisions and maintaining roads.	●	◕	◑	◕
24	Towing Contract (hourly, staged or dry-run) [Locations: I-84 west of the Flying Wye interchange]	As part of TIM, towing clears roadways and shoulders. Towing contracts are chosen as seen fit: (1) hourly, involving hourly rate payments, (2) staged, tow trucks stationed in areas of frequent collisions, or (3) dry-run, dispatched along with first-responders.	○	◕	◔	◔
25	Traffic Incident Management Strategic Plan (Laws, Program and Training) [Locations: I-84 and I-184]	A Traffic Incident Management Strategic Plan sets the overall framework for how transportation and emergency response agencies respond consistently and effectively to traffic incidents throughout the I-84 corridor.	◕	◕	●	●

Table 3. Road Weather Management Strategy

Tactic No.	Tactic [location to be applied]	Description	How well does this tactic meet the goal?			Overall Rating
			1	2	3	
ROAD WEATHER MANAGEMENT						
26	Weather Data collection and information processing (decision support, weather detection/prediction technologies) [Locations: I-184 and exit 27 Caldwell/Homedale to exit 29 Franklin Road]	Weather data collection and information processing improves driver and operator awareness, and roadway safety. During the wintertime, weather data can predict when and where frozen pavement is likely and efficiently allocate resources for preventive maintenance.	◔	◔	○	○
27	Winter Roadway Maintenance [Locations: I-84 and I-184]	Winter roadway maintenance operations can include de-icing or anti-icing (with a road weather information system) techniques. Work zone management strategies may be used to take precautionary measures during maintenance.	◔	◔	○	○

Table 4. Public Transportation Strategy

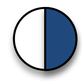
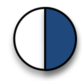
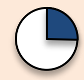
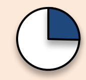
Tactic No.	Tactic [location to be applied]	Description	How well does this tactic meet each goal?			Overall Rating
			1	2	3	
		PUBLIC TRANSPORTATION				
28	Active Demand Management Strategies [Locations: I-84, I-184, and within Boise, Caldwell, Nampa, and Meridian for local transit service]	Active demand management strategies use real-time information and predictions to assist in adjusting transit service and assets. This may be in response to congestion, reducing traffic and transit demand, and planning for events.	○	◕	◔	◔
29	Real-Time Transit Information [Locations: I-84, I-184 and within Boise, Caldwell, Nampa, and Meridian for local transit service]	Provide real-time data to passengers pertaining to status of vehicles, expected arrivals, and delays. This information can be distributed through mobile technology, dynamic message signs, or onboard annunciators.	○	●	◕	◔
30	Shoulder Running Transit [Locations: I-84, I-184 and within Boise, Caldwell, Nampa, and Meridian for local transit service]	Repurpose shoulder running to transit vehicles only to improve bus travel time and reliability, incentivizing use of transit.	○	◑	○	○
31	Transit Traveler Information through Third-Party Services [Locations: I-84, I-184 and within Boise, Caldwell, Nampa, and Meridian for local transit service]	To reduce the expenses of building a real-time information system on platform or onboard, transit agencies may choose to work with third-party services to provide trip updates, service alerts, and platform and bus locations.	○	◕	◔	◔

Table 5. Performance Measurement Strategy

Tactic No.	Tactic [location to be applied]	Description	How well does this tactic meet each goal?			Overall Rating
			1	2	3	
PERFORMANCE MEASUREMENT						
32	Regional Performance Management System such as RITIS, ITS Data Warehouse [Locations: I-84 and I-184	This tactic involves leveraging data from ITS devices and other data sources to provide quantitative measures of the effectiveness of regional operations strategies. Builds upon existing regional transportation system performance measures for the Treasure Valley developed by COMPASS and ITD.	◕	◕	●	●

Table 6. Work Zone Management Strategy

Tactic No.	Tactic [location to be applied]	Description	How well does this tactic meet each goal? 1	2	3	Overall Rating
WORK ZONE MANAGEMENT						
33	Automated work zone information systems (smart arrow board technology) [Locations: Construction zones]	Automated work zone information systems (AWIS) enable motorists to observe traffic conditions before they enter a work zone and allow them to choose alternate routes based on guidance from dynamic message signs. AWIS involves traffic data collecting devices to monitor traffic conditions, dynamic message signs to display traffic information, and a server computer to calculate estimated travel times. Other options include smart arrow board technology that automatically transmits real-time coordinates and status updates of arrow boards to central software and web pages with no staff intervention.	◑	◔	○	◔
34	Dynamic lane merge (zipper merge) [Locations: exit 36 N Franklin, exit 38 Garrity Blvd, exit 42 Ten Mile Rd, exit 44 Meridian/Kuna, and exit 46 Eagle/McCall interchanges]	Dynamic lane merge is used for merging traffic where lane reductions occur. With this merge system, motorists utilize both lanes of traffic until the defined merge point and then drivers take turns alternating into the open lane, through a “zipper-like” pattern. May involve public engagement and training.	◑	◔	○	◔
35	Smart work zones (work zone data exchange) [Locations: Construction zones]	Smart work zone systems use ITS to predict travel time, delays, or current speed in a work zone on a real-time basis to improve safety for all motorists and construction workers. These systems can be used to provide real-time information to motorists during construction, incidents, temporary closures, or any unexpected roadway conditions.	◑	◔	◔	◔
36	Automated speed limit enforcement [Locations: I-84 and I-184]	The goal of automated speed limit enforcement is to encourage a change in driver behavior to reduce their speed and to increase driver awareness of the impacts of speed-related crashes in work zones. Technologies include portable radar speed display signs and automated speed limit enforcement systems that capture images of vehicles exceeding speed limits and ticket violators.	◕	○	○	◔

Tactic No.	**Tactic** **[location to be applied]**	**Description**	**How well does this tactic meet each goal?**			**Overall Rating**
			1	2	3	
37	Work zone transportation management plan [Locations: Construction zones]	A work zone transportation management plan (TMP) will lay out a set of strategies for managing the work zone impacts of a project. The work zone TMP will address the broader safety and mobility impacts of work zones along the corridor and network levels. The work zone TMP will promote more efficient and effective construction stating, duration and costs.				

PROPOSED TACTICS FOR SECOND LEVEL SCREENING

The following table presents the tactics that are recommended to move forward to the second level of screening, which involves in-depth analysis and evaluation criteria. Some tactics benefit more than one strategy. For example, roadside traveler information (DMS signs) positively affects traffic management, incident and emergency management, and road weather management. As a result, Table 7 below highlights each proposed tactic and the strategy that it benefits.

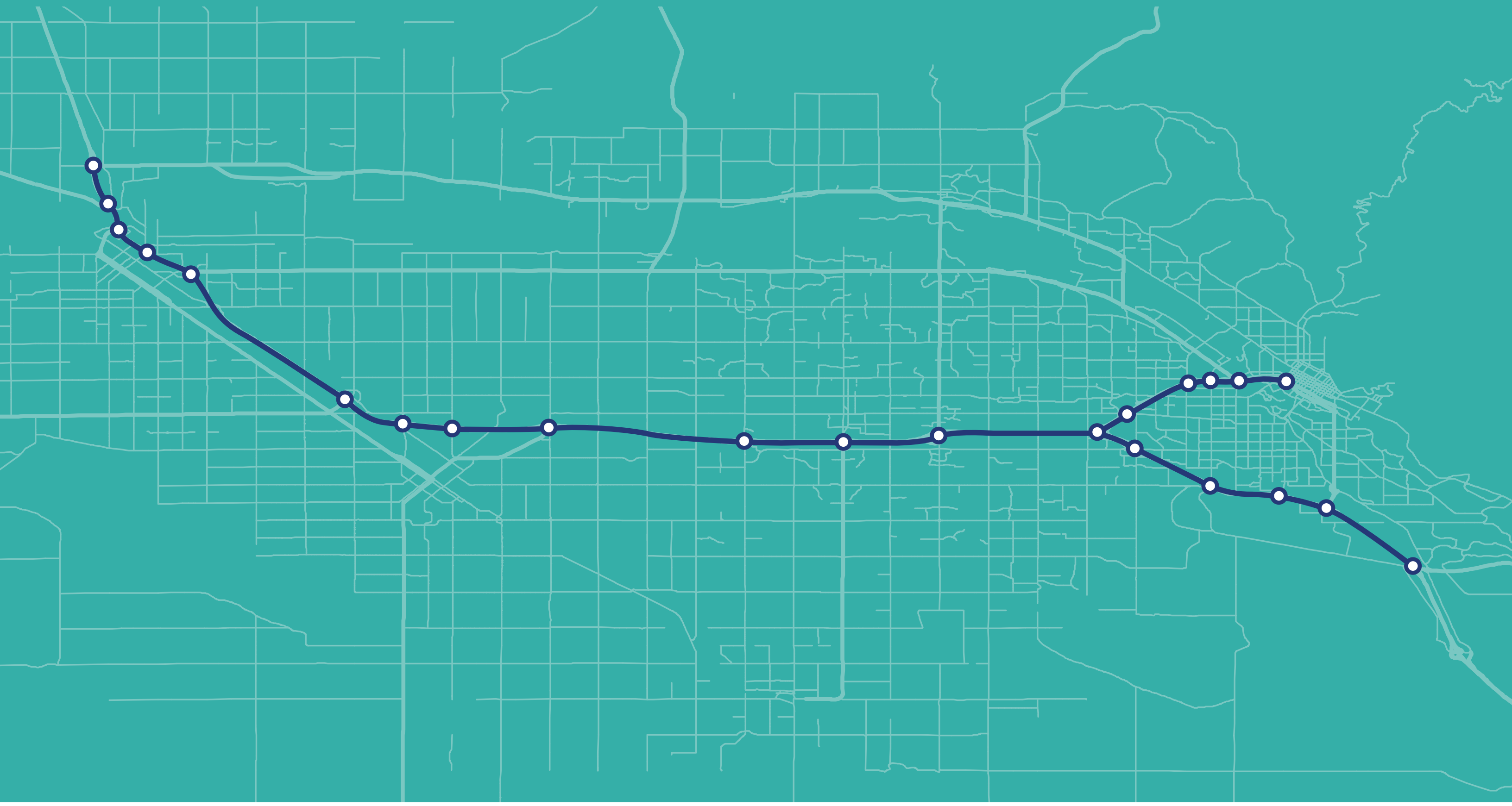
The tactics in Table 7 that are recommended for the second level screening process are up for discussion at the August stakeholder meeting. Some of the tactics listed in Table 7 did not score highly enough to be considered one of the top tactics, but they complement or support the higher scoring tactics. For example, ramp metering scored highly but on-ramp configuration did not. If ramp metering is analyzed as part of the second level screening, on-ramp configuration would also be evaluated.

Table 7. Proposed Tactics to Advance for 2nd Level Screening

		Strategy				
Tactic No.	Tactic	Traffic Management	Incident and Emergency Management	Road Weather Management	Public Transportation	Work Zone Management
3	Ramp Metering (HOV/Transit Bypass)	✓			✓	
5	Regional Video & Data Sharing (Monitoring and Control)	✓	✓			✓
6 & 7	Roadside Traveler Information (Dynamic Message Signs, travel time estimates)	✓	✓	✓		✓
8	Dynamic Roadway Warning (hotspots/water on roadway)	✓	✓	✓		
9	Traffic Signal Management and Operations (coordination and signal performance measures)	✓	✓		✓	

		Strategy				
Tactic No.	Tactic	Traffic Management	Incident and Emergency Management	Road Weather Management	Public Transportation	Work Zone Management
15	On-ramp Configuration and Auxiliary Lanes	✓				
17	Corridor Operations Team	✓	✓	✓		✓
19	Enhanced Detour Plans		✓	✓		✓
20	Interoperable Communications Procedures/ Operations Playbook (SOP)	✓	✓			
23	Roadway Service Patrols		✓	✓		
25	Traffic Incident Management Laws		✓			
29	Real-time Transit Information				✓	
32	Regional Performance Management System such as RITIS, ITS Data Warehouse	✓				
35	Smart Work Zones					✓

Second Level Screening



I-84 CORRIDOR OPERATIONS PLAN

TACTICS SCREENING RESULTS MEMO

COMPASS
COMMUNITY PLANNING ASSOCIATION
of Southwest Idaho

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INTRODUCTION

This memorandum summarizes the second level screening analysis for the 17 tactics that were identified in the first level screening process for the I-84 Corridor Operations Plan. These 17 tactics were developed into conceptual projects, including locations, general definitions, and operational objectives. For the second level screening process, the tactics were then evaluated using sketch level planning tools such as TOPS-BC, to assess the benefits, costs, and feasibility. The findings in this memorandum will be used to select tactics to be included in the implementation plan, a document that will include an operational vision of the corridor, detailed tactic definitions, order of implementation, cost estimate refinements, and institutional issues related to project deployment.

BACKGROUND

The project team assembled a full-range of transportation system management and operations (TSMO) toolbox of tactics to best meet the identified needs, goals and operations objectives for the I-84 corridor study area. The initial TSMO toolbox included 37 tactics, organized into six strategies:

- Traffic Management
- Incident and Emergency Management
- Road Weather Management
- Public Transportation
- Performance Measurement
- Work Zone Management

The first level screening process focused on selecting the tactics that could best achieve the project goals identified for the I-84 Corridor Operations Plan: Safety, Capacity and Reliability, and Integrated Management of the Transportation System. The process, scoring, and results of the first level screening can be found in the ***Toolbox of Tactics Initial Scoring Memo*** (August 2021). Seventeen tactics that best met the first level screening criteria were advanced for the second level screening using criteria that included: Benefits, Costs, and Feasibility.

The screening process is shown in Figure 1, here:

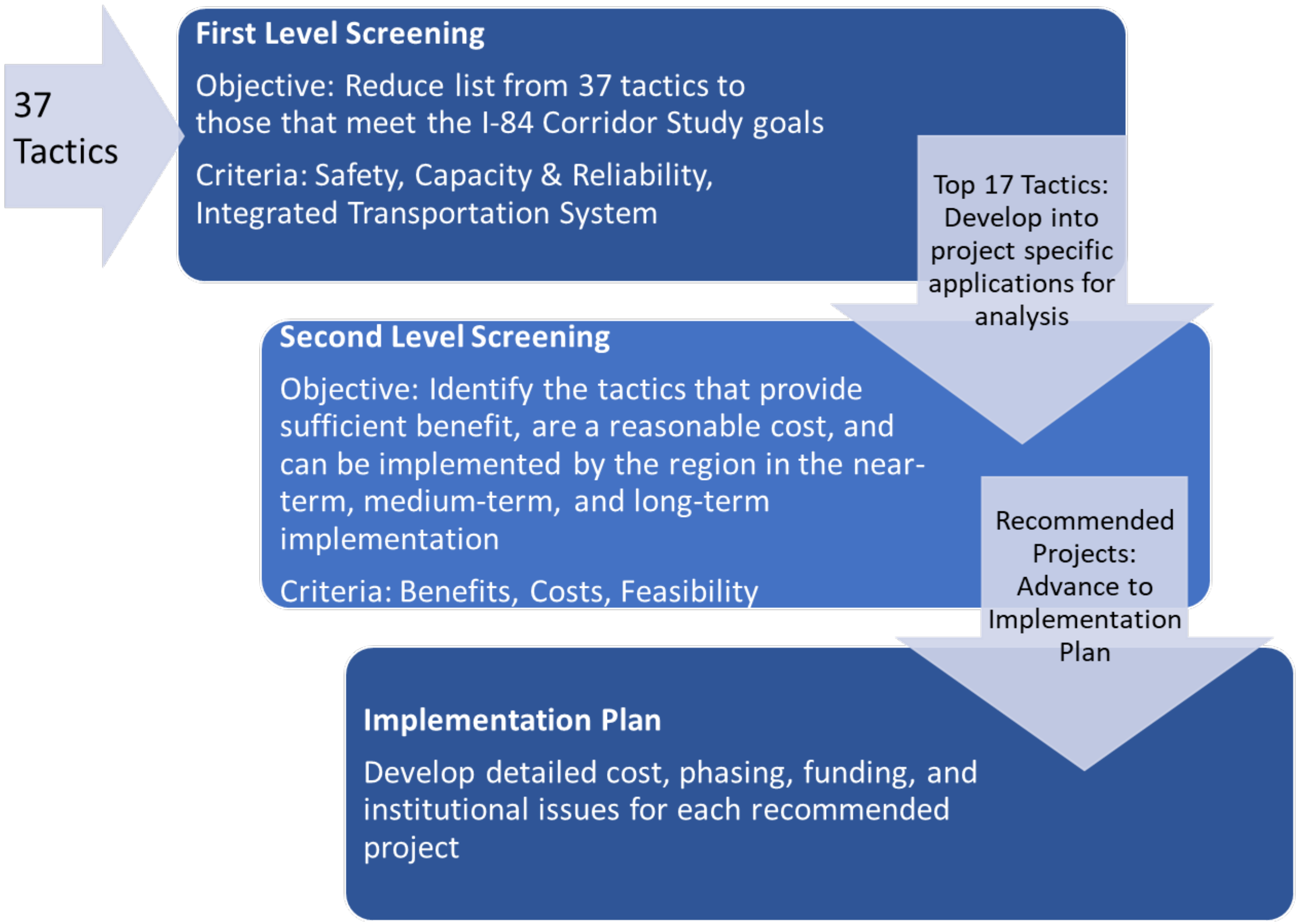


FIGURE 1: OPERATIONAL TACTICS SCREENING PROCESS

Table 1 presents the tactics that moved forward to the second level screening, and the strategy(ies) that the tactic supports. Some tactics can benefit more than one strategy. For example, roadside traveler information (DMS signs) could positively impact traffic management, incident and emergency management, and road weather management. As a result, the table below highlights each proposed tactic and the potential strategy that it could impact. Descriptions of each tactic can be found in the *I-84 Corridor Operations Plan – Toolbox of Strategies Initial Scoring* memorandum.

TABLE 1: TACTICS SELECTED FOR SECOND LEVEL SCREENING AND RELATED STRATEGY(IES)

Tactic	Strategy				
General Description	Traffic Management	Incident and Emergency Management	Road Weather Management	Public Transportation	Work Zone Management
Ramp Metering	✓			✓	
Regional Video & Data Sharing (Monitoring, Control, cameras, detection)	✓	✓			✓
Roadside Traveler Information (Dynamic Message Signs, travel time estimates)	✓	✓	✓		✓
Dynamic Roadway Warning (hotspots/water on roadway)	✓	✓	✓		
Traffic Signal Management and Operations (coordination and signal performance measures)	✓	✓		✓	
On-ramp Configuration and Auxiliary Lanes	✓				
Corridor Operations Team	✓	✓	✓		✓
Enhanced Detour Plans		✓	✓		✓
Interoperable Communications Procedures/ Operations Playbook (SOP)	✓	✓			
Roadway Service Patrols		✓	✓		
Traffic Incident Management Laws		✓			
Real-time Transit Information				✓	
Regional Performance Management System such as RITIS, ITS Data Warehouse	✓				
Smart Work Zones (automated information systems, smart arrow boards)					✓
Shoulder Running Transit	✓			✓	
Event Management	✓				
Active Traffic Management	✓	✓	✓		✓

SECOND LEVEL SCREENING METHODOLOGY

This section of the memorandum describes the second level screening process including the screening criteria, ranking scale, and analysis methodology for each tactic.

SECOND LEVEL SCREENING CRITERIA AND RANKING SCALE

The second level screening applied three criteria to each tactic:

- Benefits (operations and safety)
- Costs (implementation and annual operations and maintenance)
- Feasibility (geometric and construction, institutional, operational, and maintenance)

BENEFITS

This assessment identifies the level of potential operational benefits for each strategy as it applies to the I-84/I-184 corridor. The project team applied the following ranking system to evaluate each strategy for operational benefits.

Icon	Meaning
●	High operational and/or safety benefits, with the most transformative positive impacts on the corridor
◕	Significant operational and/or safety benefits
◑	Moderate operational and/or safety benefits
◔	Limited operational and/or safety benefits; benefits may be limited to certain geographic areas and/or situations (e.g. special events)
○	Minimal or no operational and/or safety benefits

IMPLEMENTATION FEASIBILITY

Implementation Feasibility considers the physical, institutional, and operations and maintenance barriers that may affect the successful implementation of the tactic.

- **Physical Feasibility** includes characteristics necessary to design and build the system such as field devices, right of way availability, central systems, firmware/software, communications, and power connections.
- **Institutional Feasibility** includes characteristics related to the legal, organizational, and behavioral roles associated with operating and managing a transportation system. These include policies, regulations, intra- and inter-agency coordination, and public-private partnerships.
- **Operations and Maintenance Feasibility** includes characteristics related to the processes and procedures needed for day-to-day operation such as agency roles and responsibilities, operating procedures, and performance measurement.

- **Quick Start/Pilot Feasibility** includes the potential for a tactic to be implemented quickly on a trial basis, at relatively low cost, in order to establish its efficacy under real-world operating conditions in the corridor. A pilot project that is limited in scope or duration can help to provide justification for permanent or expanded implementation of the tactic.

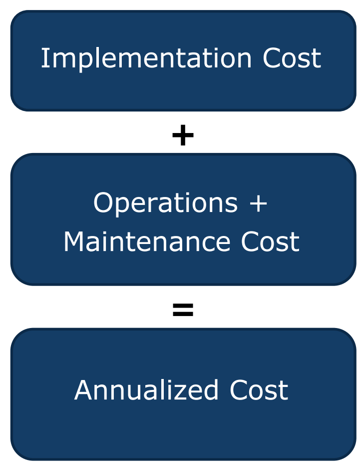
The project team applied the following ranking system to evaluate each tactic by the three feasibility factors independently.

Icon	Meaning
●	Minimal or no factors complicating implementation
◕	Few factors complicating implementation
◑	Moderate factors complicating implementation
◔	Several factors complicating implementation
○	Not feasible

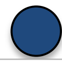
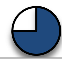
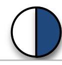
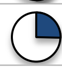
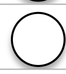
COSTS

The costs of implementation and the on-going needs for operations and maintenance are important criteria to consider when determining whether to pursue a TSMO tactic. These management and operations tactics generally require ongoing staff involvement to make the best use of the approach and to keep the technology functioning properly.

- **Implementation Cost** refers to the initial cost to construct a tactic or create a plan or policy. The implementation cost is provided for each tactic description to provide transparency regarding the required initial investment.
- **Annual Operations and Maintenance (O&M) Cost** refers to the ongoing annual cost to maintain and operate devices; fix or calibrate equipment; allocate staff time to implement tactics such as attend meetings or work in the field during a road closure event.
- **Annualized Cost** combines the implementation cost annualized over the expected lifespan of the tactic, plus the annual operations and maintenance cost. The annualized cost metric is used for comparison in the rating table for those tactics that were evaluated using TOPS-BC.



To compare tactics for the purposes of screening, the implementation cost and annual O&M costs were annualized and combined. The project team applied the following ranking system to evaluate each tactic by annualized cost.

Icon	Annualized Cost
	less than $50,000
	between $50,000 and $250,000
	between $250,000 and $1,000,000
	between $1,000,000 and $1,500,000
	over $1,500,000

ANALYSIS METHODOLOGY

Both qualitative and quantitative assessments were used to evaluate each tactic's benefit, cost, and implementation feasibility. Tactics that include infrastructure deployments, such as ramp meters, were evaluated quantitatively using a benefit-cost analysis, and evaluated qualitatively for implementation feasibility. The Tool for Operations Benefit Cost Analysis (TOPS-BC) developed by FHWA, was used to evaluate the potential benefit-cost for many of the tactics. TOPS-BC is a sketch-planning tool that guides decision-making for operational tactics but is not the sole factor on whether a tactic is appropriate for the I-84/I-184 corridor. Tactics that are not focused on infrastructure deployments and rely more on stakeholder agreement/coordination, such as regional video sharing, were evaluated qualitatively using industry experience. Table 2 provides a summary of the tactics and analysis approach.

TABLE 2: TACTICS DEFINITION AND ANALYSIS APPROACH

Tactic Name	Conceptual Implementation of Tactic	Purpose of Tactic Application	Benefits Analysis Approach
Ramp Metering	Number of locations, communications	Improve mainline operations, reduce rear-end crashes; transit bypass lanes	TOPS-BC
Regional Video & Data Sharing (Monitoring, Control, cameras, detection)	Number of locations for new cameras, communications infrastructure	Improve traveler information to inform route choice, improve operational awareness and incident response times	Qualitative
Roadside Traveler Information (Dynamic Message Signs, travel time estimates)	6 locations for new signs and/or existing	Improve traveler information to inform route choices	TOPS-BC

Tactic Name	Conceptual Implementation of Tactic	Purpose of Tactic Application	Benefits Analysis Approach
Dynamic Roadway Warning (hotspots/water on roadway)	Number of locations for new signs and/or existing	Warn drivers of water on roadway	TOPS-BC
Traffic Signal Management and Operations (coordination and signal performance measures)	Modified corridor signal timing for diversion of traffic from interstate due to incidents (at signals near interstate).	Improve traffic flow approaching ramps during incidents and detours	TOPS-BC
On-ramp Configuration and Auxiliary Lanes	Modified on-ramp configurations and added auxiliary lane between _ and_ in both directions	Improve traffic operations and safety on mainline by reducing weaving	Qualitative
Corridor Operations Team	Regional group using interagency collaboration to address I-84 corridor operations issues. Membership includes ITD, ACHD, COMPASS, local jurisdictions, and law enforcement	Group is focused on solving operational issues that cross jurisdictional boundaries and require collaborative solutions, such as regional incident management.	Qualitative
Enhanced Detour Plans	Corridor-wide set of pre-planned detour routes and response tactics to address traffic diversion caused by freeway bottlenecks and closures	Helps provide implementation-ready, coordinated regional responses to recurring congestion and incident hotspots that affect both the interstate mainline as well as spillover/diversion traffic on local arterials	Qualitative
Interoperable Communications Procedures/ Operations Playbook (SOP)	Regional update of standard operating procedures for coordinated response among traffic/emergency operations centers and field personnel	Supports more effective operations response and use of ITS assets by coordinating action plans across agencies and management centers within the Treasure Valley	Qualitative
Roadway Service Patrols	Corridor-wide tactic to expedite response to disabled vehicles, roadway cleanup, and other incidents that impact interstate congestion and safety.	Roadway service patrols reduce incident response time and duration, thereby reducing the negative impacts on interstate safety and performance. Also a “force multiplier” that frees capacity of law enforcement	Qualitative
Traffic Incident Management Laws	Corridor-wide (up to statewide) quick clearance law mandating removal of disabled vehicles from active travel lanes, and/or providing authorization of agencies to remove disable vehicles or spilled cargo.	Restores interstate capacity by clearing lane blockages, and provides liability protection to law enforcement personnel and towing companies involved in quick clearance activities	Qualitative

Tactic Name	Conceptual Implementation of Tactic	Purpose of Tactic Application	Benefits Analysis Approach
Real-time Transit Information	Installation at 3 Park and Ride facilities	Increase awareness of alternative travel options and transit travel times/service status	TOPS-BC
Regional Performance Management System	Region-wide tool drawing upon data generated by ITS systems of participating agencies	Provides quantitative metrics to allow continuous measurement, diagnosis, and improvement of regional operations needs and tactics	Qualitative
Smart Work Zones (automated information systems, smart arrow boards)	Improve safety, traveler information, and traffic flow in major work zones through the use of technology tools	Addresses the safety and congestion issues posed by major construction projects in the I-84/I-184 corridors, while providing travelers with information to make informed route choice decisions	TOPS-BC
Shoulder Running Transit	Peak-period or incident-related shoulder running transit between x and x	Allows VRT express transit services operating via the Interstate to bypass traffic congestion, reducing transit travel times and improving reliability	Qualitative
Event Management	Coordinated regional operations plans specific to pre-planned, large-scale events	Respond to traffic volumes and travel patterns unique to large-scale events such as Boise State football and Ford Idaho Center events	Qualitative
Active Traffic Management (ATM)	Uses technology that detects current conditions (like weather or congestion) and responds automatically by communicating with drivers such as variable speed limits or queue warning.	Responds to traffic volumes to reduce the potential of crashes.	TOPS-BC

TACTIC ANALYSIS RESULTS AND SECOND LEVEL SCREENING RANKING

Table 3 provides a summary of how each tactic is ranked based on the analysis. Appendix A provides a more detailed description of the analysis results. An overall numerical ranking on a scale from 1 to 10 is included with 10 being the highest score.

TABLE 3: SCREENING RESULTS

TACTIC	First Level Screening			Second Level Screening				Overall Score (1-10)
	Goal 1: Safety	Goal 2: Capacity & Reliability	Goal 3: Integrated Transportation System	Benefits	Annualized Cost	Implementation Feasibility	Benefit-Cost	
Regional Video & Data Sharing (Monitoring, Control, cameras, detection)	●	●	●	◑	●	◑	n/a	8.7
Roadside Traveler Information (Dynamic Message Signs, travel time estimates)	◑	●	●	◑	◑	●	0.36	8.0
Interoperable Communications Procedures/ Operations Playbook (SOP)	◑	◕	●	◕	◕	◕	n/a	8.0
Ramp Metering*	●	●	○	●	◔	●	7.04	7.7
Enhanced Detour Plans	◕	●	◑	◑	●	◑	n/a	7.7
Roadway Service Patrols	●	◕	◑	●	◑	◑	n/a	7.7

TACTIC	First Level Screening			Second Level Screening				Overall Score (1-10)
	Goal 1: Safety	Goal 2: Capacity & Reliability	Goal 3: Integrated Transportation System	Benefits	Annualized Cost	Implementation Feasibility	Benefit-Cost	
Corridor Operations Team	◑	◕	◔	◑	●	●	n/a	7.3
Traffic Incident Management Laws	◕	◕	●	◑	◕	◔	n/a	7.3
Dynamic Roadway Warning (hotspots/water on roadway RWIS)	●	◑	◔	○	●	◕	2.04	6.7
Regional Performance Management System	◕	◕	●	◑	◑	◑	n/a	7.3
Real-time Transit Information	○	●	◕	◔	◕	◕	1.21	6.7
Traffic Signal Management and Operations (coordination and signal performance measures)	◔	●	◕	◑	◔	◑	0.68	6.3
Smart Work Zones (automated information systems, smart arrow boards)	◑	◔	◔	◔	●	●	2.53	6.3
Event Management	○	◕	◔	◔	◕	◑	n/a	5.3

TACTIC	First Level Screening			Second Level Screening				Overall Score (1-10)
	Goal 1: Safety	Goal 2: Capacity & Reliability	Goal 3: Integrated Transportation System	Benefits	Annualized Cost	Implementation Feasibility	Benefit-Cost	
Active Traffic Management	◕	◔	○	◕	◔	◑	0.73	5.3
Shoulder Running Transit	○	◑	○	◑	◑	◑	n/a	4.7
On-ramp Configuration and Auxiliary Lanes*	◔	◑	○	◑*	◔	◔	n/a	4.3

* Further analysis will be completed once data needs are met

For more information regarding discussion, evaluation and proposed locations for each tactic in Table 3, please refer to **Appendix A.** The TOPS-BC Analysis Memorandum can be found in **Appendix B,** which highlights the assumptions used for benefits and costs calculations. For a summary table of the initial toolbox of tactics (total of 37), please refer to memo titled *I-84 Corridor Plan Toolbox Appendix*.

APPENDIX A: SECOND LEVEL SCREENING ANALYSIS

RAMP METERING

SUMMARY OF FINDINGS

Ramp metering would be a valuable operational improvement for the corridor and can be implemented in a phased approach to manage expenditures and develop experience with the tactic.

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

Ramp meters are designed to manage vehicle volumes merging into the mainline traffic from on-ramps. Large platoons of vehicles merging at one time can result in abrupt speed changes leading to rear-end crashes and degraded mainline operations. The rate of metering can be pre-set by engineers, or timed based on mainline and ramp volumes as part of an adaptive system.

Ramp meter locations for the second level screening analysis were selected at ramps with high ramp volumes and safety issues. They were evaluated using TOPS-BC to get a benefit/cost ratio and will be further evaluated using a queuing tool once ramp count data has been collected. If selected as a tactic to be developed into a future project, ramp meters could be implemented at several locations described below. They can also be implemented in a phased approach; however, phases should implement ramp meters at adjacent locations to discourage detouring away from the meter by drivers.

Ramp metering has a high benefit/cost ratio due to the reduction in crashes and the operational benefits it provides. The reduction in crashes is primarily for rear-ends and the operational benefits occur most days of the year (typical workdays).

Purpose

- Reduce mainline crashes related to merging
- Improve interstate mainline operations

Locations

The proposed locations are listed here, from east to west, and depicted in Figure A1 (a new interchange at SH 16 is expected to come online by 2025):

- 10th Ave (Exit 28) - AM Eastbound
- Franklin Rd (Exit 29) - AM Eastbound
- Karcher Rd (Exit 33) - AM Eastbound
- Northside Blvd (Exit 35) - AM Eastbound, PM Westbound
- Franklin Blvd (Exit 36) - AM Eastbound, PM Westbound
- Garrity Blvd (Exit 38) - AM Eastbound, PM Westbound
- Ten Mile Rd (Exit 42) - AM Eastbound
- Meridian Rd (Exit 44)- AM Eastbound
- Eagle Rd (Exit 46) SB and NB ramps - AM Eastbound
- W Franklin Rd on I-184 - PM Westbound
- N Curtis Rd - PM Westbound

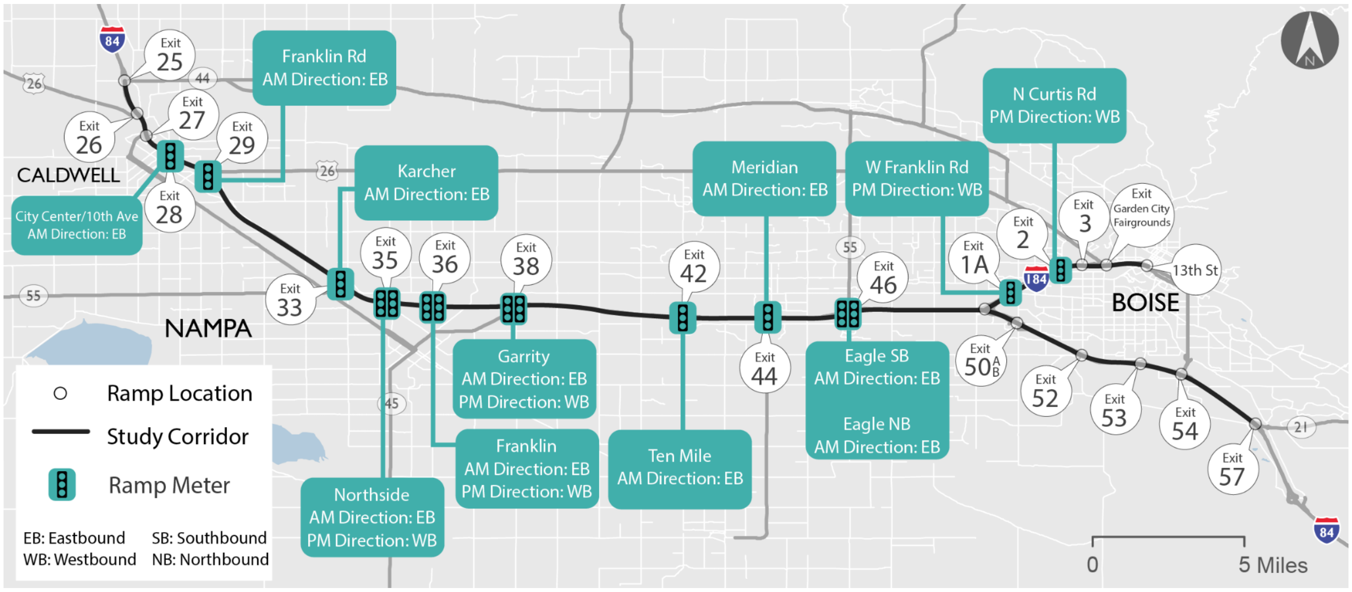


FIGURE A1: PROPOSED RAMP METER LOCATIONS ALONG THE CORRIDOR

BENEFITS AND COST

TOPS-BC B/C RATIO FOR RAMP METERING: 7.04

Implementation Cost:

- **$1,265,000 with contingency for centralized ramp metering software and equipment (one time cost)**
- **$1,173,000 per ramp meter (14 assumed) including contingency.**
- **Total: $17,687,000**

Annual Operations and Maintenance:

- $102,000 for centralized ramp metering software and equipment
- $3,250 per ramp meter

BENEFITS		ANNUALIZED COST
CRASH RATE REDUCTION	**12%**	**$1,430,469**
REDUCTION IN FUEL USE	**10%**	
PERIODS PER YEAR (DAYS)	**250**	
TOTAL AVERAGE ANNUAL BENEFIT	**$10,069,289**	

IMPLEMENTATION FEASIBILITY

Physical Feasibility

- Individual pre-timed ramp meters are a feasible and relatively inexpensive investment to reduce crash risks in merging areas. Pre-timed metering rates use historical data to manage recurring congestion, construction zones, or special events. It would not require detection in the field but requires periodic updates to cater to local conditions.
- Vehicle storage capacity/stacking within metered on-ramps and arterial feeder lanes may be a determining factor in the design and configuration of certain locations. "Form two lanes" approaches to expanding on-ramp storage capacity have been applied in other jurisdictions when ramp metering is active.

Institutional Feasibility

- Ramp meter ownership and operation would need to be agreed upon by relevant transportation agencies. Timing coordination with adjacent local jurisdiction roadways may be needed to prevent undesirable queuing or backups onto the local network. However, overall, ITD could implement and operate ramp metering while acting independently.
- In terms of future capabilities, ramp meters can be integrated into a central system and use adaptive meters to assist operations in real-time, in response to corridor-wide conditions. These systems allow ramp meters to react responsively to real time incidents and operate upstream and downstream meters accordingly. These capabilities require traffic detection and communication to a traffic management center to inform corridor-wide conditions and synchronous operation of ramps. The centralized computer system can incorporate surveillance, information dissemination, and other roadside ITS. ITD is currently procuring a new statewide Advanced Transportation Management System that will have adaptive ramp metering capabilities.
- ITD does not currently have a Transportation Management Center in the Boise area, and the responsibility to operate and maintain the ramp metering system would need to be determined before implementing this system.

Operations and Maintenance Feasibility

- Operations and maintenance would be managed by ITD as part of its overall ITS/traffic signal program.
- Individual pre-timed ramp meters require periodic timing updates; however, the overall technology maintenance is not expected to be significant.
- Integrated system meters require closer monitoring of the performance and timing of the integrated signal system, much like a coordinated arterial traffic management system.
- Once configured, ramp meter operations would be expected to operate largely on an automated basis, e.g. by time of day. Action by District 3 or State Comm operations/control center personnel is not required to initiate normal operations.

Quick Start/Pilot Feasibility

- The up-front capital costs of ramp meter implementation limit the feasibility of a low-cost ramp metering pilot. And as discussed above, ramp metering will be most effective when implemented over multiple adjacent interchanges, thereby improving the stability of mainline traffic flow.
- A phased implementation of ramp metering in two or more segments could allow for a proof of concept before committing to a full corridor build-out. The engineering and operational advantages of ramp meter phasing are worthy of further study in a future design phase.

REGIONAL VIDEO AND DATA SHARING

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

This tactic aims to improve the multi-agency understanding of the freeway system operations through the sharing of video and other data related to past or current operations between local system managers. Currently, the region has strong camera coverage with few gaps, as shown in Figure A2. For this analysis, the project team added additional cameras to fill in a few gaps. In addition to video, this tactic includes work zone event data, performance measurement for traffic incident response, freight data, ITS transit data, and data collection for smart city applications (such as traffic counts).[1]

This tactic is relatively inexpensive and fills in a few gaps in the camera infrastructure of the valley. The regional data sharing provides benefits to regional operations, incident management, and event management.

Purpose

- Improve multi-agency understanding of corridor operations

Locations

Cameras:

- I-84 at US 20/26
- I-84 at Franklin Road (may be installed with I-84 widening projects)
- I-84 at Midland Boulevard (may already be present but not functioning)
- I-84 at Eisenman Road

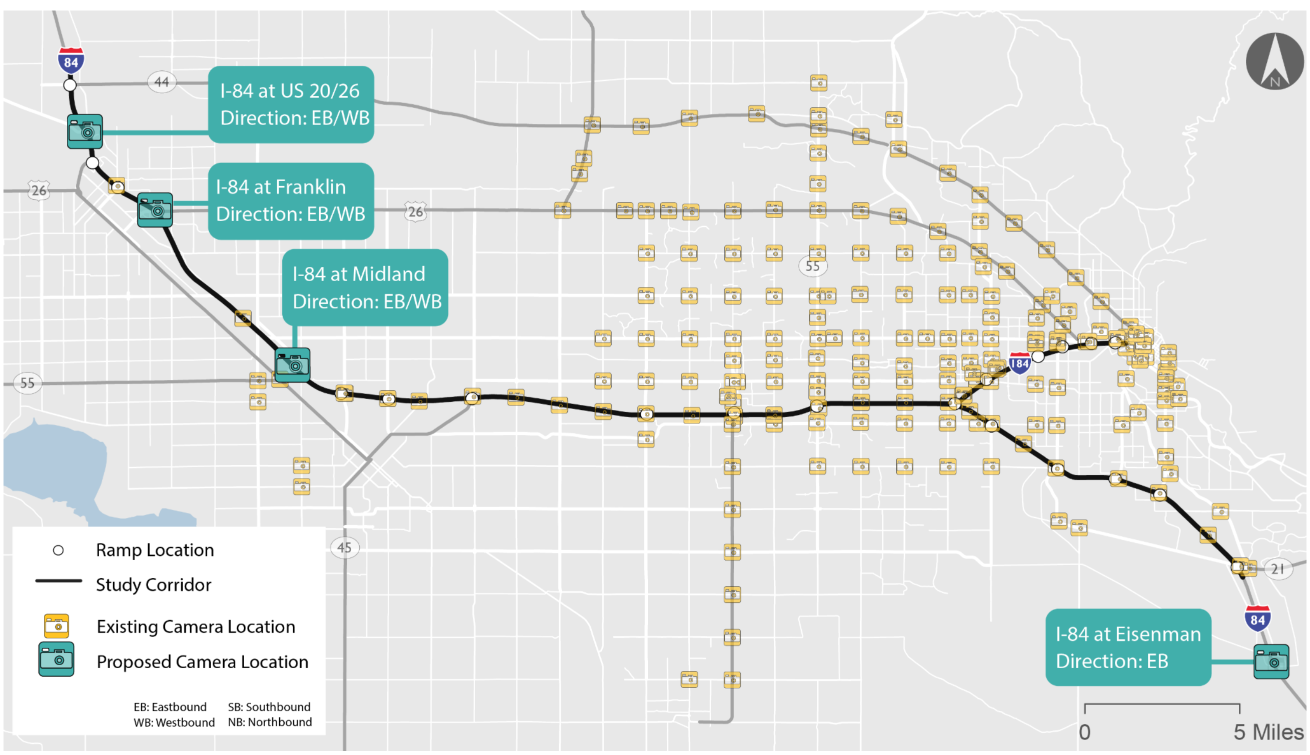


FIGURE A2: EXISTING AND PROPOSED CAMERA LOCATIONS

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[1] NCHRP 08-119 Data Integration, Sharing, and Management for Transportation Planning and Traffic Operations, April 16, 2021.

BENEFITS AND COST

BENEFITS	COST
• Provides shared real-time and historic system operations information • Improves visual information for decision makers and the public • Improves incident response times and accuracy	• 4 cameras at $60,000 per location

IMPLEMENTATION FEASIBILITY

Regional partners already share data feeds but camera control does not necessarily cross jurisdictional boundaries. Some cameras can only be controlled for tilt, pan, zoom capabilities when TMCs are in operation. Adding new cameras to the system should consider cross-agency use of data and the ability to control the cameras.

Physical Feasibility

- Regional video sharing would largely leverage existing closed-circuit television (CCTV) cameras across the Treasure Valley. New field infrastructure deployment would be limited, provided center-to-center communications links are sufficient for the anticipated volume of shared video data. CCTV technology is generally non-obtrusive, and it is likely that any new CCTV camera sites can be located on agency right-of-way with a sufficient field of view of the target area.
- ITD currently allows other agencies to view systems and data. Improvements to system integration and data access may be needed but little need is expected as far as field equipment. Due to that, this effort would largely focus on backend systems integration rather than new field ITS device deployment.

Institutional Feasibility

- Likely participants in regional video and data sharing would include: ITD, ACHD, City of Nampa (TOC), other municipalities, ISP, Ada and Canyon County Sheriffs, and local law enforcement.
- Select feeds to the media and the traveling public may also be considered for traveler information purposes.
- Regional video and data sharing will require substantial operational and technology coordination among the participating agencies. This also includes cost sharing for implementation and maintenance of the underlying video management software and communications.
- Developing video and data sharing agreements among participating agencies related to privacy, security, and storage, in a manner consistent with agency policies and state law, is anticipated to be a key institutional factor to address.

Operations and Maintenance Feasibility

- For moveable (pan-tilt-zoom) cameras, priority for control of cameras among agencies is an important consideration. This may vary by agency, ligation, and/or situation (e.g. incident type and sensitivity). Periodic maintenance of CCTV communications equipment would be conducted by the agency owning the specific asset.
- A regional approach to purchase and maintain the regional video and data sharing backend will be required. One approach is to designate a lead agency (e.g., ITD) with overall system administration responsibility, supported by financial or in-kind contributions of other participating agencies using the video management system.
- Individual agencies may also be responsible for the system licensing and hardware costs of their individual users/workstations.

Quick Start/Pilot Feasibility

- Existing regional systems provide a limited opportunity to expand video sharing among agencies through adjustments of current policies and SOPs, within the capabilities of existing technology platforms.
- Agencies could implement new video and data sharing features relatively quickly as part of ITD's upcoming traffic management system replacement project. Being a software-focused effort, this enhancement would leverage a significant amount of build CCTV and ITS device sites across the region at relatively low cost.

ROADSIDE TRAVELER INFORMATION (DMS)

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

Dynamic Message Signs (DMS) alert drivers of changing roadway conditions and other valuable information to help drivers make informed route choices. The locations of proposed DMS were selected based on driver decisions points, bridge placements and gaps of existing DMS locations. A total of 12 DMS locations were identified and are shown in Figure A3.

The benefit/cost ratio for this tactic is low primarily due to the high cost. Infrastructure needs for this system include overhead gantries, cantilever supports on the side of the interstate, the signs themselves, and any supporting infrastructure need like communications. Infrastructure needs for this tactic could be combined with other tactics (like active traffic management) in the implementation plan to realize cost savings.

Purpose

- DMS signs in this corridor would alert drivers of congestion on I-84 so that they can make alternate route choices. DMS signs are proposed for state highways and arterials approaching I-84 ramps.

Proposed Locations

- I-84 Eastbound near Centennial Way (Exit 26)
- Karcher Road (SH 55) Eastbound near Caldwell Blvd
- Garrity Blvd Eastbound near Flamingo Ave
- Ten Mile Road Northbound south of Overland Road
- Meridian Road (SH 69) Northbound south of Overland Road
- Meridian Road (SH 69) Northbound south of Victory Road
- Milwaukee Street and Franklin Road Westbound I-184 on-ramp
- Cole Road Southbound south of McMullen St
- Curtis Road Northbound south of Chinden Blvd (US 20/26)
- Curtis Road Southbound south of Northview St
- Orchard Street Southbound south of Overland Rd
- Federal Way Northbound to Gowen Road

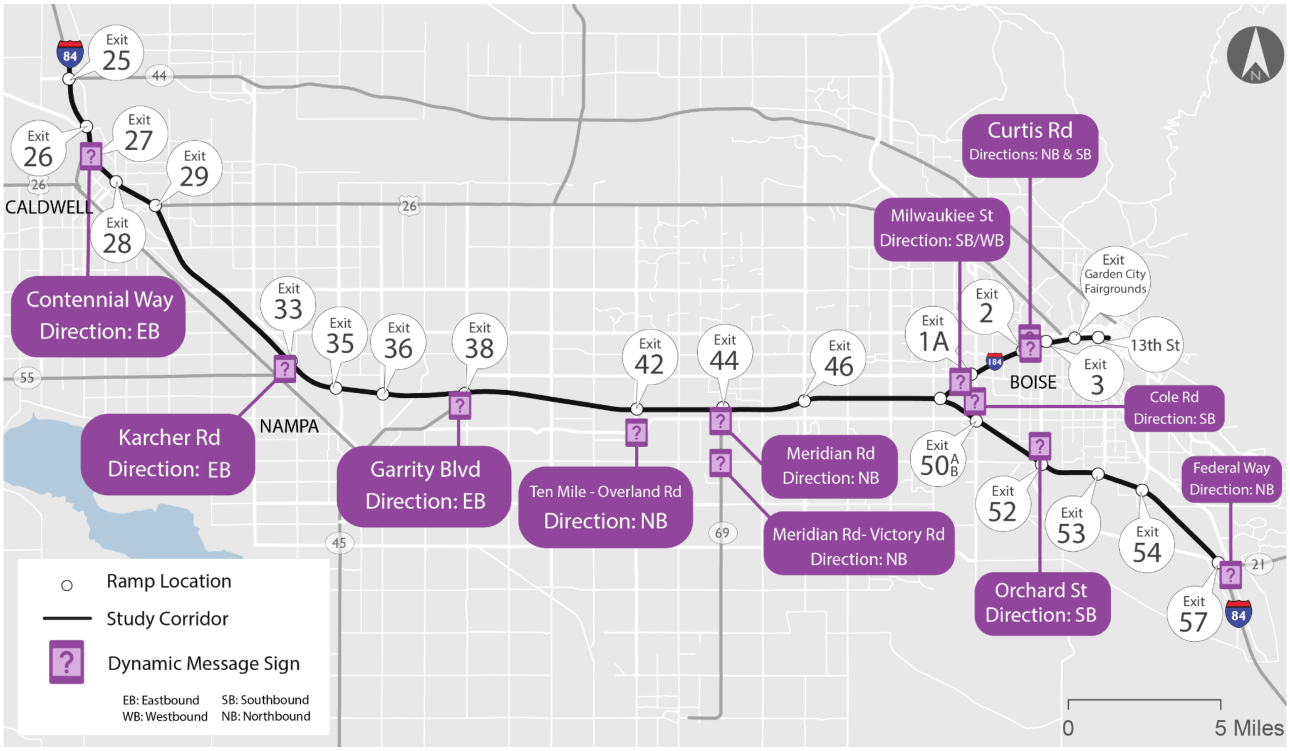


FIGURE A3: PROPOSED DYNAMIC MESSAGE SIGNS ALONG CORRIDOR

BENEFITS AND COST

TOPS-BC B/C RATIO FOR DMS: 0.36

Implementation Cost:

- **$931,500 per sign location (12 assumed) including contingency.**
- **Total: $11,178,000**

Annual Operations and Maintenance:

- $12,150 per sign

BENEFITS		ANNUALIZED COST
AVERAGE TIME (MINUTES) SAVED BY DRIVERS ACTING	**10**	**$983,063**
PERIODS PER YEAR (DAYS)	**30**	
TOTAL (AVERAGE ANNUAL BENEFIT)	**$352,588**	

IMPLEMENTATION FEASIBILITY

Messages can be easily pre-programmed and/or time-based after deciding under what circumstances messages will be deployed. Operators may need access to other systems (traffic detection sensors or video cameras) to initiate a response. Software updates and equipment maintenance is expected to be periodic. An agreement would need to specify ownership, access, and control. Some public education may be considered to bring awareness to drivers of the new addition.

Physical Feasibility

- Feasibility of DMS integration is parallel in many ways to regional CCTV video sharing. However, additional physical infrastructure construction would be required to address identified gaps in DMS coverage within the corridor.
- Detailed engineering would be required to identify appropriate DMS locations within the corridor, as well as the opportunities for use of new or existing poles/gantries for mounting DMS.
- As infill devices within the established and instrumented corridor, creation of communication links from new DMS to the control center headend is not anticipated to be a major limitation.
- New DMS could support Active Traffic Management and Dynamic Roadway Warning tactics as well.

Institutional Feasibility

- The greatest value of the DMS sign investment will be obtained through a coordinated, pre-planned initiative to develop DMS message sign sets across multiple regional agencies.
- An update of existing SOPs, including ITD approved DMS message sets used by StateComm, will be required.
- Guidelines and priorities for DMS messages displayed will need to be established in a multi-user system, with incident or emergency messages typically taking the highest precedence.

Operations and Maintenance Feasibility

- Operations staff intervention is required to effectively utilize DMS signs during the operating day. This capacity is assumed to be provided by State Comm, ACHD, and City of Nampa.
- Off-hours coverage by StateComm will extend the reach and effectiveness of ACHD and Nampa DMS assets when their respective control centers are not staffed, provided that pre-planned protocols and message sets have been established.
- Decision support capabilities of traffic management software, which can suggest DMS message sets in response to various incident types, can promote consistency in DMS use and reduce the amount of 'on-the-spot' decision making required by operations center personnel.

Quick Start/Pilot Feasibility

- Development of Pilot DMS sharing protocols for specific event types, e.g. construction or major pre-planned events, provides an easy opportunity to experiment with regional DMS coordination.
- Portable dynamic message signs (PDMS) could be used in the interim period before permanent DMS signs are constructed.

DYNAMIC ROADWAY WARNING DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

Dynamic Roadway Warning Signs can provide drivers awareness of certain traffic conditions (hazards, incidents, congestion, weather conditions, etc. via traffic detection sensors or video cameras). In particular, there are times when puddling water exists on the road along I-184 during significant rain events. The project team proposes implementing a Dynamic Roadway Warning System near Curtis Road (see Figure A4) in both directions. The Dynamic Roadway Warning System combines weather sensors that monitor the roadway condition including roadway grip factor, and presences of water on the roadway with Dynamic Message Signs to warn drivers. The Dynamic Roadway System could be combined with the variable speed system to encourage slower speeds approaching the water hazard.

This tactic has a high benefit/cost ratio due to a low cost for the benefit it achieves. The warnings would be infrequent, only coming on when there is an applicable weather event, but provide information to the traveling public that can decrease crashes. The tactic could be implemented on other parts of the corridor as part of other infrastructure deployments (like for active traffic management or DMS).

Purpose

- Provide information to drivers to warn them about hazardous traffic conditions
- RWIS can collect, monitor, and communicate real-time weather information (such as temperature, wind speed, wind direction, fog, precipitation, water depth, pavement friction and chemical concentrations)
- The weather station measures grip factor and includes an associated variable message sign for alerts

Locations

The location for the Dynamic Roadway Warning System is near Curtis Road.

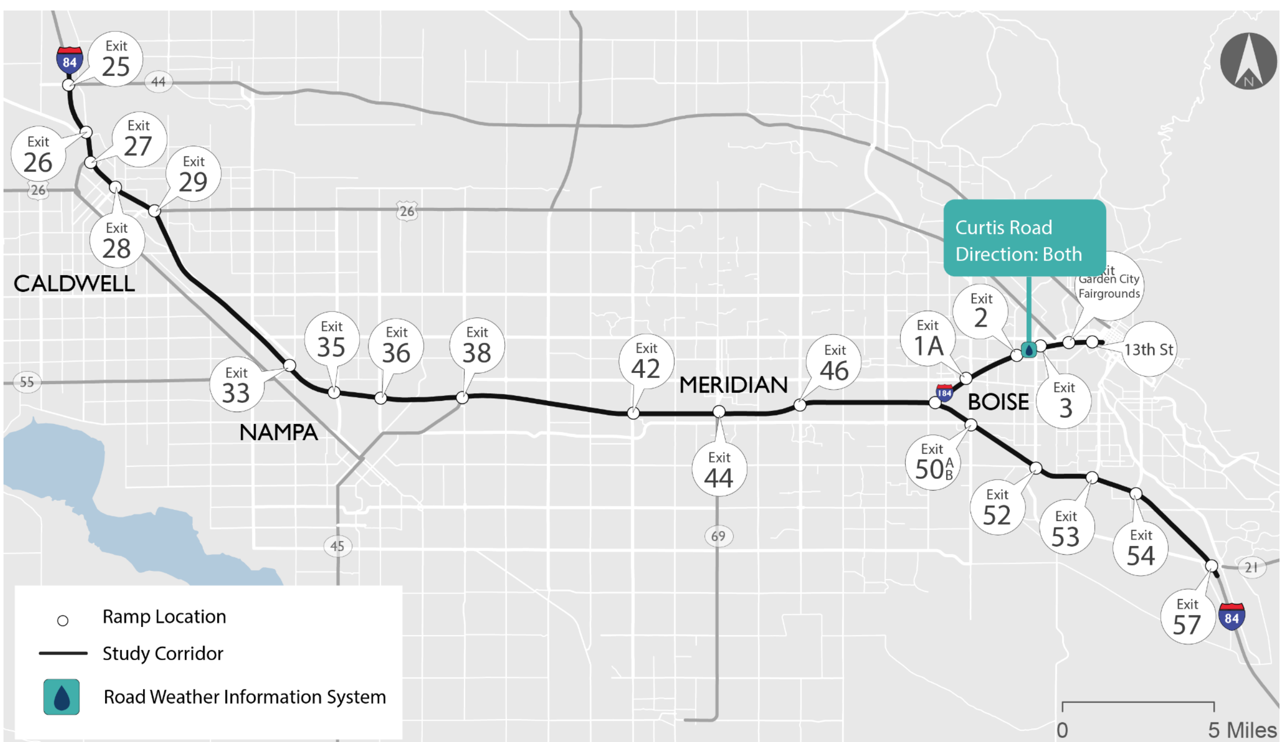


FIGURE A4: LOCATION OF PROPOSED DYNAMIC ROADWAY WARNING SYSTEM

BENEFITS AND COST

TOPS-BC B/C RATIO FOR RWIS: 2.04

Implementation Cost:

- **$402,500 per location (1 assumed) including contingency.**
- **Total: $402,500**

Annual Operations and Maintenance:

- $3,330 per location

BENEFITS		ANNUALIZED COST
TOTAL AVERAGE ANNUAL BENEFIT	$85,265	$41,768

IMPLEMENTATION FEASIBILITY

If dynamic roadway warnings were to be implemented with or after roadside traveler information (digital message signs) signs being implemented, it would be a highly feasible addition. Adding warnings would need pre-programmed thresholds that trigger the warning system and pre-programmed messages for the warning signs.

Physical Feasibility

- The limited extent of field infrastructure deployment for the weather sensors and associated driver warning equipment reduces physical barriers to implementation.
- The likely need to mount technology infrastructure on the I-184 flyover structure may add a manageable complexity to device location and power/communications feeds.

Institutional Feasibility

- The dynamic roadway warning system would be implemented and operated independently by ITD. It could be combined with the Active Traffic Management System or installed as a stand-alone system.

Operations and Maintenance Feasibility

- The dynamic roadway warning system would operate in an automated fashion. Direct manual intervention by control center personnel would be possible but not required.

- Ongoing performance/health checks and preventative maintenance would be performed by ITD District 3 in conjunction with other field ITS systems in the corridor.

- If the roadway service patrols with mounted DMS signs were positioned to provide warnings (rather than fixed signs installed on I-184), these personnel would need to be available for deployment on a 24/7 basis for dispatch when a weather station alert was detected. Patrol vehicle operators would need to be appropriately trained in vehicle positioning and appropriate messages. These could be used in addition to automated warning systems to provide additional flexibility.

Quick Start/Pilot Feasibility

- This tactic represents a “quick start” opportunity to fully implement the technology solution to address I-184 flooding and icing in the near term.
- If successful in the I-184 location, additional dynamic roadway warning systems could be deployed to other regional trouble spots if identified in the future.

TRAFFIC SIGNAL MANAGEMENT AND OPERATIONS

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

Traffic signal management involves the planning, design, integration, maintenance, and proactive operation of a traffic signal system to improve the efficiency, safety and reliability of signalized intersection operation. Although there are no signalized intersections directly along the study corridor, this tactic can benefit the freeway corridor by utilizing planned events plans or incident timing plans that synchronize groups of signals and prioritize certain traffic flows and improve performance of detour routes.

In the event of an incident on the freeway, an incident timing plan could synchronize the traffic movements that can detour around that blocked segment in the freeway system. A similar strategy could be deployed for planned events that result in a high volume of vehicle traffic traveling in a particular direction.

This tactic has a low benefit/cost ratio due to the infrequency of events or significant incidents. The tactic is still beneficial in those instances.

Purpose

- Improve corridor operations to prioritizing certain traffic flows, particularly during large planned events or significant incidents
- Reduce delays due to lane-blocking incidents

Locations

- Traffic signal management would operate region-wide
- Prioritizing vehicle flows to detour around high-incident locations during peak hours or severe weather events could reduce incident response times, and therefore mitigate the negative impacts of these events on corridor operations.

BENEFITS AND COST

TOPS-BC B/C RATIO FOR TRAFFIC SIGNAL MANAGEMNENT: 0.68

Implementation Cost:

- **$230,000 per signal (3 assumed – specific locations not identified) including contingency.**
- **Total: $690,000**

Annual Operations and Maintenance:

- $1,000 per signal

BENEFITS		ANNUALIZED COST
CRASH RATE REDUCTION	2%	$32,495
REDUCTION IN FUEL USE	5%	
PERIODS PER YEAR (DAYS)	250	
TOTAL AVERAGE ANNUAL BENEFIT	$22,011	

IMPLEMENTATION FEASIBILITY

Physical Feasibility

- This tactic would leverage existing traffic signal equipment in the field. Coordination is limited to traffic signals which have field-to-central traffic signal control capabilities.

Institutional Feasibility

- This tactic could involve some or all of the agencies in the Treasure Valley who own, operate, or maintain traffic signal systems and have central traffic signal control capabilities. At a minimum, this is anticipated to include ITD, ACHD, and City of Nampa.
- Significant pre-planning for traffic signal response plans is required to fully benefit from real-time regional signal coordination. A foundational operating agreement among partners is advised.

Operations and Maintenance Feasibility

- Implementation of this tactic requires real-time presence of trained operations control center/traffic engineering staff to monitor conditions and implement appropriate traffic signal timing plans to ameliorate degraded conditions.
- Off-hours coverage would be required for ACHD and City of Nampa signal systems, either through ITD/State Comm or other on-call staff coverage relationships. Agencies may hesitate to delegate this control outside of clear operating protocols and the availability of trained staff. Technology integration and training questions may also arise under this scenario.

Quick Start/Pilot Feasibility

- One or more agencies could focus on a specific interchange, corridor, or incident type as a pilot for broader regional coordination.

ON-RAMP CONFIGURATION AND AUXILIARY LANES

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

Construct targeted roadway improvements to meet current standards for acceleration and merge areas. Evaluate effectiveness of ramp layouts at Ten Mile, Meridian, Eagle interchanges. Define if one ramp layout performs more efficiently in regards to operations and safety.

Cost for this tactic is relatively high compared to others in the second level screening. Improvements to ramps and auxiliary lanes is a significant capital cost. Benefits can include improved operations or a reduction in crashes on the ramps and in the merge areas.

Purpose

- Evaluate existing interstate layout to determine if auxiliary lanes or ramp configuration changes would provide operational and safety benefits.

Locations

- Ten Mile Road interchange (Exit 42)
- Meridian Road interchange (Exit 44)
- Eagle Road interchange (Exit 46)

BENEFITS AND COST

BENEFITS	COST
• **Reduced number of crashes** • **Merging/weaving improvements**	• Varies

IMPLEMENTATION FEASIBILITY

When comparing ramp lengths, the Ten Mile Road interchange has longer ramps than the similar Meridian interchange.

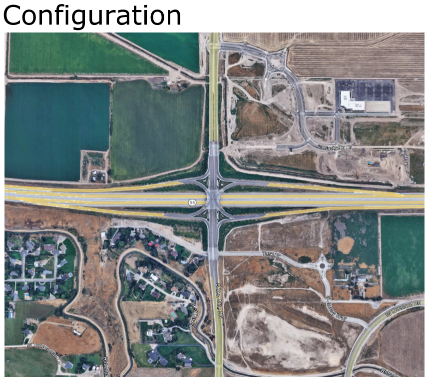
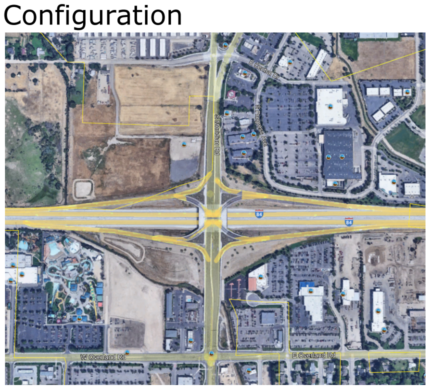
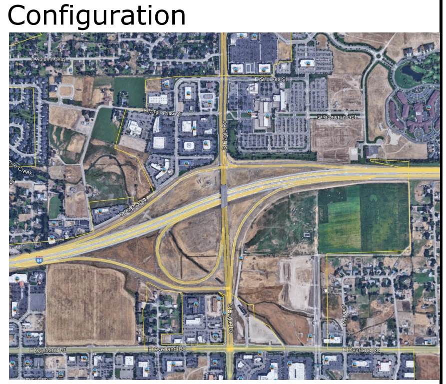
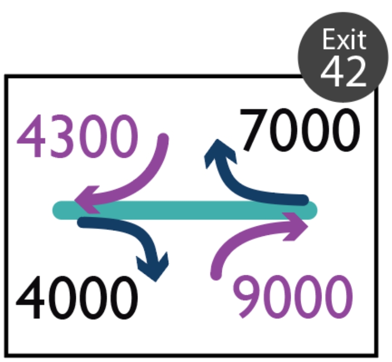
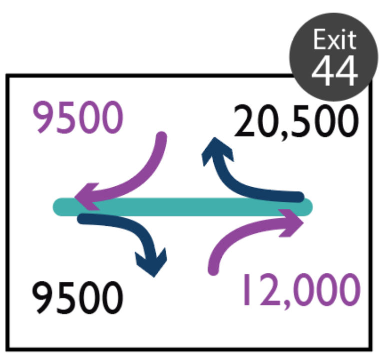
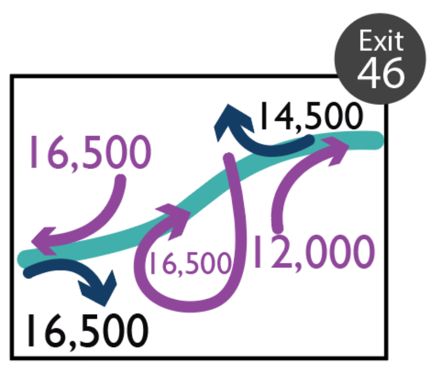
The eastbound Ten Mile Road on-ramp has three lanes initially that merge into one lane quickly before reaching mainline I-84. Meridian Road on-ramps are shorter than Ten Mile Road and merge into interstate lanes. Eagle Road has long ramps but they merge into existing interstate lanes (the western eastbound on-ramp has its own interstate lane but then merges into the same lane as the eastern eastbound on-ramp).

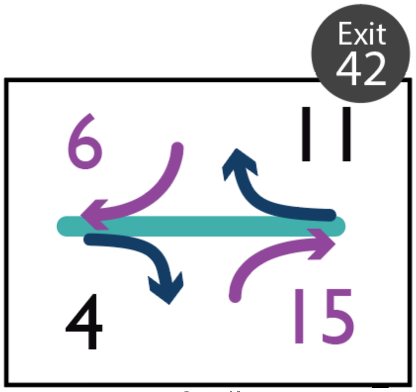
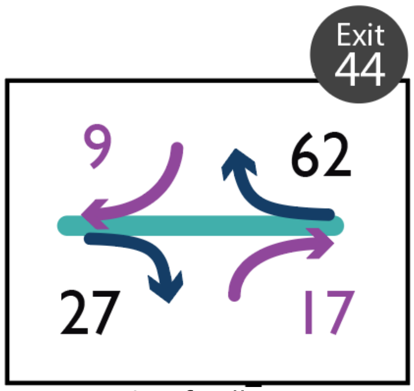
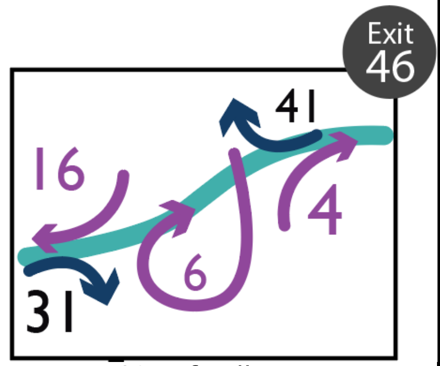
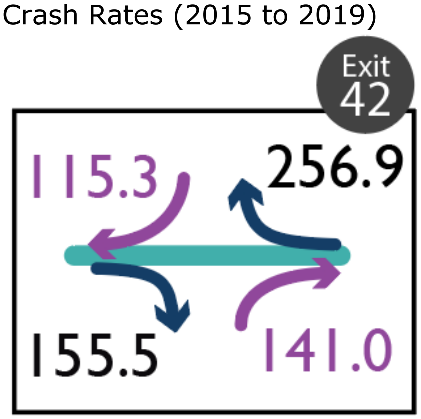
Crash data indicates that the Eagle Road interchange has the highest number of crashes followed by Meridian Road and then the Ten Mile Road interchange. The number of crashes is consistent with the volume of traffic using the interchange.

In 2020, The Idaho Transportation Department prepared a report on Idaho Traffic Crashes and reported that the average crash rate for interstate highways was 63.8 in 2020[2]. Segment crash rates were calculated for each ramp on all three interchanges to determine the relative safety by taking into account exposure data (traffic volumes). The only two ramps that were under the average for interstate highways in Idaho were on Eagle Road interchange: the eastbound on-ramp (from southbound on Eagle Road) and the westbound on-ramp. Meridian Road interchange experienced the highest crash rates compared to the

[2] Source: ITD Idaho Traffic Crashes 2020 https://apps.itd.idaho.gov/Apps/OHS/Crash/20/Analysis.pdf

other two interchanges, particularly the eastbound off-ramp and the westbound off-ramp locations. This may be partially due to signal timing at the ramp terminals or arterial congestion affecting the ramps. Additional ramp length and queue warning could decrease the crash rates.

Ten Mile Road Interchange	Meridian Road Interchange	Eagle Road Interchange
Ramp Lengths • Eastbound On-Ramp - 3,420’ (0.65 miles) • Eastbound Off-Ramp - 1,860’ (0.35 miles) • Westbound On-Ramp - 3,502’ (0.66 miles) • Westbound Off-Ramp - 1,770’ (0.34 miles)	Ramp Lengths • Eastbound On-Ramp - 2,110’ (0.40 miles) • Eastbound Off-Ramp - 1,205’ (0.23 miles) • Westbound On-Ramp - 1,960’ (0.37 miles) • Westbound Off-Ramp - 1,620’ (0.31 miles)	Ramp Lengths • Eastbound On-Ramp (west)- 2,394’ (0.45 miles) • Eastbound On-Ramp (east)- 2,823’ (0.53 miles) • Eastbound Off-Ramp - 2,854’ (0.54 miles) • Westbound On-Ramp - 2,951’ (0.56 miles) • Westbound Off-Ramp - 2,490’ (0.47 miles)
Configuration 	Configuration 	Configuration 
2019 AADT 	2019 AADT 	2019 AADT 

<table>
<tr><th>Ten Mile Road Interchange</th><th>Meridian Road Interchange</th><th>Eagle Road Interchange</th></tr>
<tr>
<td>Number of Crashes (2015 to 2019)

• 17% of collisions reported "speed too fast for conditions", 20% "inattention" and another 25% "following too close".
• 38% of collisions were rear-end and 17% reported hitting a curb
Recommendations: Re-evaluate the speeds along the ramps and post more appropriate speed advisory signs. Install road delineators or improve edgeline markings to improve visibility. Evaluate merging distances on the eastbound on-ramp.</td>
<td>Number of Crashes (2015 to 2019)

• 15% of collisions reported "inattention" and another 33% "following too close".
• 58% of collisions were rear-end and 8% reported head-on turning
• 17% occurred in dark conditions
Recommendations: Install road delineators or improve edgeline markings to improve visibility. Improve lighting conditions at ramp locations</td>
<td>Number of Crashes (2015 to 2019)

• 18% of collisions reported "inattention" and another 42% "following too close".
• 63% of collisions were rear-end and 10% reported sideswipe
• 17% occurred in dark conditions
Recommendations: Install road delineators or improve edgeline markings to improve visibility. Improve lighting conditions at ramp locations where appropriate.</td>
</tr>
<tr>
<td>Crash Rates (2015 to 2019)
</td>
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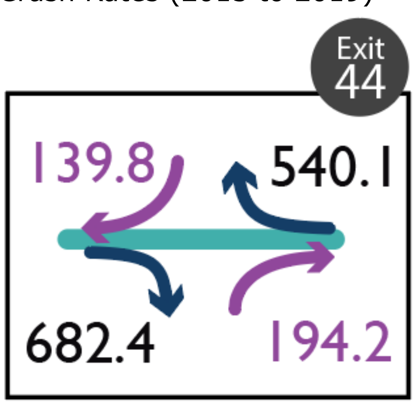
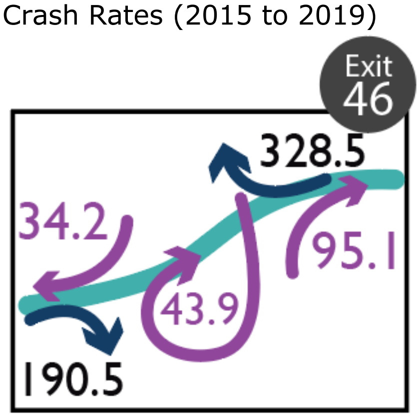
</td>
<td>Crash Rates (2015 to 2019)
</td>
</tr>
</table>

Physical Feasibility

- Physical conditions and available right-of-way will have a profound and direct impact on the feasibility of ramp improvements and auxiliary lanes.

Institutional Feasibility

- This tactic is envisioned to be implemented by ITD operating in an independent capacity on its own infrastructure and right-of-way.

Operations and Maintenance Feasibility

- Expanded facilities would be operated and maintained by ITD as with the existing interstate facilities.

Quick Start/Pilot Feasibility

- Due to engineering requirements and capital improvements, this tactic is generally viewed as a medium- to long-term strategy.
- Consider prioritizing locations with relatively few engineering or cost barriers to implementation, to provide a proof-of-concept motivating further implementation.

CORRIDOR OPERATIONS TEAM

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

The Corridor Operations Team tactic includes a standing committee of traffic management and emergency response agencies to conduct pre- and post-incident and event coordination, with the goal of improving effectiveness of coordinated incident response.

Activities of a Corridor Operations Team are typically more focused on actual operations events as opposed to planning activities (like the Treasure Valley Regional Operations Work Group, ROWG), though the activities of the two groups are interrelated.

Sample Corridor Operations Team topics may include: debriefs of major incident/accident responses to identify lessons learned; pre-construction season coordination; major event planning; identification of training needs and/or delivery of training.

The corridor operations team has a low cost but could achieve a high benefit. The team can push implementation forward for several of the tactics outlined in this document. The operations team could serve as a regional work group that determines who owns infrastructure, who operates infrastructure, and phasing for infrastructure implementation.

Purpose

Many of the operational needs of the I-84/I-184 corridor span multiple jurisdictions, including transportation, transit, law enforcement, and emergency management agencies. In such a corridor, a collaborative approach is necessary to plan, execute, evaluate, and refine operational tactics.

The Corridor Operations Team is envisioned as a permanent, multi-agency group of "hands-on" operations personnel drawn from across the region. The team can be used as means for continual improvement of operational partnerships and agreements, implementation of technological/infrastructure improvements, and other issues like training, staffing, and performance monitoring.

Corridor Operations Team participation would be open to all agencies involved in interstate operations, including but not limited to:

- Idaho Transportation Department (HQ and District 3)
- State Communications
- Idaho State Patrol
- Ada County Highway District
- Ada County Sheriff
- Canyon County Sheriff
- City of Nampa
- City of Caldwell
- Valley Regional Transit
- COMPASS
- Representatives of Private Tow Operators

In comparison to the existing Regional Operations Work Group, the Corridor Operations Team is envisioned to have a more tactical focus on specific day-to-day operations issues associated with the I-84/I-184 corridors. This may include incident planning/debriefs, pre-construction season coordination, ITS project implementation, traffic incident management training, operating procedure updates, etc.

Locations

- The Corridor Operations Team would operate over the entire Treasure Valley, potentially including non-interstate state highways and local arterials. The group would likely focus on the I-84/I-184 corridor initially with other working groups forming later for additional corridors.

BENEFITS AND COST

BENEFITS	COST
• **More coordinated approach to addressing regional operational issues that span jurisdictional boundaries.** • **Forum for discussion of current corridor operations needs and challenges and to formulate action plans.** • **Focus on tactical operational issues raised by stakeholder agencies, such as coordination of operating protocols, DMS message sets, training needs, etc.**	• Approx. 0.25 FTE for lead agency Corridor Operation Team coordinator • Approx. 0.1 FTE for other Corridor Operations Team Participants

IMPLEMENTATION FEASIBILITY

Physical Feasibility

- This tactic is focused on interagency collaboration and does not have a physical element.

Institutional Feasibility

- The Corridor Operations Team could be coordinated by ITD as the facility owner, or by COMPASS as the regional planning organization, in cooperation with traffic and emergency management agencies across the Treasure Valley.
- The success of the Corridor Operations Team depends on the sustained participation of individual agencies, as well as institutional support from the leadership of the respective agencies.
- An interagency agreement is recommended to charter the group and define its objectives, scope, activities, and governance.

Operations and Maintenance Feasibility

- The Corridor Operations Team would require a small operating budget and staff support for ongoing meeting facilitation, program administration, and technical support.
- Contributions of other participating agencies would be limited to in-kind staff participation (e.g., 0.1-0.25 FTE per month)

Quick Start/Pilot Feasibility

- Launch of the Corridor Operations Team could begin almost immediately and represents a quick start opportunity for the region.

ENHANCED DETOUR PLANS, TRAFFIC SIGNAL OPERATIONS, AND INTEROPERABLE COMMUNICATION PROCEDURES

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

Establishing an enhanced detour plan in the case of an emergency will lessen the impacts of congestion or road closures on drivers and freight through use of predetermined detour routes. A detour may be needed in the possibility of a hazardous spill, crash, or impeding maintenance. The region's stakeholders have developed detour plans for I-84, but this tactic focuses on enhancements to the existing plan, which may include integration with traffic management systems, automation, and performance measurement to improve the effectiveness and ease of implementation.

Effective detour designs consider accommodation for the characteristics of design vehicles and freight vehicles, provide adequate signage, and are identified in coordination with local transportation agencies. If a road is considered suitable for a detour route, temporary signage and message boards can assist in diverting travelers to desired routes.

Interoperable Communication Procedures/Operations Procedures help to establish a set of standardized operating procedures for response to common Interstate and incident management scenarios. The procedures help clarify roles/responsibilities, decision making, and response actions.

A key objective of the interoperable communications procedures/standard operating procedures tactic is to develop formalized, pre-approved guidelines that are applicable to dynamic corridor conditions and define the specific roles and expectations of each participating agency.

Purpose

- Establish a standard procedure and guidelines for planning, designing, and implementing detour plans
- Pre-determine the best alternate routes to reduce traffic disruption and shorten the period of incident plan implementation

Locations

- The detour plan would be implemented corridor-wide.
- For information on existing detour routes see the *Treasure Valley Incident Operations Manual* (2017) online map, maintained by COMPASS, located here: https://www.arcgis.com/apps/webappviewer/index.html?id=608419d084424972aadad0580f0a8d3e&extent=-13045821.2525%2C5345986.0136%2C-12850142.4601%2C5469508.2513%2C102100

BENEFITS AND COST

BENEFITS	COST
• Reduces traffic interruptions in travel and freight movement **• Enable an efficient and effective response when dispatched to support any jurisdiction**	• Detour Plan Update: Approx. $75,000 cost per update

IMPLEMENTATION FEASIBILITY

Physical Feasibility

- This strategy is focused on interagency collaboration and has a limited physical element.
- Detour routes established would be constrained by the availability and capacity of suitable diversion routes. These routes have been analyzed in previous detour plans developed for the region and would only require updates where network or significant traffic changes have occurred since the last update.
- Flip signs/alternative route signs, and vehicles or temporary barricades for ramp/roadway closures, are supporting physical infrastructure for detour plan implementation.

Institutional Feasibility

- The lack of awareness and training of frontline staff has been a significant barrier to the efficacy of detour plan implementation in the past.
- As with previous detour plans, it is anticipated that COMPASS would maintain and update the detour plan as an electronic document, with periodic participation by other agencies.

Operations and Maintenance Feasibility

- A barrier for implementation is the need for full-time staffing and extensive agency coordination in response to both planned and unplanned incidents necessitating implementation of the detour plan.
- An overall traffic incident management lead agency, such as ITD, is recommended to oversee overall implementation and training activities related to the detour plan.
- Use of maintenance and/or roadway service patrols in certain support functions (e.g. ramp closures) could serve as a force multiplier for law enforcement personnel dealing directly with incident response.

Quick Start/Pilot Feasibility

- Building on the existing base of detour planning and traffic incident management planning, this tactic could be implemented at relatively low cost in the near future as a quick start initiative.

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

Roadway service patrols help in reducing the risk of secondary collisions and maintaining roads through active field patrol. Responsibilities of service patrols include responding to minor incidents, clearing obstructions to roadways, and assisting stranded vehicles with specially equipped vehicles. Clearance of minor incidents and debris reduce roadway hazards and the risk of secondary collisions. Designated to segments of the highway, they provide incident management support and keep the roadway clear of hazards.

Roadway service patrols score highly due to their ability facilitate incident or other event response on the interstate. Costs include vehicles and staffing which is low for the benefit this tactic can achieve.

Purpose

Motorist distress such as a vehicle breakdown, flat tire, dislodged cargo, or similar situations can result in bottlenecks and impacts on the interstate, even when the affected vehicles are safely off the shoulder. These disruptions, in turn, create traffic safety hazards for the stranded motorists as well as approaching vehicles that may encounter unexpected lane blockages, debris, congestion, or stopped traffic.

From a traffic operations perspective, the benefit of a roadway service patrol is quicker and safer clearance of disabled vehicles and similar roadway emergencies, restoring the freeway to normal operations as quickly as possible.

Law enforcement personnel expressed support for roadway service patrols as a "force multiplier" during incident scenarios, allowing sworn officers to focus on the most critical aspects of incident response while roadway service patrol vehicles handled other aspects of traffic management, traveler information, and cleanup.

Outfitted with on-board DMS signs and push bumpers, roadway service patrols can be a valuable addition to many aspects of roadway incident management, as well as a source of peace of mind for traveling motorists.

Locations

- Roadway service patrols would operate corridor-wide.
- Pre-positioning of vehicles at high-incident locations during peak hours or severe weather events could reduce incident response times, and therefore mitigate the negative impacts of these events on corridor operations.

BENEFITS AND COST

BENEFITS	COST
• **Reduced interstate bottlenecks and delays due to blocked lanes and roadside incidents** • **Reduced potential for crashes and serious injuries caused by unexpected debris, lane closures, or slowed/stopped traffic** • **"Force Multiplier" support for law enforcement incident response, detour implementation, and event management** • **Increased public service and safety for disabled motorists**	• $60,000 per outfitted Roadway Service Patrol vehicle • 4-6 FTEs for O&M

IMPLEMENTATION FEASIBILITY

Physical Feasibility

- This tactic relies primarily on fleet vehicles, with limited physical impacts.
- Safety refuge areas on the shoulders, and/or tactic U-turn locations for roadway service patrols and law enforcement could enhance the capabilities for roadway service response.

Institutional Feasibility

- The roadway service patrol would be implemented and operated by ITD, though coordination with other agencies would improve the efficacy of dispatch and incident response.

Operations and Maintenance Feasibility

- Roadway service patrol vehicles and staff would be maintained by ITD District 3, provided sustainable funding were available for this purpose.

Quick Start/Pilot Feasibility

- The Roadway service patrol has significant potential as a valuable "early win" with strong stakeholder support, and which is also highly visible in the community.

TRAFFIC INCIDENT MANAGEMENT (TIM) LAWS

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

A traffic incident management strategic plan sets the overall framework for how transportation and emergency response agencies respond to incidents. This tactic would develop a TIM strategic plan for the region that could be used to develop TIM laws in the future. This tactic was evaluated qualitatively on institutional, and operational needs. Public information dissemination needs were also considered.

A common practice implemented through a TIM plan are quick clearance laws. Quick clearance is the practice of safely and rapidly removing temporary obstructions, such as debris or disabled vehicles, from the roadway. Quick clearance practices can increase the safety for incident responders by minimizing the exposure to adjacent passing traffic, reduce the potential of secondary incidents, and relieve overall congestion delay.

TIMs score highly due to their ability to help clear incidents on the interstate. Effectively clearing incidents can reduce crashes, incident duration, and bottlenecks on the interstate. Cost is largely associated with training and public awareness campaigns.

Purpose

The purpose of the strategic plan would be to develop consistent and effective responses to traffic incidents. TIM laws can be enforced through static roadside signs and public outreach.

Locations

Traffic incident management laws would be implemented for I-84 and I-184. They could also apply to other regions throughout the state.

BENEFITS AND COST

BENEFITS	COST
• **Reduced incident duration, traffic delays, and bottlenecks caused by operable vehicles blocking interstate travel lanes** • **Improved safety for persons involved in traffic incidents due to safe relocation from travel lanes** • **Reduced secondary incidents and safety hazards due to unexpected debris, lane closures, or slowed/stopped traffic**	• Initial training/public awareness campaign: $200,000 • Static roadside signage notifying public of quick clearance laws: $30,000 • 0.25 FTE for ongoing training and awareness activities

IMPLEMENTATION FEASIBILITY

Physical Feasibility

- This tactic is focused on state legislation and ITD policy and does not have a significant physical element.

- Roadside awareness signs (e.g. State Law - removed crash vehicles from travel lane) would be posted throughout the corridor.

Institutional Feasibility

- The quick clearance policy would be implemented by the Idaho State Patrol, with the support of ITD and other law enforcement agencies.

Operations and Maintenance Feasibility

- Initially and on an ongoing basis, public awareness and education campaigns would be necessary to introduce the new law and the expected behavior of motorists during an incident situation.
- DMS signs operated by ITD/State Comm could be used as an element of a public education campaign.

Quick Start/Pilot Feasibility

- A necessary precondition to implementing this tactic is authorization by the Idaho State Legislature.
- A quick clearance law could be implemented relatively quickly through training and public awareness once this significant legislative hurdle was cleared.

REAL-TIME TRANSIT INFORMATION AND TRANSIT TRAVELER INFORMATION THROUGH THIRD-PARTY SERVICES

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

To reduce the expenses of building a real-time information system on platform or onboard, transit agencies may choose to work with third-party services to provide trip updates, service alerts, and platform and bus locations. It can reduce expenses of building real-time information systems on platform or onboard. Transit riders may find this to be an attractive option as it assists in trip planning and potentially decreases wait time, raising rider satisfaction. VRT is currently working with third-party services to disseminate information to the traveling public. Since VRT is proactively pursuing that portion of this tactic, this analysis focused on providing real-time transit information at key stops or park n' rides that VRT currently services. An information kiosk or sign would be installed at the locations described below to provide information like expected bus arrival time, current bus location, expected route travel time, among other potential information.

This tactic was evaluated with TOPS-BC to provide a benefit/cost ratio. The benefit/cost ratio is over 1.0 due to the low cost of the infrastructure. The infrastructure was assumed to inform a percentage of current ridership but as ridership increases, the benefit/cost ratio will also increase.

Purpose

- Provide information to riders on bus location, arrival time, and other operational information.

Locations

The informational kiosks could be located at several locations, but initial locations are shown in Figure A5 and include the following:

- Ten Mile Park n' Ride
- Canyon/Caldwell VRT transit stop
- N Idaho Center Blvd/E Gate Blvd VRT transit stop

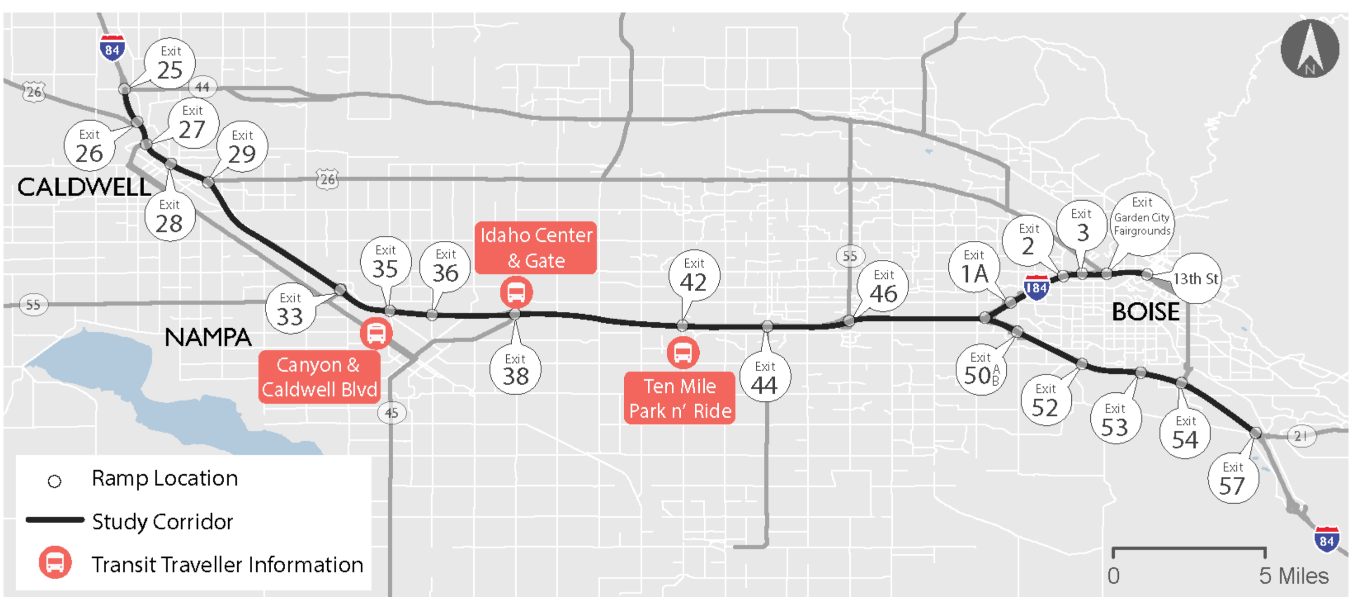


FIGURE A5: PROPOSED TRANSIT TRAVELER INFORMATION LOCATIONS AT PARK AND RIDES

BENEFITS AND COST

TOPS-BC B/C RATIO FOR REAL TIME TRANSIT INFORMATION: 1.21

Implementation Cost:

- **$690,000 with contingency for per location (3 assumed) for trip planning software and equipment**
- **Total: $2,070,000**

Annual Operations and Maintenance:

- $2,000 per location

BENEFITS		ANNUALIZED COST
TOTAL AVERAGE ANNUAL BENEFIT	**$123,439**	**$102,271**

IMPLEMENTATION FEASIBILITY

Physical Feasibility

- Emerging e-paper sign technologies allow implementation of real-time information using solar and cellular technologies, eliminating the need for expensive power and wired communications infrastructure.
- The third-party data feed is a backend/central systems improvement, with no physical components to be installed in the field.

Institutional Feasibility

- Real time traveler information signs and third-party data feeds would be implemented by Valley Regional Transit, which could execute the tactic in an independent fashion.

Operations and Maintenance Feasibility

- Valley Regional Transit would be responsible for operating and maintaining the real-time signs and third-party data feeds.
- The system would operate in a largely automated fashion, requiring limited oversight by VRT personnel.

Quick Start/Pilot Feasibility

- This tactic would be implemented directly by Valley Regional Transit as part of its system-wide customer information strategy.
- Signs could be implemented in the near term, leveraging existing real-time GTFS data feeds generated by VRT to supply bus arrival and service update information to the park-and-ride signs and third-party services.

REGIONAL PERFORMANCE MANAGEMENT SYSTEM

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

This tactic involves leveraging data from ITS devices and other data sources to provide quantitative measures of the effectiveness of regional operations strategies. Regional performance management builds upon existing regional transportation system performance measures for the Treasure Valley developed by COMPASS. Implementing regional performance management for TSMO in the Treasure Valley will help to make the case for ongoing investment, by demonstrating the contributions of TSMO technologies, personnel, and programs to meeting regional transportation goals such as safety and congestion reduction.

The Regional performance management tactic would entail development of data sharing, device management, and performance measurement for multiple regional partners. The system would incorporate current data collected by individual agencies and provide that information to other regional partners. Regional actions could then be coordinated quickly for incidents, events, or other regional needs. This tactic was evaluated qualitatively based on institutional, management, and coordination needs amongst the various regional stakeholders.

The benefit from this tactic comes from increased regional coordination and data sharing. Coordination and data sharing can improve regional operations, incident response, and event management. The cost is primarily associated with acquiring a central data management system and the associated communications infrastructure.

Purpose

"Making the Case" for regional operations is an important part of sustaining policy support and funding for TSMO. It also helps agencies understand operational phenomena (especially non-recurring events), plan future improvements, and monitor/adjust TSMO strategies that have been deployed in the region. Better performance measurement can also help establish the contribution of operations programs to meeting regional mobility goals as established through the *Communities in Motion 2040 2.0* plan.

COMPASS currently maintains a repository of regional transportation data, including data generated by field ITS systems of participating agencies. The Regional Performance Management System tactic builds upon this foundation by establishing specific operational measures, formalizing data collection strategies, and building tools (e.g. dashboards, reports), to allow for ongoing monitoring of operational effectiveness. This system can play an important role in helping to demonstrate the benefits of new TSMO strategies proposed in this plan once they are implemented live in the Treasure Valley.

Locations

- The Regional Performance Management System is a software platform deployed to cover the entire Treasure Valley, Ada and Canyon Counties.

BENEFITS AND COST

BENEFITS	COST
• Data-driven insight into regional operations issues, including non-recurring events • Data repository and analysis tools to help measure the efficacy of operational strategies implemented. • Supports regional transportation performance measurement, for metrics that rely on operations data and/or provide insight into operations measures like travel time reliability.	• Estimated $150,000-$250,000 for central data management systems upgrades, ITS systems data integration, dashboard/analysis tools, and software licensing

IMPLEMENTATION FEASIBILITY

Physical Feasibility

- This tactic is focused on data systems integration and does not have a physical element.
- Performance management systems would leverage existing ITS field equipment and detectors as data sources.
- Select additional field sensors could be deployed where data gaps or quality issues are identified.

Institutional Feasibility

- The responsibility to operate and maintain the Regional Performance Management System would need to be determined.

Operations and Maintenance Feasibility

- Regional Performance Management System operation and maintenance responsibilities would need to be determined. COMPASS is a possibility as part of its current mandate for archiving and analyzing regional transportation data and combining regional transportation performance measures. ITD is a possibility because of the potential need for a statewide performance management system.
- The success of the system relies on the ongoing ability and willingness of partner operating agencies to make ITS system data and operational logs (e.g., incident reports) available on a consistent basis.
- Data would be made available to agencies or third parties to support project-specific analysis, e.g. design studies for infrastructure or TSMO improvements.

Quick Start/Pilot Feasibility

- Using improvements to regional data systems, Regional Performance Management System implementation could advance in the near term and on an ongoing incremental basis.
- Development of data sources and dashboards to support regional transportation performance measures is an example of a phased implementation objective that could be prioritized to address an existing need.

SMART WORK ZONES AND AUTOMATED WORK ZONE INFORMATION SYSTEMS

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

Smart work zone systems use ITS to predict travel time, delays, or current speed in a work zone on a real-time basis to improve safety for all motorists and construction workers. These systems can be used to provide real-time information to motorists during construction, incidents, temporary closures, or any unexpected roadway conditions.

Automated work zone information systems (AWIS) alert motorists to traffic conditions before they enter a work zone and allows them to choose alternate routes based on guidance from dynamic message signs.

AWIS installation involves traffic data collecting devices to monitor traffic conditions, dynamic message signs to display traffic information, dynamic work zone speed signs, and a system to calculate estimated travel times. Other options include smart arrow board technology that automatically transmits real-time coordinates and status updates of arrow boards to central software and web pages with no staff intervention. This tactic was evaluated using TOPS-BC to get a benefit/cost ratio.

New technologies are emerging that use video captured from vehicles traveling through the work zone to geo-locate all traffic control devices within a work zone and share it digitally. This information can be combined with recent crash/incident data to enable operators to evaluate the effectiveness of work zone traffic control on a daily basis.

Smart work zones achieve a high benefit/cost ratio due to the relatively low cost of the infrastructure. The benefit comes from providing information to travelers so they can change lanes, change speed, or divert to a different route. The information can reduce crashes through work zones.

Purpose

- Provide work zone information to drivers so they can divert, merge into a proper lane, or adjust speeds to match work zone conditions.
- Reduce crash rates through work zones.

Locations

This tactic could be implemented along all of I-84 and I-184. For TOPS-BC analysis purposes, a typical work zone from recent expansion of I-84 was used.

BENEFITS AND COST

TOPS-BC B/C RATIO FOR WORK ZONES: 2.53

Implementation Cost:

- **$310,500 per deployment (1 assumed) including contingency.**
- **Total: $310,500**

Annual Operations and Maintenance:

- $3,360 per location

BENEFITS		ANNUALIZED COST
TOTAL AVERAGE ANNUAL BENEFIT	**$50,578**	**$33,104**

IMPLEMENTATION FEASIBILITY

Physical Feasibility

- By their nature, smart work zone technologies are designed to be temporary. Deployments would utilize temporary field equipment.
- Systems would be supported by existing field ITS infrastructure like DMS and CCTV locations in the vicinity of construction.

Institutional Feasibility

- In the I-84/I-184 corridor, smart work zone technology would be implemented by ITD in partnership with its construction contractors.
- Under certain circumstances, roadway service patrol vehicles equipped with on-board Dynamic Message Signs may be an option to augment smart work zone traveler information systems (e.g., providing upstream notifications about work zone delays, closures, or detours).

Operations and Maintenance Feasibility

- Participating entities are advised to develop a project concept of operations to describe the operational objectives, roles, technologies used, and operating procedure to effectively use the smart work zone technologies.
- Coordination with State Comm and/or ITD District 3 may be advisable to coordinate work zone management with overall corridor operations activities, including control of fixed ITS assets.

Quick Start/Pilot Feasibility

- Variable speeds in work zones are currently being used as part of the expansion of I-84. Additional smart work zone tactics could be implemented in future pilots could be based on upcoming major construction project as a proof of concept. Technology feasibility and success as measured through reductions in crashes, delay, etc. would be used to justify expanded use of smart work zones in the future.

EVENT MANAGEMENT

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

Event transportation management systems can help control the impact of congestion at stadiums or event centers (specifically at Ford Idaho Center and Albertsons Stadium). In areas with frequent events, large changeable destination signs or other lane control equipment can be installed. In areas with occasional or one-time events, portable equipment can help smooth traffic flow. Major construction projects share many similarities with scheduled events and can be considered an extension of event management.

Travel patterns associated with events differ from routine, peak-hour commuter traffic in location, frequency, and duration. If compounded by real-time incidents like traffic accidents or severe weather, event traffic can quickly degrade into a temporary but frustrating gridlock situation for travelers and event patrons.

This tactic would involve interagency coordination, event management coordination, and event plan preparation. Event management was evaluated based on institutional and operational feasibility.

Event management scores lower than several of the tactics in this document due primarily to the infrequency of events. Traffic management during events like a Boise State Football game provides benefits for local roadways as well as interstate operations. Cost is low for developing these plans.

Purpose

- Develop agency operating partnerships and procedures specific to major events in the Treasure Valley.
- Mitigate operational impacts to the interstate system

Locations

The Ford Idaho Center in Nampa (e.g. concerts, Snake River Stampede) and Albertsons Stadium in Boise (Boise State football) are the two most critical event locations in the region; however other large scale events at additional locations (e.g. Treefort) may also justify a pre-planned event management response. This tactic applies to roadways connecting to the interstate system and interstate ramps.

BENEFITS AND COST

BENEFITS	COST
• **Formulation of specific response plans for major recurring event and construction scenarios in the Treasure Valley** • **Improved coordination across multiple agencies involved in event traffic management** • **Leveraging of ITS assets and personnel for a new use case, beyond traditional peak-period commuting and incident scenarios.**	• Approx. $50,000 to develop event management plan and SOPs per major event type or venue

IMPLEMENTATION FEASIBILITY

Physical Feasibility

- This tactic is focused on interagency collaboration and does not have a physical element.
- Portable equipment, e.g. dynamic message signs, could be deployed to supplement fixed infrastructure if necessary to support seasonal or special event needs (e.g., special event parking guidance).

Institutional Feasibility

- Event management tactics require collaboration of the relevant traffic jurisdictions, law enforcement (which often plays a prominent role in event traffic management), and the venue operators themselves.
- The specific players will vary based on the event types and locations under consideration. The Ford Idaho Center is a notably complex location, with anticipated involvement from City of Nampa (DPW and Police), ITD (I-84 freeway access), ACHD (given proximity to the County Line), Ford Idaho Center Management, and potentially others.

Operations and Maintenance Feasibility

- Major events often occur on evenings or weekends. An important consideration is the availability of traffic management personnel during these periods. For example, ACHD and City of Nampa traffic management centers would typically not be staffed at these times, unless specific arrangements were implemented as part of an event management plan.
- Events by their nature are infrequent, with even major recurring events like Boise State football games having a significant off-season. Refresher training, therefore, is a key consideration to maintain the viability of the event management plan during inactive periods and in the face of inevitable staff turnover.
- Appropriate documentation of roles, procedures, traffic control device/personnel placement, DMS message configurations, etc. can help to maintain the viability of the event plan from season to season.

- An advantage of off-seasons is the ability to debrief on the effectiveness of the prior season's event management activities, and to plan for improvements the following season. This point is applicable to scheduled events as well as major construction.

Quick Start/Pilot Feasibility

- Event management tactics are amenable to incremental or pilot approaches. An incident management plan attempted on a trial basis for one event can be expanded, revised, or discontinued based on the results.
- Willingness of agency and event management participants do develop a plan bodes well for success and can be a guide for selecting pilot event management opportunities.

SHOULDER RUNNING TRANSIT

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

The shoulder running transit tactic uses existing hard interstate shoulders for additional roadway capacity to improve bus travel time and reliability, incentivizing use of transit due to the improvement in relative travel times under congested conditions. Examples have been implemented nationally with a positive response by agencies and riders.

Shoulder running transit programs are typically implemented such that shoulder use is permissible when mainline travel speeds drop below a given threshold. There is typically also an upper speed limit restriction for buses using the shoulder for safety purposes, such as no more than 15 MPH over the speed of the adjacent travel lanes. Buses are required to merge back into traffic if necessary due to disabled vehicles, incidents, or other factors such as debris.

Shoulder running transit with respect to I-84 and I-184 were evaluated on the width of shoulders, existing transit use, side of operation, and pavement suitability.

Per the Valley Regional Transit website, existing daily transit on the I-84 corridor includes:

- Eight buses per direction from route 40
- One bus per direction from route 43
- Seven buses per direction from route 45

Shoulder running transit scores lower than other tactics in this document. The benefit comes from decreased travel times and improved reliability for transit routes. Costs are relatively low where the shoulder is sufficiently wide and has appropriate pavement for transit operations. The benefit is only realized during peak periods and may be stifled if there is an incident.

Purpose

Certain Valley Regional Transit Intercounty bus routes (40, 42, 43, and 45) operate via I-84 and I-184 as limited express services. An ongoing operational challenge for VRT and its customers is the unpredictability of travel times of these routes due to freeway congestion and incidents. As a result, VRT is operating via arterial routes which, although resulting in longer travel times, can be more predictable.

Hard shoulder transit running would attempt to alleviate this challenge by allowing VRT buses to bypass the worst of congestion by driving on the shoulder. The fact that VRT buses are operated by professional commercial drivers provides a higher margin of safety as compared to hard shoulder running for general purpose traffic (which is also used in some jurisdictions). Transit Cooperative Research Program (TCRP) guidelines (Report 151, 2020) recommends side shoulders of a minimum of ten feet in width to implement shoulder running transit, and a minimum of 12 feet for center-running transit lanes.

Locations

- Transit shoulder running is applicable in any freeway segment where VRT operates Intercounty express services. This includes:
  - I-184 from S. 13th St. in downtown Boise to the “Y” junction with I-84 (Exit 50).
  - I-84 from the “Y” junction (Exit 50) with I-184 to Franklin Road, Caldwell (Exit 29).
- Narrow shoulders of I-184 likely preclude bus-on-shoulder implementation
- The mainline of I-84 appears to have sufficient side shoulder width for bus on shoulder implementation, from the “Y” junction in the east to Caldwell. This includes the most frequently

congested segment of I-84 between Exits 42 and 46, which could be a priority segment for implementation.

BENEFITS AND COST

BENEFITS	COST
● Provides competitive travel time advantage for Intercounty transit routes, without significant new investments in roadway infrastructure **● Use of professional bus drivers simplifies implementation reduces risk compared to general purpose shoulder running schemes** **● Can be implemented on a trial basis before committing to long term implementation**	● Implementation Planning: $100,000 ● Operator Training and Public Outreach: $50,000 ● Roadside signage and striping: $75,000 ● Pilot Project Evaluation: $30,000

IMPLEMENTATION FEASIBILITY

Physical Feasibility

- Shoulder running transit would use existing suitable segments of hard shoulder, to reduce the implementation costs and timeline of this alternative. I-84 appears to have sufficient shoulder width for shoulder running transit, while I-184 appears to have insufficient shoulder width.
- The shoulders on I-84 have been designed to the same standard as the active lanes and therefore can support bus-on-shoulder without significant modifications.
- Shoulders of on- and off-ramps may also be considered at interchanges where express routes enter and exit the interstate (Meridian, Ten Mile, Garrity, and Franklin).
- Small improvements to signage and lane striping would be implemented to raise awareness of the operation of shoulder running transit in the corridor.
- Future engineering analysis of interchange areas will be required to determine operational feasibility in these areas. In peer city implementations, shoulder running buses using the right shoulder commonly yield to merging traffic at interchange ramps, or merge back into mainline traffic prior to reaching ramp merge areas. For left shoulder running, ramps typically do not require buses merge into traffic unless they are exiting. Left shoulder running transit could avoid the need to merge into traffic if transit specific ramps are built for buses to exit the interstate.
- Interchange considerations and ramp traffic volumes are factors in determining the most appropriate strategy at a given location.

Institutional Feasibility

- Shoulder Running Transit would be operated by Valley Regional Transit, in coordination with ITD.

Operations and Maintenance Feasibility

- Real-time coordination would be required between VRT dispatch and ITD/State Comm to manage or suspend service in the event of incidents or blockages.

- For winter operations, road plowing practices may need to be adjusted to maintain treated surfaces, free of plowed snow and ice, where shoulders are used by VRT buses.
- ITD and law enforcement agencies may benefit from the additional “eyes and ears” of VRT bus drivers in identifying and locating freeway incidents spotted along their routes.

Quick Start/Pilot Feasibility

- Hard shoulder running is conducive to a pilot “proof of concept” test. For example, SMART (Wilsonville, OR) recently began a pilot test of hard shoulder running on a two-mile segment of the I-5 corridor south of Portland. The test will run for one year followed by a review and assessment period.
- There may be opportunities to integrate shoulder running bus operations with future ramp metering implementation. The objective is to use ramp meters to provide appropriate gaps in traffic (by holding on-ramp traffic at a metered red signal) in order to allow the safe passage of an approaching shoulder running bus, without conflicts with merging traffic.

DESCRIPTION OF TACTIC AS APPLIED IN I-84 CORRIDOR

The active traffic management tactic improves the efficiency and safety of the transportation system through the use of technology that detects current conditions (i.e. weather or traffic) and responds automatically by displaying information such as variable speed limits, queue warnings, or lane closures to inform drivers of changing traffic conditions. Variable speeds, queue warning, and lane closure warnings give the driving public information on roadway conditions downstream of their current position. This allows them to alter speeds or change lanes in a safe manner rather than approaching a slow-moving lane at full interstate speeds. This tactic would include variable message signs mounted on gantries over travel lanes or mounted on the side of the Interstate to communicate information to drivers TOPS-BC was used to calculate a benefit/cost ratio of the active traffic management system. Costs include signs, software, and operations/maintenance.

On I-84 and I-184 the tactics include:

Variable Speed Limits (VSL) - enable adjustments to the posted speed (regulatory or advisory) based on real time congestion and weather conditions. If weather conditions are incorporated, weather sensors are necessary to measure the roadway condition and adjust speeds based on the current measured conditions. The primary purpose of a variable speed system is to recommend speeds based on information about current conditions to reduce crashes. The variable speed signs may be displayed on side mount structures or on overhead gantries with a dynamic message sign over each lane. The speeds can be increased or decreased depending on the operational situation. During project planning, ITD and stakeholders would need to evaluate whether to make the variable speeds regulatory or simply an advisory speed. There are advantages and disadvantages associated with each.

Queue Warning - automatically posts slow or stopped traffic ahead warning messages on the dynamic message signs when slow or stopped traffic is detected downstream. The queue warning functionality relies on speed and occupancy sensors to detect the presence of a queue. The active traffic management logic can be configured to automatically post the queue warning messages.

Dynamic Lane Control - using dynamic lance control signs over lanes, enables operators to close lanes or shift traffic to improve safety and operations during a variety of scenarios (closing a lane in advance of a high volume on-ramp that requires an extra lane, closing a lane and merging traffic in advance of an incident that blocked a lane, other special events).

Active traffic management has a high cost compared to most of the tactics in this document. Due to the cost, the benefit/cost ratio is below 1.0. Active traffic management does benefit operations and safety on the interstate. Some cost savings can be realized by combining infrastructure needs with other tactics (like DMS).

Purpose

- Provide real-time information to drivers for advisory speeds, queue warnings, and lane closures.
- Decrease driver speeds as they approach a congested area due to an incident or recurring congestion. This harmonizes speeds to an extent and reduces rear-end crashes.

Locations

Locations on I-84 and I-184 are shown in Figure A6 below and include:

- Between 11th Avenue and Garrity Blvd exit

- Between Robinson Rd overpass and McDermott Rd
- Between McDermott Rd and Black Cat Rd overpass
- Ten Mile Rd exit
- Between Ten Mile Rd exit and Meridian Rd exit
- Between Meridian Rd exit and Locust Grove Rd overpass
- Between Eagle Rd exit and Cloverdale Rd overpass
- Between Cloverdale Rd overpass and Five Mile Rd overpass
- Between Franklin Rd exit and Cole Rd overpass
- Between Cole Rd overpass and Emerald St overpass
- Between Emerald St overpass and Curtis Rd exit

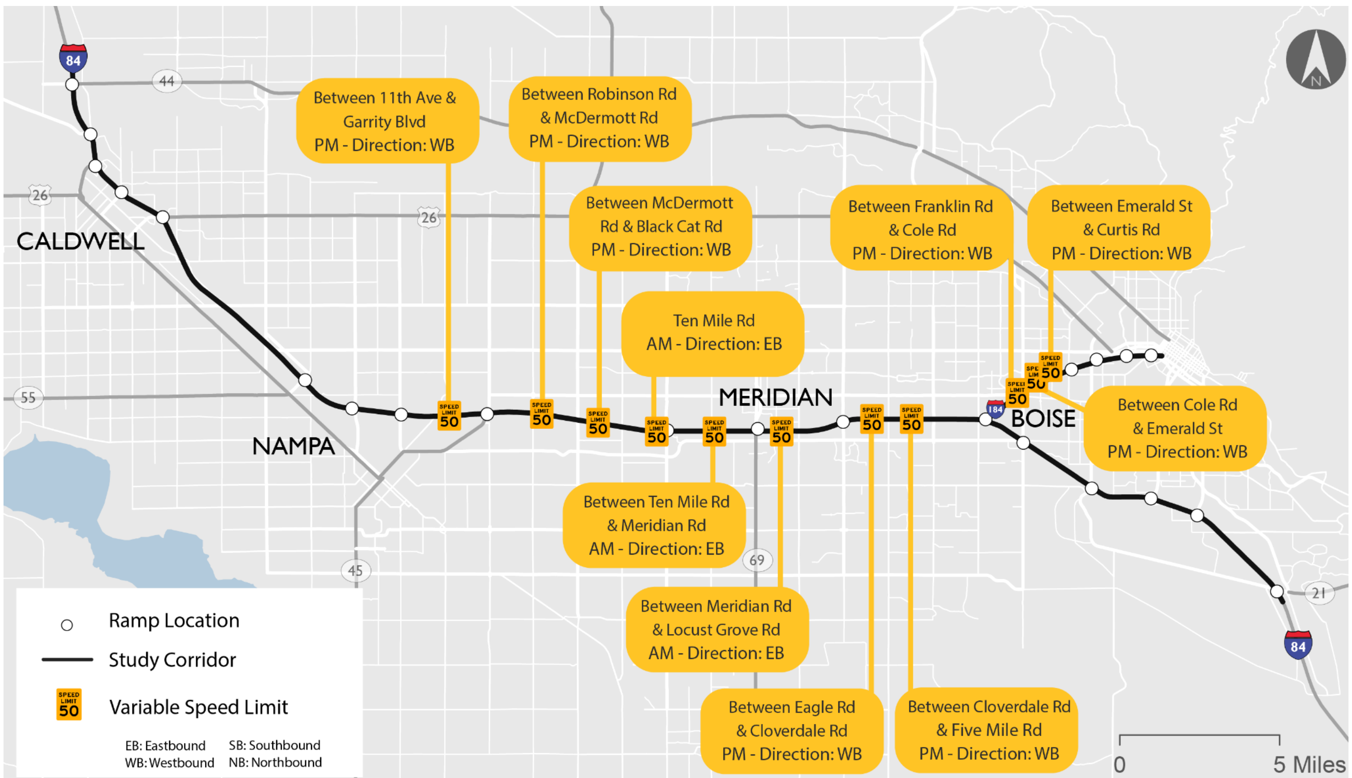


FIGURE A6: LOCATION OF PROPOSED VARIABLE SPEED LIMITS ALONG I-84 AND I-184

BENEFITS AND COST

TOPS-BC B/C RATIO FOR ACTIVE TRAFFIC MANAGEMENT: 0.73

Implementation Cost:

- **$1,667,500 with contingency for centralized active traffic management software and equipment (one time cost)**
- **$14,679,750 for system, includes a combination of overhead locations and roadside locations (11 total).**
- **Total: $16,347,250**

Annual Operations and Maintenance:

- $81,250 for centralized active traffic management
- $311,113 for field equipment

BENEFITS		ANNUALIZED COST
CRASH RATE REDUCTION	**15%**	**$1,377,980**
REDUCTION IN FUEL USE	**5%**	
PERIODS PER YEAR	**250**	
TOTAL AVERAGE ANNUAL BENEFIT	**$1,000,640**	

IMPLEMENTATION FEASIBILITY

Physical Feasibility

- As shown in the map figures, ATM implementation across the I-84/I-184 corridors requires an extensive investment in new ITS equipment across the corridor, supported by backend software technology upgrades.
- While some existing infrastructure may support ATM deployment in a few locations, the need for lane control gantries, spacing considerations of signage, etc. will likely result in substantial new infrastructure investment.
- Electronic signs over the lane may be preferred for maximum effectiveness, but side mounted signs could be a feasible, lower-cost alternative. Side mounted signs would require signs mounted in the median and on the right side of the roadway to improve effectiveness.

Institutional Feasibility

- Advanced Traffic Management systems would be implemented by ITD, which could deploy these technologies in an independent fashion on its own right-of-way. ITD is currently procuring a new statewide Advanced Transportation Management System, which will support ATM capabilities.
- ITD does not currently have a traffic management center in the Boise area, and the responsibility to operate and maintain the ATM infrastructure would need to be determined before implementing this system.
- If operated by State Comm on behalf of ITD, new operating procedures and training would need to be developed for effective use of ATM technologies.
- Public acceptance and adherence to variable speed limits is a potential challenge and requires careful consideration of enforcement strategy (if regulatory).
- Implementation of ATM should be supported by a robust public information and education campaign, given the novelty of this technology in the Treasure Valley.

- The relatively high cost of ATM implementation (at least compared to other TSMO tactics) is likely to require detailed assessment of the potential benefits to justify the investment in the eyes of policy makers and the public.

Operations and Maintenance Feasibility

- Advanced Traffic Management technology would be operated and maintained by ITD, similar to other existing ITS and communications infrastructure along the I-84/I-184 corridors.
- Automation of ATM device operations through ITD's future traffic management system would reduce the need for active manual intervention by StateComm or ITD personnel during operations. For example, advisory speed reductions could be implemented automatically when traffic flow detectors indicate a certain reduction in segment speed.

Quick Start/Pilot Feasibility

- Active Traffic Management is by its nature a "heavy" TSMO investment given the extent of supporting field infrastructure. It should be construed as a medium- to long-term opportunity to fully realize its benefits.
- Limited benefits may be gained by using strategically-placed DMS signs to offer upstream warning of congestion or incident conditions downstream. These benefits however would be limited compared to even phased implementation of the full ATM instrumentation along a prioritized segment of the corridor.

APPENDIX B: TOPS-BC ANALYSIS (NOVEMBER 2021)

I-84 CORRIDOR OPERATIONS PLAN – TOPS BC ANALYSIS

NOVEMBER 5, 2021

COMPASS
COMMUNITY PLANNING ASSOCIATION
of Southwest Idaho

DKS

IDAHO TRANSPORTATION DEPARTMENT

IBI

The DKS team provided a summary workbook of the TOPS-BC analysis performed for several tactics in the I-84 Corridor Operations Plan to COMPASS and ITD for review. This memo describes the cost and benefit inputs for the TOPS-BC analysis tool, provides a summary of the B/C ratio calculated by the tool for each tactic, followed by additional detail for each tactic.

Please note that not all tactics considered in the I-84 Corridor Operations Plan are suitable for analysis using the TOPS-BC framework and will undergo a separate assessment.

COSTS

The cost analysis reflects two components, the infrastructure and the incremental (TOPS-BC terminology). The infrastructure cost is the background cost for all the supporting equipment such as communications hardware and software. The incremental cost is the cost of each deployment, for example, in the ramp metering tactic the incremental cost is the cost per ramp. Depending on the existing equipment in the field, not all cost elements will apply at every location. For this reason, the assumptions of applicable costs are included in each summary. All costs are converted to annual costs.

BENEFITS

The annual benefit of each tactic is based on the number of people that will be impacted by the tactic, the length of the analysis period, and the number of periods per year.

- Number of people that will use the tactic: Based on vehicle volumes and assumes single occupant vehicles. For transit applications, we were able assign a number.
- Length of the analysis period: The TOPS-BC default number of periods per year is 250. This means that the tactic will be active 250 times. Many of the tactics use this default assumption.
- Length of analysis period: This is reflected in the traffic volume that benefits from this tactic. Assuming that the period is active for 2 hours results in twice as much volume (and capacity) than assuming that the period is active for 1 hour. The maximum period possible is 4 hours.

The table located below shows the overall benefit/cost results from the TOPS-BC analysis. Assumptions for each cost and benefits per tactic are further described in the remainder of this memorandum. These assumptions are can also be found in the TOPS-BC spreadsheets.

SUMMARY OF BENEFIT COSTS PER TACTIC		
TACTIC	**LEVELIZED ANNUAL COSTS**	**TOPS-BC RESULT**
VARIABLE MESSAGE SIGNS	$983,063	0.36
TRAFFIC SIGNAL SYSTEM TIMING ADJUSTMENTS	$36,900	0.68
RAMP METERING	$1,430,469	7.04
VARIABLE SPEED LIMITS	$1,377,980	0.73
ROAD WEATHER INFORMATION	$41,768	2.04
SMART WORK ZONES	$33,104	2.53
TRANSIT TRAVELER INFORMATION (FIXED LOCATIONS)	$102,271	1.21

VARIABLE MESSAGE SIGNS

- No basic infrastructure is needed – the system can use the existing system
- 12 locations identified for incremental deployments
    - I-84 EB near Centennial Way
    - Karcher Road northbound to I-84
    - Garrity Blvd northbound to I-84
    - Ten Mile near Overland northbound to I-84
    - Meridian Road northbound near Overland
    - Meridian Road northbound near Victory Road
    - Milwaukie Street/I-184 on-ramp
    - Cole Road southbound to I-84
    - Curtis Road northbound to I-84
    - Curtis Road southbound to I-84
    - Orchard Street southbound to I-84
    - Federal Way northbound to Gowen Road
- Annual cost per deployment is $42,665
- B/C Ratio: 0.36

BENEFITS	6 IMPLEMENTATIONS
VOLUME PASSING (3HR PERIOD)	39672
PERCENT OF TIME INFORMATION IS USEFUL	10%
PERCENT OF DRIVERS ACTING ON THE INFORMATION	90%
AVERAGE TIME (MINUTES) SAVED BY DRIVERS ACTING	10
PERIODS PER YEAR (DAYS)	30
TOTAL (AVERAGE ANNUAL BENEFIT)	$352,588

TRAFFIC SIGNAL SYSTEM TIMING ADJUSTMENTS

- Assume three incremental deployments
- No infrastructure deployments (there is an existing central control location)
- 3 incremental deployments
    - Annual cost per deployment is $12,300
- B/C ratio: 0.68

BENEFITS	IMPLEMENTATION 1
VOLUME PASSING (3HR PERIOD)	5,868
CHANGE IN CAPACITY	12%
CRASH RATE REDUCTION	2%
REDUCTION IN FUEL USE	5%
PERIODS PER YEAR (DAYS)	250
TOTAL AVERAGE ANNUAL BENEFIT	$22,011

RAMP METERING

- Assume one infrastructure deployment (TMC)
  - Annual cost per deployment is $219,150
- 15 incremental deployments
  - Annual cost per deployment is $30,280
- B/C ratio: 7.04

BENEFITS	IMPLEMENTATION (EACH)
VOLUME PASSING (2HR PEAK PERIOD)	14,400
RAMP VOLUME (2HR)*	3000
CHANGE IN CAPACITY FWY	12%
CHANGE IN CAPACITY LINK	-35%
CRASH RATE REDUCTION	12%
REDUCTION IN FUEL USE	10%
PERIODS PER YEAR (DAYS)	250
TOTAL AVERAGE ANNUAL BENEFIT	$10,069,289

*Ramp volume assumptions will be adjusted once count data is available

VARIABLE SPEED LIMITS

- Assume one infrastructure deployment (TMC)
  - Annual cost per deployment is $121,675
- 11 incremental deployments
  - Annual cost per deployment is $66,480
- B/C Ratio: 0.73

BENEFITS	IMPLEMENTATION
VOLUME PASSING (4HR)	26,208
CRASH RATE REDUCTION	15%
REDUCTION IN FUEL USE	5%
PERIODS PER YEAR	250
TOTAL AVERAGE ANNUAL BENEFIT	$1,000,640

ROAD WEATHER INFORMATION

- No basic infrastructure is needed – the system can use the existing system
- One location identified for deployment on I-184
  - Annual cost per deployment is $28,105
- B/C Ratio: 2.04

BENEFITS	IMPLEMENTATION (EACH)
CHANGE IN CAPACITY	5%
CHANGE IN SPEED	5%
CRASH RATE	7%
VOLUME PASSING (1HR)	8460
PERCENT OF TIME INFORMATION IS USEFUL	5%
PERCENT OF DRIVERS ACTING	10%
AVERAGE TIME SAVED BY DRIVERS ACTING	5
PERIODS PER YEAR (DAYS)	50
TOTAL AVERAGE ANNUAL BENEFIT	$85,265

SMART WORK ZONES

- No basic infrastructure is needed – the system can use the existing equipment
- One location used as example for deployment
  - Cost per deployment is $22,948
- B/C Ratio: 2.53

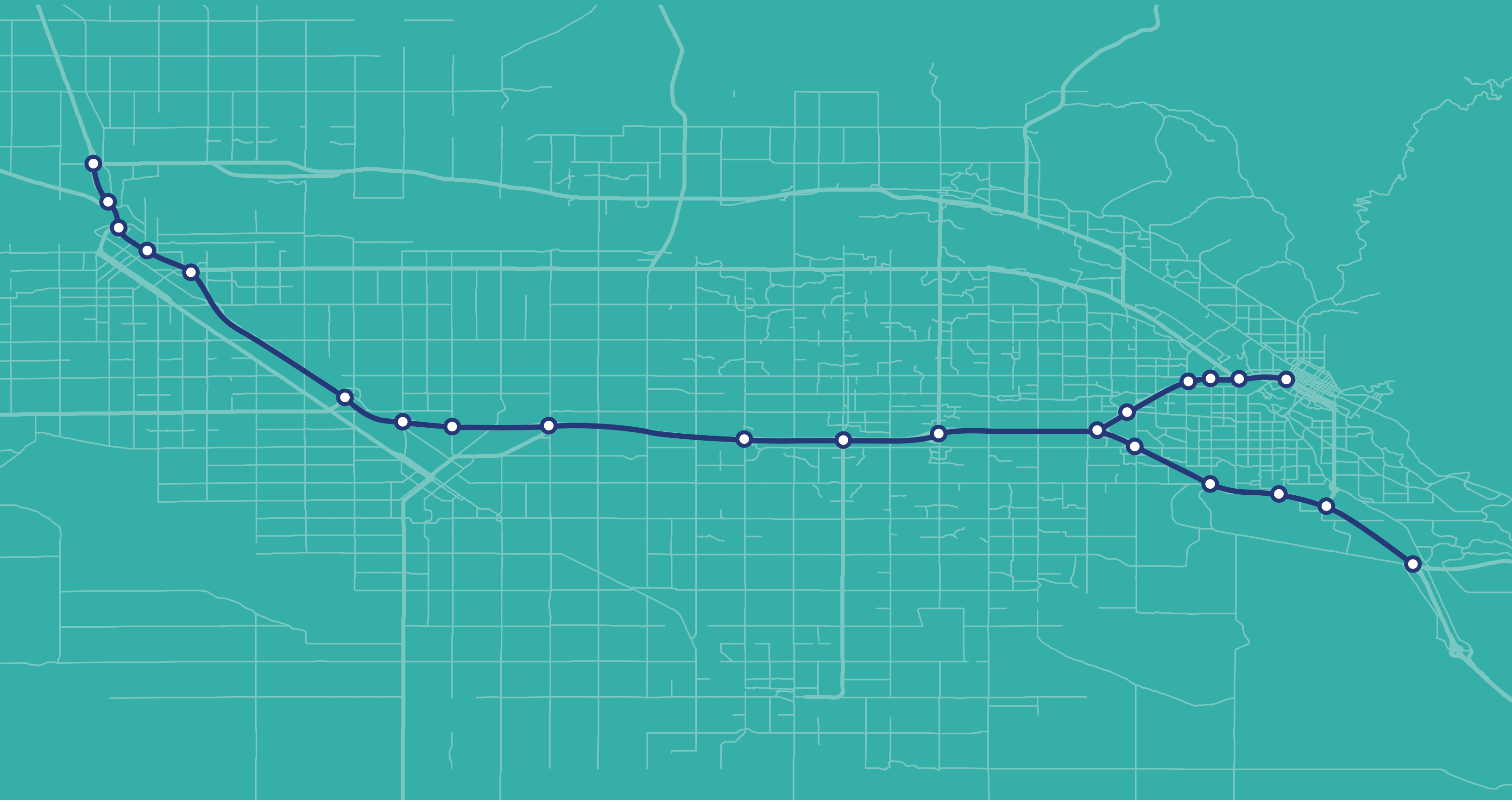
BENEFITS	IMPLEMENTATION
CHANGE IN SPEED	5%
CRASH RATE	5%
CRASH DURATION	10%
VOLUME PASSING (2 HR)	7200
PERIODS PER YEAR	50
TOTAL AVERAGE ANNUAL BENEFIT	$83,682

TRANSIT TRAVELLER INFORMATION AT FIXED LOCATIONS

- Three installations (at park and rides)
  - Annual cost per deployment is $35,900
- B/C Ratio: 1.21

BENEFITS	IMPLEMENTATION
PERCENT TIME INFORMATION IS USEFUL	25%
PERCENT RIDERS ACTING ON INFORMATION	100%
MINUTES SAVED	0
VOLUME OF RIDERSHIP THAT SEE INFORMATION	1,500
PERIODS PER YEAR (DAYS)	250
TOTAL AVERAGE ANNUAL BENEFIT	$123,439

Ramp Metering Analysis



RAMP METERING FEASIBILITY ANALYSIS

DATE: June 3, 2022

TO: Project Management Team

FROM: Dock Rosenthal, Jim Peters | DKS Associates

SUBJECT: I-84 Corridor Operations Plan

The purpose of this analysis was to determine any critical issues arising at the proposed ramp metering locations in the study area. Table 1 below shows the characteristics of each location. This evaluation is preliminary and additional analysis should be completed as a part of any ramp metering implementation.

Definitions:

Storage Length – The distance available from the proposed meter location back to nearest street. Used to determine spillback potential.

Acceleration Length – The distance from the proposed meter location forward to the merge point with the freeway mainline.

Number of lanes – The proposed number of lanes needed to serve the on-ramp volume and minimize the risk of a spillback to the street network. All 2 lane ramp meter configurations are envisioned to be alternating release meaning that one lane releases before the adjacent lane. In some cases this still results in a risk of spillback.

Spillback potential – answer to the question: is there a risk of spillback from the ramp meter to the street network? This is based on the allowed capacity at the meter which is determined by the number of lanes, the meter release type (alternating or dual), and the release rate. Increasing the capacity of the ramp meter will result in more volume entering the freeway system so tradeoffs of spillback risk versus freeway merging management should be considering when designing the system.

Considerations

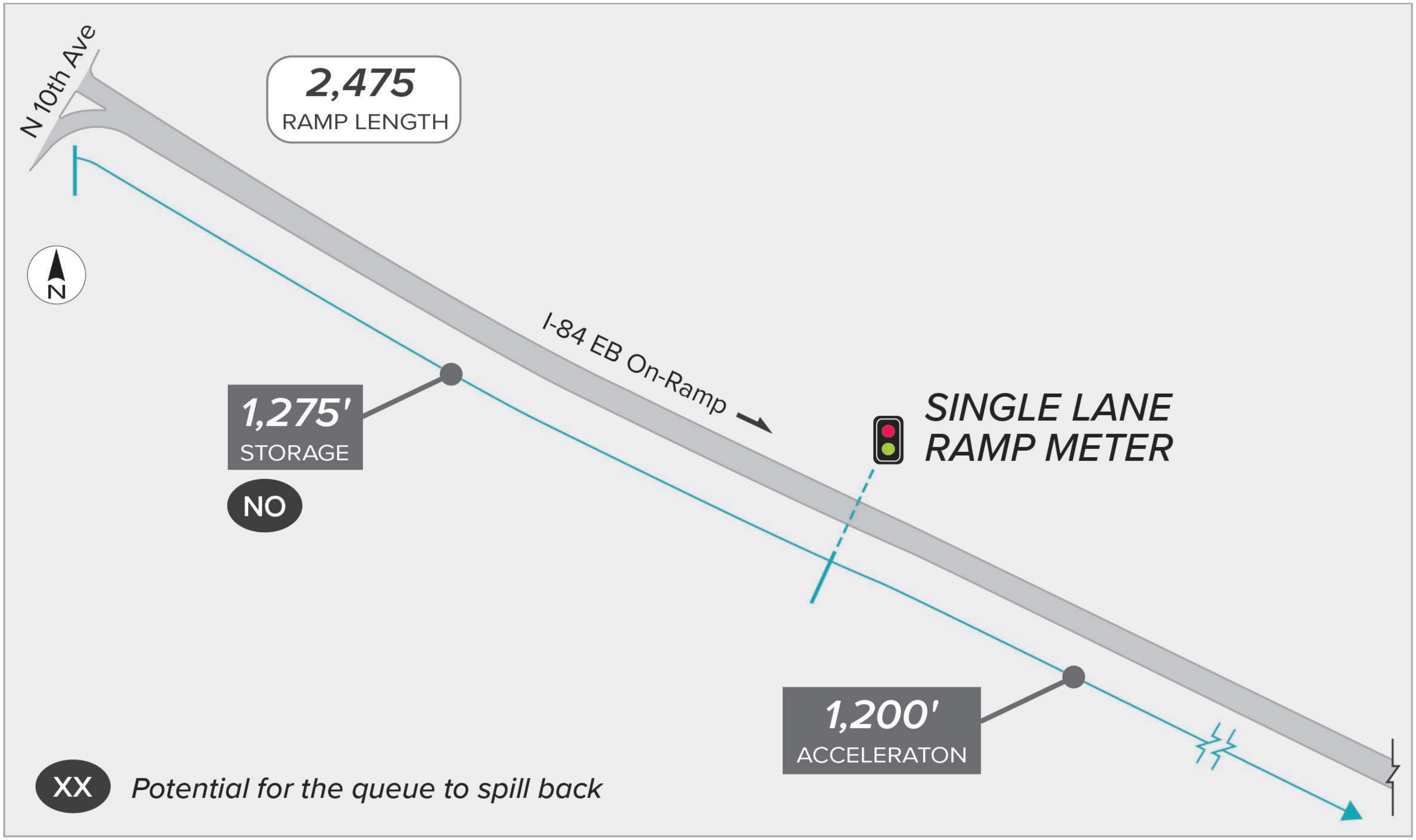
- At the westbound Curtis Road on-ramp the existing width is not wide enough to accommodate two lanes but the short ramp length and high volume require the additional capacity. There is existing curb that needs to be removed to widen the ramp. The cost of installing a meter at this location is expected to be higher than other locations in the study area.

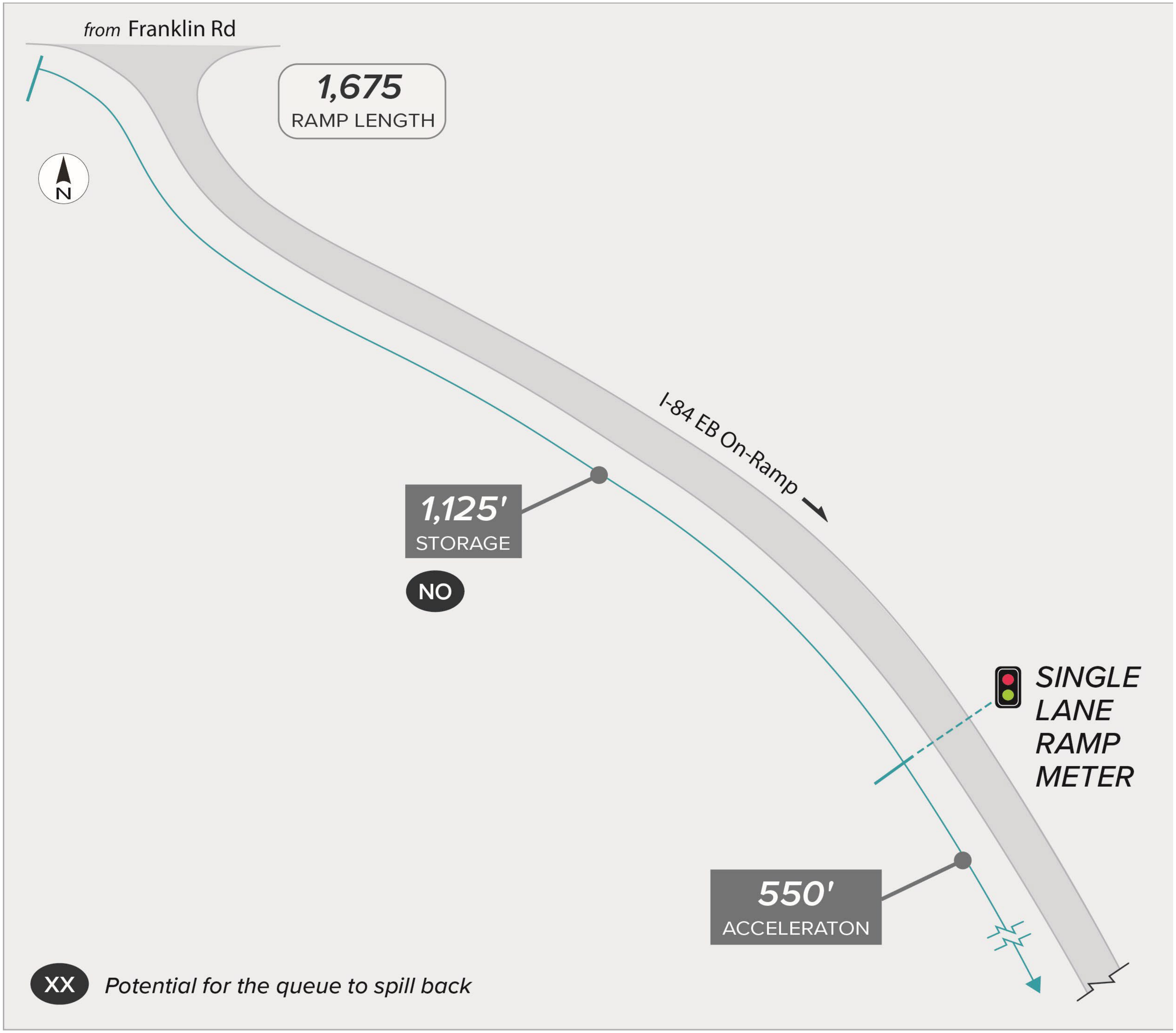
- The ramps at Ten Mile Rd (eastbound) and Franklin Rd (westbound to I-184) are both expected to spill back to the street network and potentially cause additional congestion at those locations due to freeway traffic blocking a lane. This occurs with a two-lane, alternating release ramp meter. A higher average release rate may be needed at these locations to accommodate the traffic volume.

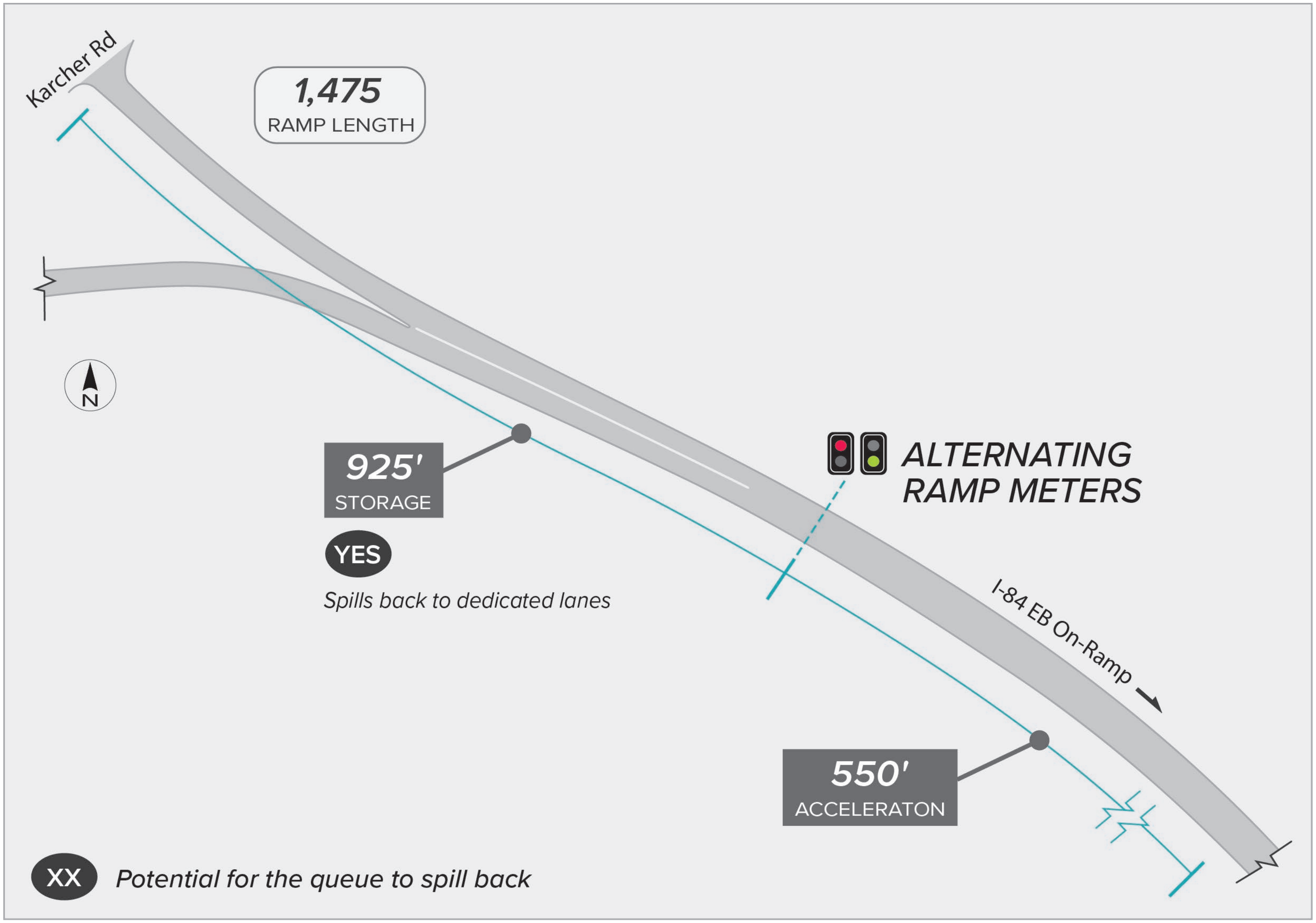
RAMP	TRAFFIC VOLUME	RAMP LENGTH	STORAGE LENGTH	ACCELERATION LENGTH	APPROXIMATE PAVEMENT WIDTH	NUMBER OF LANES PROPOSED	SPILLBACK POTENTIAL	ADDITIONAL NOTES
				AM				
EB 10TH	650	2475	1275	1200	27	1	No	
EB FRANKLIN - 29	650	1675	1125	550	28	1	No	
EB KARCHER	1650	1475	925	550	38	2	YES	Spills back to a dedicated lane
EB NORTHSIDE	1100	1300	750	550	30	2	No	
EB FRANKLIN - 36	1250	875	535	340	42	2	No	
EB GARRITY	1750	1500	1100	400	43	2	YES	NB leg spills back to dedicated lanes
EB TEN MILE	1550	3650	1250	2400	33	2	YES	queue spill would likely block through traffic (short pocket)
EB MERIDIAN	1650	2400	1025	1375	38	2	YES	Spills back to a dedicated lane

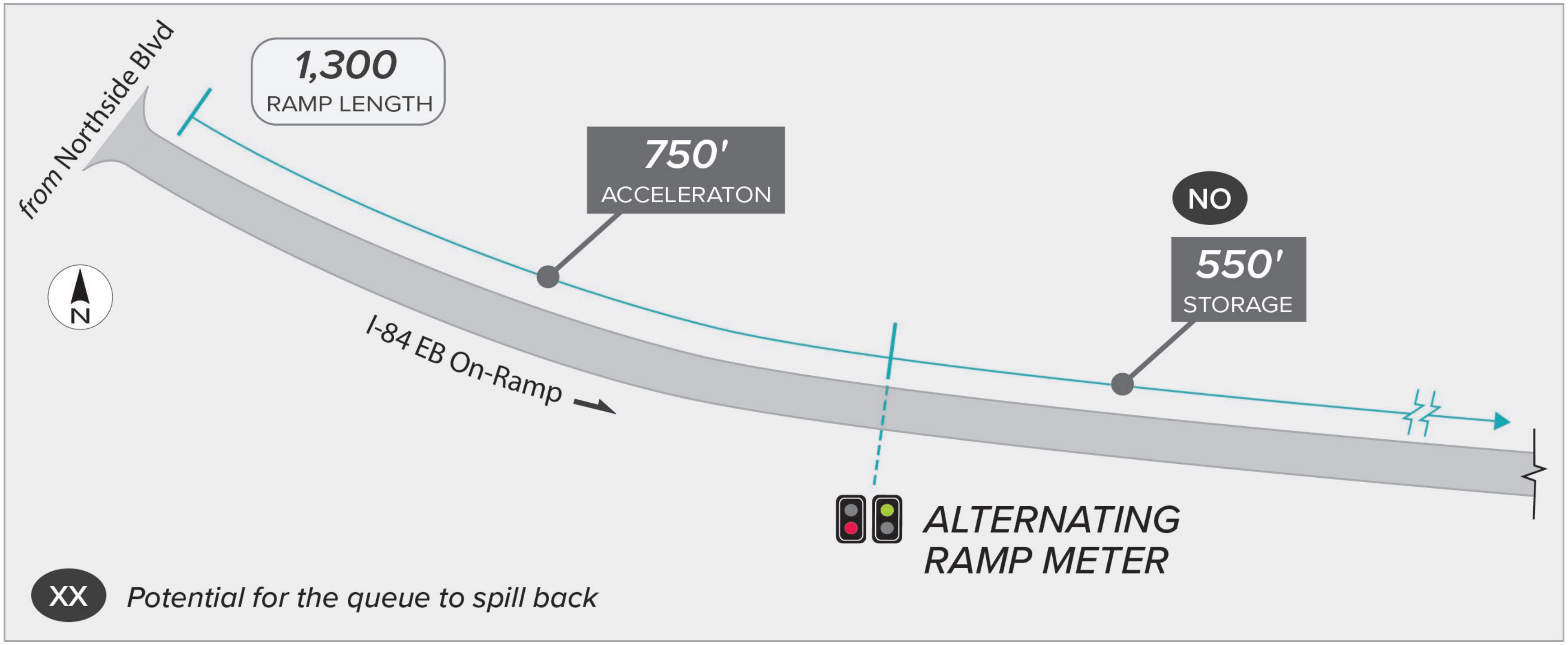
RAMP	TRAFFIC VOLUME	RAMP LENGTH	STORAGE LENGTH	ACCELERATION LENGTH	APPROXIMATE PAVEMENT WIDTH	NUMBER OF LANES PROPOSED	SPILLBACK POTENTIAL	ADDITIONAL NOTES
EB EAGLE - NB RAMP	1150	2750	1850	900	28	2	No	
EB EAGLE - SB RAMP	1200	2410	1860	550	24	1	YES	Spills back to a dedicated lane
				PM				
WB CURTIS	1350	1150	600	550	22*	2	No	short ramp with limited queueing distance - additional widening is needed to accommodate two lanes
WB FRANKLIN (184)	1450	1375	825	550	43	2	YES	short distance to upstream intersection would likely block through traffic
WB GARRITY	950	1800	1250	550	30	1	No	
WB FRANKLIN - 36	800	1025	475	550	37	1	No	

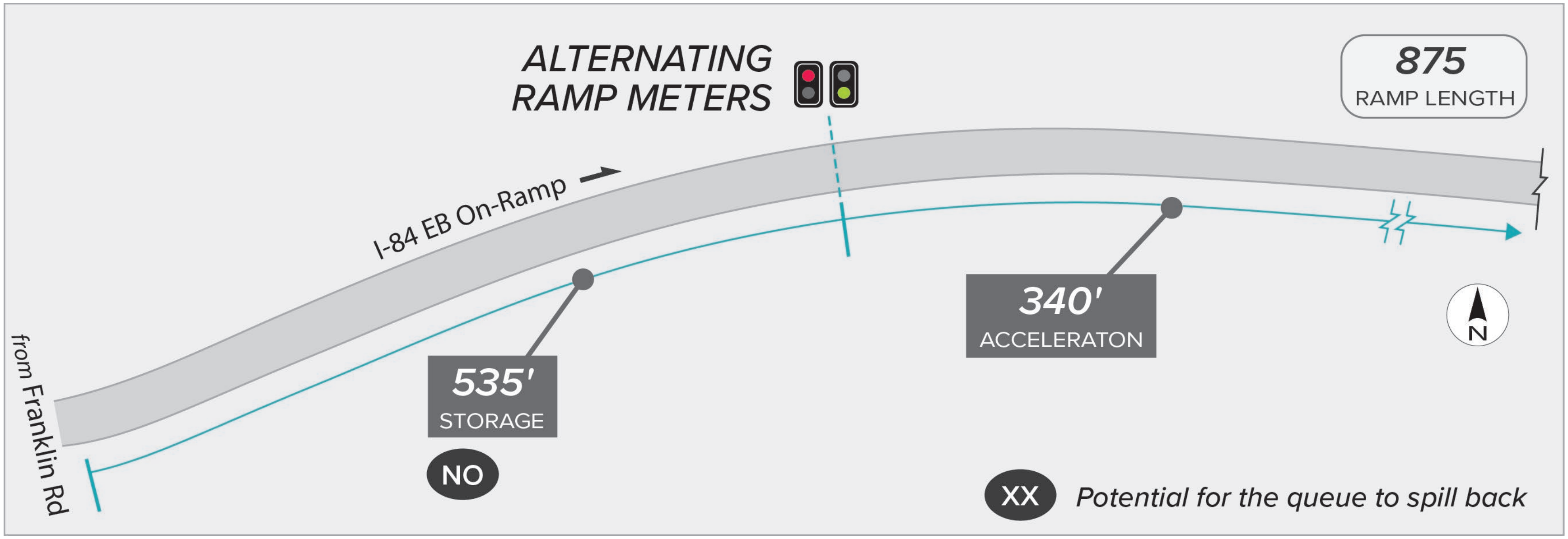
RAMP	TRAFFIC VOLUME	RAMP LENGTH	STORAGE LENGTH	ACCELERATION LENGTH	APPROXIMATE PAVEMENT WIDTH	NUMBER OF LANES PROPOSED	SPILLBACK POTENTIAL	ADDITIONAL NOTES
WB NORTHSIDE	550	1250	700	550	22	1	No	

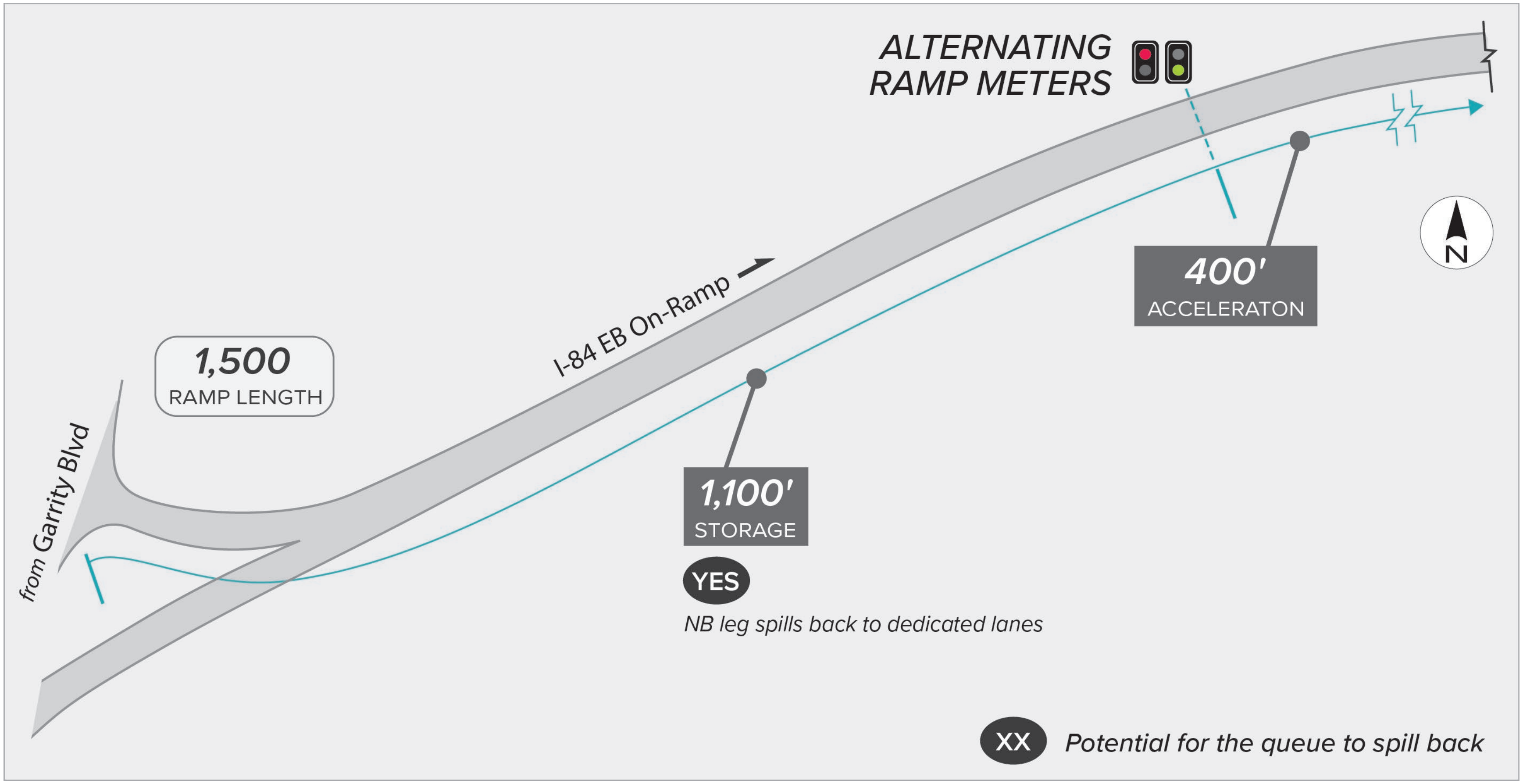

N 10th Ave
2,475
RAMP LENGTH
I-84 EB On-Ramp
SINGLE LANE
RAMP METER
1,275'
STORAGE
NO
1,200'
ACCELERATON
XX
Potential for the queue to spill back

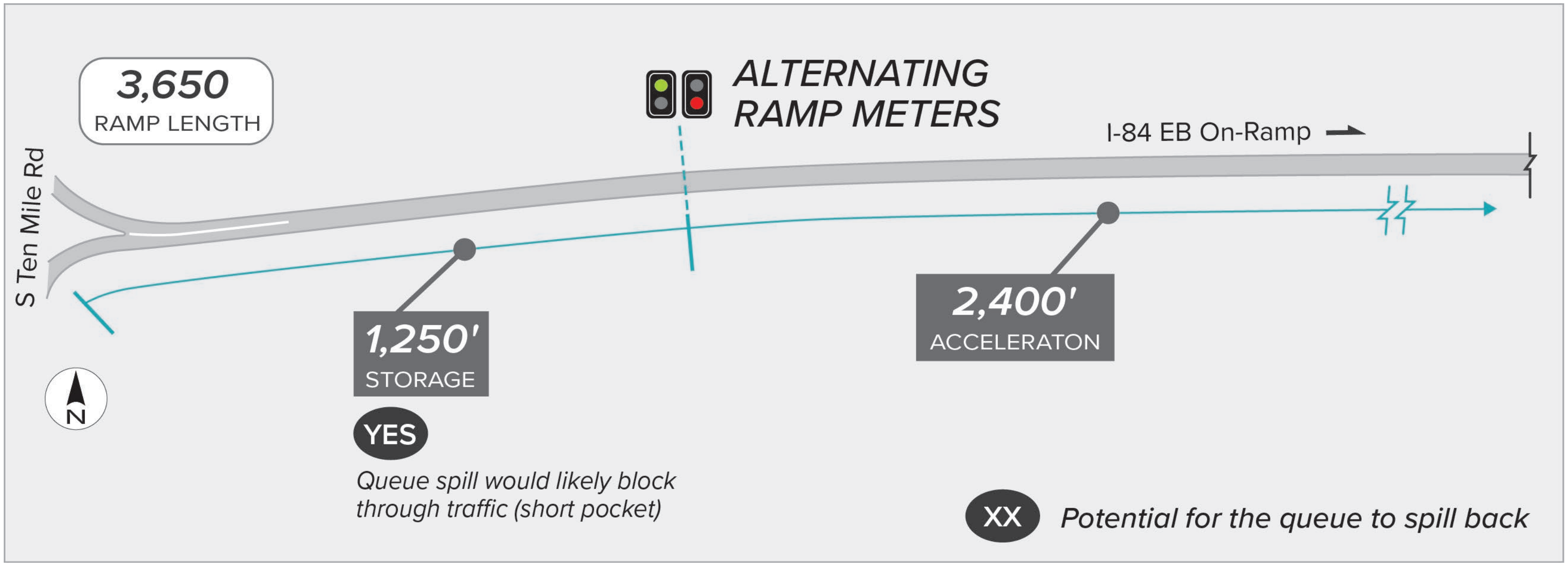

from Franklin Rd
1,675
RAMP LENGTH
N
I-84 EB On-Ramp
1,125'
STORAGE
NO
SINGLE
LANE
RAMP
METER
550'
ACCELERATON
XX
Potential for the queue to spill back

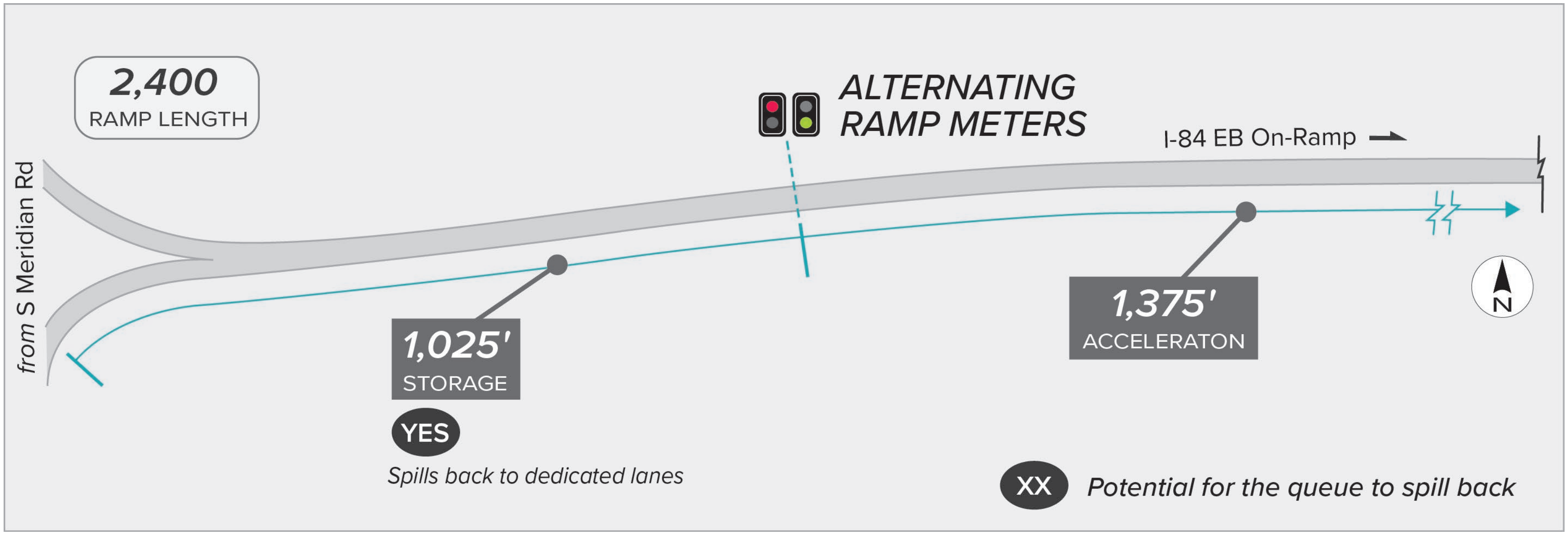

Karcher Rd
1,475
RAMP LENGTH
N
925'
STORAGE
YES
Spills back to dedicated lanes
ALTERNATING
RAMP METERS
I-84 EB On-Ramp
550'
ACCELERATON
XX
Potential for the queue to spill back

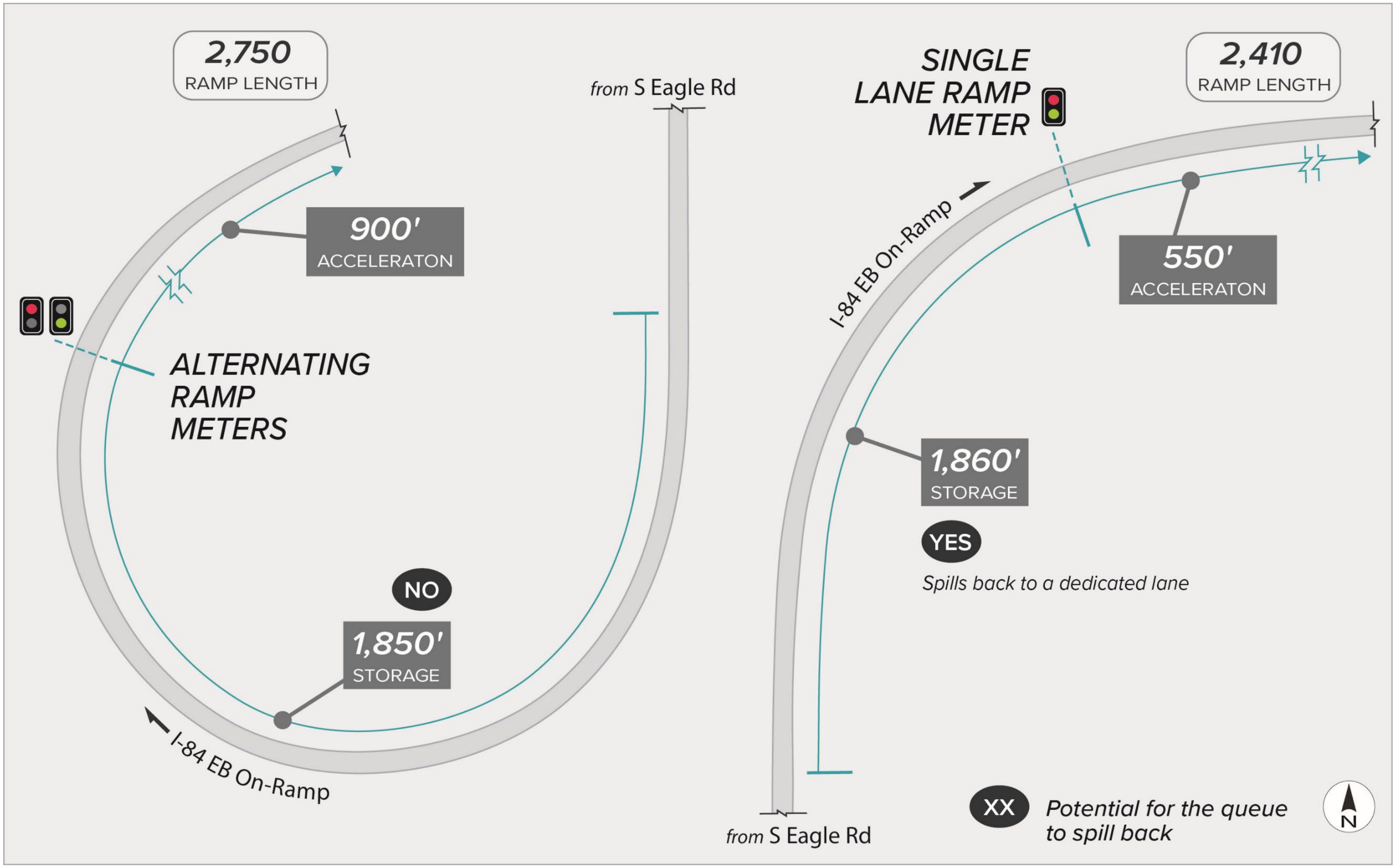

from Northside Blvd
1,300
RAMP LENGTH
750'
ACCELERATON
NO
550'
STORAGE
I-84 EB On-Ramp
ALTERNATING
RAMP METER
XX
Potential for the queue to spill back

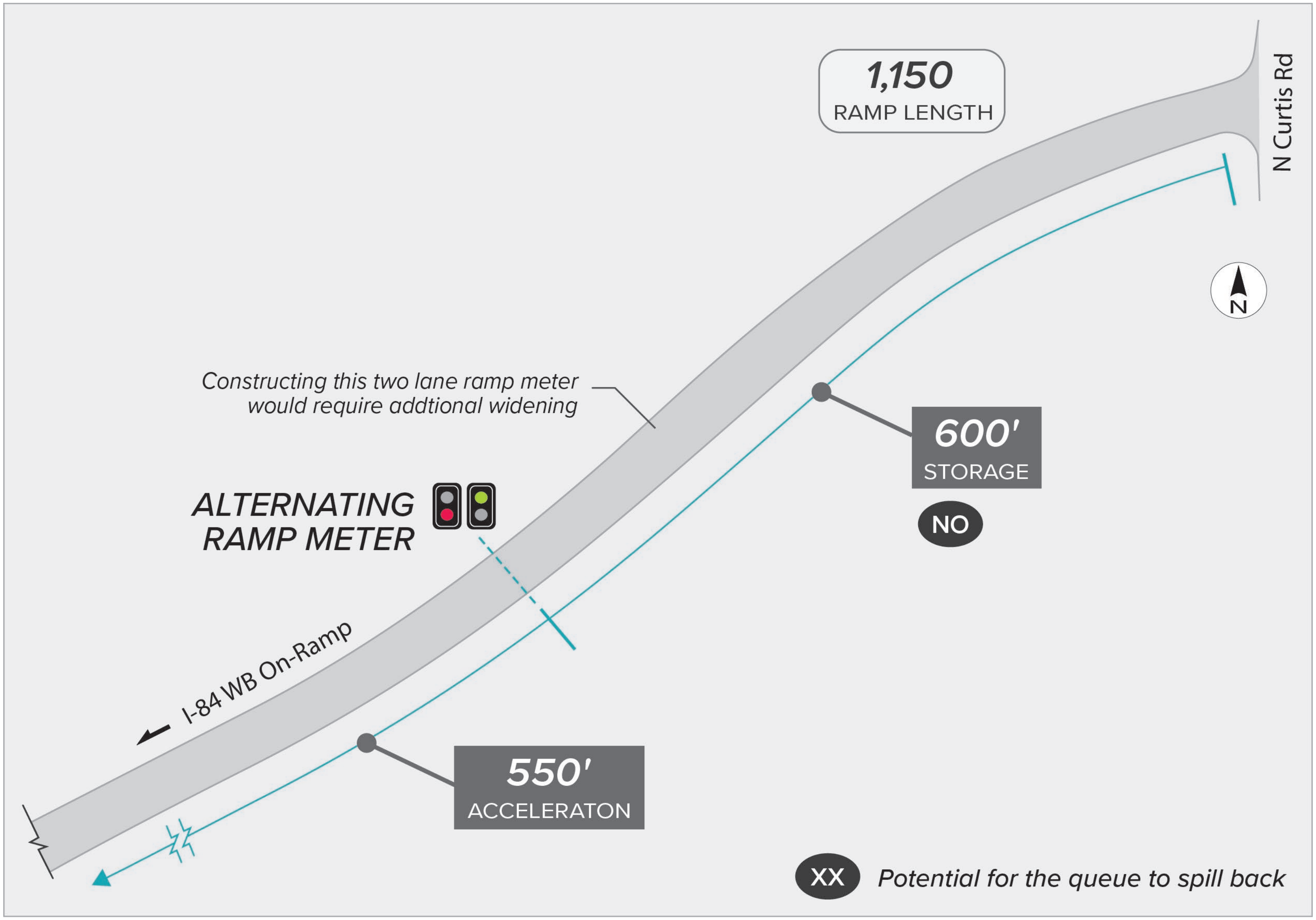

ALTERNATING
RAMP METERS
875
RAMP LENGTH
I-84 EB On-Ramp
from Franklin Rd
535'
STORAGE
NO
340'
ACCELERATON
N
XX
Potential for the queue to spill back

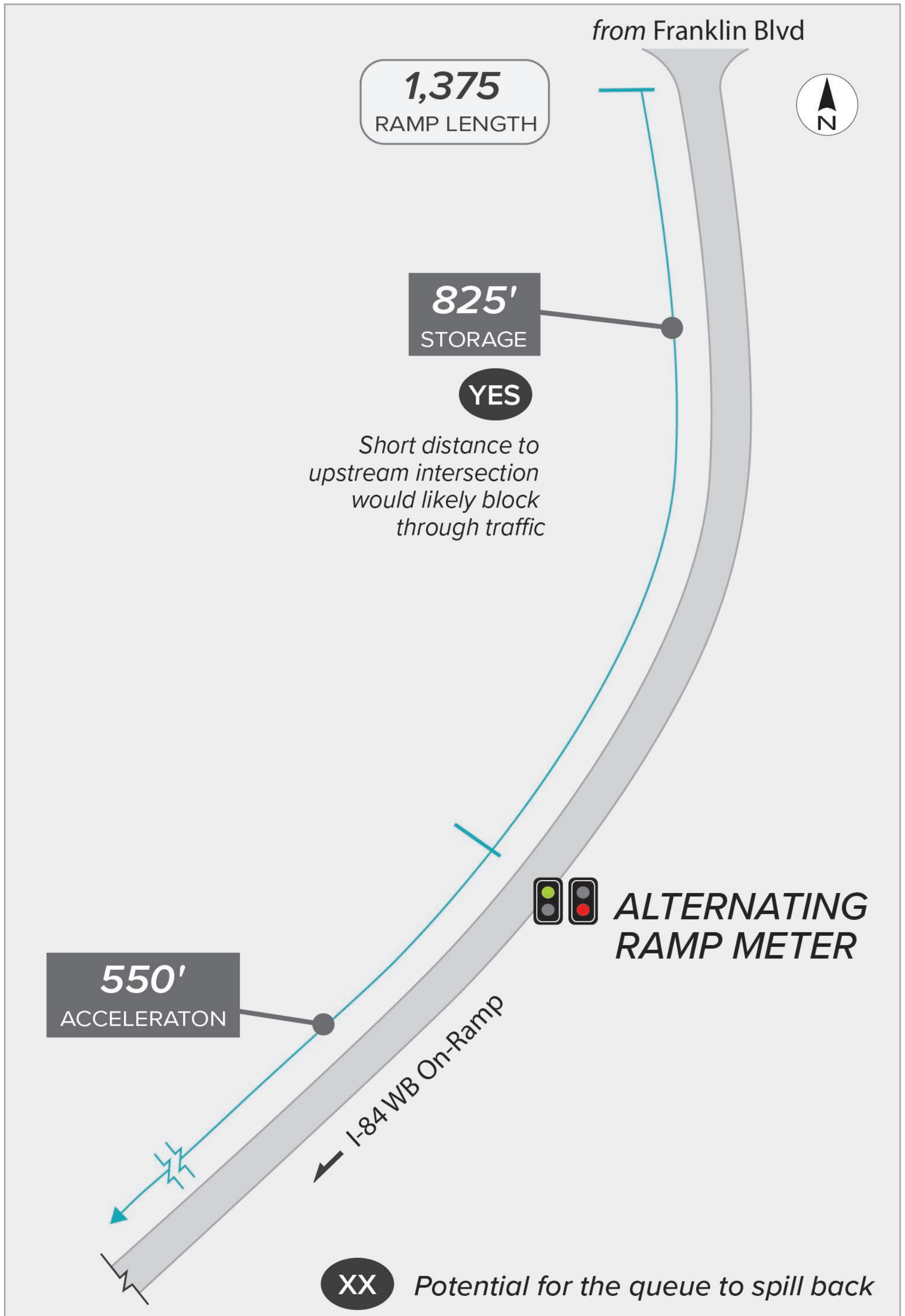

ALTERNATING
RAMP METERS
I-84 EB On-Ramp
1,500
RAMP LENGTH
from Garrity Blvd
1,100'
STORAGE
YES
NB leg spills back to dedicated lanes
400'
ACCELERATON
N
XX
Potential for the queue to spill back

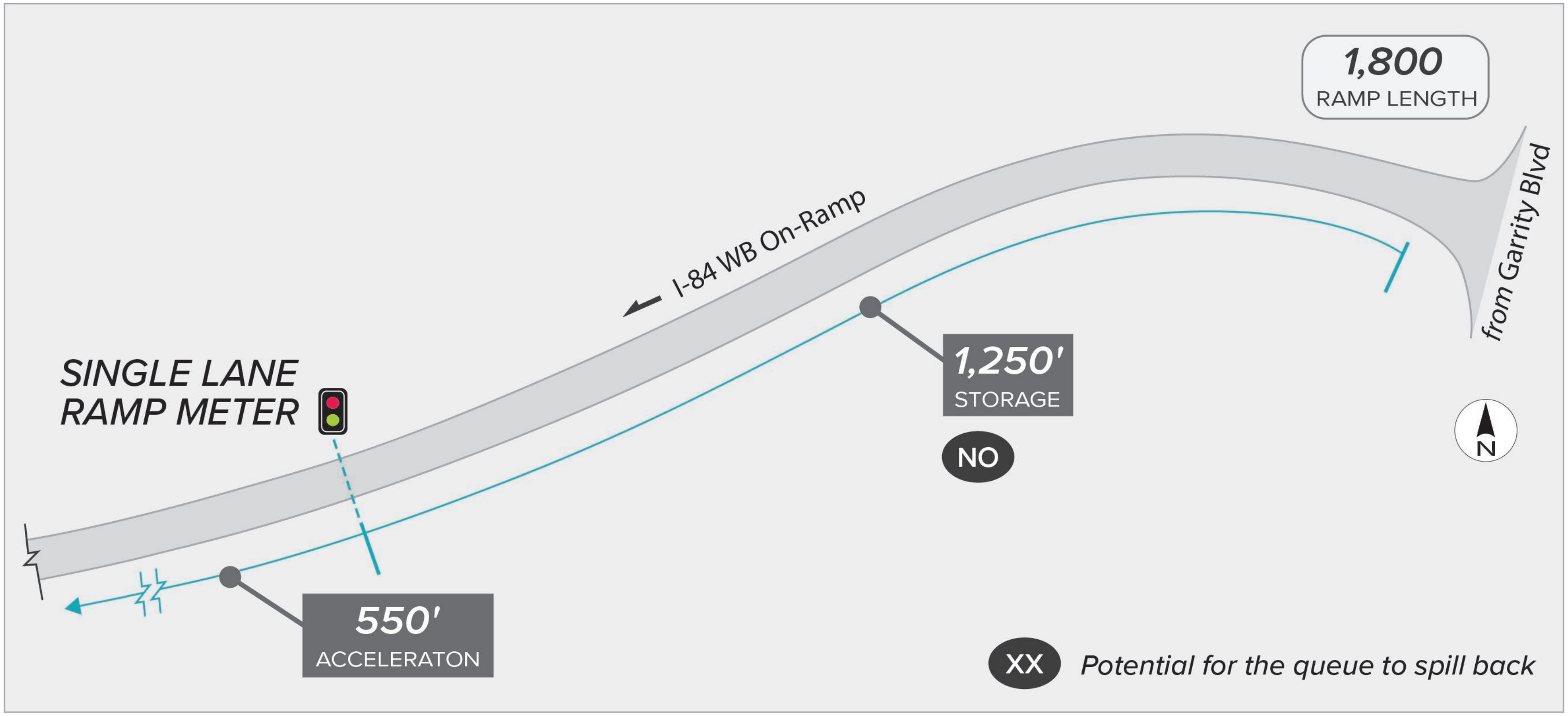

3,650
RAMP LENGTH
ALTERNATING
RAMP METERS
I-84 EB On-Ramp
S Ten Mile Rd
N
1,250'
STORAGE
YES
Queue spill would likely block through traffic (short pocket)
2,400'
ACCELERATON
XX
Potential for the queue to spill back

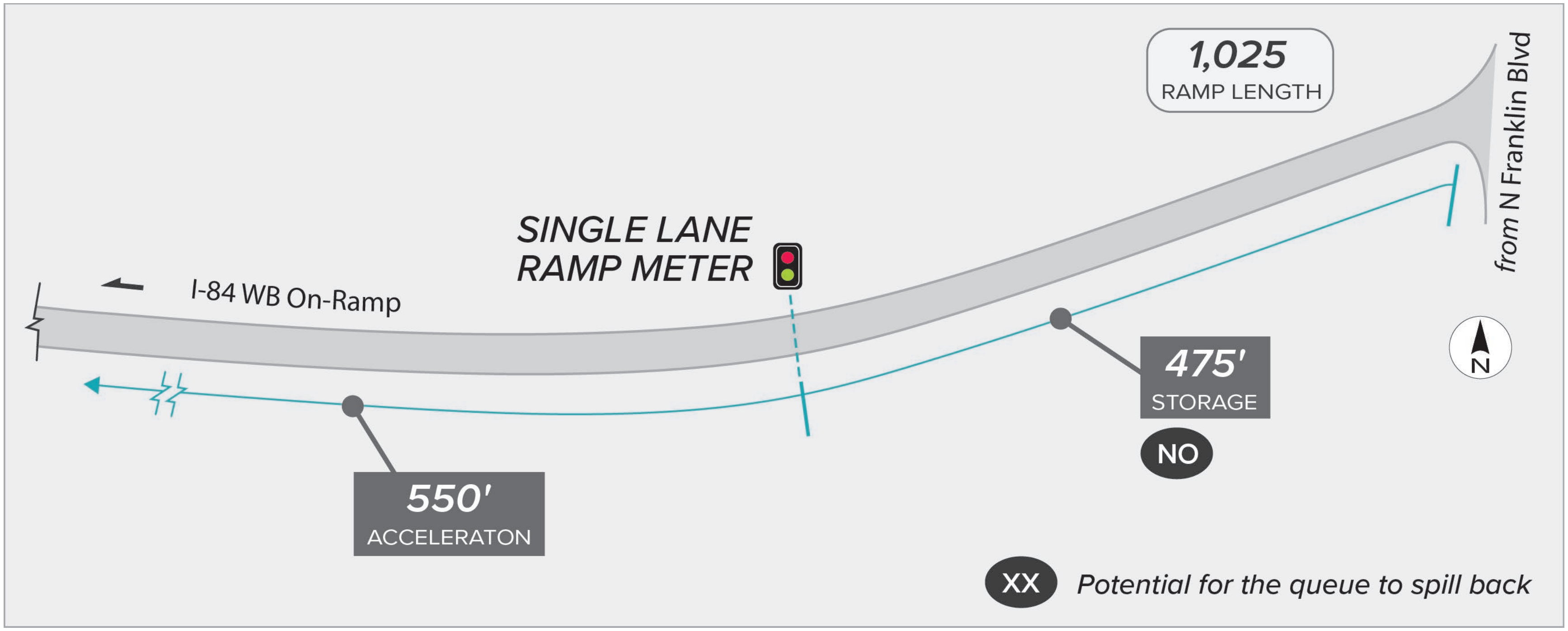

2,400
RAMP LENGTH
ALTERNATING
RAMP METERS
I-84 EB On-Ramp
from S Meridian Rd
1,025'
STORAGE
YES
Spills back to dedicated lanes
1,375'
ACCELERATON
N
XX
Potential for the queue to spill back

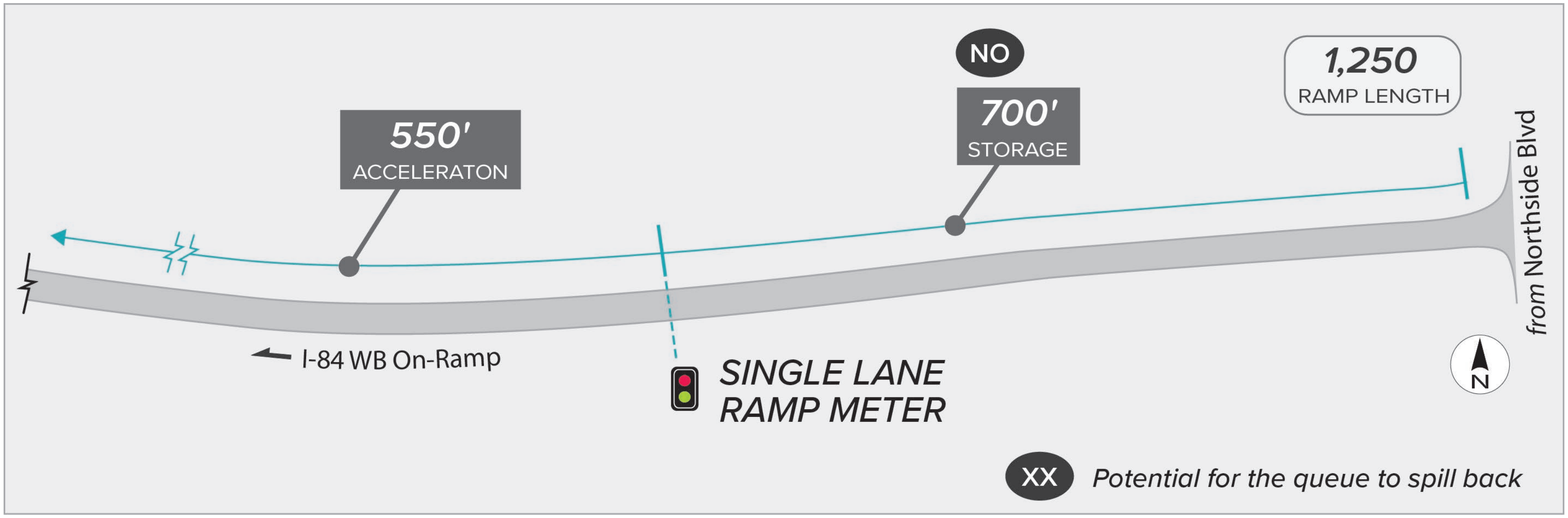

2,750
RAMP LENGTH
900'
ACCELERATON
ALTERNATING
RAMP
METERS
NO
1,850'
STORAGE
I-84 EB On-Ramp
from S Eagle Rd
SINGLE
LANE RAMP
METER
2,410
RAMP LENGTH
I-84 EB On-Ramp
550'
ACCELERATON
1,860'
STORAGE
YES
Spills back to a dedicated lane
from S Eagle Rd
XX
Potential for the queue
to spill back
N


1,150
RAMP LENGTH
N Curtis Rd
N
Constructing this two lane ramp meter would require addtional widening
600'
STORAGE
NO
ALTERNATING RAMP METER
I-84 WB On-Ramp
550'
ACCELERATON
XX
Potential for the queue to spill back


from Franklin Blvd
1,375
RAMP LENGTH
N
825'
STORAGE
YES
Short distance to
upstream intersection
would likely block
through traffic
ALTERNATING
RAMP METER
550'
ACCELERATON
I-84 WB On-Ramp
XX
Potential for the queue to spill back


1,800
RAMP LENGTH
I-84 WB On-Ramp
from Garrity Blvd
SINGLE LANE
RAMP METER
1,250'
STORAGE
NO
N
550'
ACCELERATON
XX
Potential for the queue to spill back


1,025
RAMP LENGTH
from N Franklin Blvd
SINGLE LANE
RAMP METER
I-84 WB On-Ramp
N
475'
STORAGE
NO
550'
ACCELERATON
XX
Potential for the queue to spill back


NO
1,250
RAMP LENGTH
700'
STORAGE
550'
ACCELERATON
from Northside Blvd
I-84 WB On-Ramp
SINGLE LANE
RAMP METER
N
XX
Potential for the queue to spill back