FINAL REPORT

SR 90/SR 80 Corridor Profile Study

Junction I-10 to Junction US 191

PREPARED FOR ADOT APRIL 2023

ADOT WORK TASK NO.
MPD 0041-17

ADOT CONTRACT NO.
18-177731

Prepared by

WILSON & COMPANY

SR 90/SR 80 CORRIDOR PROFILE STUDY

SR 90: I-10 TO SR 80
SR 80: SR 90 TO US 191

ADOT WORK TASK NO. MPD 022-21
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FINAL REPORT

APRIL 2023

PREPARED FOR:

ARIZONA DEPARTMENT OF TRANSPORTATION

PREPARED BY:

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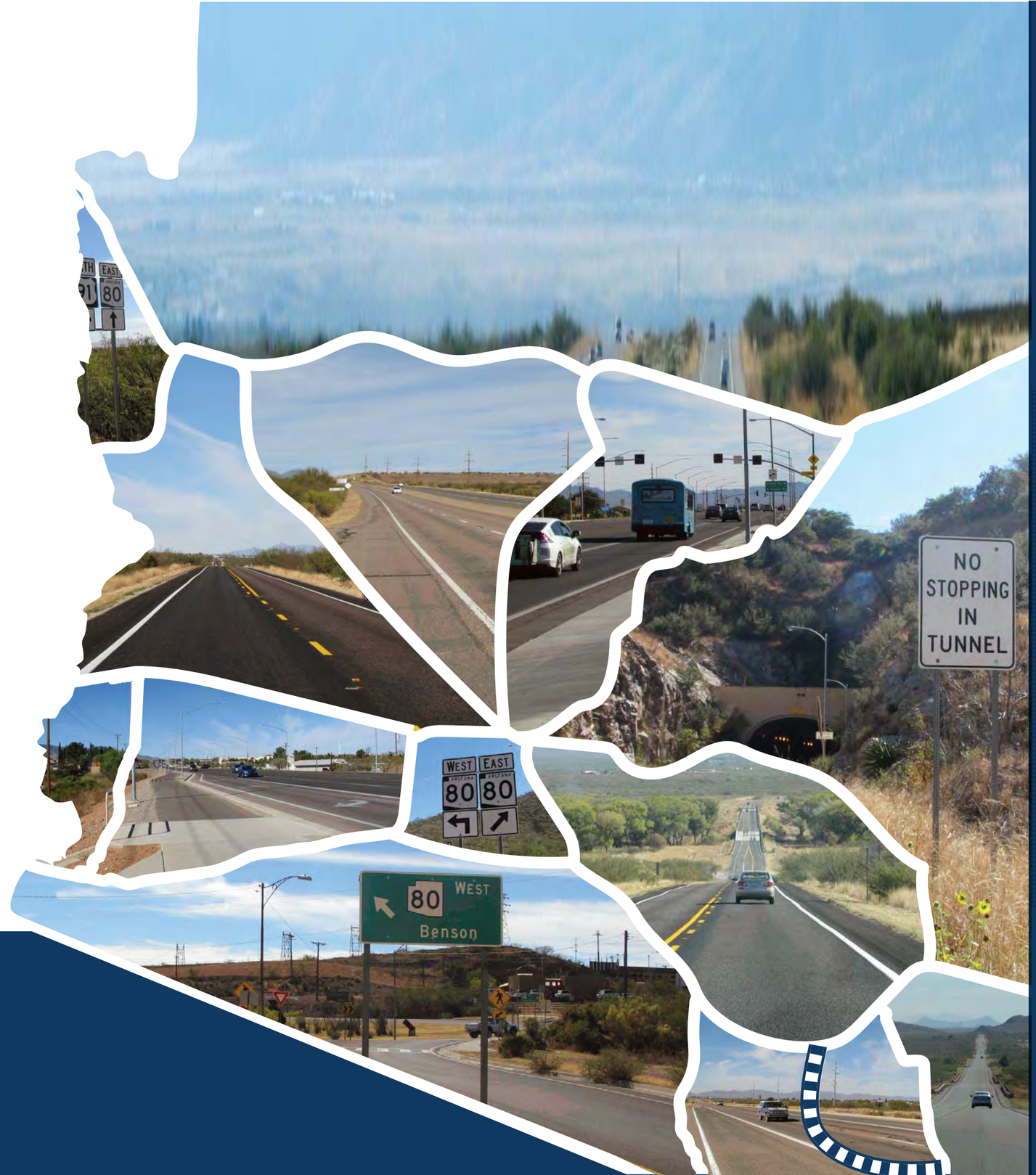
ACRONYMS & ABBREVIATIONS

AADT	Average Annual Daily Traffic
ABISS	Arizona Bridge Information and Storage System
ADOT	Arizona Department of Transportation
AGFD	Arizona Game and Fish Department
ASLD	Arizona State Land Department
AZTDM	Arizona Statewide Travel Demand Model
BLM	Bureau of Land Management
BQAZ	Building a Quality Arizona
CCTV	Closed Circuit Television
CR	Cracking Rating
CYMPO	Central Yavapai Metropolitan Planning Organization
DCR	Design Concept Report
DMS	Dynamic Message Sign
FHWA	Federal Highway Administration
FY	Fiscal Year
HCRS	Highway Condition Reporting System.
HPMS	Highway Performance Monitoring System
I	Interstate
INRIX	Real-time traffic conditions database
IRI	International Roughness Index
ITS	Intelligent Transportation System
LCCA	Life-Cycle Cost Analysis
LOTTR	Level of Travel Time Reliability
LOS	Level of Service
LRTP	Long-Range Transportation Plan
MAG	Maricopa Association of Governments
MAP-21	Moving Ahead for Progress in the 21st Century
MP	Milepost
MPD	Multimodal Planning Division
NACOG	Northern Arizona Council of Governments
NB	Northbound
NPV	Net Present Value
OP	Overpass
PES	Performance Effectiveness Score
P2P	Planning to Programming
PDI	Pavement Distress Index
PSR	Pavement Serviceability Rating
PTI	Planning Time Index
RTP	Regional Transportation Plan
SB	Southbound
SHSP	Strategic Highway Safety Plan
SR	State Route
TI	Traffic Interchange
TIP	Transportation Improvement Plan
TTTR	Truck Travel Time Reliability
UP	Underpass
USDOT	United States Department of Transportation
V/C	Volume to Capacity Ratio
VMT	Vehicle-Miles Traveled
WIM	Weigh-in-motion



Executive Summary

EXECUTIVE SUMMARY

INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study (CPS) of State Route 90 (SR 90) from Interstate 10 (I-10) to SR 80 and of SR 80 from SR 90 to US 191. The study examines key performance measures relative to the SR 90/SR 80 corridor, and the results of this performance evaluation are used to identify potential strategic improvements. The intent of the corridor profile program, and of ADOT's Planning-to-Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network.

ADOT has completed 21 CPS within four separate groupings or rounds. In 2020, ADOT separated the previously studied corridors into six groupings to be updated and reassessed. The SR 90/SR 80 corridor, depicted in **Figure ES-1**, is one of the strategic statewide corridors identified and the subject of this CPS Update.

Corridor Study Purpose, Goals and Objectives

The purpose of the CPS is to measure corridor performance to inform the development of strategic solutions that are cost-effective and account for potential risks. This purpose can be accomplished by following the process described below:

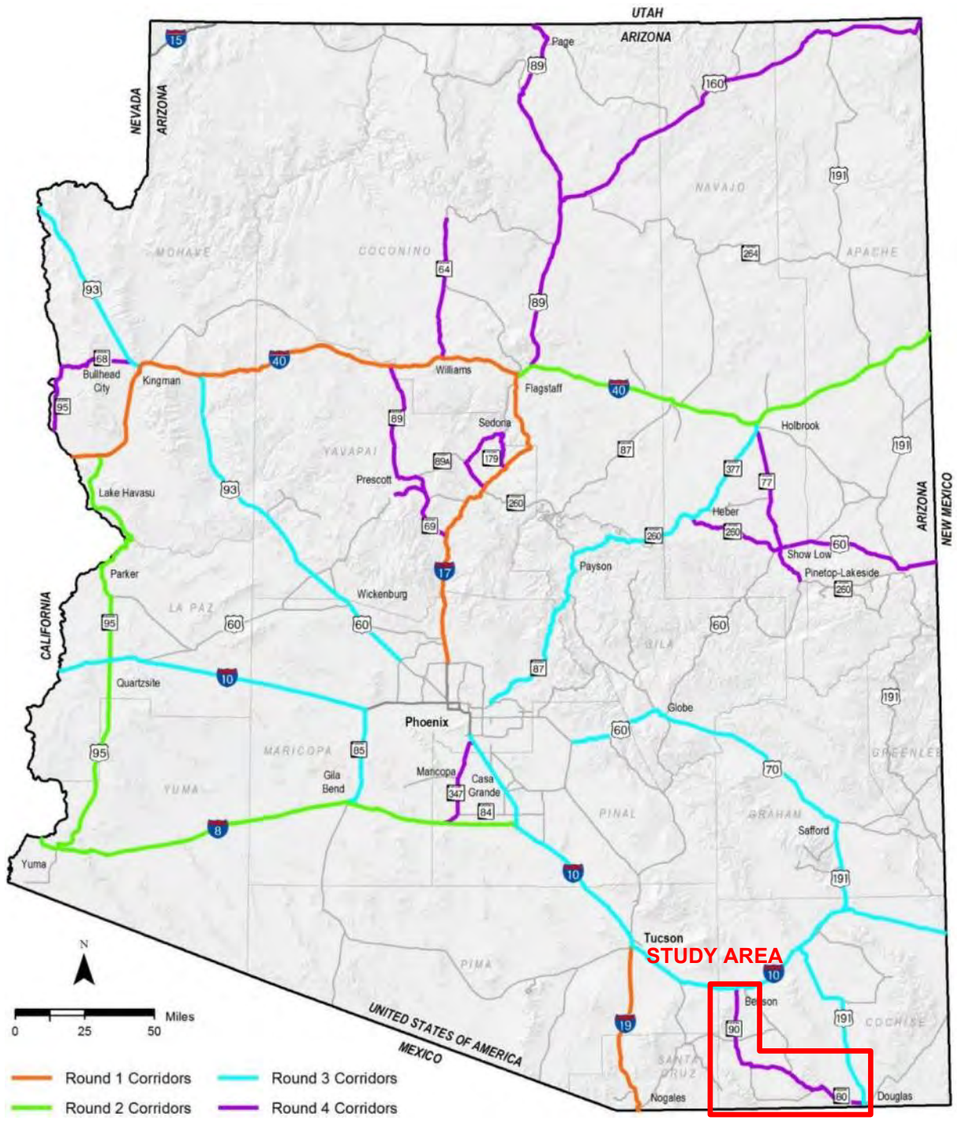
- Inventory past improvement recommendations
- Define corridor goals and objectives
- Assess existing performance based on quantifiable performance measures
- Propose various solutions to improve corridor performance
- Identify specific solutions that can provide quantifiable benefits relative to the performance measures
- Prioritize solutions for future implementation, accounting for performance effectiveness and risk analysis findings

The objective of this study is to identify a recommended set of prioritized potential solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The SR 90/SR 80 CPS defines solutions and improvements for the corridor that are evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance.

The following goals are identified as the outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Develop solutions that address identified corridor needs based on measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

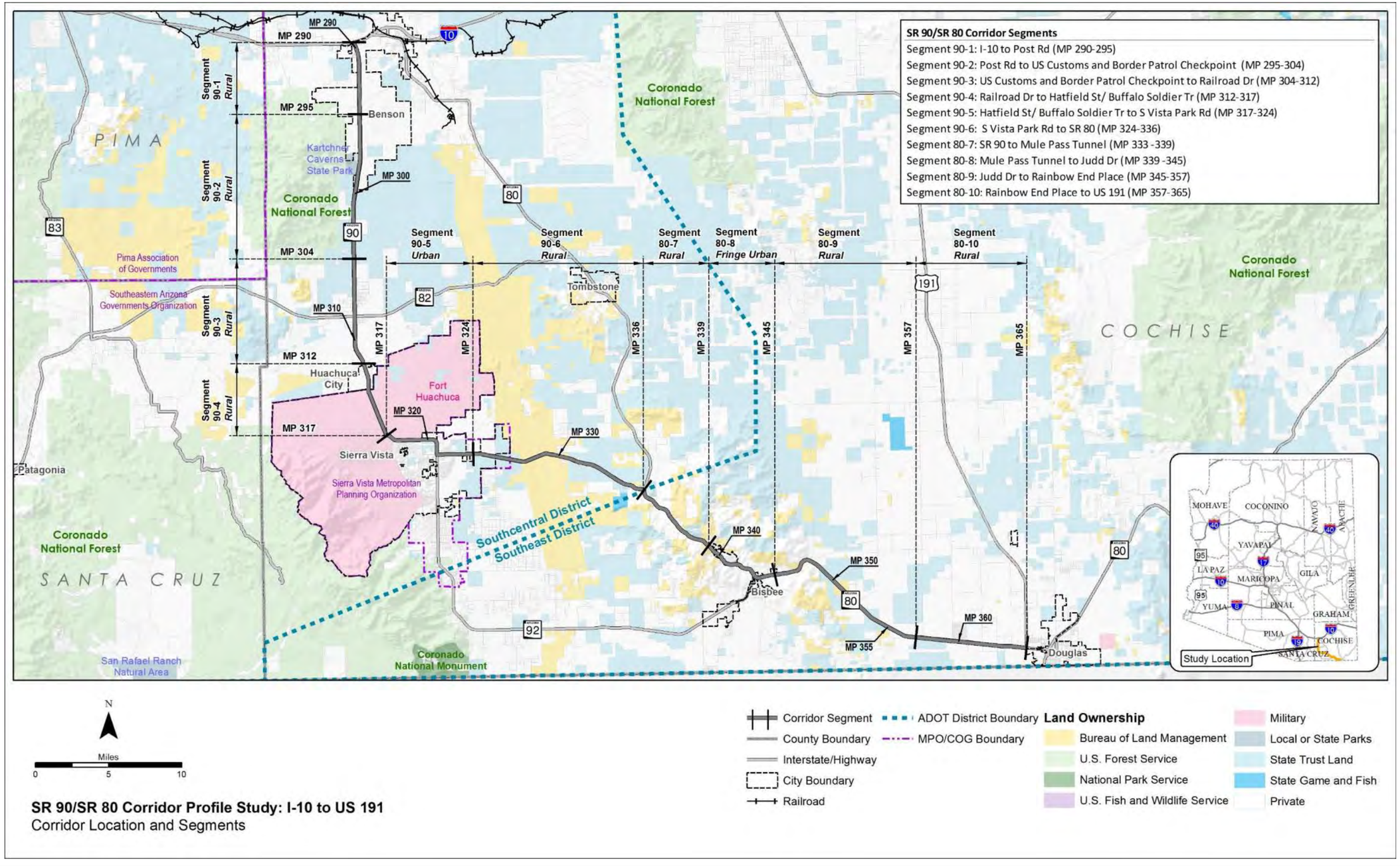
Figure ES-1: Corridor Study Area



Study Location and Corridor Segments

The SR 90/SR 80 corridor is divided into 10 planning segments for analysis and evaluation. The corridor is segmented at logical breaks where the context changes due to differences in characteristics such as terrain, daily traffic volumes, or roadway typical sections. Corridor segments are shown in **Figure ES-2**.

Figure ES-2: Corridor Location and Segments



SR 90/SR 80 Corridor Profile Study: I-10 to US 191
Corridor Location and Segments

CORRIDOR PERFORMANCE

A series of performance measures is used to assess the SR 90/SR 80 corridor. The results of the performance evaluation are used to define corridor needs relative to the long-term goals and objectives for the corridor.

Corridor Performance Framework

This study uses a performance-based process to define baseline corridor performance, diagnose corridor needs, develop corridor solutions, and prioritize strategic corridor investments. In support of this objective, a framework for the performance-based process was developed through a collaborative process involving ADOT and the CPS consultant teams.

Figure ES-3 illustrates the performance framework, which includes a two-tiered system of performance measures (primary and secondary) to evaluate baseline performance.

Figure ES-3: Corridor Profile Performance Framework

The following five performance areas guide the performance-based corridor analyses:

- Pavement
- Bridge
- Mobility
- Safety
- Freight

The performance measures include five primary measures: Pavement Index, Bridge Index, Mobility Index, Safety Index, and Freight Index. Additionally, a set of secondary performance measures provides for a more detailed analysis of corridor performance. **Table ES-1** provides the complete list of primary and secondary performance measures for each of the five performance areas.

Table ES-1: Corridor Performance Measures

Performance Area	Primary Measure	Secondary Measures
Pavement	**Pavement Index** Based on a combination of International Roughness Index, cracking, and rutting	• Directional Pavement Serviceability • Pavement Failure • Pavement Hot Spots
Bridge	**Bridge Index** Based on lowest of deck, substructure, superstructure and structural evaluation rating	• Bridge Sufficiency • Bridge Rating • Bridge Hot Spots
Mobility	**Mobility Index** Based on combination of existing and future daily volume-to-capacity ratios	• Future Congestion • Peak Congestion • Travel Time Reliability • Multimodal Opportunities
Safety	**Safety Index** Based on frequency of fatal and incapacitating injury crashes	• Directional Safety Index • Strategic Traffic Safety Plan Emphasis Areas • Other Crash Unit Types • Safety Hot Spots
Freight	**Freight Index** Based on bi-directional truck travel time reliability	• Travel Time Reliability • Bridge Vertical Clearance • Bridge Vertical Clearance Hot Spots

Each of the primary and secondary performance measures identified in the table above is comprised of one or more quantifiable indicators. A three-level scale was developed to standardize the performance scale across the five performance areas, with numerical thresholds specific to each performance measure:

Good/Above Average Performance – Rating is above the identified desirable/average range

Fair/Average Performance – Rating is within the identified desirable/average range

Poor/Below Average Performance – Rating is below the identified desirable/average range

The terms “good”, “fair”, and “poor” apply to the Pavement, Bridge, Mobility, and Freight performance measures, which have defined thresholds. The terms “above average”, “average”, and “below average” apply to the Safety performance measures, which have thresholds referenced to statewide averages.

Corridor Performance Summary

Table ES-2 shows a summary of corridor performance for all primary measures and secondary measure indicators for the SR 90/SR 80 corridor. A weighted corridor average rating (based on the length of the segment) was calculated for each primary and secondary measure as shown in **Table ES-2**. The following general observations were made related to the performance of the SR 90/SR 80 corridor:

- Overall Performance: The Pavement performance and Safety performance areas show a mix of “good”, “fair”, and “poor” performance; Mobility performance shows generally “good” performance; the Bridge performance area shows generally “fair” performance; the Freight performance area shows generally “poor” performance
- Pavement Performance: The weighted average of the Pavement Index shows “fair” overall performance for the SR 90/SR 80 corridor; Segments 90-3 through 90-5 and 80-8 show “fair” or “poor” performance for all Pavement performance area measures; A majority of the segments show “poor” performance for the Area Failure measure except Segments 90-6 and 80-7
- Bridge Performance: The weighted average of the Bridge Index shows “fair” overall performance for the SR 90/SR 80 corridor; Segments 80-7 through 80-9 show “fair” performance for all Bridge performance area measures; the Lowest Bridge Rating measure shows “fair” performance for all segments; the weighted average for the Sufficiency Rating measure shows “good” performance; Segments 90-2, 90-4, and 90-5 contain no bridges
- Mobility Performance: The weighted average of the Mobility Index shows “good” overall performance for the SR 90/SR 80 corridor; the Future Daily V/C and Existing Peak Hour V/C measures show “good” performance for all segments along the corridor; the Directional Closure Extent measure show generally “good” or “fair” performance; Segment 90-1 shows “poor” performance in both directions for the Directional LOTTR measure; the weighted average for the Directional LOTTR measure shows “fair” in the NB/WB direction and “good” for the SB/EB direction; Segments 90-5 through 80-8 show “poor” performance for the % Bicycle Accommodation measure and the weighted average for the corridor shows “fair” performance
- Safety Performance: The weighted average of the Safety Index and Directional Safety Indices show “above average” performance for the SR 90/SR 80 corridor; The crash unit type performance measures for crashes involving Lane Departures, Pedestrians, Trucks and Bicycles had insufficient data to generate reliable performance ratings; The weighted average of the crash unit type performance measure involving Intersections shows “below average” performance; The Safety Index value for Segments 90-5, 80-7 and 80-8 are “below average”, meaning this segment has more crashes than is typical statewide for a similar operating environment; The Directional Safety Index value for NB/WB travel for Segment 80-7 and 80-8 are “below average” and for SB/EB travel, Segments 90-1, 90-5 and 80-7 and 80-8 are “below average”
- Freight Performance: The weighted average of the Freight Index shows “poor” overall performance for the SR 90/SR 80 corridor; All segments show “fair” or “poor” performance for the Freight Index and Directional Max TTTR (for NB/WB travel) measures except for Segment 90-6; Directional Max TTTR in the SB/EB direction shows a mix of “good,” “fair,” and “poor.” Segment 80-7 in the NB/WB direction shows “poor” performance in the Closure Duration performance measure; Most of the segments show “fair” or “good” performance for the Closure Duration performance measure; three bridge vertical clearance hot spots exist in Segment 80-8
- Lowest Performing Segments: Segments 90-1, 90-5, and 80-7 show “poor/below average” performance for many performance measures
- Highest Performing Segments: Segment 80-10 shows “good/above average” performance for many performance measures

Table ES-2: Corridor Performance Summary by Segment and Performance Measure

Segment #	Segment Length (miles)	Pavement Performance Area				Bridge Performance Area			Mobility Performance Area									
		Pavement Index	Directional PSR		% Area Failure	Bridge Index	Sufficiency Rating	Lowest Bridge Rating	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent (instances/ milepost/year/mile)		Directional Max LOTTR (all vehicles)		% Bicycle Accommodation	% Non-Single Occupancy Vehicle (SOV) Trips
			NB/WB	SB/EB							NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB		
90-1[2*a]	5	3.27	4.10	4.01	80%	No Bridges			0.32	0.36	0.21	0.20	0.00	0.00	2.00	1.69	88%	11.2%
90-2[2*a]	10	3.67	4.36	3.99	50%	6.49	94.36	6	0.15	0.17	0.11	0.11	0.00	0.02	2.05	1.04	100%	11.9%
90-3[2*a]	7	2.80	3.40	3.12	88%	6.33	94.03	6	0.36	0.40	0.28	0.29	0.10	0.18	1.23	1.11	96%	15.0%
90-4[2^a]	5	3.39	3.01	3.35	30%	No Bridges			0.26	0.29	0.17	0.17	0.00	0.12	1.10	1.11	96%	15.4%
90-5[2*a]	7	2.96	2.93	2.89	71%	No Bridges			0.40	0.44	0.31	0.30	0.14	0.03	1.22	1.38	26%	18.5%
90-6[2*a]	12	3.68	3.45	3.39	17%	6.60	93.22	5	0.31	0.34	0.25	0.25	0.15	0.05	1.10	1.10	3%	15.0%
80-7[2^a]	5	4.20	3.91	3.96	0%	5.85	73.37	5	0.41	0.26	0.42	0.43	0.50	0.10	1.07	1.16	0%	14.6%
80-8[1*a]	6	2.88	2.84	3.12	88%	5.92	71.56	5	0.21	0.13	0.25	0.22	0.20	0.54	1.17	1.13	43%	15.8%
80-9[2^a]	12	3.62	3.68	3.66	50%	6.02	77.46	5	0.09	0.04	0.15	0.17	0.40	0.90	1.11	1.19	88%	10.9%
80-10[2*a]	8	3.60	3.50	3.64	50%	5.00	86.30	5	0.10	0.07	0.13	0.13	0.00	0.05	1.21	1.07	97%	14.0%
Weighted Corridor Average		3.44	3.55	3.52	50%	6.07	81.37	5.24	0.24	0.24	0.22	0.22	0.16	0.23	1.32	1.18	63%	14.0%

SCALES

Performance Level	Non-Interstate		All			Urban and Fringe Urban	All	Uninterrupted	All	All
Good/Above Average	> 3.50	< 5%	> 6.5	> 80	> 6	< 0.71	< 0.22	< 1.15	> 90%	> 17%
Fair/Average	2.90 - 3.50	5% - 20%	5.0 - 6.5	50 - 80	5 - 6	0.71 - 0.89	0.22 - 0.62	1.15 - 1.5	60% - 90%	11% - 17%
Poor/Below Average	< 2.90	> 20%	< 5.0	< 50	< 5	> 0.89	> .62	> 1.5	< 60%	< 11%

Performance Level	Rural
Good/Above Average	< 0.56
Fair/Average	0.56 - 0.76
Poor/Below Average	> 0.76

^Uninterrupted Flow Facility
*Interrupted Flow Facility
[a]2 or 3 or 4 Lane Divided Highway
[b]4 or 5 Lane Undivided Highway
[c]2 or 3 Lane Undivided Highway
[1]Urban Operating Environment
[2]Rural Operating Environment

Table ES-2: Corridor Performance Summary by Segment and Performance Measure (continued)

Segment #	Segment Length (miles)	Safety Performance Area								Freight Performance Area						
		Safety Index	Directional Safety Index		% of Fatal + Suspected Serious Injury Crashes at Intersections	% of Fatal + Suspected Serious Injury Crashes Involving Lane Departures	% of Fatal + Suspected Serious Injury Crashes Involving Pedestrians	% of Segment Fatal + Suspected Serious Injury Crashes Involving Trucks	% of Segment Fatal + Suspected Serious Injury Crashes Involving Bicycles	Freight TTTR	Directional Max TTTR		Combined Average Peak TTTR	Average Minutes Per Year Given Milepost Is Closed Per Segment Mile (NB/EB)		Bridge Vertical Clearance (feet)
			NB/WB	SB/EB							NB/WB	SB/EB		NB/WB	SB/EB	
90-1[2*a]	5	0.77	0.08	1.45	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	5.06	2.75	7.37	5.06	0.00	0.00	No UP
90-2[2*a]	10	0.04	0.04	0.04	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	4.85	8.62	1.08	4.85	0.00	1.33	No UP
90-3[2*a]	7	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.69	1.87	1.52	1.69	10.25	20.33	No UP
90-4[2^a]	5	0.04	0.08	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.34	1.42	1.25	1.34	0.00	14.76	No UP
90-5[2*a]	7	1.63	0.93	2.32	61.1%	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	2.05	1.86	2.23	2.05	12.00	6.83	No UP
90-6[2*a]	12	0.18	0.16	0.21	42.9%	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.35	1.40	1.30	1.35	10.00	3.00	No UP
80-7[2^a]	5	1.93	1.95	1.92	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.45	1.25	1.65	1.45	156.07	15.57	No UP
80-8[1*a]	6	1.82	1.81	1.83	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.45	1.48	1.42	1.45	36.77	109.34	13.95
80-9[2^a]	12	0.00	0.00	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.92	1.37	2.48	1.92	95.00	102.20	No UP
80-10[2*a]	8	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.84	2.38	1.29	1.84	0.00	3.00	No UP
Weighted Corridor Average		0.84	0.52	0.79	50%	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	2.29	2.59	2.00	2.29	31.31	29.75	13.95

SCALES

Performance Level	2 or 3 or 4 Lane Divided Highway						Uninterrupted	All	
Good/Above Average	< 0.81	< 23.4%	< 56.4%	< 16%	< 3.7%	< 0%	< 1.15	< 44.18	> 16.5
Fair/Average	0.81 - 1.19	23.4% - 29.3%	56.4% - 65.0%	16% - 26%	3.7% - 9.9%	0% - 2%	1.15 - 1.35	44.18-124.86	16.0 - 16.5
Poor/Below Average	> 1.19	> 29.3%	> 65.0%	> 26%	> 9.9%	> 2%	> 1.35	> 124.86	< 16.0
Performance Level	**2 or 3 Lane Undivided Highway**						**Interrupted**		
Good/Above Average	< 0.92	< 11.2%	< 66.9%	< 3.8%	< 4.2%	< 0%	< 1.45		
Fair/Average	0.92 - 1.08	11.2% - 15.6%	66.9% - 74.5%	3.8% - 7.2%	4.2% - 8.0%	0% - 3.3%	1.45 – 1.85		
Poor/Below Average	> 1.08	> 15.6%	> 74.5%	> 7.2%	> 8.0%	> 3.3%	> 1.85		
Performance Level	**4 or 5 Undivided Highway**								
Good/Above Average	< 0.78	< 43.8%	< 21.1%	< 8.8%	< 0.8%	< 0.5%			
Fair/Average	0.78 - 1.22	43.8% - 49.5%	21.1% - 32.1%	8.8% - 13.5%	0.8% - 5.5%	0.5% - 3.8%			
Poor/Below Average	> 1.22	> 49.5%	> 32.1%	> 13.5%	> 5.5%	> 3.8%			

^Uninterrupted Flow Facility
*Interrupted Flow Facility
[a]2 or 3 or 4 Lane Divided Highway
[b]4 or 5 Lane Undivided Highway
[c]2 or 3 Lane Undivided Highway
[1]Urban Operating Environment
[2]Rural Operating Environment

Notes: *"Insufficient Data" indicates there was not enough data available to generate reliable performance ratings*
"No UP" indicates no underpasses are present in the segment

NEEDS ASSESSMENT

Corridor Description

The SR 90/SR 80 corridor between I-10 and US 191 provides movement for freight, tourism, and recreation needs within southeastern Arizona. It provides a key link between I-10 and the United States/Mexico border crossing at Douglas/Agua Prieta and connects Benson, Sierra Vista, Bisbee, and Douglas. This corridor also serves the Kartchner Caverns State Park and other recreational and historic areas.

Corridor Objectives

Statewide goals and performance measures were established by the ADOT Long-Range Transportation Plan (LRTP) 2010-2035 goals and objectives that were updated in 2017. Statewide performance goals that are relevant to SR 90/SR 80 performance areas were identified and corridor goals were then formulated for each of the five performance areas that aligned with the overall statewide goals established by the LRTP. Based on stakeholder input, corridor goals, corridor objectives, and performance results, three "emphasis areas" were identified for the SR 90/SR 80 corridor: Pavement, Safety, and Freight.

Taking into account the corridor goals and identified emphasis areas, performance objectives were developed for each quantifiable performance measure that identify the desired level of performance based on the performance scale levels for the overall corridor and for each segment of the corridor. For the performance emphasis areas, the corridor-wide weighted average performance objectives are identified with a higher standard than for the other performance areas.

Achieving corridor and segment performance objectives will help ensure that investments are targeted toward improvements that support the safe and efficient movement of travelers on the corridor. Corridor performance is measured against corridor and segment objectives to determine needs – the gap between observed performance and performance objectives.

Needs Assessment Process

The performance-based needs assessment evaluates the difference between the baseline performance and the performance objectives for each of the five performance areas used to characterize the health of the corridor: Pavement, Bridge, Mobility, Safety, and Freight. The performance-based needs assessment process is illustrated in **Figure ES-4**.

The needs assessment compares baseline corridor performance with performance objectives to provide a starting point for the identification of performance needs. This mathematical comparison results in an initial need rating of None, Low, Medium, or High for each primary and secondary performance measure. An illustrative example of this process is shown in **Figure ES-5**.

The initial level of need for each segment is refined to account for hot spots and recently completed or under construction projects, resulting in a final level of need for each segment. The final levels of need for each primary and secondary performance measure are combined to produce a weighted final need rating for each segment. A detailed review of available data helps identify contributing factors to the need and if there is a high level of historical investment.

Figure ES-4: Needs Assessment Process

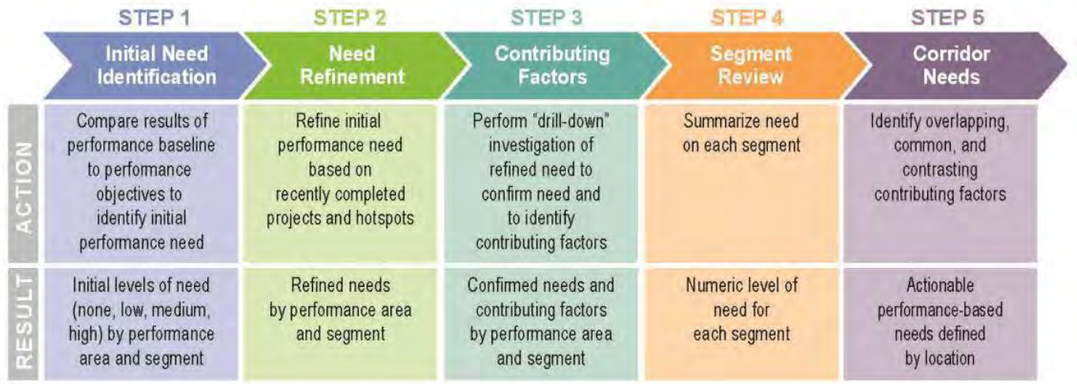


Figure ES-5: Initial Need Ratings in Relation to Baseline Performance (Bridge Example)

Performance Thresholds	Performance Level	Initial Level of Need	Description
6.5	Good	None*	All levels of Good and top 1/3 of Fair (>6.0)
	Good		
	Good		
	Fair		
5.0	Fair	Low	Middle 1/3 of Fair (5.5-6.0)
	Fair	Medium	Lower 1/3 of Fair and top 1/3 of Poor (4.5-5.5)
	Poor		
	Poor	High	Lower 2/3 of Poor (<4.5)
	Poor		

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Summary of Needs

Table ES-3 provides a summary of needs for each segment across all performance areas, with the average need score for each segment presented in the last row of the table. A weighting factor of 1.5 is applied to the need scores of the performance areas identified as emphasis areas (Pavement, Safety, and Freight for the SR 90/SR 80 corridor). There is one segment with a High average need, five segments with a Medium average need, and four segments with a Low average need. More information on the identified final needs in each performance area is provided below.

Pavement Needs

- Nine segments (90-1 through 90-6 and 80-8 through 80-10) contain Pavement hot spots
- Segments 90-3, 90-5 and 80-8 have final needs of High; Segment 90-1 has a final need of Medium; Segments 90-2, 90-4, 90-6, 80-9 and 80-10 have final needs of Low; Segment 80-7 has a final need of None
- Segments 90-1 was identified as having potential pavement repetitive historical investment issues

Bridge Needs

- Two segments (90-6 and 80-9) have bridge hot spots and they both have potential repetitive historical investment issues
- Segments 90-1, 90-4, and 90-5 do not contain any bridges
- Segment 80-10 has a final need of Medium; Segments 90-6 through 80-9 have final needs of Low; all other segments on the corridor have a final need of None

Mobility Needs

- Segments 90-3 and 90-4 have a final segment need of None; all other segments on the corridor have a final segment need of Low
- Mobility needs are primarily related to high directional LOTTR, closure extent and lack of bicycle accommodation

Safety Needs

- Segments 90-5, 80-7 and 80-8 have final segment needs of High; Segment 90-3 and 80-10 have a final segment need of N/A due to insufficient data to generate reliable ratings; Segments 90-2, 90-4, and 80-9 has final segment needs of None; all other segments on the corridor have a final need of Low
- Safety hot spots exist in Segments 90-3 and 90-5
- There is insufficient data to generate reliable ratings for the secondary measures including Strategic Traffic Safety Plan Emphasis Area crashes involving lane departures, pedestrians, trucks, and bicycles

Freight Needs

- There are three bridge vertical clearance hot spots along the corridor: Mule Pass Tunnel and Lowell RR UP (both directions)
- Segments 90-1, 90-2, 90-5, 80-7 and 80-9 have a final segment need of High while Segments 90-4 and 80-10 have a final segment need of Medium; all other segments on the corridor have a final segment need of Low or None

Overlapping Needs

This section identifies overlapping performance needs on the SR 90/SR 80 corridor, which provides guidance to develop strategic solutions that address more than one performance area with elevated levels of need (i.e., Medium or High). Completing projects that address multiple needs presents the opportunity to more effectively improve overall performance. A summary of the overlapping needs that relate to locations with elevated levels of need is provided below:

- Segment 90-1 contains elevated needs in the Pavement and Freight performance areas
- Segment 90-5 contains elevated needs in the Pavement, Safety and Freight performance areas
- Segment 80-7 contains elevated needs in the Safety and Freight performance areas
- Segment 80-8 contains elevated needs in the Pavement and Safety performance areas
- Segment 80-10 contains elevated needs in the Bridge and Freight performance areas

Table ES-3: Summary of Needs by Segment

Performance Area	Segment Number and Mileposts (MP)									
	90-1	90-2	90-3	90-4	90-5	90-6	80-7	80-8	80-9	80-10
	MP 290-295	MP 295-304	MP 304-312	MP 312-317	MP 317-324	MP 324-336	MP 333-339	MP 339-345	MP 345-357	MP 357-365
Pavement*	Medium	Low	High	Low	High	Low	None	High	Low	Low
Bridge	None	None	None	None	None	Low	Low	Low	Low	Medium
Mobility	Low	Low	None	None	Low	Low	Low	Low	None	None
Safety*	Low	None	N/A	None	High	Low	High	High	None	N/A
Freight*	High	High	Low	Medium	High	None	High	Low	High	Medium
Average Need	**1.31**	**1.08**	**0.92**	**0.69**	**2.23**	**0.77**	**1.69**	**1.92**	**1.08**	**1.00**

* Identified as Emphasis Area
# N/A indicates insufficient or no data available to determine level of need
+ A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study

Level of Need	Average Need Range
None+	< 0.1
Low	0.1 - 1.0
Medium	1.0 - 2.0
High	> 2.0

STRATEGIC SOLUTIONS

The principal objective of the CPS is to identify strategic solutions (investments) that are performance-based to ensure that available funding resources are used to maximize the performance of the State's key transportation corridors. One of the first steps in the development of strategic solutions is to identify areas of elevated levels of need as addressing these needs will have the greatest effect on corridor performance. Segments with Medium or High needs and specific locations of hot spots are considered strategic investment areas for which strategic solutions should be developed. Segments with lower levels of need or without identified hot spots are not considered candidates for strategic investment and are expected to be addressed through other ADOT programming processes. The SR 90/SR 80 strategic investment areas (resulting from the elevated needs) are shown in **Figure ES-6**.

Screening Process

In some cases, needs that are identified do not advance to solutions development and are screened out from further consideration because they have been or will be addressed through other measures including:

- A project is programmed to address this need
- The need is a result of a Pavement or Bridge hot spot that does not show historical investment or rating issues; these hot spots will likely be addressed through other ADOT programming means
- A bridge is not a hot spot but is located within a segment with a Medium or High level of need; this bridge will likely be addressed through current ADOT bridge maintenance and preservation programming processes
- The need is determined to be non-actionable (i.e., cannot be addressed through an ADOT project)
- The conditions/characteristics of the location have changed since the performance data was collected that was used to identify the need

Candidate Solutions

For each elevated need within a strategic investment area that is not screened out, a candidate solution is developed to address the identified need. Each candidate solution is assigned to one of the following three P2P investment categories based on the scope of the solution:

- Preservation
- Modernization
- Expansion

Documented performance needs serve as the foundation for developing candidate solutions for corridor preservation, modernization, and expansion. Candidate solutions are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT's traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the SR 90/SR 80 corridor will be considered along with other candidate projects in the ADOT statewide programming process.

Candidate solutions include some or all of the following characteristics:

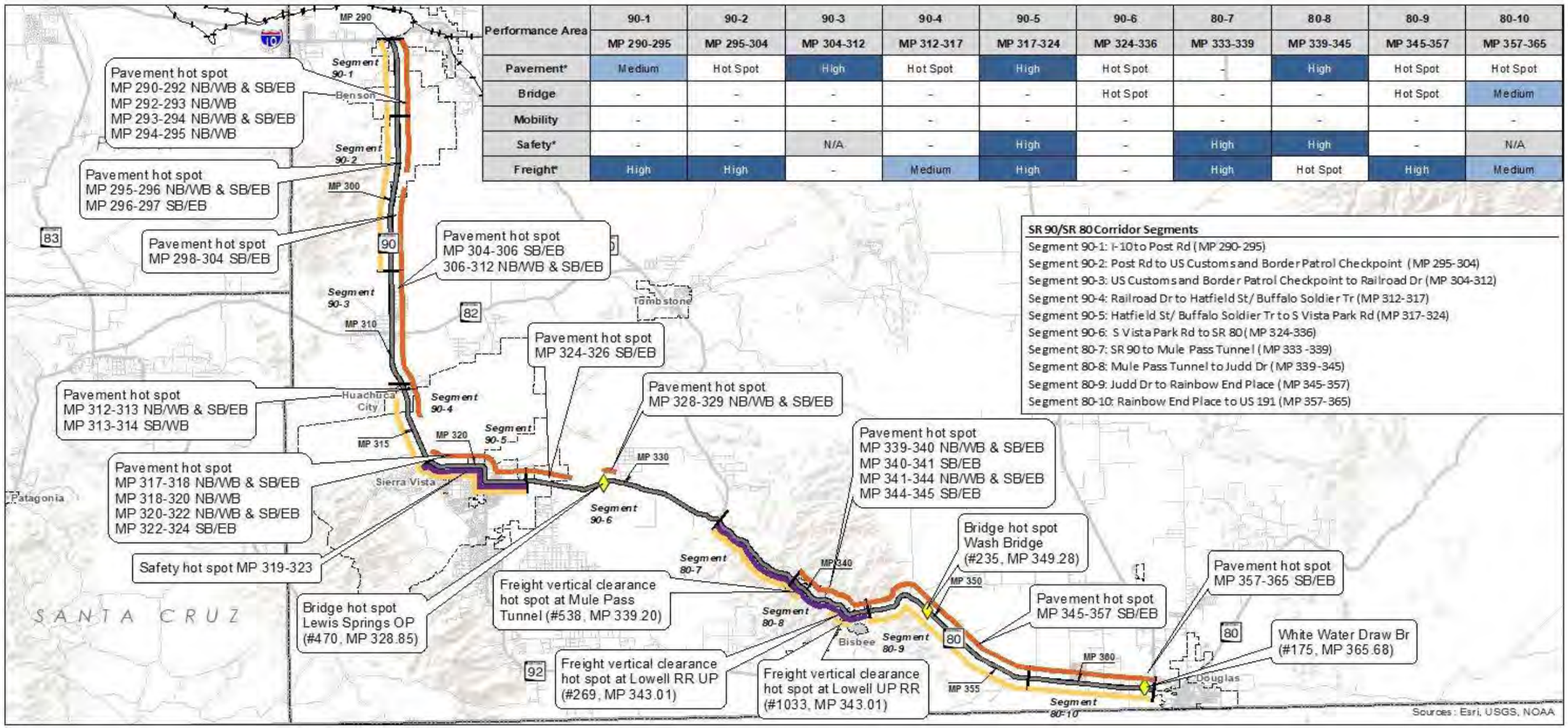
- Do not recreate or replace results from normal programming processes
- May include programs or initiatives, areas for further study, and infrastructure projects
- Address elevated levels of need (High or Medium) and hot spots
- Focus on investments in modernization projects (to optimize current infrastructure)
- Address overlapping needs
- Reduce costly repetitive maintenance
- Extend operational life of system and delay expansion
- Leverage programmed projects that can be expanded to address other strategic elements
- Provide measurable benefit

Candidate solutions developed to address an elevated need in the Pavement or Bridge performance areas include two options; rehabilitation or full replacement. These solutions are initially evaluated through a Life-Cycle Cost Analysis (LCCA) to provide insights into the cost-effectiveness of these options so a recommended approach can be identified. Candidate solutions developed to address an elevated need in the Mobility, Safety, or Freight performance areas are advanced directly to the Performance Effectiveness Evaluation. In some cases, there may be multiple solutions identified to address the same area of need.

Candidate solutions that are recommended to expand or modify the scope of an already programmed project are noted and are not advanced to solution evaluation and prioritization. These solutions are directly recommended for programming.

Figure ES-6: Strategic Investment Areas

Performance Area	90-1	90-2	90-3	90-4	90-5	90-6	80-7	80-8	80-9	80-10
	MP 290-295	MP 295-304	MP 304-312	MP 312-317	MP 317-324	MP 324-336	MP 333-339	MP 339-345	MP 345-357	MP 357-365
Pavement*	Medium	Hot Spot	High	Hot Spot	High	Hot Spot	-	High	Hot Spot	Hot Spot
Bridge	-	-	-	-	-	Hot Spot	-	-	Hot Spot	Medium
Mobility	-	-	-	-	-	-	-	-	-	-
Safety*	-	-	N/A	-	High	-	High	High	-	N/A
Freight*	High	High	-	Medium	High	-	High	Hot Spot	High	Medium



SR 90/SR 80 Corridor Segments

Segment 90-1: I-10 to Post Rd (MP 290-295)
Segment 90-2: Post Rd to US Customs and Border Patrol Checkpoint (MP 295-304)
Segment 90-3: US Customs and Border Patrol Checkpoint to Railroad Dr (MP 304-312)
Segment 90-4: Railroad Dr to Hatfield St/ Buffalo Soldier Tr (MP 312-317)
Segment 90-5: Hatfield St/ Buffalo Soldier Tr to S Vista Park Rd (MP 317-324)
Segment 90-6: S Vista Park Rd to SR 80 (MP 324-336)
Segment 80-7: SR 90 to Mule Pass Tunnel (MP 333-339)
Segment 80-8: Mule Pass Tunnel to Judd Dr (MP 339-345)
Segment 80-9: Judd Dr to Rainbow End Place (MP 345-357)
Segment 80-10: Rainbow End Place to US 191 (MP 357-365)

* Identified as Emphasis Areas for SR 90/SR 80 Corridor

Note: Figure shows strategic investment areas, which are segments with Medium and High levels of need and locations of hot spots. A "-" symbol indicates a segment level of need of Low or None, which is not considered strategic

Miles 0 5 10 N

Corridor Segment
County Boundary
Interstate/Highway
City Boundary
Railroad

Performance Area Needs
Pavement
Mobility
Safety
Freight
Bridge

Level of Need
Low
Medium
High

SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Strategic Investment Areas

SOLUTION EVALUATION AND PRIORITIZATION

Candidate solutions are evaluated using the following steps: LCCA (where applicable), Performance Effectiveness Evaluation, Solution Risk Analysis, and Candidate Solution Prioritization. The methodology and approach to this evaluation is shown in **Figure ES-7** and described more fully below.

Life-Cycle Cost Analysis

All Pavement and Bridge candidate solutions have two options: rehabilitation/repair or reconstruction. These options are evaluated through an LCCA to determine the best approach for each location where a Pavement or Bridge solution is recommended. The LCCA can eliminate options from further consideration and identify which options should be carried forward for further evaluation.

When multiple independent candidate solutions are developed for Mobility, Safety, or Freight strategic investment areas, these candidate solution options advance directly to the Performance Effectiveness Evaluation without an LCCA.

Performance Effectiveness Evaluation

After completing the LCCA process, all remaining candidate solutions are evaluated based on their performance effectiveness. This process includes determining a Performance Effectiveness Score (PES) based on how much each solution impacts the existing performance and needs scores for each segment. This evaluation also includes a Performance Area Risk Analysis to help differentiate between similar solutions based on factors that are not directly addressed in the performance system.

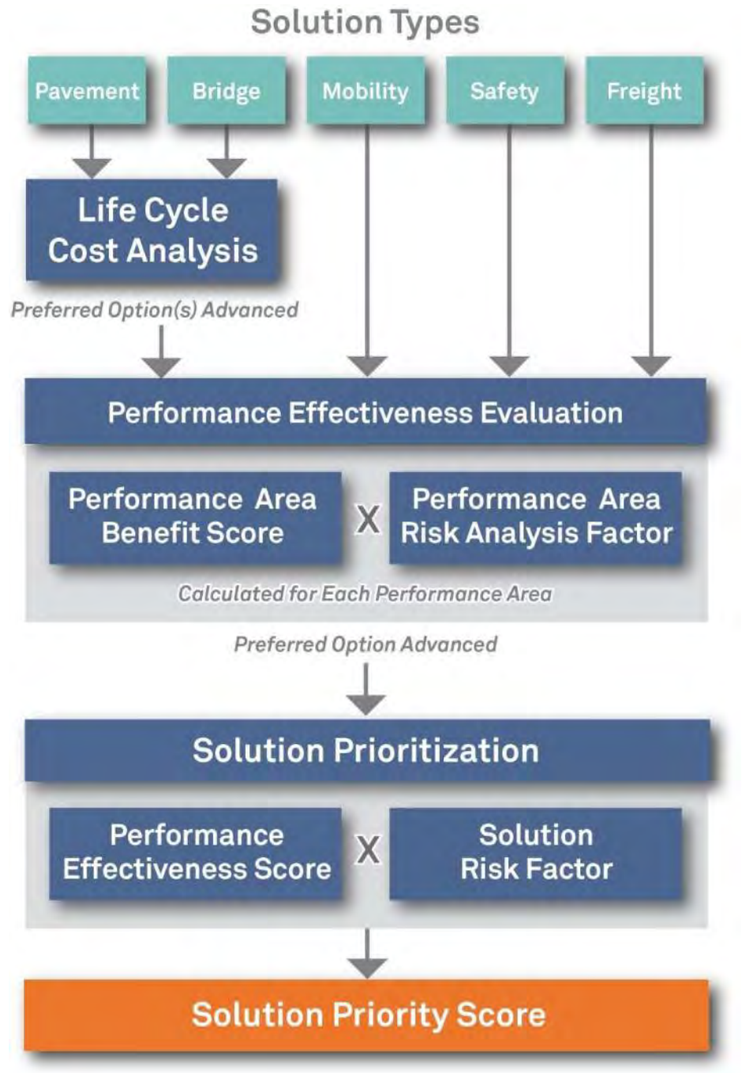
Solution Risk Analysis

All candidate solutions advanced through the Performance Effectiveness Evaluation are also evaluated through a Solution Risk Analysis process. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of the performance failure.

Candidate Solution Prioritization

The PES, weighted risk factor, and segment average need score are combined to create a prioritization score. The candidate solutions are ranked by prioritization score from highest to lowest. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process.

Figure ES-7: Candidate Solution Evaluation Process



SUMMARY OF CORRIDOR RECOMMENDATIONS

Prioritized Candidate Solution Recommendations

Table ES-4 and **Figure ES-8** show the prioritized candidate solutions recommended for the SR 90/SR 80 corridor in ranked order of priority. The highest prioritization score indicates the candidate solution is recommended as the highest priority. Implementation of these solutions is anticipated to improve performance of the SR 90/SR 80 corridor. The following observations were noted about the prioritized solutions:

- Most of the anticipated improvements in performance are in the Mobility, Safety and Freight performance areas.
- The highest priority solutions address needs in the Huachuca City area (SR 90 MP 313-317) and Sierra Vista area (SR 90 MP 317-324).

Other Corridor Recommendations

As part of the investigation of strategic investment areas and candidate solutions, other corridor recommendations can also be identified. These recommendations could include modifications to the existing Statewide Construction Program, areas for further study, or other corridor specific recommendations that are not related to construction or policy. The list below identifies other corridor recommendations for the SR 90/SR 80 corridor:

- Removal of the Lowell RR UP Bridges (#269 and #1033 at MP 343.01) would relieve the low vertical clearance issue in the area; however, the Mule Pass Tunnel would still be a vertical clearance hot spot at MP 339.20
- Conduct seat belt-related enforcement and education, particularly in the Sierra Vista area
- Signal coordination proposed in Solution CS90.2 should include signal coordination with nearby SR 92 as well

Policy and Initiative Recommendations

In addition to location-specific needs, general corridor and system-wide needs have also been identified through the CPS process. While these needs are more overarching and cannot be individually evaluated through the CPS process, it is important to document them. A list of recommended policies and initiatives was developed for consideration when programming future projects not only on the SR 90/SR 80 corridor, but across the entire state highway system where conditions are applicable. The following list, which is in no particular order of priority, was derived from the four CPS rounds:

- Install Intelligent Transportation System (ITS) conduit with all new infrastructure projects
- Prepare strategic plans for Closed Circuit Television (CCTV) camera and Road Weather Information System (RWIS) locations statewide
- Leverage power and communication at existing weigh-in-motion (WIM), dynamic messaging signs (DMS), and call box locations to expand ITS applications across the state
- Consider solar power for lighting and ITS where applicable
- Investigate ice formation prediction technology where applicable
- Conduct highway safety manual evaluation for all future programmed projects
- Develop infrastructure maintenance and preservation plans (including schedule and funding) for all pavement and bridge infrastructure replacement or expansion projects
- Develop standardized bridge maintenance procedures so districts can do routine maintenance work
- Review historical ratings and level of previous investment during scoping of pavement and bridge projects; in pavement locations that warrant further investigation, conduct subsurface investigations during project scoping to determine if full replacement is warranted
- For pavement rehabilitation projects, enhance the amount/level of geotechnical investigations to address issues specific to the varying conditions along the project
- Expand programmed and future pavement projects as necessary to include shoulders
- Expand median cable barrier guidelines to account for safety performance
- Install CCTV cameras with all DMS
- In locations with limited communications, use CCTV cameras to provide still images rather than streaming video
- Develop statewide program for pavement replacement
- Install additional continuous permanent count stations along strategic corridors to enhance traffic count data
- When reconstruction or rehabilitation activities will affect existing bridge vertical clearance, the dimension of the new bridge vertical clearance should be a minimum of 16.25 feet where feasible
- All new or reconstructed roadway/shoulder edges adjacent to an unpaved surface should be constructed with a Safety Edge
- Collision data on tribal lands may be incomplete or inconsistent; additional coordination for data on tribal lands is recommended to ensure adequate reflection of safety issues
- Expand data collection devices statewide to measure freight delay
- Evaluate and accommodate potential changes in freight and goods movement trends that may result from improvements and expansions to the state roadway network
- At traffic interchanges with existing communication connectivity to the ADOT Traffic Operations Center, consideration should be given to adding thermal detection cameras for vehicle detection with the capability for wrong way vehicle detection
- Improved vehicle detection systems, as recommended by ADOT Systems Technology group, should be deployed at traffic interchanges for improved traffic control

Next Steps

The candidate solutions recommended in this study are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT's traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the SR 90/SR 80 corridor will be considered along with other candidate projects in the ADOT statewide programming process.

It is important to note that the candidate solutions are intended to represent strategic solutions to address existing performance needs related to the Pavement, Bridge, Mobility, Safety, and Freight performance areas. Therefore, the strategic solutions are not intended to preclude recommendations related to the ultimate vision for the corridor that may have been defined in the context of prior planning studies and/or design concept reports. Recommendation from such studies are still relevant to addressing the ultimate corridor objectives.

These results will be incorporated into a summary document comparing all corridors that is expected to provide a performance-based review of statewide needs and candidate solutions.

CPS Program Refinements

This CPS assessment is an update to the originally produced CPS assessments conducted between 2017 and 2019. Due to changes in state and federal reporting standards as well as data availability, the original methodology has been adapted to produce comparable and relatable performance, need, and evaluation results. The methodology changes include:

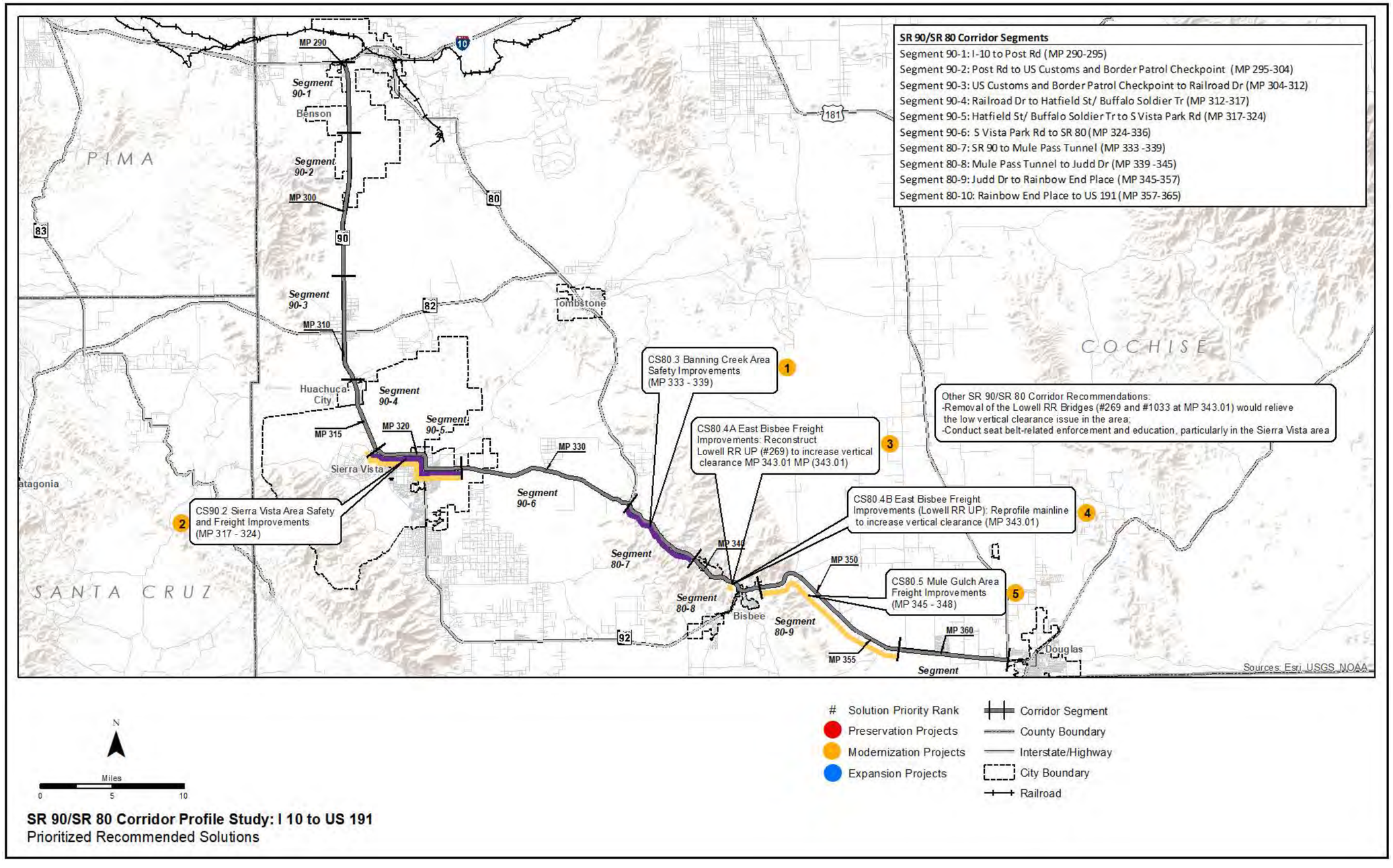
- Pavement performance now includes the addition of rutting as a component of the Pavement Distress measure
- Bridge performance no longer includes the % Functionally Obsolete secondary measure
- Safety performance includes updated secondary measure categories, and is evaluated against updated statewide averages.
- Mobility and Freight performance are evaluated using updated reliability measures based on Level of Travel Time Reliability and Truck Travel Time Reliability, which are new federal standard measure adapted from the previous Travel Time Index and Planning Time Index measures

Table ES-4: Prioritized Recommended Solutions

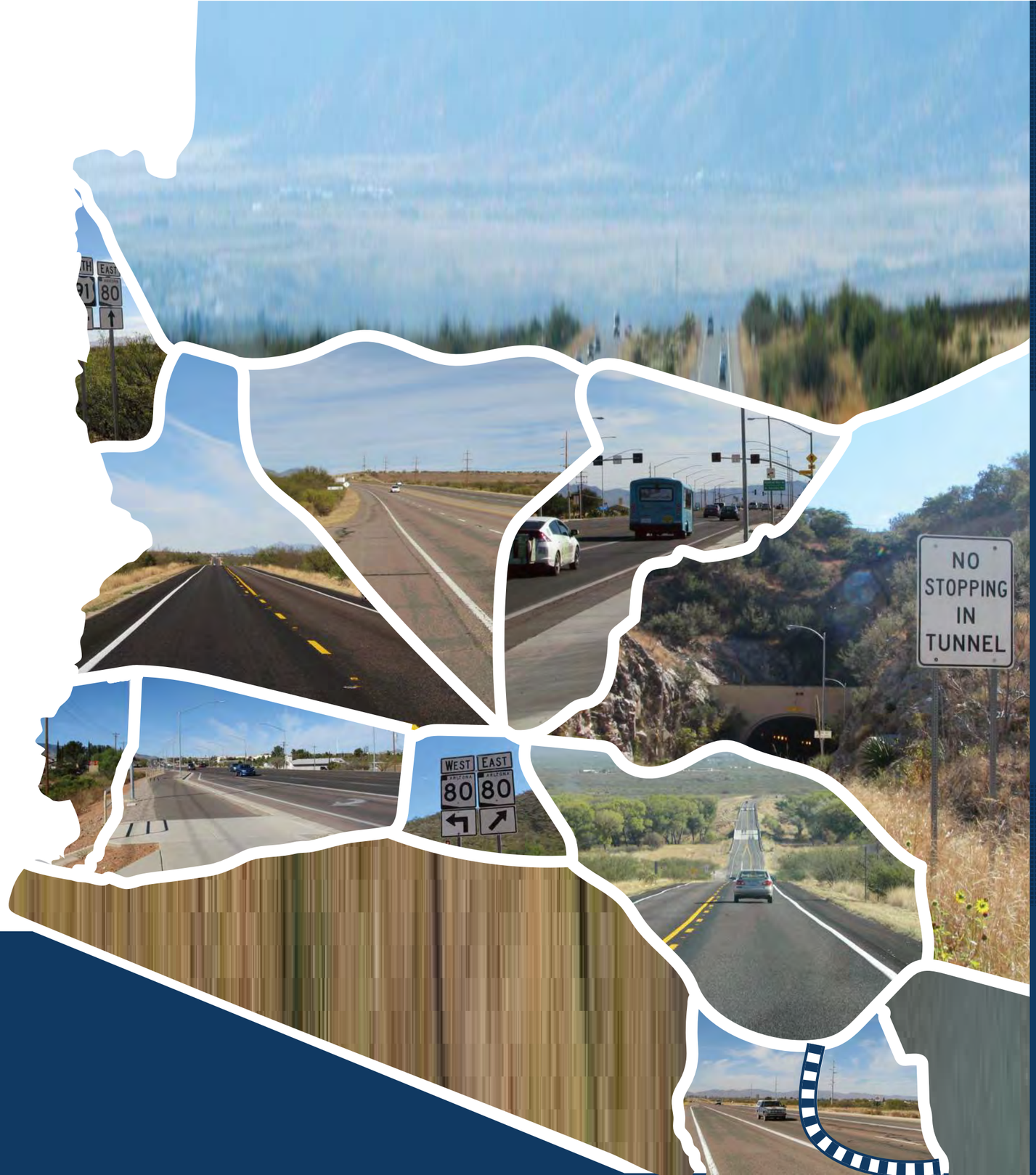
Rank	Candidate Solution #	Option	Candidate Solution Name	Candidate Solution Scope	Estimated Cost (in millions)	Investment Category (Preservation [P], Modernization [M], Expansion [E])	Prioritization Score
1	CS80.3	-	Banning Creek Area Safety Improvements	-Construct edge line rumble strips or shoulder rumble strips between MP 333-339 EB -Construct centerline rumble strips between MP 333-339 -Widen Shoulders MP 333-339 WB	$3.5	M	254.0
2	CS90.2	-	Sierra Vista Safety and Freight Improvements	-Install speed feedback and signal ahead signs, MP 318 EB and MP 320 WB -Construct raised median, MP 317-323.7	$10.6	M	125.3
3	CS80.4	A	East Bisbee Freight Improvements	Reconstruct Lowell RR UP (#269) to increase vertical clearance	$8.0	E	19.0
4	CS80.4	B	East Bisbee Freight Improvements	Reprofile mainline to increase vertical clearance	$0.2	M	13.3
5	CS80.5	-	Mule Gulch Area Freight Improvements	-Construct passing lane WB, MP 346.9-347.6 -Construct passing lane EB, MP 345.6-346.1 -Construct acceleration and deceleration lanes at entrance to Paul Spur Douglas quarry	$8.9	M	0.1

Note: Candidate solutions shown in *italics* represent the lowest prioritization score among the options evaluated.

Figure ES-8: Prioritized Recommended Solutions



SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Prioritized Recommended Solutions



Final Report

1.0 INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study (CPS) of State Route 90 (SR 90) from Interstate 10 (I-10) to SR 80 and of SR 80 from SR 90 to US 191. The study examines key performance measures relative to the SR 90/SR 80 corridor, and the results of this performance evaluation are used to identify potential strategic improvements. The intent of the corridor profile program, and of ADOT's Planning-to-Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network.

ADOT has completed 21 original CPS within four separate groupings or rounds. In 2020, ADOT separated the previously studied corridors into six groupings to be updated and reassessed: Northeast, Northcentral, Northwest, Southeast, Southcentral, and Southwest. The 8 corridor studies within the three southern groupings began in Spring 2022 and include:

Southeast

- US 60: Meridian Road to US 70; US 70: US 60 to 191 (1ST Avenue); US 191: US 70 to I-10 and SR 80 to I-10
- SR 90: SR 80 to I-10; SR 80: US 191 to SR 90

Southcentral

- SR 347: SR 84 to Peters and Nall Road; SR 84: I-8 to SR 347
- I-10E: MP 187 to NM border
- I-19: Mexico border to I-10

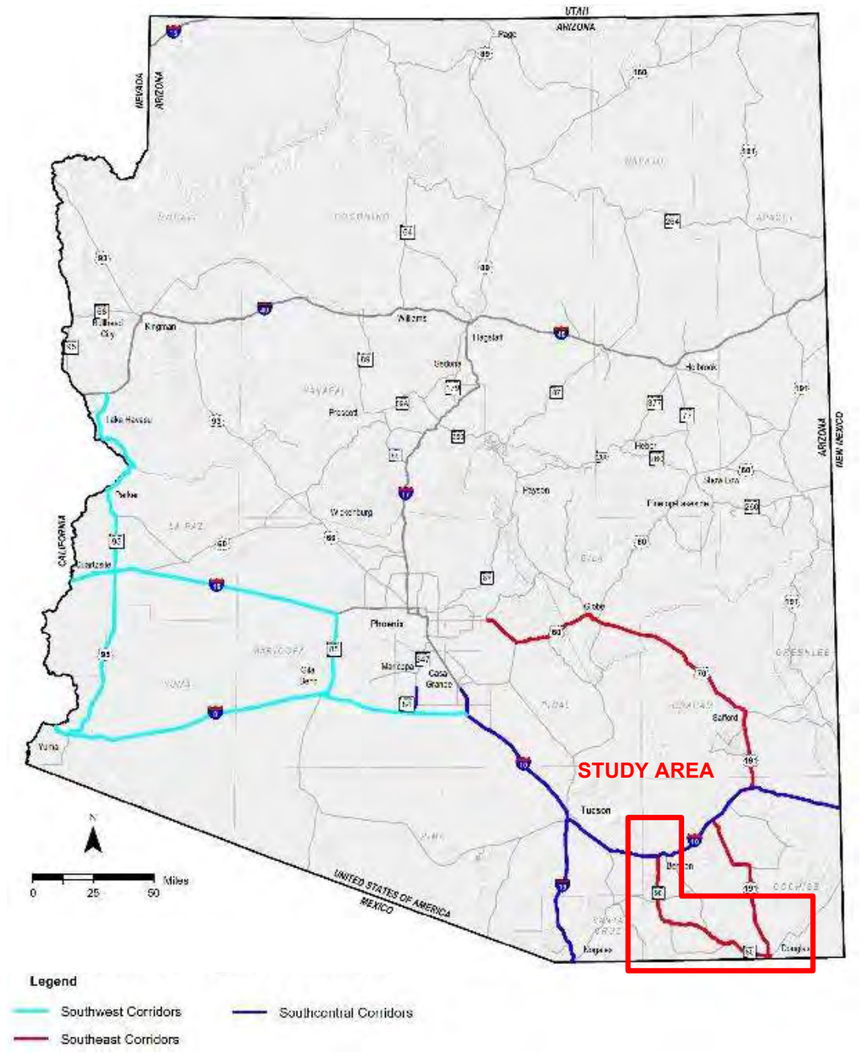
Southwest

- I-8: California border to I-10
- I-10W: California border to SR 85; SR 85: I-10 to I-8
- SR 95: I-10 to I-40; US 95: I-8 to I-10

The studies under this program assess the overall health, or performance, of the state's strategic highways. The CPS will identify candidate solutions for consideration in the Multimodal Planning Division's (MPD) P2P project prioritization process, providing information to guide corridor-specific project selection and programming decisions.

The SR 90/SR 80 corridor, depicted in **Figure 1,** along with all CPS corridors, is one of the strategic statewide corridors identified and the subject of this CPS update.

Figure 1: Corridor Study Area



1.1 Corridor Study Purpose

The purpose of the CPS is to measure corridor performance to inform the development of strategic solutions that are cost-effective and account for potential risks. This purpose can be accomplished by following the process described below:

- Inventory past improvement recommendations
- Define corridor goals and objectives
- Assess existing performance based on quantifiable performance measures
- Propose various solutions to improve corridor performance
- Identify specific solutions that can provide quantifiable benefits relative to the performance measures
- Prioritize solutions for future implementation, accounting for performance effectiveness and risk analysis findings

1.2 Study Goals and Objectives

The objective of this study is to identify a recommended set of prioritized potential solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The SR 90/SR 80 CPS defines solutions and improvements for the corridor that are evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance. Corridor benefits can be categorized by the following three investment types:

- Preservation: Activities that protect transportation infrastructure by sustaining asset condition or extending asset service life
- Modernization: Highway improvements that upgrade efficiency, functionality, and safety without adding capacity
- Expansion: Improvements that add transportation capacity through the addition of new facilities and/or services

This study identifies potential actions to improve the performance of the SR 90/SR 80 corridor. Proposed actions are compared based on their likelihood of achieving desired performance levels, life-cycle costs, cost-effectiveness, and risk analysis to produce a prioritized list of solutions that help achieve corridor goals.

The following goals are identified as the desired outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Develop solutions that address identified corridor needs based on measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

1.3 Corridor Overview and Location

The SR 90/SR 80 corridor between I-10 and US 191 provides movement for freight, tourism, and recreation needs within southeastern Arizona. It provides a key link between I-10 and the United States/Mexico border crossing at Douglas/Agua Prieta and connects Benson, Sierra Vista, Bisbee, and Douglas. This corridor also serves the Kartchner Caverns State Park and other recreational and historic areas. The SR 90/SR 80 corridor between I-10 and US 191 is approximately 78 miles in length.

1.4 Corridor Segments

The SR 90/SR 80 corridor is divided into 10 planning segments to allow for an appropriate level of detailed needs analysis, performance evaluation, and comparison between different segments of the corridor. The corridor is segmented at logical breaks where the context changes due to differences in characteristics such as terrain, daily traffic volumes, or roadway typical sections. Corridor segments are described in **Table 1** and shown in **Figure 2**.

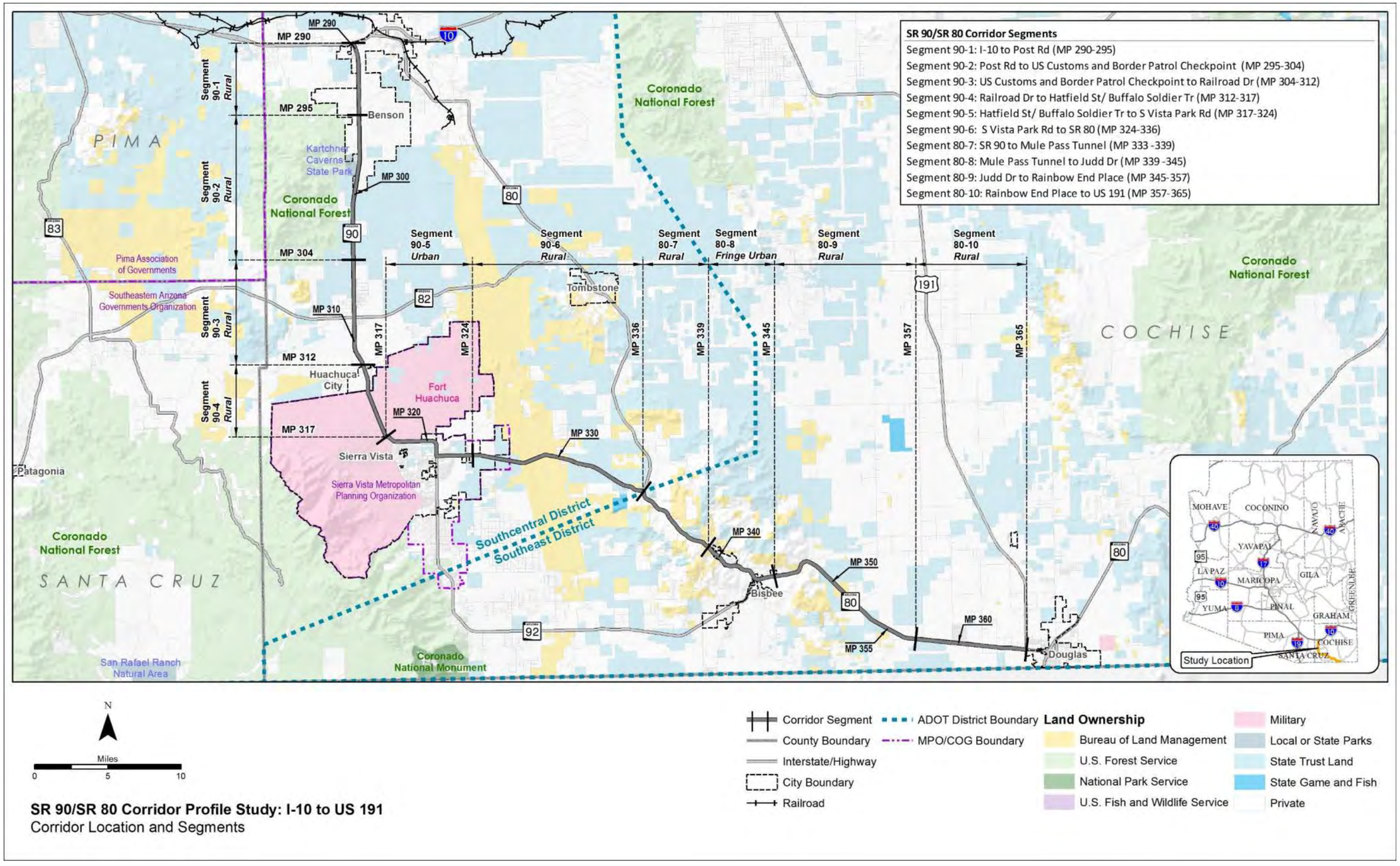
Table 1: SR 90/SR 80 Corridor Segments

Segment #	Route	Begin	End	Approx. Begin Milepost	Approx. End Milepost	Approx. Length (miles)	Typical Through Lanes (NB/WB, SB/EB)	2020/2040 Average Annual Daily Traffic Volume (vpd)	Character Description
90-1	SR 90	I-10	Post Rd	290	295	5	2,2	9,000/12,000	This rural segment has interrupted flow, consistent traffic volumes, a four-lane divided section, and is located within the incorporated area of Benson. There is a traffic signal located at the SR 90/Whetstone Commerce Dr/Village Loop intersection, near the I-10 interchange.
90-2	SR 90	Post Rd	US Customs and Border Patrol Checkpoint	295	304	9	2,2	9,000/12,000	This rural segment has interrupted flow, consistent traffic volumes, and a four-lane divided section. The entrance to Kartchner Caverns is located at MP 298.5. A United States Customs and Border Patrol checkpoint is located at approximately MP 304.5.
90-3	SR 90	US Customs and Border Patrol Checkpoint	Railroad Dr	304	312	8	2,2	10,000/13,000	This rural segment has interrupted flow and consists of a four-lane divided section. There is a traffic signal at the SR 90/SR 82 intersection at MP 308.4. There is a frontage road on the west side of the road between MP 308.1 - 308.3.
90-4	SR 90	Railroad Dr	Hatfield St/ Buffalo Soldier Trail	312	317	5	2,2	15,000/19,000	This rural segment has uninterrupted flow, a five-lane undivided section, and traverses the town of Huachuca City. Gonzales Blvd runs parallel to and east of SR 90 and serves as a frontage road for part of this section. The road transitions to a four-lane undivided section at approximately MP 314.1.
90-5	SR 90	Hatfield St/ Buffalo Soldier Trail	S Vista Park Rd	317	324	7	2,2	12,000/14,000	This urban segment with interrupted flow is in the City of Sierra Vista and has a four-lane undivided section between the Hatfield St/Buffalo Soldier Trail and Industry Drive. South of Industry Drive, the road becomes a four-lane divided section. East of the Fry Blvd/SR 92 intersection the road transitions to a five-lane section. There are seven traffic signals located in this segment, at the Hatfield Drive/Buffalo Soldier Trail, 7th St, Coronado Drive, Campus Drive, Martin Luther King Jr. Parkway/Charleston Rd, Fry Blvd, and Avenida De Sol/Giulio Cesare Ave intersections.
90-6	SR 90	S Vista Park Rd	SR 80	324	336	12	1,1	5,000/6,000	This rural segment has primarily uninterrupted flow, and is comprised of a two-lane undivided section. The road briefly widens to accommodate four-through lanes at the Moson Road signalized intersection.
80-7	SR 80	SR 90	Mule Pass Tunnel	333	339	6	1,1	5,000/2,000	This rural segment with uninterrupted flow is comprised of a two-lane undivided section. There is a passing lane section from approximately MP 337.6 to MP 338.5.

Table 1: SR 90/SR 80 Corridor Segments (continued)

Segment #	Route	Begin	End	Approx. Begin Milepost	Approx. End Milepost	Approx. Length (miles)	Typical Through Lanes (NB/EB, SB/WB)	2020/2040 Average Annual Daily Traffic Volume (vpd)	Character Description
80-8	SR 80	Mule Pass Tunnel	Judd Dr	339	345	6	1,2 2,2 1,1	5,000/2,000	This fringe urban segment with interrupted flow traverses the City of Bisbee and the community of Warren. There is a three-lane undivided section with two through lanes westbound from approximately MP 339.0 to MP 339.6 and MP 340.4 to 341.4. Traffic uses ramps to access the Old Bisbee area. East of Old Bisbee, this segment has a four-lane undivided section, which narrows to a two-lane undivided section near the Bisbee roundabout. There are several curves in this section, which traverses the Bisbee copper mine area.
80-9	SR 80	Judd Dr	Rainbow End Place	345	357	12	1,1	4,000/1,000	This rural segment with uninterrupted flow is a two-lane undivided section.
80-10	SR 80	Rainbow End Place	US 191	357	365	8	2,2	4,000/2,000	This rural segment with interrupted flow has a four-lane divided section. There is a traffic signal at the US 191 intersection.

Figure 2: Corridor Location and Segments



SR 90/SR 80 Corridor Profile Study: I-10 to US 191
Corridor Location and Segments

1.5 Corridor Characteristics

The SR 90/SR 80 corridor is an important travel corridor in the southeastern part of the state. The corridor functions as a route for recreational, tourist, freight, and cross border and regional traffic and provides critical connections between the communities it serves and the rest of the regional network.

National Context

The SR 90/SR 80 corridor is a strategic transportation link across southeast Arizona for freight, intercity, international and tourism travel. The SR 90/SR 80 corridor links I-10 to the Douglas Port of Entry. This corridor also serves Fort Huachuca, a major U.S Army installation and military intelligence center.

Regional Connectivity

The SR 90/SR 80 corridor between I-10 and US 191 provides movement for freight, tourism, and recreation needs within southeastern Arizona. The corridor is located in two ADOT Districts (Southcentral, and Southeast); two planning areas (Sierra Vista Metropolitan Planning Organization (SVMPO) and SouthEastern Arizona Governments Association (SEAGO) and in Cochise County. Within the corridor study limits, SR 90/SR 80 offers connections to several major roadways, including I-10, US 191, SR 82, and SR 92. This corridor serves Arizona cities and towns including Benson, Bisbee, Douglas, Sierra Vista, and Huachuca City. Douglas has a border crossing with Mexico, providing access to Agua Prieta, Sonora, a town of approximately 79,000 persons.

Commercial Truck Traffic

Communities along the SR 90/SR 80 corridor are dependent on the corridor to access the state economy through freight deliveries and travel to other locations. The corridor also services local mining operations. Freight traffic (trucks) comprise from 7% to 20% of the total traffic flow on the corridor, with the higher truck percentages on SR 90 near I-10 and SR 80, between Paul Spur Road and US 191.

Commuter Traffic

A majority of the commuter traffic along the SR 90/SR 80 corridor occurs within the urbanized areas of Benson, Bisbee, Sierra Vista, and Douglas. These areas are economic centers along what is considered mostly a rural combination of state routes. According to the most recent traffic volume data maintained by ADOT, traffic volumes range from approximately 5,000 vehicles per day on sections of SR 80 to approximately 15,000 vehicles per day on SR 90 in Sierra Vista.

According to the 2020 American Community Survey data from the US Census Bureau, 79% of the workforce in Cochise County relies on a private vehicle to get to work.

Recreation and Tourism

SR 90/SR 80 provides access to Arizona attractions such as state parks, museums, historic sites, and other recreational activities.

SR 90 provides access to the Kartchner Caverns State Park. In the Sierra Vista area, nearby recreation opportunities include the Ramsey Canyon Preserve, the San Pedro National Conservation area, the Coronado National Monument in the Huachuca Mountains. SR 80 provides access to Bisbee, where visitors can take underground tours of the Queen Copper Mine, or visit historic Warren Ballpark, the oldest ballpark in the US still in use, and explore the Old Bisbee area, with its many historic buildings. SR 80 provides access to Douglas, which is home to the historic Gadsden Hotel as well as many historic buildings.

Multimodal Uses

Freight Rail

The San Pedro and Southwestern Railroad (SPSR) runs from a connection with the Union Pacific Railroad at Benson to Curtiss, Arizona. A track is available for transloading at Benson. SPSR's sole customer, at Curtiss, produces ammonium nitrate and generates approximately 1,350 annual carloads (inbound anhydrous ammonia, outbound fertilizer). SPSR serves this customer three days a week.[1]

Passenger Rail

The Union Pacific Railroad Sunset Limited route provides intercity passenger service three times a week to the community of Benson, as well as Tucson, Maricopa, and Yuma.

Bicycles/Pedestrians

There are opportunities for bicycle and pedestrian travel on the SR 90/SR 80 corridor. Segments of the SR 90/SR 80 corridor are on U.S. Bicycle Route 90, part of a network of interstate long-distance cycling routes. These segments include SR 90, between SR 82 (MP 308) and the SR 90 Bypass/Hatfield Rd (MP 317), SR 90, between SR 92 (MP 321.5) and S. Ave Del Sol (MP 322.5), and SR 80 between SR 90 (MP 333) and US 191 (MP 366).

Bicycle traffic is permitted on the mainline outside shoulder and on SR 90 between I-10 and Sierra Vista where effective shoulder widths are typically greater than the preferred 4-foot minimum width. Within Sierra Vista there are shared use paths on SR 90 between the SR 90 Bypass/Hatfield Road (MP 317) and 7th Street (MP 318.6) and between SR 92 (MP 321.5) and just east of Colonia De Salud (MP 323). East of Sierra Vista, SR 90 and SR 80 shoulder widths vary, with some areas having rumble strips that can reduce the rideable area for bicyclists. SR 80 approaching the Douglas area from MP 358 to MP 366, has wider outside shoulders that are approximately 10 feet wide.

[1] Source: Arizona State Rail Plan (2011), page 102

Bus/Transit
Vista Transit, the transit service for the Sierra Vista area, offers five bus routes which run Monday through Friday, and two routes which run on Saturday only. Two of the weekday bus routes have stops on SR 90. The City of Douglas operates the Douglas Rides service, which is a deviated fixed route service within the City of Douglas and surrounding communities. The City of Douglas also operates the Bisbee Bus transit system, which services the communities of Old Bisbee, San Jose, Naco, Saginaw, and Warren on northbound route and southbound routes. Greyhound operates intercity bus transit along I-10 in Arizona, with a stop in Benson.

Aviation
There are several general aviation facilities in proximity to the SR 90/SR 80 corridor. These include the Sierra Vista Municipal Airport, which is jointly operated by the U.S Army as Libby Army Airfield, and the Bisbee-Douglas International Airport, owned by Cochise County. Other public use airports in the area include the Douglas Municipal Airport, Bisbee Municipal Airport, and the Cochise College Airport, which is also used by Cochise College's aviation program.

Land Ownership, Land Uses and Jurisdictions
As shown previously in **Figure 2**, the SR 90/SR 80 corridor traverses Cochise County and multiple jurisdictions and land. Land ownership in Benson, Sierra Vista, Bisbee, and Douglas urban areas is mainly private, with much of the corridor (SR 90 and SR 80) traversing a mix of private land and State Trust Land. East of Sierra Vista, the San Pedro Riparian area, owned by the Bureau of Land Management (BLM), crosses SR 90.

Population Centers
Population centers of various sizes exist along the SR 90/SR 80 corridor. **Table 2** provides a summary of the populations for communities along the corridor. Projected population growth varies between 2010 and 2040 in the major population centers along the corridor according to the Arizona State Demographer's Office. Benson is projected to grow 12 percent during this time period, while Bisbee, Douglas, and Huachuca City are projected to have a loss in population.

Table 2: Current and Future Population

Community	2010 Population	2020 Population	2040 Population	% Change 2010-2040	Total Growth
Cochise County	131,346	131,277	130,456	-1%	-890
Benson	5,105	5,137	5,698	12%	593
Bisbee	5,575	5,336	4,657	-16%	-918
Douglas	17,378	16,416	15,448	-11%	-1,930
Huachuca City	1,853	1,771	1,486	-20%	-367
Sierra Vista	43,888	45,592	44,662	2%	774

Source: U.S. Census, Arizona Department of Administration – Employment and Population Statistics

Major Traffic Generators
The city of Sierra Vista, along with the cities of Bisbee, Benson, and Douglas, and Kartchner Caverns State Park, are major traffic generators for the SR 90/SR 80 corridor.

Tribes
There are no tribal reservation areas near this corridor.

Wildlife Linkages
The Arizona State Wildlife Action Plan (SWAP) provides a 10-year vision for the entire state, identifying wildlife and habitats in need of conservation, insight regarding the stressors to those resources, and actions that can be taken to alleviate those stressors. Using the Habimap Tool that creates an interactive database of information included in the SWAP, the following were identified in relation to the SR 90/SR 80 corridor:

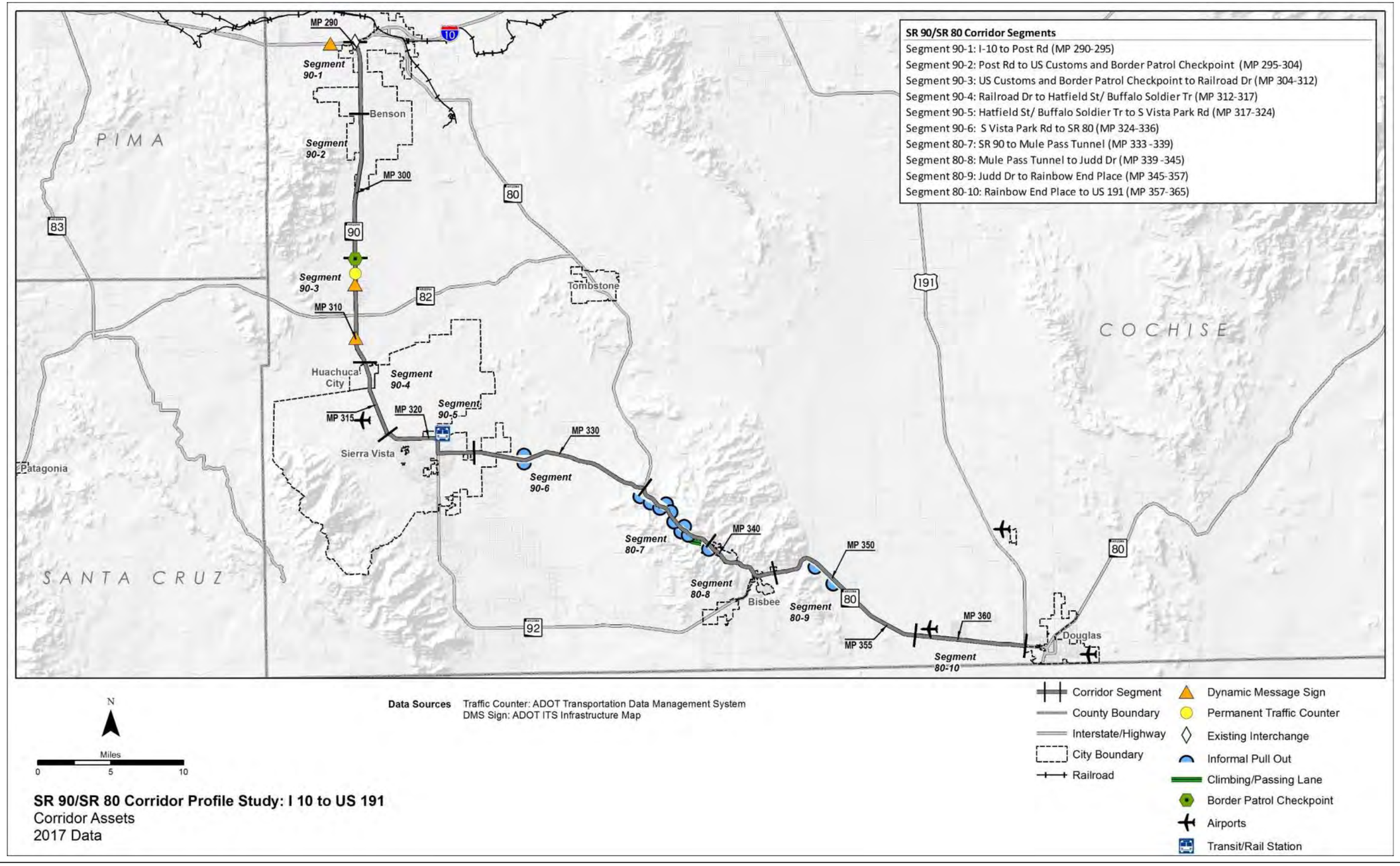
- Arizona Game and Fish Department (AGFD) Wildlife Waters were not identified near the corridor.
- Arizona Important Bird Areas: The San Pedro Riparian National Conservation Area, which crosses SR 90 east of Moson Road, approximately between MP 327 and 330, is an Important Bird Area
- The corridor travels through allotments controlled by the Arizona State Land Department (ASLD).
- Riparian areas include crossings along SR 90 approximately from MP 311 to MP 312 and MP 328 to MP 329. On SR 80 there are riparian areas on the south side of SR 80 near MP 335.
- Arizona Wildlife Linkages: No missing linkages are noted, but there are potential Arizona Wildlife Linkage Zones along SR 90 from MP 295 to MP 302 (linking the Coronado National Forest to the San Pedro Riparian Area) and between MP 314 to MP 321.
- According to the Species and Habitat Conservation Guide (SHCG), sensitive habitats that have moderate to high conservation potential exist along much of the corridor; with the exception of the City of Sierra Vista, the Bisbee area on SR 80 between MP 341 and 343, and other scattered areas.
- Areas where Species of Greatest Conservation Need (SGCN) are high or moderately vulnerable are located along SR 90, from approximately MP 291 to MP 314, and from MP 327 to 336, as well as along much of the SR 80 corridor from MP 333 to MP 366, with the exception of the Bisbee area between MP 341 and 343.
- Identified areas of moderate or high levels of Species of Economic and Recreational Importance (SERI) are similar to the SHCG habitat areas noted above.

Corridor Assets

Corridor transportation assets are summarized in **Figure 3**. There is one passing lane section on SR 80 between MP 337 and MP 338. The corridor includes one grade-separated traffic interchange (TI) at I-10 and SR 90, at the northern terminus of the corridor area at MP 289. A United States Customs and Enforcement Border Patrol Check Point is located on SR 90 NB MP 304.5.

Other assets include dynamic message signs (DMS) located SR 90 NB, MP 309.9, and SB at MP 306.4; informal pull-off areas along the southern portion of the corridor; 12 ADOT traffic signals along SR 90; one ADOT traffic signal along SR 80; and one permanent traffic counter on SR 90 at MP 305.6. Vista Transit runs routes in Sierra Vista.

Figure 3: Corridor Assets



1.6 Corridor Stakeholders and Input Process

A Technical Advisory Committee (TAC) was created that was comprised of representatives from key stakeholders. TAC meetings were held at key milestones to present results and obtain feedback. In addition, several meetings were conducted with key stakeholders to present the results and obtain feedback.

Key stakeholders identified for this study included:

- ADOT Southcentral District
- ADOT Southeast District
- ADOT Technical Groups
- SEAGO
- SVMPO
- AGFD
- ASLD
- Federal Highway Administration (FHWA)

Several Working Papers were developed during the course of the CPS. The chapters were provided to the TAC for review and comment.

1.7 Prior Studies and Recommendations

This study identified recommendations from previous studies, plans, and preliminary design documents. Studies, plans, and programs pertinent to the SR 90/SR 80 corridor were reviewed to understand the full context of future planning and design efforts within and around the study area. These studies are organized below into four categories: Framework and Statewide Studies, Regional Planning Studies, Planning Assistance for Rural Areas (PARAs) and Small Area Transportation Studies (SATS), and Design Concept Reports (DCRs) and Project Assessments (PAs).

Framework and Statewide Studies

- ADOT Bicycle and Pedestrian Plan Update (2013) ADOT Pedestrian Safety Action Plan (2017)
- ADOT Five-Year Transportation Facilities Construction Program (2021-2025)
- ADOT Climbing and Passing Lane Prioritization Study (2015)
- ADOT Arizona Key Commerce Corridors (2014)
- ADOT Arizona Multimodal Freight Analysis Study (2009)
- ADOT Arizona Ports of Entry Study (2021)
- ADOT Arizona State Airport Systems Plan (2008)
- ADOT Arizona State Freight Plan (2017)
- ADOT Arizona State Rail Plan (2011)
- AGFD Arizona State Wildlife Action Plan (2012)
- AGFD Arizona Wildlife Linkages Assessment (2006)
- ADOT Arizona Statewide Dynamic Message Sign Master Plan (2011)
- ADOT Arizona Statewide Intelligent Transportation System (ITS) Architecture (2018)
- ADOT Arizona Statewide Rail Framework Study (2010)
- ADOT Arizona Statewide Rest Area Study (2011)
- ADOT Arizona Statewide Shoulders Study (2015)
- ADOT Arizona Strategic Traffic Safety Plan (2019)
- ADOT Arizona Roadway Departure Safety Implementation Plan (RDSIP) (2014)
- ADOT AASHTO U.S. Bicycle Route System (2015)
- ADOT Low Volume State Routes Study (2017)
- ADOT Statewide Stormwater & Erosion Control Study (2020)
- ADOT Statewide Transportation Planning Framework – Building a Quality Arizona (BQAZ) (2009)
- ADOT Transportation Asset Management Plan (2019)
- ADOT What Moves You Arizona? Long-Range Transportation Plan (2016-2040)

Regional Planning Studies

- Arizona-Sonora Border Master Plan (February 2013)
- Sierra Vista MPO Regional Transportation Plan, 2015-2040 (2015)
- Sierra Vista MPO Transportation Improvement Program, Fiscal Year 2017-2021
- Sierra Vista MPO Origin and Destination Study (2017)
- Southeastern Arizona Regional Transportation Coordination Plan Update 2016-2017
- SEAGO Region 2017-2021 Transportation Improvement Program
- 2012 Regional Mobility Management Plan for the SEAGO Region – Graham, Greenlee, Cochise, and Santa Cruz Counties (2012)
- SR-80 and SR-191 Oversize Load Study Final Report and Executive Summary (2013)

Planning Assistance for Rural Areas and Small Area Transportation Studies

- City of Benson Small Area Transportation Study (2007)
- City of Bisbee Comprehensive Transportation Plan (2013)
- City of Douglas Small Area Transportation Study (2007)
- City of Sierra Vista Safe Bicycle and Pedestrian Routes Plan (2011)
- Northwest Cochise County Long-Range Transportation Plan Final Report (2010)
- Sierra Vista Small Area Transportation Study (2003)
- Sierra Vista Transportation Efficiency Study (2013)
- 2040 Long-Range Transportation Plan Final Report (2015)

Design Concept Reports and Project Assessments

- SR 80: MP 356.37 to 356.73 Construct Left and Right Turn Lanes Final Project Assessment (2002)
- SR 90 Bypass-Sierra Vista Shared Use Path: Fort Huachuca East Gate Spur to Seventh Street Final Project Assessment (2003)
- SR 90 Sierra Vista: SR 92 to Central Avenue, Final Project Assessment (2009)
- SR 90 Sierra Vista: SR 92 to Central Avenue, Addendum Number 1 to Final Project Assessment (2010)
- SR 90 Widening Project, Central Avenue to Moson Road, Final Project Assessment (2008)
- Davis Road – SR 80 to Central Highway: Final Project Assessment (2016)

Summary of Prior Recommendations

Various studies and plans have recommended improvements to the SR 90/SR 80 corridor as shown in **Table 3** and **Figure 4**. They include, but are not limited to:

- Widening of numerous sections of SR 90/SR 80, some of which will require right-of-way acquisition; many other proposed improvements are associated with the recommended widening:
  - Adding one general purpose lane in each direction on SR 90 from MP 290 to MP 336
  - Adding one general purpose lane in each direction on SR 80 from MP 345 to MP 357
- Perform and implement findings of an access management plan on SR 90 from MP 290 to MP 299
- Install edge line or shoulder rumble strips on numerous segments of SR 90 between MP 290 and MP 329
- Climbing and passing lanes have been recommended in two areas on the SR 90 corridor and two areas on the SR 80 corridor
- Two areas on SR 80 were recommended for further study as potential truck escape ramp locations
- Several intersections on SR 90 and SR 80 have recommendations for studies to be performed or recommendations from studies that should be implemented
- One dynamic message sign is recommended on SR 90 at MP 296.7 southbound
- Two bridge rehabilitation projects are recommended on SR 80 at MP 352.4 and MP 364
- Construct shoulder improvements on several segments on both SR 90 and SR 80
- Install centerline rumble strips on SR 90 between MP 310 and 320
- The extension of Chino Road to SR 80 will make the SR 80/Chino Road signalized intersection a four-legged intersection
- Construct bicycle lanes on SR 90, between MP 317 and 322
- Widen sidewalk on SR 80 between MP 340 and MP 343
- Transit improvements:
  - Construct a bus pullout on both sides of SR 90, approximately MP 322
  - Implement intercity bus service that connects the Douglas and Bisbee bus systems to the Sierra Vista (Vista Transit) bus system
  - Implement intercity Bus Service that connects the Sierra Vista (Vista Transit) bus system to the Greyhound Bus System in Benson, Arizona
  - Implement intercity bus service between Benson, Sierra Vista, Bisbee, Douglas, and Tombstone
  - Construct a minor transit center in Benson and Douglas

Table 3: Corridor Recommendations from Previous Studies

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization [M], Expansion [E])			Status of Recommendation			Name of Study
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)?	
SR 90											
1	290	294	4	Widen SR 90 to 6 lanes between I-10 and Post Ranch Road			√	-	N/A	N	Northwest Cochise County Long Range Transportation Plan (2010)
2	290	336	46	Widen/upgrade SR 90 to 6 lanes/4 lanes, I-10 to SR 80			√	-	N/A	N	BQAZ 2010 Statewide Transportation Planning Framework Final Report (2010) Sierra Vista Small Area Transportation Study (2003) – widening SR 90 from Campus Dr to Fry Blvd within the CPS area
3	290	299	9	Conduct and implement findings of an access management plan for SR 90 from I-10 (MP 290) to Kartchner Caverns State Park entrance, MP 298.5		√		-	N/A	N	City of Benson Small Area Transportation Study (2007)
4	290	309	19	Install edge line rumble strips or shoulder rumble strips recommended in 20 segments between MP 290 and 309. Alignment delineation and lighting is recommended between MP 292.5-293, MP 295.5-296, MP 298.5-299, MP 305-305.5, MP 307-307.5		√		-	N/A	N	ADOT Arizona Roadway Departure Safety Implementation Plan (2014)
5	291	N/A	-	Construct a traffic signal at SR 90/Jenella Road (developer project), MP 290.7		√		-	N/A	N	City of Benson Small Area Transportation Study (2007)
6	294	N/A	-	Construct traffic signal at SR 90/Post Road/Post Ranch Rd (listed as a developer project)		√		-	N/A	N	City of Benson Small Area Transportation Study (2007)
7	297	N/A	-	Construct dynamic message sign at MP 296.7 SB		√		-	N/A	N	Arizona Dynamic Message Sign (DMS) Master Plan (2011)
8	310	323		Centerline rumble strips recommended between MP 310-320. Edge line rumble strips or shoulder rumble strips recommended in 7 segments between MP 310-323. Alignment delineation and lighting are recommended between MP 311-311.5, MP 317.5-318, MP 320.5-321		√		-	N/A	N	ADOT Arizona Roadway Departure Safety Implementation Plan (2014)
9	317	N/A	-	Construct additional turn lanes at SR 90/SR 90 Bypass/Hatfield Street intersection at MP 317.2		√		2017	H880301C	N	2017-2021 Five Year Facilities Construction Program Sierra Vista MPO Regional Transportation Plan 2015-2040 (2016) Sierra Vista MPO Transportation Improvement Program, FY 2017-2021

Table 3: Corridor Recommendations from Previous Studies (continued)

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization [M], Expansion [E])			Status of Recommendation			Name of Study
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)?	
10	317	322	4	Construct bicycle lanes on the SR 90 bypass from Buffalo Soldier Trail (MP 317.2) to the SR 90/SR 92 intersection (MP 321.5)		√		-	N/A	N	City of Sierra Vista Safe Bicycle and Pedestrian Routes Plan (2011)
11	320	321	1	Conduct and implement the findings of a Road Safety Assessment with emphasis on pedestrian safety issues		√		-	N/A	N	Pedestrian Safety Action Update (2017)
12	321	323	2	Evaluate street lighting on SR 90 from Campus Drive (MP 321) to South Avenue Del Sol (MP 322.5)		√		-	N/A	N	Pedestrian Safety Action Update (2017)
13	322	324	2	Widen SR 90 from a five-lane undivided cross section at the SR 90/SR 92 intersection (MP 321.5) to a six-lane divided cross section east of Central Avenue (MP 323.9) 2003 SATS included bypass route alternatives which would extend SR 90 east of SR 92, connecting to SR 90 at a point at or east of Moson Road.			√	-	N/A	N	SR 90 Sierra Vista: SR 92 to Central Avenue, Final Project Assessment (2009) and Addendum (2010) Sierra Vista SATS (2003) (median, bypass route)
14	321.6	N/A	-	Construct a bus pullout eastbound		√		-	N/A	N	Sierra Vista MPO Regional Transportation Plan 2015-2040 (2016)
15	321.6	N/A	-	Construct bus pullout westbound		√		-	N/A	N	Sierra Vista MPO Regional Transportation Plan 2015-2040 (2016)
16	323	336	13	Construct shoulder improvements (both directions) on four segments between MP 323-332 and MP 334-336.4		√		-	N/A	N	ADOT Statewide Shoulders Study (2015)
17	324	325	2	Widen two-lane roadway to a four-lane divided cross section from MP 323.7 to MP 325.3			√	-	N/A	N	SR 90 Widening Project, Central Avenue to Moson Road, Final Project Assessment (2008)
18	329	327	2	Construct climbing lane on SR 90 WB from MP 329 to 327			√	-	N/A	N	ADOT Climbing and Passing Lane Prioritization Study (2015)
19	329	335	6	Construct edge line rumble strips or shoulder rumble strips between MP 329-329.5, MP 330-330.5, MP 334.5-335. Construct alignment delineation and lighting between MP 330-330.5		√		-	N/A	N	ADOT Arizona Roadway Departure Safety Implementation Plan (2014)

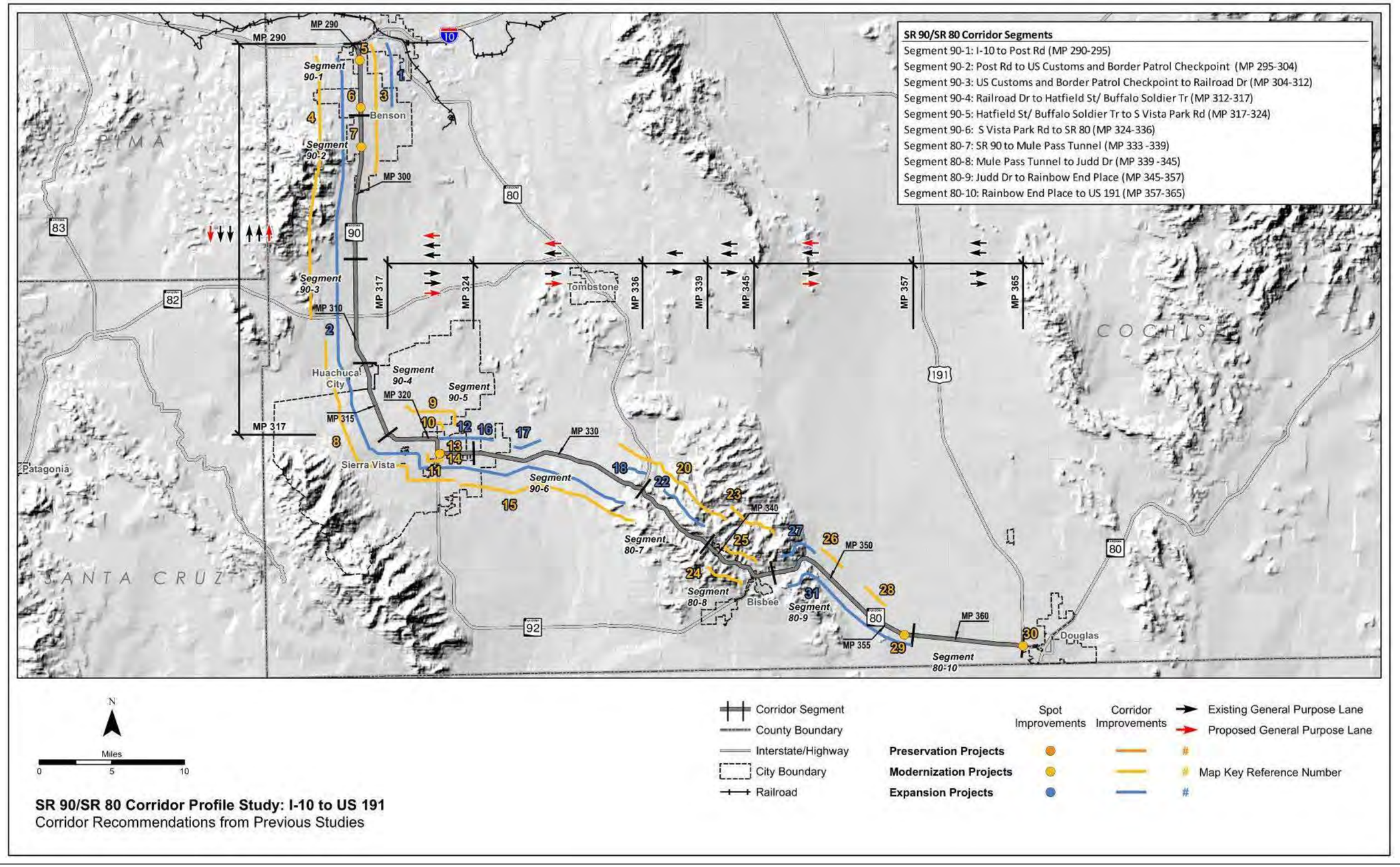
Table 3: Corridor Recommendations from Previous Studies (continued)

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization [M], Expansion [E])						Name of Study
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)?	
20	335	337	2	Construct climbing lane on SR 90 EB from MP 335 to 337 (note: CPS limits go to MP 336)			√	-	N/A	N	ADOT Climbing and Passing Lane Prioritization Study (2015)
21	N/A	N/A	-	Provide a minor transit center in Benson (note – not shown on Figure 4)		√		-	N/A	N	BQAZ 2010 Statewide Transportation Planning Framework Final Report (2010)
SR 80											
22	332	339	7	Westbound area noted as an area to study in greater detail as a potential location for a truck escape ramp.		√		-	N/A	N	ADOT Truck Escape Ramp Study (2003)
23	334	339	2	Construct shoulder improvements (both directions), MP 334-336 and MP 336-339		√		-	N/A	N	ADOT Statewide Shoulders Study (2015)
24	334	338	4	Construct climbing lane on SR 80 EB from MP 334 to MP 338			√	-	N/A	N	ADOT Climbing and Passing Lane Prioritization Study (2015)
25	339	344	5	Eastbound area noted as an area to study in greater detail as a potential location for a truck escape ramp.		√		-	N/A	N	ADOT Truck Escape Ramp Study (2003)
26	340	343	3	Widen sidewalk on south side of SR 80 from Old Bisbee to SR 92		√		-	N/A	N	City of Bisbee Comprehensive Transportation Plan (2012)
27	340	343	3	Construct signage and wayfinding information, including warning flashers, on SR 80 from approximately Mule Pass Tunnel to SR 92		√		-	N/A	N	City of Bisbee Comprehensive Transportation Plan (2012)
28	348	350		Construct shoulder improvements (both directions), MP 348-350				-	N/A	N	ADOT Statewide Shoulders Study (2015)
29	349	346	3	Construct passing lane on SR 80 WB between MP 346-349			√	-	N/A	N	ADOT Climbing and Passing Lane Prioritization Study (2015)
30	352	N/A	-	Rehabilitate Glance Creek Bridge (ADOT Structure No. 237), MP 352.38	√			2019	H891401C	N	SR 80 and SR 191 Oversize Load Study (2013) 2017-2021 Five -Year Transportation Facilities Construction Program Tentative 2018-2022 Five-Year Transportation Facilities Construction Program
31	352	354		Construct shoulder improvements (both directions), MP 352-354		√		-	N/A	N	ADOT Statewide Shoulders Study (2015)

Table 3: Corridor Recommendations from Previous Studies (continued)

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization [M], Expansion [E])			Status of Recommendation			Name of Study
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)?	
32	356	-	-	Construct left and right turn lanes at the SR 80/Paul Spur Road intersection		√		-	N/A	N	SR 80, MP 356.37 to 356.73 Construct Left and Right Turn Lanes, Final Project Assessment (2002)
33	364	N/A	-	Construct White Water Draw Bridge scour retrofit and deck rehabilitation (ADOT Structure No.1626)	√			2018	H854901C	N	2017-2021 Five -Year Transportation Facilities Construction Program Tentative 2018-2022 Five-Year Transportation Facilities Construction Program
34	365	N/A	-	Realign Chino Rd at SR 80 and update to ADOT standards. Part of Chino Road Extension, Phase 2, 9th St to SR 90 by City of Douglas, MP 364.7		√		-	DGS17-01	N	Arizona-Sonora Border Master Plan (2013) Douglas Strategic Motor Carrier Safety Inspection Station Circulation Study (2003) SEAGO 2017-2021 TIP 2040 Cochise County Long-Range Transportation Plan
35	345	357	12	Widen SR 80 to 4 lanes between MP 345 to MP 357			√	-	N/A	N	BQAZ 2010 Statewide Transportation Planning Framework
36	N/A	N/A	-	Provide intercity bus service that connects the Douglas and Bisbee bus systems to the Sierra Vista (Vista Transit) bus system (note – not shown on Figure 4)		√		-	N/A	N	SEAGO 2016-2017 Transportation Coordination Plan Update Sierra Vista MPO Origin-Destination Study (2017)
37	N/A	N/A	-	Intercity Bus Service that connects the Sierra Vista (Vista Transit) bus system to the Greyhound Bus System in Benson, Arizona (note – not shown on Figure 4)		√		-	N/A	N	SEAGO 2016-2017 Transportation Coordination Plan Update
38	N/A	N/A	-	Provide intercity bus service between Benson, Sierra Vista, Bisbee, Douglas, and Tombstone (note – not shown on Figure 4)		√		-	N/A	N	BQAZ 2010 Statewide Transportation Planning Framework
39	N/A	N/A	-	Provide a minor transit center in Douglas (note – not shown on Figure 4)		√		-	N/A	N	BQAZ 2010 Statewide Transportation Planning Framework

Figure 4: Corridor Recommendations from Previous Studies



2.0 CORRIDOR PERFORMANCE

This chapter describes the evaluation of the existing performance of the SR 90/SR 80 corridor. A series of performance measures is used to assess the corridor. The results of the performance evaluation are used to define corridor needs relative to the long-term goals and objectives for the corridor.

2.1 Corridor Performance Framework

This study uses a performance-based process to define baseline corridor performance, diagnose corridor needs, develop corridor solutions, and prioritize strategic corridor investments. In support of this objective, a framework for the performance-based process was developed through a collaborative process involving ADOT and the CPS consultant teams.

Figure 5 illustrates the performance framework, which includes a two-tiered system of performance measures (primary and secondary) to evaluate baseline performance. The primary measures in each of five performance areas are used to define the overall health of the corridor, while the secondary measures identify locations that warrant further diagnostic investigation to delineate needs. Needs are defined as the difference between baseline corridor performance and established performance objectives.

Figure 5: Corridor Profile Performance Framework

The following five performance areas guide the performance-based corridor analyses:

- Pavement
- Bridge
- Mobility
- Safety
- Freight

These performance areas reflect national performance goals stated in *Moving Ahead for Progress in the 21st Century* (MAP-21):

- Safety: To achieve a significant reduction in traffic fatalities and serious injuries on all public roads
- Infrastructure Condition: To maintain the highway infrastructure asset system in a state of good repair
- Congestion Reduction: To achieve a significant reduction in congestion on the National Highway System
- System Reliability: To improve the efficiency of the surface transportation system
- Freight Movement and Economic Vitality: To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development
- Environmental Sustainability: To enhance the performance of the transportation system while protecting and enhancing the natural environment
- Reduced Project Delivery Delays: To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion

In 2015, the *Fixing America's Surface Transportation Act* (FAST Act) was passed. The FAST Act continued to emphasize the performance management approach identified in MAP-21 but included additional provisions for meeting established performance targets.

The MAP-21 and FAST Act performance areas were considered in the development of ADOT's P2P process, which integrates transportation planning with capital improvement programming and project delivery. Because the P2P program requires the preparation of annual transportation system performance reports using the five performance areas adopted for the CPS, consistency is achieved in the performance measures used for various ADOT analysis processes.

While these performance areas were established prior to the earlier rounds of the CPS program, several related federal and ADOT reporting measures and targets were not yet in place at that time. These measures and targets have since been established (subsequent to completion of the prior CPS rounds). As such, it became necessary to revisit and revise the CPS performance measures to be more consistent with the latest federal and ADOT reporting measures and targets.

The performance measures include five primary measures: Pavement Index, Bridge Index, Mobility Index, Safety Index, and Freight Index. Additionally, a set of secondary performance measures provides for a more detailed analysis of corridor performance.

Each of the primary and secondary performance measures is comprised of one or more quantifiable indicators. A three-level scale was developed to standardize the performance scale across the five performance areas, with numerical thresholds specific to each performance measure:

Good/Above Average Performance – Rating is above the identified desirable/average range

Fair/Average Performance – Rating is within the identified desirable/average range

Poor/Below Average Performance – Rating is below the identified desirable/average range

Table 4 provides the complete list of primary and secondary performance measures for each of the five performance areas.

Table 4: Corridor Performance Measures

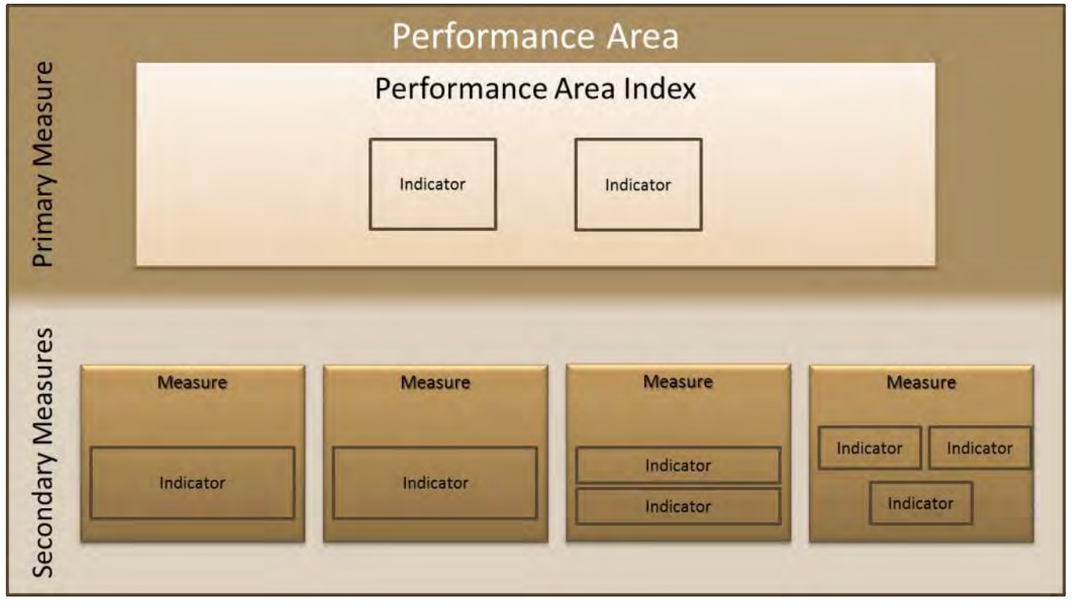
Performance Area	Primary Measure	Secondary Measures
Pavement	**Pavement Index** Based on a combination of International Roughness Index, cracking, and rutting	• Directional Pavement Serviceability • Pavement Failure • Pavement Hot Spots
Bridge	**Bridge Index** Based on lowest of deck, substructure, superstructure and structural evaluation rating	• Bridge Sufficiency • Bridge Rating • Bridge Hot Spots
Mobility	**Mobility Index** Based on combination of existing and future daily volume-to-capacity ratios	• Future Congestion • Peak Congestion • Travel Time Reliability • Multimodal Opportunities
Safety	**Safety Index** Based on frequency of fatal and suspected serious injury crashes	• Directional Safety Index • Strategic Traffic Safety Plan Emphasis Areas • Crash Unit Types • Safety Hot Spots
Freight	**Freight Index** Based on bi-directional truck travel time reliability	• Travel Time Reliability • Bridge Vertical Clearance • Bridge Vertical Clearance Hot Spots

The general template for each performance area is illustrated in **Figure 6**.

The guidelines for performance measure development are:

- Indicators and performance measures for each performance area should be developed for relatively homogeneous corridor segments
- Performance measures for each performance area should be tiered, consisting of primary measure(s) and secondary measure(s)
- Primary and secondary measures should assist in identifying those corridor segments that warrant in-depth diagnostic analyses to identify performance-based needs and a range of corrective actions known as solution sets
- One or more primary performance measures should be used to develop a Performance Index to communicate the overall health of a corridor and its segments for each performance area; the Performance Index should be a single numerical index that is quantifiable, repeatable, scalable, and capable of being mapped; primary performance measures should be transformed into a Performance Index using mathematical or statistical methods to combine one or more data fields from an available ADOT database
- One or more secondary performance measure indicators should be used to provide additional details to define corridor locations that warrant further diagnostic analysis; secondary performance measures may include the individual indicators used to calculate the Performance Index and/or “hot spot” features

Figure 6: Performance Area Template

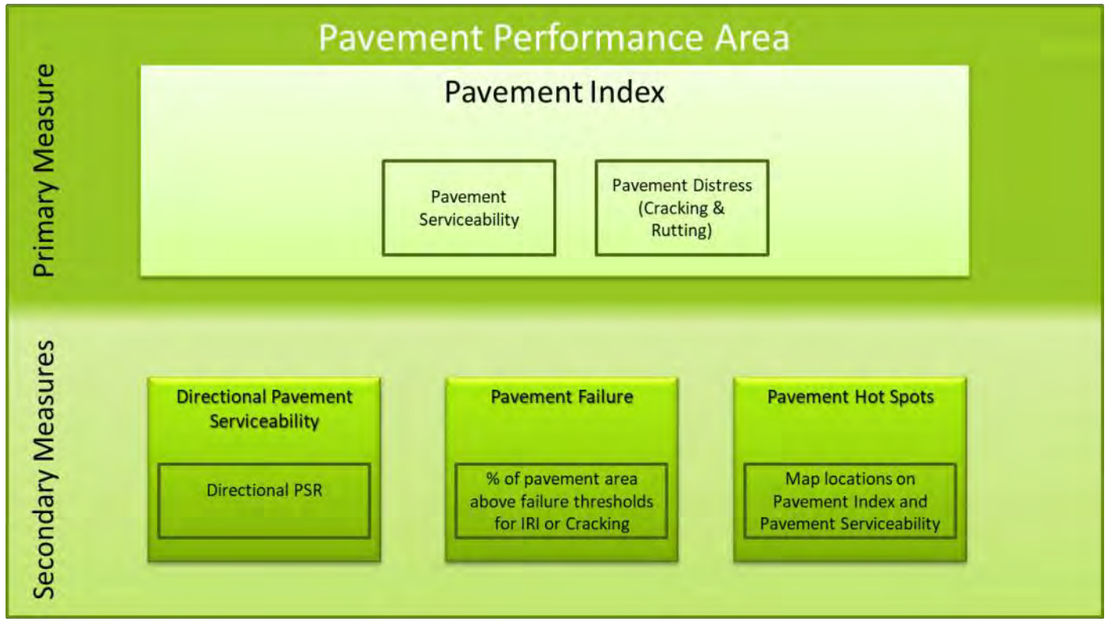


2.2 Pavement Performance Area

The Pavement performance area consists of a primary measure (Pavement Index) and three secondary measures, as shown in **Figure 7**. These measures assess the condition of the existing pavement along the SR 90/SR 80 corridor. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

This CPS is an update to a previously completed report. The performance measures and performance thresholds have been revised from the previous version. For the Pavement performance area, the new methodology includes the use of Rutting data and the performance thresholds have been slightly modified.

Figure 7: Pavement Performance Measures



Primary Pavement Index

The Pavement Index is calculated using two pavement condition ratings: the Pavement Serviceability Rating (PSR) and the Pavement Distress Index (PDI).

The PSR is extracted from the International Roughness Index (IRI), a measurement of pavement roughness based on field-measured longitudinal roadway profiles. The PDI is extracted from the Cracking Rating (CR) and Rutting Rating, a field-measured sample from each mile of highway.

Both the PSR and PDI use a 0 to 5 scale with 0 representing the lowest performance and 5 representing the highest. The Pavement Index for each segment is a weighted average of the directional ratings based on the number of travel lanes. Therefore, the condition of a section with more travel lanes will have a greater influence on the resulting segment Pavement Index than the condition of a section with fewer travel lanes.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the Pavement performance area, the relevant operating environments are designated as interstate and non-interstate segments. For the SR 90/SR 80 corridor, the following operating environment was identified:

- Non-interstate: all segments

Secondary Pavement Measures

Three secondary measures provide an in-depth evaluation of the different characteristics of pavement performance.

Directional Pavement Serviceability

- Weighted average (based on number of lanes) of the PSR for the pavement in each direction of travel

Pavement Failure

- Percentage of pavement area rated above failure thresholds for IRI, Cracking or Rutting

Pavement Hot Spots

- A Pavement “hot spot” exists where a given one-mile section of roadway rates as being in “poor” condition
- Highlights problem areas that may be under-represented in a segment average; this measure is recorded and mapped, but not included in the Pavement performance area rating calculations

Pavement Performance Results

The Pavement Index provides a high-level assessment of the pavement condition for the corridor and for each segment. The three secondary measures provide more detailed information to assess pavement performance.

Based on the results of this analysis, the following observations were made:

- The weighted average of the Pavement Index shows “fair” overall performance for the SR 90/SR 80 corridor
- According to the Pavement Index, half of the pavement is in “good” condition while Segments 90-1, 90-3-90-5, and 80-8 show either “fair” or “poor” condition
- All Segments show “poor” % Area Failure ratings except for Segments 90-6 and 80-7

- The weighted average of the % Area Failure shows “poor” overall performance for the SR 90/80 corridor
- The weighted average of the Directional PSR shows “good” overall performance for the SR 90/SR 80 corridor
- There are pavement hot spots in every segment of the corridor except for Segment 80-7

Table 5 summarizes the Pavement performance results for the SR 90/SR 80 corridor. **Figure 8** illustrates the primary Pavement Index performance and locations of Pavement hot spots along the SR 90/SR 80 corridor. Maps for each secondary measure can be found in **Appendix A**.

Table 5: Pavement Performance

Segment #	Segment Length (miles)	Pavement Index	Directional PSR		% Area Failure
			NB/WB	SB/EB	
90-1	5	3.27	4.10	4.01	80%
90-2	9	3.67	4.36	3.99	50%
90-3	8	2.80	3.40	3.12	88%
90-4	5	3.39	3.01	3.35	30%
90-5	7	2.96	2.93	2.89	71%
90-6	12	3.68	3.45	3.39	17%
80-7	6	4.20	3.91	3.96	0%
80-8	6	2.88	2.84	3.12	88%
80-9	12	3.62	3.68	3.66	50%
80-10	8	3.60	3.50	3.64	50%
Weighted Corridor Average		3.44	3.55	3.51	50%

SCALES		
Performance Level	**Non-Interstate**	
Good	> 3.50	< 5%
Fair	2.90 - 3.50	5% - 20%
Poor	< 2.90	> 20%

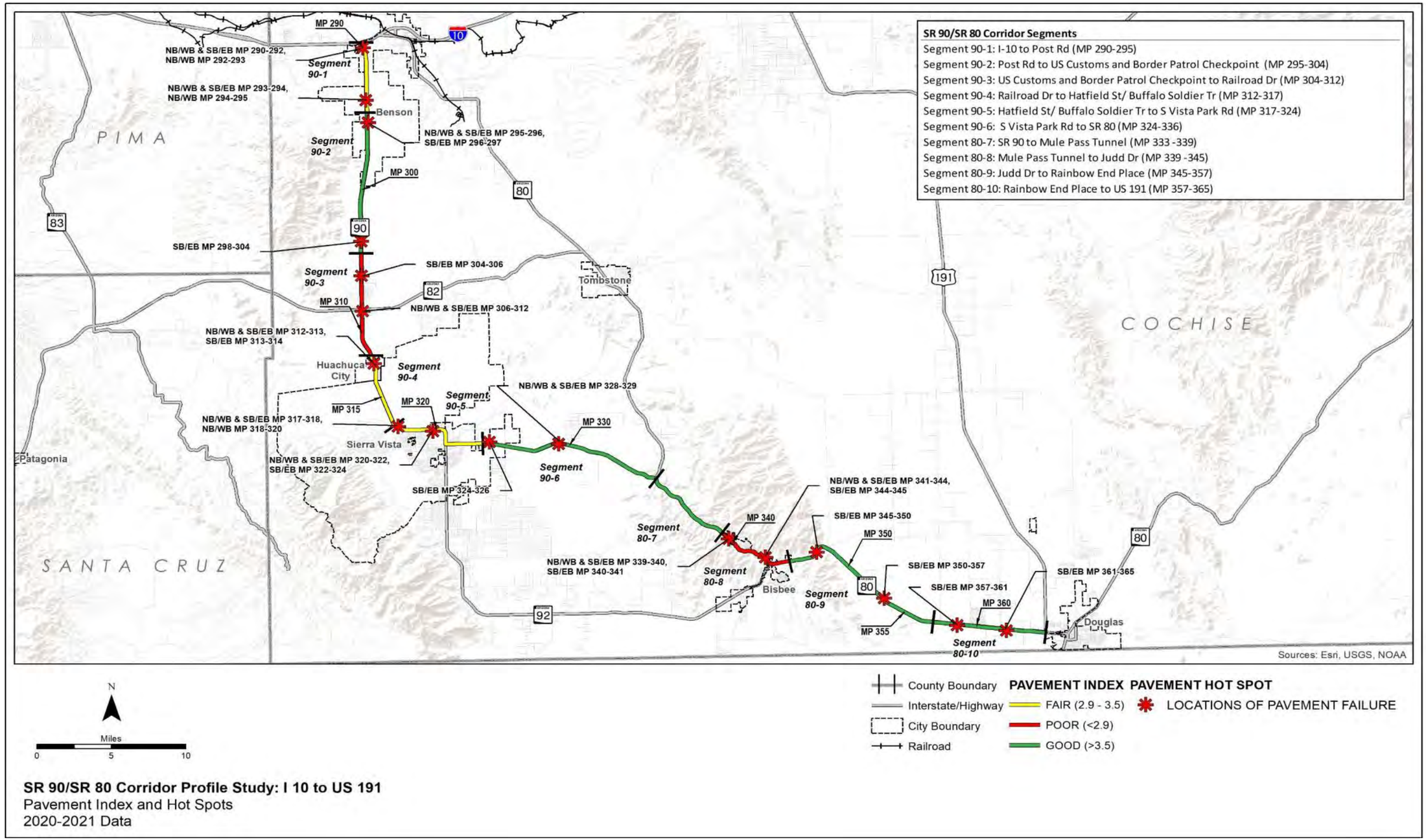
Statewide Transportation Asset Management Plan

Moving Ahead for Progress in the 21st Century Act of 2012 (MAP-21), identified national transportation system goals. The transportation asset management regulations associated with the infrastructure condition goals required the development of a Transportation Asset Management Plan (TAMP) covering National Highway System (NHS) bridges and pavements. As part of the statewide TAMP, ADOT developed pavement performance metrics and thresholds in compliance with federal tracking and reporting requirements, as shown in **Table 6**. The thresholds shown in Table 6 are the basis for the TAMP and ADOT’s federal reporting and are different than those used in this CPS, which are based on ADOT’s Pavement Management System, as shown in Table 5. The TAMP reports asset condition information in the aggregate at the statewide level and applying the thresholds shown in Table 6 would result in different segment-level performance than shown in Table 5.

Table 4: Statewide TAMP Metrics

Metric	Good	Fair	Poor
IRI (in./mile)	< 95	95-170	> 170
Cracking (%)	< 5	5-20 (asphalt) 5-15 (jointed concrete) 5-10 (cont. reinforced concrete)	> 20 > 15 > 10
Rutting (in.)	< 0.20	0.20–0.40	> 0.40
Faulting (in.)	<0.10	0.10-0.15	> 0.15

Figure 8: Pavement Performance



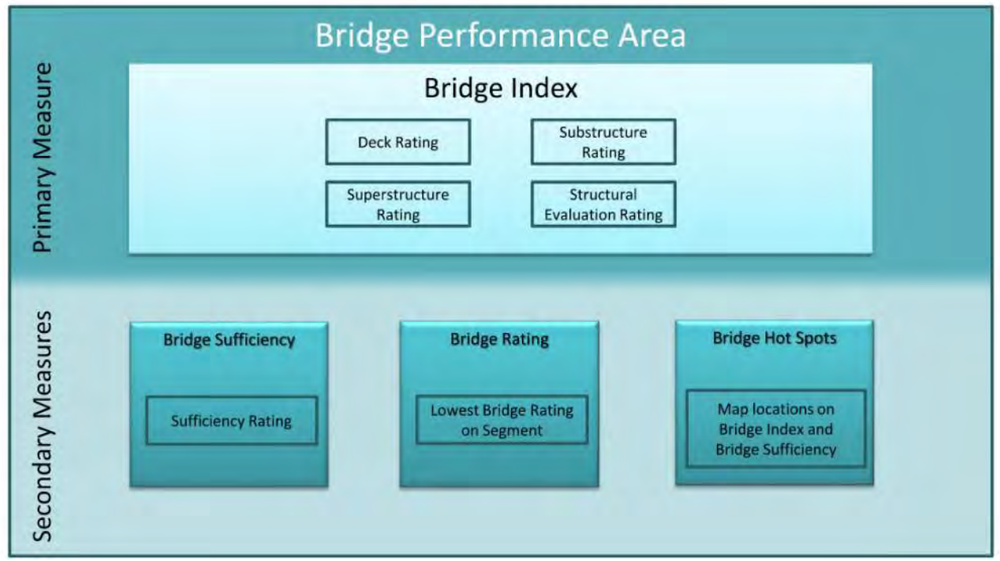
SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Pavement Index and Hot Spots
2020-2021 Data

2.3 Bridge Performance Area

The Bridge performance area consists of a primary measure (Bridge Index) and three secondary measures, as shown in **Figure 9**. These measures assess the condition of the existing bridges along the SR 90/SR 80 corridor. Only bridges that carry mainline traffic or bridges that cross the mainline are included in the calculation. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

This CPS is an update to a previously completed report. The performance measures and performance thresholds have been revised from the previous version. For the Bridge performance area, the new methodology does not include the performance metric related to Functionally Obsolete bridges, which was used in the previous methodology.

Figure 9: Bridge Performance Measures



Primary Bridge Index

The Bridge Index is calculated based on the use of four different bridge condition ratings from the ADOT Bridge Database, also known as the Arizona Bridge Information and Storage System (ABISS). The four ratings are the Deck Rating, Substructure Rating, Superstructure Rating, and Structural Evaluation Rating. These ratings are based on inspection reports and establish the structural adequacy of each bridge. The performance of each individual bridge is established by using the lowest of these four ratings. The use of these ratings, and the use of the lowest rating, is consistent with the approach used by the ADOT Bridge Group to assess the need for bridge rehabilitation. The Bridge Index is calculated as a weighted average for each segment based on deck area.

Secondary Bridge Measures

Three secondary measures provide an in-depth evaluation of the characteristics of each bridge:

Bridge Sufficiency

- Multipart rating includes structural adequacy and safety factors as well as functional aspects such as traffic volume and length of detour
- Rates the structural and functional sufficiency of each bridge on a 100-point scale

Bridge Rating

- The lowest rating of the four bridge condition ratings (substructure, superstructure, deck, and structural evaluation) on each segment
- Identifies lowest performing evaluation factor on each bridge

Bridge Hot Spots

- A Bridge “hot spot” is identified where a given bridge has a bridge rating of 4 or lower or multiple ratings of 5 between the deck, superstructure, and substructure ratings
- Identifies particularly low-performing bridges or those that may decline to low performance in the immediate future

Bridge Performance Results

The Bridge Index provides a high-level assessment of the structural condition of bridges for the corridor and for each segment. The four secondary measures provide more detailed information to assess bridge performance.

Based on the results of this analysis, the following observations were made:

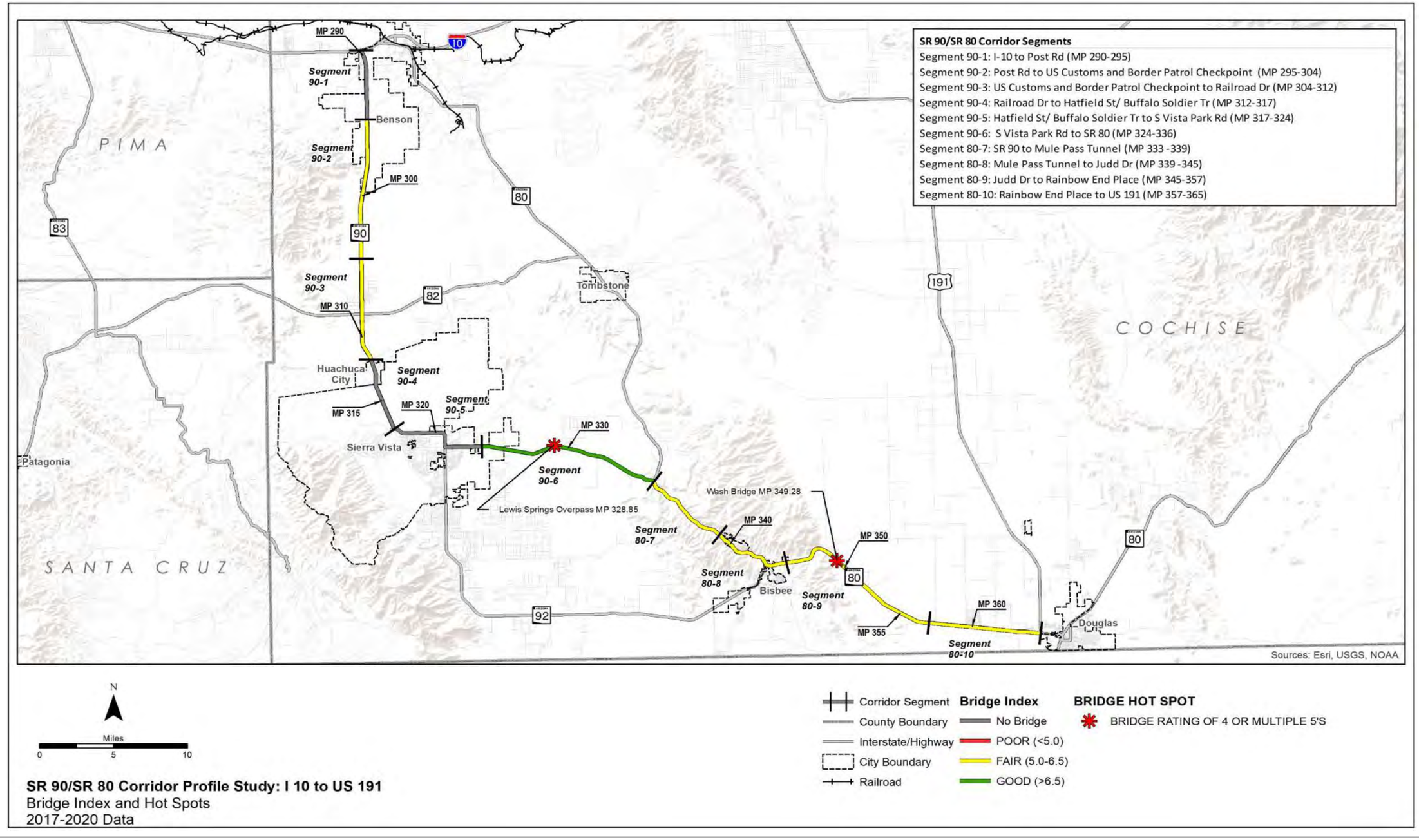
- The weighted average of the Bridge Index shows “fair” overall performance for the SR 90/SR 80 corridor
- Segments 90-1, 90-4, and 90-5 contain no bridges
- All segments that contain bridges have a “fair” or “good” Bridge Index rating
- All segments that contain bridges have a “good” Sufficiency Rating except Segments 80-7, 80-8 and 80-9, which have a “fair” Sufficiency Rating
- All segments that contain bridges have a “fair” Lowest Bridge Rating measure
- The corridor includes two bridge hot spots:
    - Lewis Springs Overpass (OP) (#470), MP 328.85
    - Wash Bridge (#235), MP 349.28

Table 7 summarizes the Bridge performance results for the SR 90/SR 80 corridor. **Figure 10** illustrates the primary Bridge Index performance and locations of Bridge hot spots along the SR 90/SR 80 corridor. Maps for each secondary measure can be found in **Appendix A**.

Table 7: Bridge Performance

Segment #	Segment Length (miles)	# of Bridges	Bridge Index	Sufficiency Rating	Lowest Bridge Rating
90-1	5	0	No Bridges		
90-2	9	2	6.49	94.36	6
90-3	8	3	6.33	94.03	6
90-4	5	0	No Bridges		
90-5	7	0	No Bridges		
90-6	12	2	6.60	93.22	5
80-7	6	3	5.85	73.37	5
80-8	6	5	5.92	71.56	5
80-9	12	5	6.02	77.46	5
80-10	8	1	5.00	86.30	5
Weighted Corridor Average			6.07	81.37	5.24
SCALES					
Performance Level			**All**		
Good			> 6.5	> 80	> 6
Fair			5.0 - 6.5	50 - 80	5 - 6
Poor			< 5.0	< 50	< 5

Figure 10: Bridge Performance

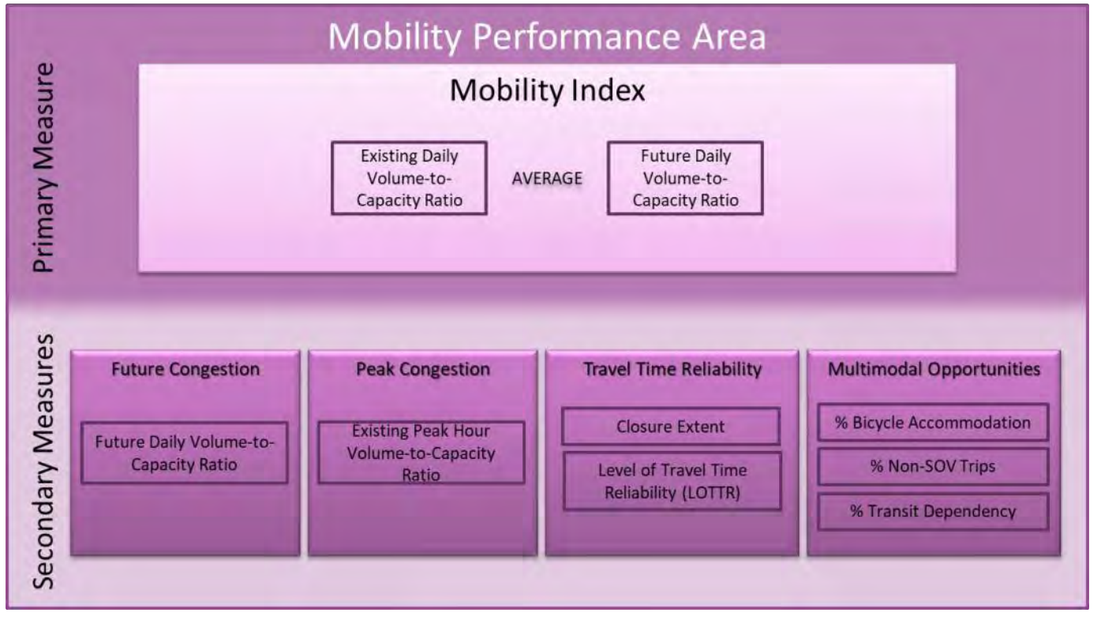


SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Bridge Index and Hot Spots
2017-2020 Data

2.4 Mobility Performance Area

The Mobility performance area consists of a primary measure (Mobility Index) and four secondary measures, as shown in **Figure 11**. These measures assess the condition of existing mobility along the SR 90/SR 80 corridor. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

Figure 11: Mobility Performance Measures



Primary Mobility Index

The Mobility Index is an average of the existing (2019) daily volume-to-capacity (V/C) ratio and the future (2040 AZTDM) daily V/C ratio for each segment of the corridor. The V/C ratio is an indicator of the level of congestion. This measure compares the average annual daily traffic (AADT) volume to the capacity of the corridor segment as defined by the service volume for level of service (LOS) E. By using the average of the existing and future year daily volumes, this index measures the level of daily congestion projected to occur in approximately ten years (2030) if no capacity improvements are made to the corridor.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the Mobility performance area, the relevant operating environments are urban vs. rural setting and interrupted flow (e.g., signalized at-grade intersections are present) vs. uninterrupted flow (e.g., controlled access grade-separated conditions such as a freeway or interstate highway). For the SR 90/SR 80 corridor, the following operating environments were identified:

- Rural Interrupted Flow: Segments 90-1, 90-2, 90-3, 90-6, and 80-10
- Rural Uninterrupted Flow: Segments 90-4, 80-7, and 80-9
- Urban Interrupted Flow: Segments 90-5 and 80-8

Secondary Mobility Measures

Four secondary measures provide an in-depth evaluation of operational characteristics of the corridor:

Future Congestion – Future Daily V/C

- The future (2040 AZTDM) daily V/C ratio; this measure is the same value used in the calculation of the Mobility Index
- Provides a measure of future congestion if no capacity improvements are made to the corridor

Peak Congestion – Existing Peak Hour V/C

- The peak hour V/C ratio for each direction of travel
- Provides a measure of existing peak hour congestion during typical weekdays

Travel Time Reliability– Two separate travel time reliability indicators together provide a comprehensive picture of how much time may be required to travel within the corridor:

- Closure Extent:
  - The average number of instances a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel; a weighted average was applied to each closure that takes into account the distance over which the closure occurs
  - Closures related to crashes, weather, or other incidents are a significant contributor to non-recurring delays; construction-related closures were excluded from the analysis
- Level of Travel Time Reliability (LOTTR)
  - The ratio of the 80th percentile travel time to average (50th percentile) travel time for a given corridor segment in a specific direction; as corridor segments were often comprised of multiple roadway sections for which LOTTR was reported, a weighted average was applied to each section based on the section length in order to arrive at the segment
  - The LOTTR reflects how consistent or dependable the travel might be from day to day or during different times of day

Multimodal Opportunities – Three multimodal opportunity indicators reflect the characteristics of the corridor that promote alternate modes to the single occupancy vehicle (SOV) for trips along the corridor:

- % Bicycle Accommodation:

    - Percentage of the segment that accommodates bicycle travel; bicycle accommodation on the roadway or on shoulders varies depending on traffic volumes, speed limits, and surface type
    - Encouraging bicycle travel has the potential to reduce automobile travel, especially on non-interstate highways
- % Non-SOV Trips:
    - The percentage of trips (less than 50 miles in length) by non-SOVs
    - The percentage of non-SOV trips in a corridor gives an indication of travel patterns along a section of roadway that could benefit from additional multimodal options
- % Transit Dependency:
    - The percentage of households that have zero or one automobile and households where the total income level is below the federally defined poverty level
    - Used to track the level of need among those who are considered transit dependent and more likely to utilize transit if it is available

Mobility Performance Results

The Mobility Index provides a high-level assessment of mobility conditions for the corridor and for each segment. The four secondary measures provide more detailed information to assess mobility performance.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the mobility performance area, the relevant operating environments included urban or rural locations, as well as interrupted flow (where signalized at-grade intersections are present) and uninterrupted flow (grade-separated).

Based on the results of this analysis, the following observations were made:

- The weighted average of the Mobility Index shows “good” overall performance for the SR 90/SR 80 corridor
- The Mobility Index performance shows “good” for all corridor segments
- During the existing peak hour, traffic operations are “good” for all segments
- All Segments are anticipated to have “good” performance in the future, according to the Future Daily V/C performance indicator
- The weighted average for the Closure Extent performance indicator show “good” in the NB/WB travel and “fair" and the SB/EB travel; Closure extent for all of the segments show “good” or "fair performance in both directions with the exception Segment 80-9 for the SB/EB travel which shows “poor” performance
- The LOTTR performance indicator for both directions show that all segments on the SR 90/SR 80 corridor show “good” or “fair” performance levels with the exception of Segments 90-1 and 90-2 for the NB/WB travel and 90-1 for the SB/EB travel which show “poor” performance
- A majority of SR 90/SR 80 segments show “fair” performance for non-SOV trips, indicating single occupant trips are more common
- A majority of the corridor shows “fair” or “poor” performance in % Bicycle Accommodation, indicating most of the corridor has narrow shoulders

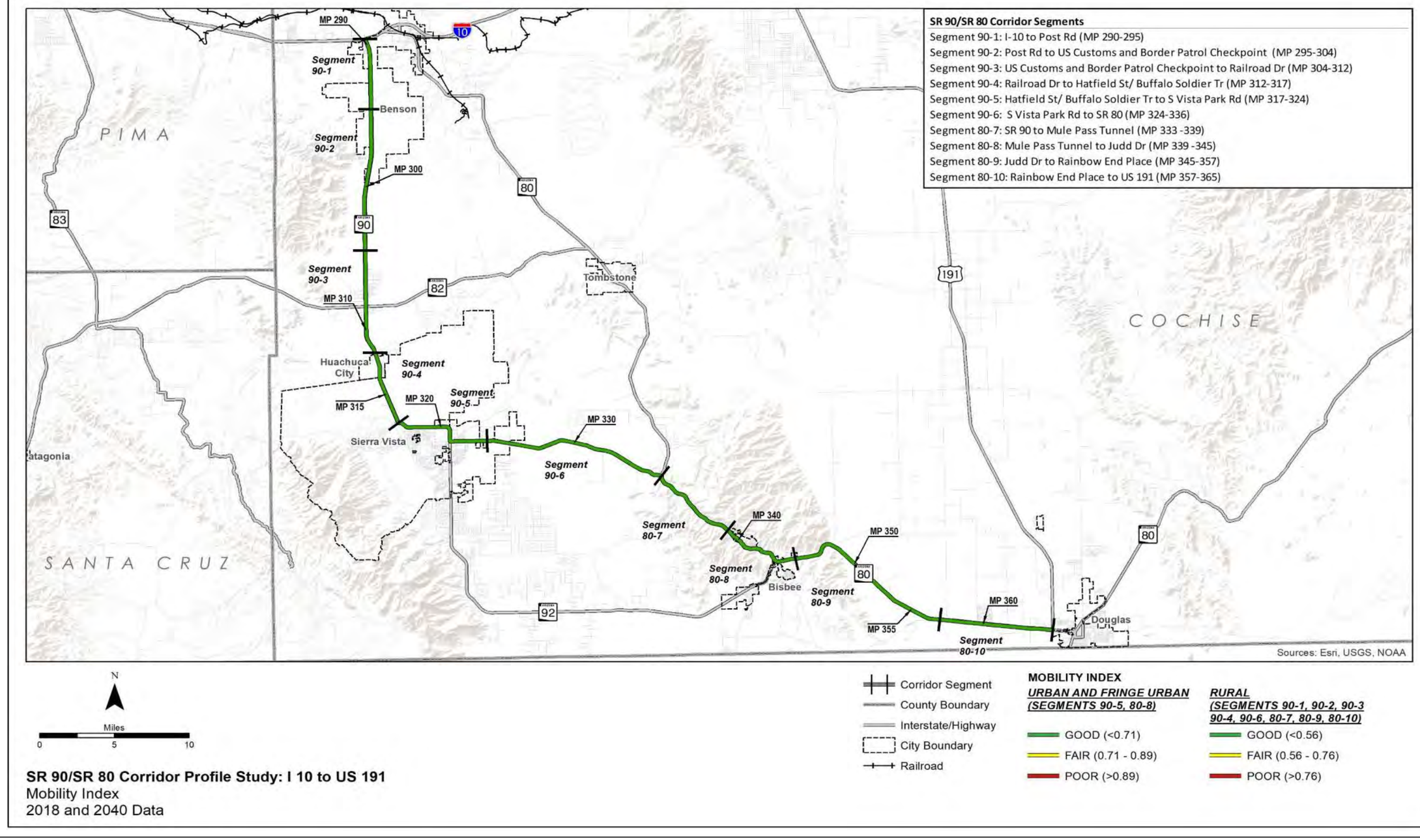
Table 8 summarizes the Mobility performance results for the SR 90/SR 80 corridor. **Figure 12** illustrates the primary Mobility Index performance along the SR 90/SR 80 corridor. Maps for each secondary measure can be found in **Appendix A**.

Table 8: Mobility Performance

Segment #	Segment Length (miles)	Mobility Index	Future V/C	Existing Peak Hour V/C		Closure Extent (instances/milepost/year/mile)		Directional LOTTR (all vehicles)		% Bicycle Accommodation	% Non-Single Occupancy Vehicle (SOV) Trips
				NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB		
90-1[2]	5	0.32	0.36	0.21	0.20	0.00	0.00	2.00	1.69	88%	11.2%
90-2[2]	10	0.15	0.17	0.11	0.11	0.00	0.02	2.05	1.04	100%	11.9%
90-3[2]	7	0.36	0.40	0.28	0.29	0.10	0.18	1.23	1.11	96%	15.0%
90-4[2]	5	0.26	0.29	0.17	0.17	0.00	0.12	1.10	1.11	96%	15.4%
90-5[1]	7	0.40	0.44	0.31	0.30	0.14	0.03	1.22	1.38	26%	18.5%
90-6[2]	12	0.31	0.34	0.25	0.25	0.15	0.05	1.10	1.10	3%	15.0%
80-7[2]	5	0.41	0.26	0.42	0.43	0.50	0.10	1.07	1.16	0%	14.6%
80-8[1]	6	0.21	0.13	0.25	0.22	0.20	0.54	1.17	1.13	43%	15.8%
80-9[2]	12	0.09	0.04	0.15	0.17	0.40	0.90	1.11	1.19	88%	10.9%
80-10[2]	8	0.10	0.07	0.13	0.13	0.00	0.05	1.21	1.07	97%	14.0%
Weighted Corridor Average		0.24	0.24	0.22	0.22	0.16	0.23	1.32	1.18	63%	0.14
SCALES											
Performance Level		**Urban Rural**		**All**		**All**		**All**			
Good		< 0.71[1] < 0.56[2]		< 0.22		< 1.15		> 90%		> 17%	
Fair		0.71 - 0.89[1] 0.56 - 0.76[2]		0.22 – 0.62		1.15 - 1.5		60% - 90%		11% - 17%	
Poor		> 0.89[1] > 0.76[2]		> 0.62		> 1.5		< 60%		< 11%	

[1]Urban Operating Environment
[2]Rural Operating Environment

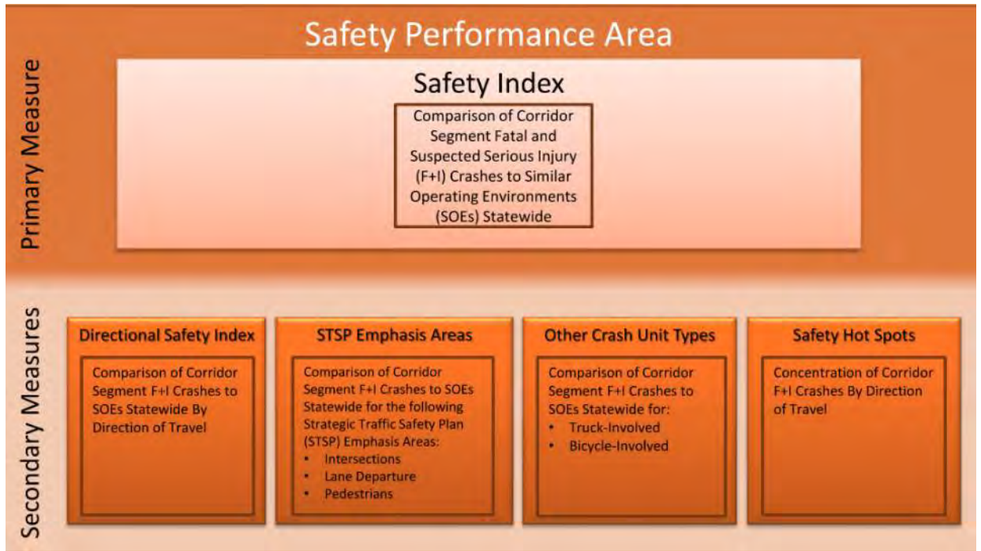
Figure 12: Mobility Performance



2.5 Safety Performance Area

The Safety performance area consists of a primary measure (Safety Index) and four secondary measures, as illustrated in **Figure 13**. All measures relate to crashes that result in fatal and suspected serious injuries, as these types of crashes are the emphasis of the ADOT Strategic Traffic Safety Plan (STSP), FHWA, and MAP-21. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C.**

Figure 13: Safety Performance Measures



Primary Safety Index

The Safety Index is based on the bi-directional frequency and rate of fatal and suspected serious injury crashes, the relative cost of those types of crashes, and crash occurrences on similar roadways in Arizona. According to ADOT's 2018 Highway Safety Improvement Program Manual, fatal crashes have an estimated cost that is 17.3 times the estimated cost of incapacitating injury crashes ($9.5 million compared to $555,000).

Each corridor segment is rated on a scale by comparing the segment score with the average statewide score for similar operating environments. Because crash frequencies and rates vary depending on the operating environment of a particular roadway, statewide values were developed for similar operating environments defined by functional classification, urban vs. rural setting, number of travel lanes, and traffic volumes. For the SR 90/SR 80 corridor, the following operating environments were identified:

- 2 or 3 or 4 Lane Divided Highway: Segments 90-1, 90-2, 90-3, and 80-10
- 4 or 5 Lane Undivided Highway: Segments 90-4 and 90-5
- 2 or 3 lane Undivided Highway: Segments 90-6, 80-7, 80-8, and 80-9

Secondary Safety Measures

Four secondary measures provide an in-depth evaluation of the different characteristics of safety performance:

Directional Safety Index

- This measure is based on the directional frequency and rate of fatal and suspected serious crashes

STSP Emphasis Areas

ADOT's 2019 STSP identified several emphasis areas for reducing fatal and suspected serious injury crashes. This measure compared rates of crashes in three STSP emphasis areas to other corridors with a similar operating environment. The three STSP emphasis areas related to crashes involving:

- Intersections
- Lane departures
- Pedestrians

Other Crash Unit Types

- The percentage of total fatal and suspected serious injury crashes that involves crash unit types of trucks and bicycles is compared to the statewide average on roads with similar operating environments

Safety Hot Spots

- The hot spot analysis identifies abnormally high concentrations of fatal and suspected serious injury crashes along the study corridor by direction of travel

For the Safety Index and the secondary safety measures, any segment that has too small of a sample size to generate statistically reliable performance ratings for a particular performance measure is considered to have "insufficient data" and is excluded from the safety performance evaluation for that particular performance measure.

Safety Performance Results

The Safety Index provides a high-level assessment of safety performance for the corridor and for each segment. The four secondary measures provide more detailed information to assess safety performance.

Based on the results of this analysis, the following observations were made:

- The crash unit type performance measures for crashes involving Lane Departures, Pedestrians, Trucks and Bicycles had insufficient data to generate reliable performance ratings for the SR 90/SR 80 corridor
- The percentage of Fatal and Incapacitating Injury Crashes at Intersections is “below average” for Segments 90-5 and 90-6
- A total of 45 fatal and incapacitating injury crashes occurred along the SR 90/SR 80 corridor in 2015-2019; of these crashes, 12 were fatal and 33 involved incapacitating injuries
- The weighted average of the Safety Index and Directional Safety Indices show “above average” performance for the SR 90/SR 80 corridor
- The Safety Index value for Segments 90-5, 80-7 and 80-8 are “below average”, meaning this segment has more crashes than is typical statewide for a similar operating environment
- Safety Index and Directional Safety Index performance measures for Segments 90-3 and 80-10 had insufficient data
- The Directional Safety Index value for NB/WB travel for Segment 80-7 and 80-8 are “below average” and for SB/EB travel, Segments 90-1, 90-5 and 80-7 and 80-8 are “below average”
- Safety hot spots include:
    - MP 308-309
    - MP 319-323

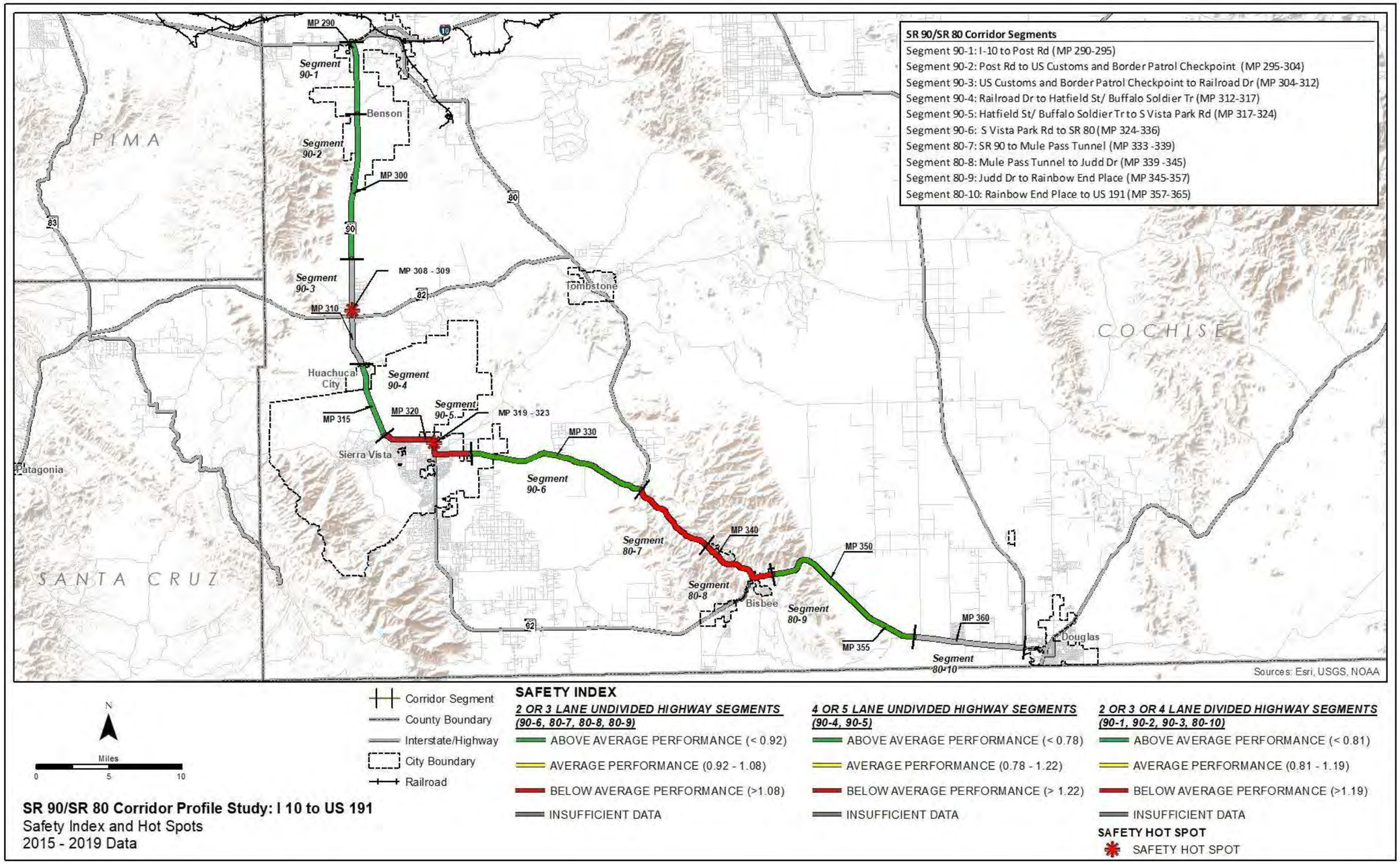
Table 9 summarizes the Safety performance results for the SR 90/SR 80 corridor. **Figure 14** illustrates the primary Safety Index performance and locations of Safety hot spots along the SR 90/SR 80 corridor. Maps for each secondary measure can be found in **Appendix A**.

Table 9: Safety Performance

Segment	Segment Length (miles)	Overall Safety Index	NB/EB Directional Safety Index	SB/WB Directional Safety Index	% of Fatal + Suspected Serious Injury Crashes at Intersections	% of Fatal + Suspected Serious Injury Crashes Involving Lane Departures	% of Fatal + Suspected Serious Injury Crashes Involving Pedestrians	% of Segment Fatal + Suspected Serious Injury Crashes Involving Trucks	% of Segment Fatal + Suspected Serious Injury Crashes Involving Bicycles
90-1[a]	5	0.77	0.08	1.45	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
90-2[a]	9	0.04	0.04	0.04	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
90-3[a]	8	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
90-4[b]	5	0.04	0.08	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
90-5[b]	7	1.63	0.93	2.32	61%	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
90-6[c]	12	0.18	0.16	0.21	43%	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
80-7[c]	6	1.93	1.95	1.92	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
80-8[c]	6	1.82	1.81	1.83	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
80-9[c]	12	0.00	0.00	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
80-10[a]	8	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
Weighted Corridor Average		0.84	0.52	0.79	50%	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
SCALES									
Performance Level		**2 or 3 or 4 Lane Divided Highway**							
Above Average		< 0.81			< 23.4%	< 56.4%	< 16%	<3.7%	< 0%
Average		0.81 - 1.19			23.4% - 29.3%	56.4% - 65.0%	16% - 26%	3.7% - 9.90%	0% - 2.2%
Below Average		> 1.19			> 29.3%	> 65.0%	> 26%	9.90%	> 2.2%
Performance Level		**2 or 3 Lane Undivided Highway**							
Above Average		< 0.92			< 11.2%	< 66.9%	< 3.8%	<4.2%	< 0%
Average		0.92 - 1.08			11.2% - 15.6%	66.9% - 74.5%	3.8% - 7.2%	4.2% - 8.0%	0% - 3.3%
Below Average		> 1.08			> 15.6%	> 74.5%	> 7.2%	> 8.0%	> 3.3%
Performance Level		**4 or 5 Undivided Highway**							
Above Average		< 0.78			< 43.8%	< 21.1%	< 8.8%	< 0.8%	< 0.5%
Average		0.78 - 1.22			43.8% - 49.5%	21.1% - 32.1%	8.8% - 13.5%	0.8% - 5.5%	0.5% - 3.8%
Below Average		> 1.22			> 49.5%	> 32.1%	< 13.5%	> 5.5%	> 3.8%

[a]2 or 3 or 4 Lane Divided Highway
[b]4 or 5 Lane Undivided Highway
[c]2 or 3 Lane Undivided Highway
Note: "Insufficient Data" indicates there was not enough data available to generate reliable performance ratings.

Figure 14: Safety Performance



2.6 Freight Performance Area

The Freight performance area consists of a single primary measure (Freight Index) and three secondary measures, as illustrated in **Figure 15**. All measures related to the reliability of truck travel as measured by observed truck travel time speed and delays to truck travel from road closures or physical restrictions to truck travel. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

Figure 15: Freight Performance Measures

Primary Freight Index

The Freight Index is a reliability performance measure based on the travel time reliability for truck travel. The Truck Travel Time Reliability (TTTR) is the ratio of the 95th percentile truck travel time to average (50th percentile) truck travel time. The TTTR reflects the extra buffer time needed for on-time delivery while accounting for delay resulting from circumstances such as recurring congestion, crashes, inclement weather, and construction activities.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the Freight performance area, the relevant operating environments are interrupted flow (e.g., signalized at-grade intersections are present) and uninterrupted flow (e.g., controlled access grade-separated conditions such as a freeway or interstate highway).

For the SR 90/SR 80 corridor, the following operating environments were identified:

- Interrupted Flow: Segments 90-1, 90-2, 90-3, 90-5, 90-6, 80-8, and 80-10
- Uninterrupted Flow: Segments 90-4, 80-7, and 80-9

Secondary Freight Measures

The Freight performance area includes three secondary measures that provide an in-depth evaluation of the different characteristics of freight performance:

Travel Time Reliability – Two separate travel time reliability indicators together provide a comprehensive picture of how much time may be required to travel within the corridor:

- Directional Truck Travel Time Reliability (TTTR):
  - The ratio of the 95th percentile truck travel time to average (50th percentile) truck travel time for a given corridor segment in a specific direction; as corridor segments were often comprised of multiple roadway sections for which TTTR was reported, a weighted average was applied to each section based on the section length in order to arrive at the segment TTTR
- Directional Closure Duration
  - The average time (in minutes) a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel; a weighted average is applied to each closure that takes into account the distance over which the closure occurs

Bridge Vertical Clearance

- The minimum vertical clearance (in feet) over the travel lanes for underpass structures on each segment

Bridge Vertical Clearance Hot Spots

- A Bridge vertical clearance "hot spot" exists where the underpass vertical clearance over the mainline travel lanes is less than 16.25 feet and no exit/entrance ramps exist to allow vehicles to bypass the low clearance location
- If a location with a vertical clearance less than 16.25 feet can be avoided by using immediately adjacent exit/entrance ramps rather than the mainline, it is not considered a hot spot

Freight Performance Results

The Freight Index provides a high-level assessment of freight mobility for the corridor and for each segment. The three secondary measures provide more detailed information to assess freight performance.

Based on the results of this analysis, the following observations were made:

- The weighted average of the Freight Index shows “poor” overall performance for the SR 90/SR 80 corridor
- A majority of the segments show either “poor” performance for the Directional TTTR measure for the NB/EB travel
- Six out of the ten segments show “poor” or “fair” performance for the Directional TTTR measure for the SB/WB travel
- Segment 80-7 in the NB/WB direction shows “poor” performance in the closure duration performance measure; all other segments show “good” or “fair” performance
- Three bridge vertical clearance hot spots exist in Segment 80-8; Mule Pass Tunnel (#538, MP 339.06), Lowell RR UP (#269, MP 343.01), and Lowell UP RR (#1033, MP 343.01)

Table 10 summarizes the Freight performance results for the SR 90/SR 80 corridor. **Figure 16** illustrates the primary Freight Index performance and locations of freight hot spots along the SR 90/SR 80 corridor. Maps for each secondary measure can be found in **Appendix A**.

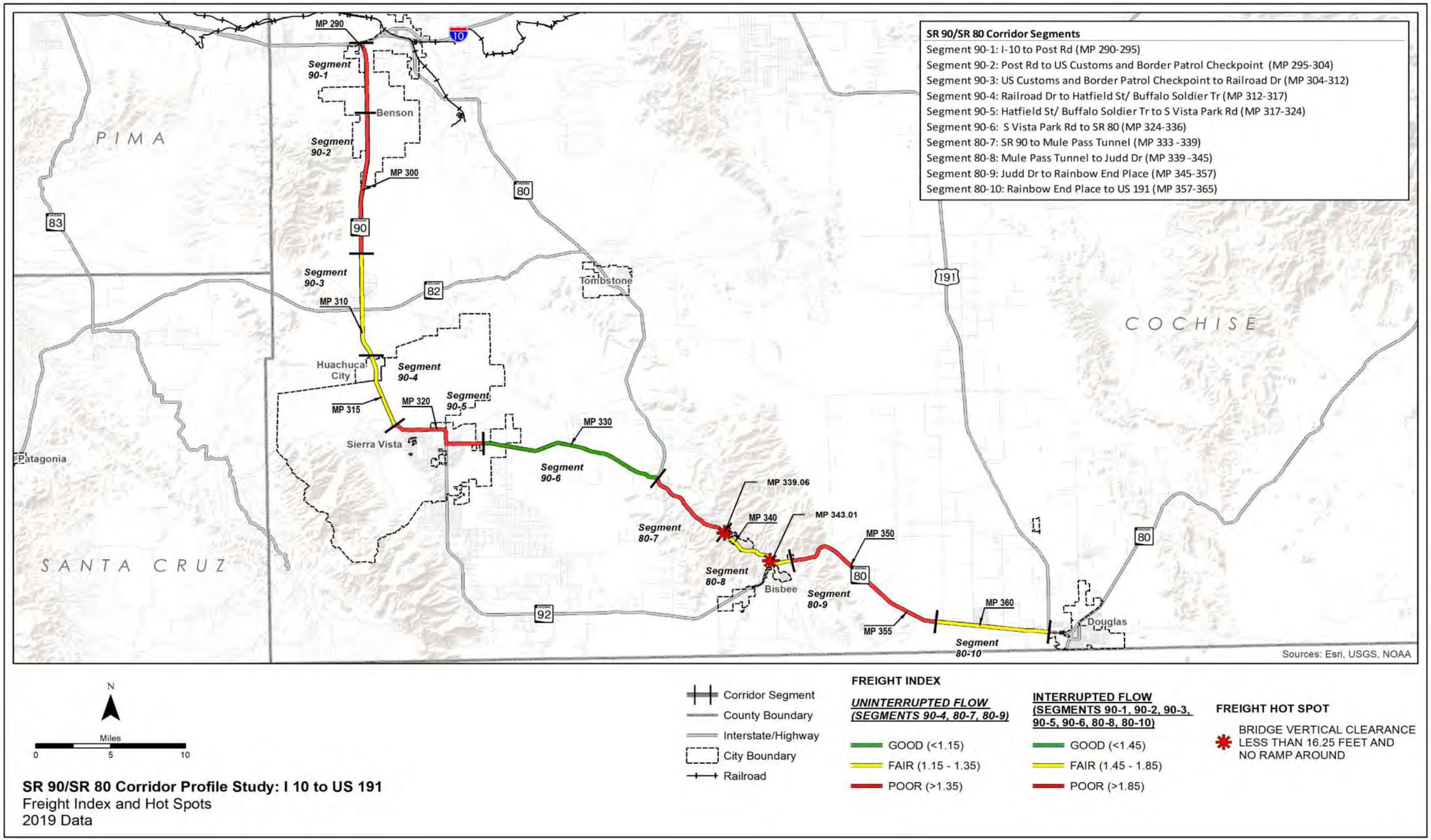
Table 10: Freight Performance

Segment #	Segment Length (miles)	Freight TTTR	NB/EB MAX TTTR	SB/WB MAX TTTR	Combined Average Peak TTTR	Average Minutes Per Year Given Milepost Is Closed Per Segment Mile (NB/WB)	Average Minutes Per Year Given Milepost Is Closed Per Segment Mile (SB/EB)	Bridge Vertical Clearance in Feet
90-1*	**5**	5.06	2.75	7.37	5.06	0.00	0.00	No UP
90-2*	**10**	4.85	8.62	1.08	4.85	0.00	1.33	No UP
90-3*	**7**	1.69	1.87	1.52	1.69	10.25	20.33	No UP
90-4^	**5**	1.34	1.42	1.25	1.34	0.00	14.76	No UP
90-5*	**7**	2.05	1.86	2.23	2.05	12.00	6.83	No UP
90-6*	**12**	1.35	1.40	1.30	1.35	10.00	3.00	No UP
80-7^	**5**	1.45	1.25	1.65	1.45	156.07	15.57	No UP
80-8*	**6**	1.45	1.48	1.42	1.45	36.77	109.34	13.95
80-9^	**12**	1.92	1.37	2.48	1.92	95.00	102.20	No UP
80-10*	**8**	1.84	2.38	1.29	1.84	0.00	3.00	No UP
Weighted Corridor Average		2.29	2.59	2.00	2.29	31.31	29.75	13.95

SCALES			
Performance Level	**Uninterrupted Interrupted**	**All**	
Good	< 1.15^ <1.45*	< 44.18	> 16.5
Fair	1.15 – 1.35^ 1.45-1.85*	44.18 -124.86	16.0 - 16.5
Poor	> 1.35^ >1.85	> 124.86	< 16.0

^Uninterrupted Flow Facility
*Interrupted Flow Facility

Figure 16: Freight Performance



SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Freight Index and Hot Spots
2019 Data

2.7 Corridor Performance Summary

Based on the results presented in the preceding sections, the following general observations were made related to the performance of the SR 90/SR 80 corridor:

- Overall Performance: The Pavement performance and Safety performance areas show a mix of “good”, “fair”, and “poor” performance; Mobility performance shows generally “good” performance; the Bridge performance area shows generally “fair” performance; the Freight performance area shows generally “poor” performance
- Pavement Performance: The weighted average of the Pavement Index shows “fair” overall performance for the SR 90/SR 80 corridor; Segments 90-3 through 90-5 and 80-8 show “fair” or “poor” performance for all Pavement performance area measures; A majority of the segments show “poor” performance for the Area Failure measure except Segments 90-6 and 80-7
- Bridge Performance: The weighted average of the Bridge Index shows “fair” overall performance for the SR 90/SR 80 corridor; Segments 80-7 through 80-9 show “fair” performance for all Bridge performance area measures; the Lowest Bridge Rating measure shows “fair” performance for all segments; the weighted average for the Sufficiency Rating measure shows “good” performance; Segments 90-2, 90-4, and 90-5 contain no bridges
- Mobility Performance: The weighted average of the Mobility Index shows “good” overall performance for the SR 90/SR 80 corridor; the Future Daily V/C and Existing Peak Hour V/C measures show “good” performance for all segments along the corridor; the Directional Closure Extent measure show generally “good” or “fair” performance; Segment 90-1 shows “poor” performance in both directions for the Directional LOTTR measure; the weighted average for the Directional LOTTR measure shows “fair” in the NB/WB direction and “good” for the SB/EB direction; Segments 90-5 through 80-8 show “poor” performance for the % Bicycle Accommodation measure and the weighted average for the corridor shows “fair” performance
- Safety Performance: The weighted average of the Safety Index and Directional Safety Indices show “above average” performance for the SR 90/SR 80 corridor; The crash unit type performance measures for crashes involving Lane Departures, Pedestrians, Trucks and Bicycles had insufficient data to generate reliable performance ratings; The weighted average of the crash unit type performance measure involving Intersections shows “below average” performance; The Safety Index value for Segments 90-5, 80-7 and 80-8 are “below average”, meaning this segment has more crashes than is typical statewide for a similar operating environment; The Directional Safety Index value for NB/WB travel for Segment 80-7 and 80-8 are “below average” and for SB/EB travel, Segments 90-1, 90-5 and 80-7 and 80-8 are “below average”
- Freight Performance: The weighted average of the Freight Index shows “poor” overall performance for the SR 90/SR 80 corridor; All segments show “fair” or “poor” performance for the Freight Index and Directional Max TTTR (for NB/WB travel) measures except for Segment 90-6; Directional Max TTTR in the SB/EB direction shows a mix of “good,” “fair,” and “poor.” Segment 80-7 in the NB/WB direction shows “poor” performance in the Closure Duration performance measure; Most of the segments show “fair” or “good” performance for the Closure Duration performance measure; three bridge vertical clearance hot spots exist in Segment 80-8
- Lowest Performing Segments: Segments 90-1, 90-5, and 80-7 show “poor/below average” performance for many performance measures
- Highest Performing Segments: Segment 80-10 shows “good/above average” performance for many performance measures

Figure 17 shows the percentage of the SR 90/SR 80 corridor that rates either “good/above average” performance, “fair/average” performance, or “poor/below average” performance for each primary measure. On the SR 90/SR 80 corridor, Freight has the lowest performing area with 100% of the corridor having “fair” or “poor” performance as it relates to primary measures. Mobility is the highest performing area along the SR 90/SR 80 corridor with 100% of the corridor having “good” condition as it relates to primary measures. Safety performance areas shows “above average” and “below average”, and insufficient data. Pavement performance shows a mix of “good,” “fair,” and “poor” as it relates to its primary measures. Bridge performance area shows “fair” and “good” as performance for each primary measure.

Table 11 shows a summary of corridor performance for all primary measures and secondary measure indicators for the SR 90/SR 80 corridor. A weighted corridor average rating (based on the length of the segment) was calculated for each primary and secondary measure. The weighted average ratings are summarized in **Figure 18** which also provides a brief description of each performance measure. **Figure 18** represents the average for the entire corridor and any given segment or location could have a higher or lower rating than the corridor average.

Figure 17: Performance Summary by Primary Measure

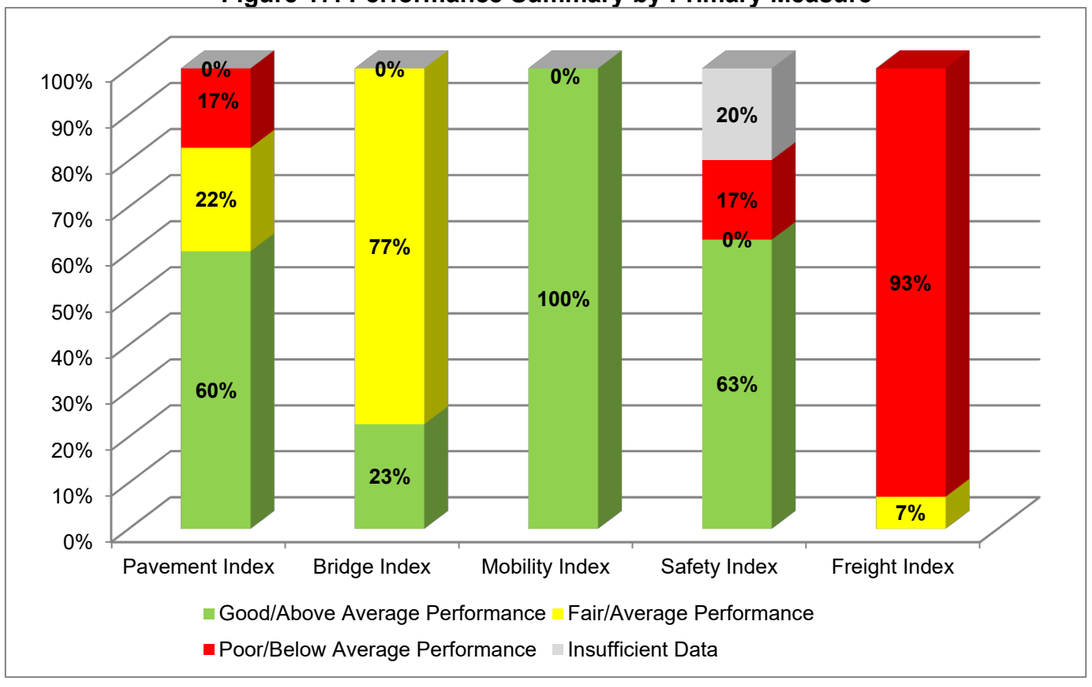


Figure 18: Corridor Performance Summary by Performance Measure

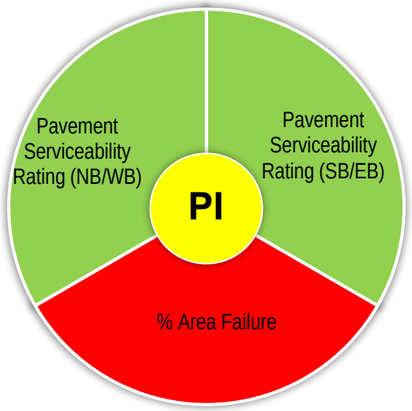
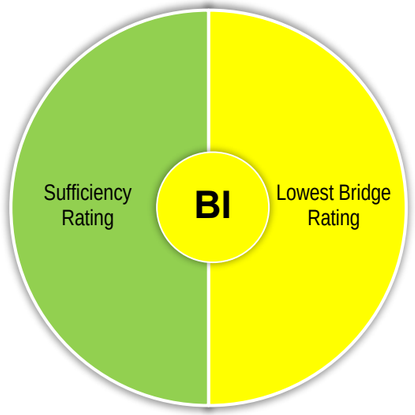
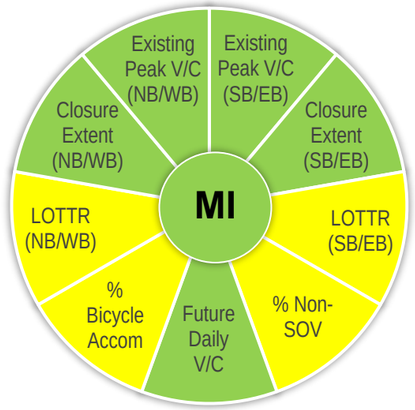
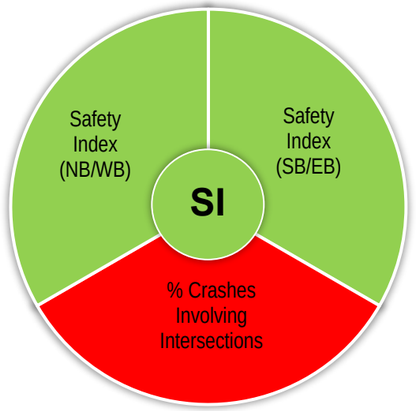
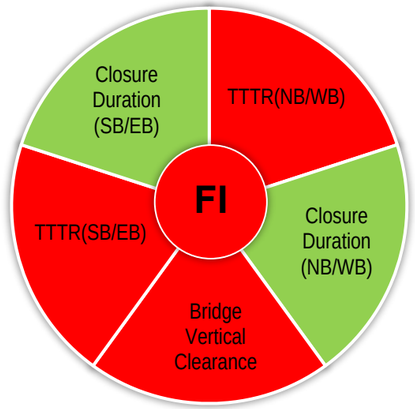
Pavement	Bridge	Mobility	Safety	Freight
				
Pavement Index (PI): based on three pavement condition ratings from the ADOT Pavement Database; the three ratings are the International Roughness Index (IRI), the Cracking Rating, and the Rutting Rating	**Bridge Index (BI):** based on four bridge condition ratings from the ADOT Bridge Database; the four ratings are the Deck Rating, Substructure Rating, Superstructure Rating, and Structural Evaluation Rating	**Mobility Index (MI):** an average of the existing daily volume-to-capacity (V/C) ratio and the projected long-term future daily V/C ratio	**Safety Index (SI):** combines the bi-directional frequency and rate of fatal and suspected serious injury crashes, compared to crash occurrences on roads with similar operating environments in Arizona	**Freight Index (FI):** a reliability performance measure based on the bi-directional Truck Travel Time Reliability (TTTR) for truck travel
➢ **Directional Pavement Serviceability Rating (PSR)** – the weighted average (based on number of lanes) of the PSR for the pavement in each direction of travel ➢ **% Area Failure** – the percentage of pavement area rated above failure thresholds for IRI or Cracking	➢ **Sufficiency Rating**– multipart rating includes structural adequacy and safety factors as well as functional aspects such as traffic volume and length of detour ➢ **Lowest Bridge Rating** –the lowest rating of the four bridge condition ratings on each segment	➢ **Future Daily V/C** – the future daily V/C ratio provides a measure of future congestion if no capacity improvements are made to the corridor ➢ **Existing Peak Hour V/C** – the existing peak hour V/C ratio for each direction of travel provides a measure of existing peak hour congestion during typical weekdays ➢ **Closure Extent** – the average number of instances a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel ➢ **Directional Level of Travel Time Reliability (LOTTR)** – the ratio of the 80th percentile peak period travel time to the 50th percentile peak period travel time for all vehicles ➢ **% Bicycle Accommodation** – the percentage of a segment that accommodates bicycle travel ➢ **% Non-Single Occupancy Vehicle (Non-SOV) Trips** –the percentage of trips that are taken by vehicles carrying more than one occupant	➢ **Directional Safety Index** – the combination of the directional frequency and rate of fatal and suspected serious injury crashes, compared to crash occurrences on roads with similar operating environments in Arizona ➢ **% of Fatal + Suspected Serious Injury Crashes at Intersections** – the percentage of total fatal and suspected serious injury crashes at intersections compared to the statewide average percentage on roads with similar operating environments ➢ **% of Fatal + Suspected Serious Injury Crashes Involving Lane Departures** – the percentage of total fatal and suspected serious injury crashes involving lane departures compared to the statewide average percentage on roads with similar operating environments	➢ **Directional TTTR** – the ratio of the 95th percentile peak period travel time to the 50th percentile peak period travel time for trucks ➢ **Closure Duration** – the average time a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel ➢ **Bridge Vertical Clearance** – the minimum vertical clearance over the travel lanes for underpass structures on each segment.

Table 11: Corridor Performance Summary by Segment and Performance Measure

Segment #	Segment Length (miles)	Pavement Performance Area				Bridge Performance Area			Mobility Performance Area									
		Pavement Index	Directional PSR		% Area Failure	Bridge Index	Sufficiency Rating	Lowest Bridge Rating	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent (instances/ milepost/year/mile)		Directional Max LOTTR (all vehicles)		% Bicycle Accommodation	% Non-Single Occupancy Vehicle (SOV) Trips
			NB/WB	SB/EB							NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB		
90-1[2*a]	5	3.27	4.10	4.01	80%	No Bridges			0.32	0.36	0.21	0.20	0.00	0.00	2.00	1.69	88%	11.2%
90-2[2*a]	10	3.67	4.36	3.99	50%	6.49	94.36	6	0.15	0.17	0.11	0.11	0.00	0.02	2.05	1.04	100%	11.9%
90-3[2*a]	7	2.80	3.40	3.12	88%	6.33	94.03	6	0.36	0.40	0.28	0.29	0.10	0.18	1.23	1.11	96%	15.0%
90-4[2^a]	5	3.39	3.01	3.35	30%	No Bridges			0.26	0.29	0.17	0.17	0.00	0.12	1.10	1.11	96%	15.4%
90-5[2*a]	7	2.96	2.93	2.89	71%	No Bridges			0.40	0.44	0.31	0.30	0.14	0.03	1.22	1.38	26%	18.5%
90-6[2*a]	12	3.68	3.45	3.39	17%	6.60	93.22	5	0.31	0.34	0.25	0.25	0.15	0.05	1.10	1.10	3%	15.0%
80-7[2^a]	5	4.20	3.91	3.96	0%	5.85	73.37	5	0.41	0.26	0.42	0.43	0.50	0.10	1.07	1.16	0%	14.6%
80-8[1*a]	6	2.88	2.84	3.12	88%	5.92	71.56	5	0.21	0.13	0.25	0.22	0.20	0.54	1.17	1.13	43%	15.8%
80-9[2^a]	12	3.62	3.68	3.66	50%	6.02	77.46	5	0.09	0.04	0.15	0.17	0.40	0.90	1.11	1.19	88%	10.9%
80-10[2*a]	8	3.60	3.50	3.64	50%	5.00	86.30	5	0.10	0.07	0.13	0.13	0.00	0.05	1.21	1.07	97%	14.0%
Weighted Corridor Average		3.44	3.55	3.52	50%	6.07	81.37	5.24	0.24	0.24	0.22	0.22	0.16	0.23	1.32	1.18	63%	14.0%

SCALES

Performance Level	Non-Interstate		All			Urban and Fringe Urban	All	Uninterrupted	All	All
Good/Above Average	> 3.50	< 5%	> 6.5	> 80	> 6	< 0.71	< 0.22	< 1.15	> 90%	> 17%
Fair/Average	2.90 - 3.50	5% - 20%	5.0 - 6.5	50 - 80	5 - 6	0.71 - 0.89	0.22 - 0.62	1.15 - 1.5	60% - 90%	11% - 17%
Poor/Below Average	< 2.90	> 20%	< 5.0	< 50	< 5	> 0.89	> .62	> 1.5	< 60%	< 11%

Performance Level	Rural
Good/Above Average	< 0.56
Fair/Average	0.56 - 0.76
Poor/Below Average	> 0.76

^Uninterrupted Flow Facility
*Interrupted Flow Facility
[a]2 or 3 or 4 Lane Divided Highway
[b]4 or 5 Lane Undivided Highway
[c]2 or 3 Lane Undivided Highway
[1]Urban Operating Environment
[2]Rural Operating Environment

Table 11: Corridor Performance Summary by Segment and Performance Measure (continued)

Segment #	Segment Length (miles)	Safety Performance Area								Freight Performance Area						
		Safety Index	Directional Safety Index		% of Fatal + Suspected Serious Injury Crashes at Intersections	% of Fatal + Suspected Serious Injury Crashes Involving Lane Departures	% of Fatal + Suspected Serious Injury Crashes Involving Pedestrians	% of Segment Fatal + Suspected Serious Injury Crashes Involving Trucks	% of Segment Fatal + Suspected Serious Injury Crashes Involving Bicycles	Freight TTTR	Directional Max TTTR		Combined Average Peak TTTR	Average Minutes Per Year Given Milepost Is Closed Per Segment Mile (NB/EB)		Bridge Vertical Clearance (feet)
			NB/WB	SB/EB							NB/WB	SB/EB		NB/WB	SB/EB	
90-1[2*a]	5	0.77	0.08	1.45	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	5.06	2.75	7.37	5.06	0.00	0.00	No UP
90-2[2*a]	10	0.04	0.04	0.04	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	4.85	8.62	1.08	4.85	0.00	1.33	No UP
90-3[2*a]	7	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.69	1.87	1.52	1.69	10.25	20.33	No UP
90-4[2^a]	5	0.04	0.08	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.34	1.42	1.25	1.34	0.00	14.76	No UP
90-5[2*a]	7	1.63	0.93	2.32	61.1%	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	2.05	1.86	2.23	2.05	12.00	6.83	No UP
90-6[2*a]	12	0.18	0.16	0.21	42.9%	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.35	1.40	1.30	1.35	10.00	3.00	No UP
80-7[2^a]	5	1.93	1.95	1.92	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.45	1.25	1.65	1.45	156.07	15.57	No UP
80-8[1*a]	6	1.82	1.81	1.83	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.45	1.48	1.42	1.45	36.77	109.34	13.95
80-9[2^a]	12	0.00	0.00	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.92	1.37	2.48	1.92	95.00	102.20	No UP
80-10[2*a]	8	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.84	2.38	1.29	1.84	0.00	3.00	No UP
Weighted Corridor Average		0.84	0.52	0.79	50%	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	2.29	2.59	2.00	2.29	31.31	29.75	13.95

SCALES

Performance Level	2 or 3 or 4 Lane Divided Highway					Uninterrupted	All	
Good/Above Average	< 0.81	< 23.4%	< 56.4%	< 16%	< 3.7%	< 0%	< 1.15	< 44.18	> 16.5
Fair/Average	0.81 - 1.19	23.4% - 29.3%	56.4% - 65.0%	16% - 26%	3.7% - 9.9%	0% - 2%	1.15 - 1.35	44.18-124.86	16.0 - 16.5
Poor/Below Average	> 1.19	> 29.3%	> 65.0%	> 26%	> 9.9%	> 2%	> 1.35	> 124.86	< 16.0
Performance Level	**2 or 3 Lane Undivided Highway**					**Interrupted**		
Good/Above Average	< 0.92	< 11.2%	< 66.9%	< 3.8%	< 4.2%	< 0%	< 1.45		
Fair/Average	0.92 - 1.08	11.2% - 15.6%	66.9% - 74.5%	3.8% - 7.2%	4.2% - 8.0%	0% - 3.3%	1.45 – 1.85		
Poor/Below Average	> 1.08	> 15.6%	> 74.5%	> 7.2%	> 8.0%	> 3.3%	> 1.85		
Performance Level	**4 or 5 Undivided Highway**							
Good/Above Average	< 0.78	< 43.8%	< 21.1%	< 8.8%	< 0.8%	< 0.5%		
Fair/Average	0.78 - 1.22	43.8% - 49.5%	21.1% - 32.1%	8.8% - 13.5%	0.8% - 5.5%	0.5% - 3.8%		
Poor/Below Average	> 1.22	> 49.5%	> 32.1%	> 13.5%	> 5.5%	> 3.8%		

^Uninterrupted Flow Facility
*Interrupted Flow Facility
[a]2 or 3 or 4 Lane Divided Highway
[b]4 or 5 Lane Undivided Highway
[c]2 or 3 Lane Undivided Highway
[1]Urban Operating Environment
[2]Rural Operating Environment

Notes: *"Insufficient Data" indicates there was not enough data available to generate reliable performance ratings*
"No UP" indicates no underpasses are present in the segment

3.0 NEEDS ASSESSMENT

3.1 Corridor Objectives

Statewide goals and performance measures were established by the ADOT Long-Range Transportation Plan (LRTP) 2016-2040 goals and objectives that were updated in 2018. Statewide performance goals that are relevant to SR 90/SR 80 performance areas were identified and corridor goals were then formulated for each of the five performance areas that aligned with the overall statewide goals established by the LRTP. Based on stakeholder input, corridor goals, corridor objectives, and performance results, three “emphasis areas” were identified for the SR 90/SR 80 corridor: Pavement, Safety, and Freight.

Taking into account the corridor goals and identified emphasis areas, performance objectives were developed for each quantifiable performance measure that identify the desired level of performance based on the performance scale levels for the overall corridor and for each segment of the corridor. For the performance emphasis areas, the corridor-wide weighted average performance objectives are identified with a higher standard than for the other performance areas. **Table 12** shows the SR 90/SR 80 corridor goals, corridor objectives, and performance objectives, and how they align with the statewide goals.

It is not reasonable within a financially constrained environment to expect that every performance measure will always be at the highest levels on every corridor segment. Therefore, individual corridor segment objectives have been set as “fair/average” or better and should not fall below that standard.

Achieving corridor and segment performance objectives will help ensure that investments are targeted toward improvements that support the safe and efficient movement of travelers on the corridor. Addressing current and future congestion, thereby improving mobility on congested segments, will also help the corridor fulfill its potential as a significant contributor to the region’s economy.

Corridor performance is measured against corridor and segment objectives to determine needs – the gap between observed performance and performance objectives.

Goal achievement will improve or reduce current and future congestion, increase travel time reliability, and reduce fatalities and incapacitating injuries resulting from vehicle crashes. Where performance is currently rated “good”, the goal is always to maintain that standard, regardless of whether or not the performance is in an emphasis area.

Table 12: Corridor Performance Goals and Objectives

ADOT Statewide LRTP Goals	SR 90/SR 80 Corridor Goals	SR 90/SR 80 Corridor Objectives	Performance Area	Primary Measure / Secondary Measure Indicators	Performance Objective: Corridor Average	Performance Objective: Segment
Improve Mobility, Reliability, and Accessibility **Make Cost-Effective Investment Decisions and Support Economic Vitality**	Improve mobility through additional capacity and improved roadway geometry Provide a safe and reliable route for recreational and tourist travel Provide safe, reliable and efficient connection to all communities along the corridor to permit efficient regional travel Implement critical/cost-effective investments to improve access to multimodal transportation	Reduce current congestion and plan to facilitate future congestion that accounts for anticipated growth Reduce delays from recurring and non-recurring events to improve reliability Emphasize the deployment of technology to optimize existing system capacity and performance Support and facilitate better accessibility to the statewide multimodal transportation system	Mobility	Mobility Index	Fair or better	Fair or better
				Future Daily V/C		
				Existing Peak Hour V/C		
				Closure Extent		
				Directional Level of Travel Time Reliability		
				% Bicycle Accommodation		
				% Non-SOV Trips		
	Provide a safe, reliable, and efficient freight route	Implement the most cost-effective transportation solutions Reduce delays and restrictions to freight movement to improve reliability Improve travel time reliability (including impacts to motorists due to freight traffic)	Freight *(Emphasis Area)*	Freight Index	Good	Fair or better
				Truck Travel Time Reliability		
				Closure Duration		
				Bridge Vertical Clearance		
Preserve and Maintain the State Transportation System	Maintain, preserve, extend the service life, and modernize State Transportation System infrastructure	Maintain structural integrity of bridges	Bridge	Bridge Index	Fair or better	Fair or better
				Sufficiency Rating		
				Lowest Bridge Rating		
		Improve pavement ride quality for all corridor users Reduce long-term pavement maintenance costs	Pavement (*Emphasis Area*)	Pavement Index	Good	Fair or better
				Directional Pavement Serviceability Rating		
				% Area Failure		
Enhance Safety and Security	Provide a safe, reliable, and efficient connection for the communities along the corridor Improve transportation system safety for all modes	Reduce the number and rate of fatal and incapacitating injury crashes for all roadway users	Safety *(Emphasis Area)*	Safety Index	Above Average	Average or better
				Directional Safety Index		
				% of Fatal + Suspected Serious Injury Crashes at Intersections		
				% of Fatal + Suspected Serious Injury Crashes Involving Lane Departures		
				% of Fatal + Suspected Serious Injury Crashes Involving Pedestrians		
				% of Fatal + Suspected Serious Injury Crashes Involving Trucks		
				% of Fatal + Suspected Serious Injury Crashes Involving Bicycles		

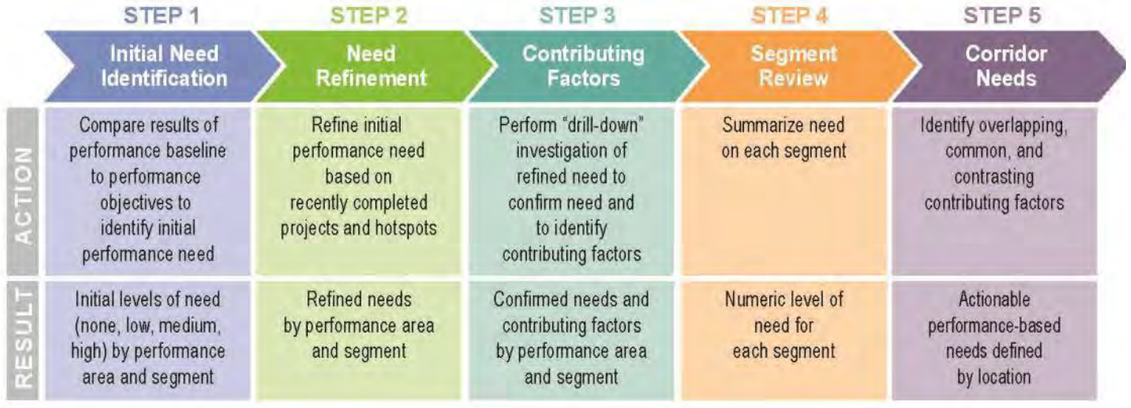
3.2 Needs Assessment Process

The following guiding principles were used as an initial step in developing a framework for the performance-based needs assessment process:

- Corridor needs are defined as the difference between the corridor performance and the performance objectives
- The needs assessment process should be systematic, progressive, and repeatable, but also allow for engineering judgment where needed
- The process should consider all primary and secondary performance measures developed for the study
- The process should develop multiple need levels including programmatic needs for the entire length of the corridor, performance area-specific needs, segment-specific needs, and location-specific needs (defined by MP limits)
- The process should produce actionable needs that can be addressed through strategic investments in corridor preservation, modernization, and expansion

The performance-based needs assessment process is illustrated in **Figure 19** and described in the following sections.

Figure 19: Needs Assessment Process



Step 1: Initial Needs Identification

The first step in the needs assessment process links baseline (existing) corridor performance with performance objectives. In this step, the baseline corridor performance is compared to the performance objectives to provide a starting point for the identification of performance needs. This mathematical comparison results in an initial need rating of None, Low, Medium, or High for each primary and secondary performance measure. An illustrative example of this process is shown below in **Figure 20**.

Figure 20: Initial Need Ratings in Relation to Baseline Performance (Bridge Example)

Performance Thresholds	Performance Level	Initial Level of Need	Description
6.5	Good	None*	All levels of Good and top 1/3 of Fair (>6.0)
	Good		
	Good		
	Fair		
	Fair	Low	Middle 1/3 of Fair (5.5-6.0)
5.0	Fair	Medium	Lower 1/3 of Fair and top 1/3 of Poor (4.5-5.5)
	Poor		
	Poor	High	Lower 2/3 of Poor (<4.5)
	Poor		

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

The initial level of need for each segment is refined to account for hot spots and recently completed or under construction projects, resulting in a final level of need for each segment. The final levels of need for each primary and secondary performance measure are combined to produce a weighted final need rating for each segment. Values of 0, 1, 2, and 3 are assigned to the initial need levels of None, Low, Medium, and High, respectively. A weight of 1.0 is applied to the Performance Index need and equal weights of 0.20 are applied to each need for each secondary performance measure. For directional secondary performance measures, each direction of travel receives a weight of 0.10.

Step 2: Need Refinement

In Step 2, the initial level of need for each segment is refined using the following information and engineering judgment:

- For segments with an initial need of None that contain hot spots, the level of need should be increased from None to Low
- For segments with an initial level of need where recently completed projects or projects under construction are anticipated to partially or fully address the identified need, the level of need should be reduced or eliminated as appropriate
-

- Programmed projects that are expected to partially or fully address an identified need are not justification to lower the initial need because the programmed projects may not be implemented as planned; in addition, further investigations may suggest that changes in the scope of a programmed project may be warranted

The resulting final needs are carried forward for further evaluation in Step 3.

Step 3: Contributing Factors

In Step 3, a more detailed review of the condition and performance data available from ADOT is conducted to identify contributing factors to the need. Typically, the same databases used to develop the baseline performance serve as the principal sources for the more detailed analysis. However, other supplemental databases may also be useful sources of information. The databases used for diagnostic analysis are listed below:

Pavement Performance Area

- Pavement Rating Database

Bridge Performance Area

- ABISS

Mobility Performance Area

- Highway Performance Monitoring System (HPMS) Database
- AZTDM
- Real-time traffic conditions data produced by INRIX Database
- Highway Conditions Reporting System (HCRS) Database

Safety Performance Area

- Crash Database

Freight Performance Area

- INRIX Database
- HCRS Database

In addition, other sources considered helpful in identifying contributing factors are:

- Maintenance history (from ADOT PeCoS database for pavement), the level of past investments, or trends in historical data that provide context for pavement and bridge history
- Field observations from ADOT district personnel can be used to provide additional information regarding a need that has been identified
- Previous studies can provide additional information regarding a need that has been identified
- Maintenance history, the level of past investments, or trends in historical data that provide context for pavement and bridge history. (ADOT PeCoS data results from the original ADOT CPS studies were used for pavement; updated PeCoS information is not regularly at the time of completion of the updated assessments)

Step 3 results in the identification of performance-based needs and contributing factors by segment (and MP locations, if appropriate) that can be addressed through investments in preservation, modernization, and expansion projects to improve corridor performance. See **Appendix D** for more information.

Step 4: Segment Review

In this step, the needs identified in Step 2 and refined in Step 3 are quantified for each segment to numerically estimate the level of need for each segment. Values of 0 to 3 are assigned to the final need levels (from Step 3) of None, Low, Medium, and High, respectively. A weighting factor is applied to the performance areas identified as emphasis areas and a weighted average need is calculated for each segment. The resulting average need score can be used to compare levels of need between segments within a corridor and between segments in different corridors.

Step 5: Corridor Needs

In this step, the needs and contributing factors for each performance area are reviewed on a segment-by-segment basis to identify actionable needs and to facilitate the formation of solution sets that address multiple performance areas and contributing factors. The intent of this process is to identify overlapping, common, and contrasting needs to help develop strategic solutions. This step results in the identification of corridor needs by specific location.

3.3 Corridor Needs Assessment

This section documents the results of the needs assessment process described in the prior section. The needs in each performance area were classified as either None, Low, Medium, or High based on how well each segment performed in the existing performance analysis. The needs for each segment were numerically combined to estimate the average level of need for each segment of the corridor.

The final needs assessments for each performance measure, along with the scales used in analysis, are shown in **Table 13** through **Table 17**.

Pavement Needs Refinement and Contributing Factors

- Hot spots are present in every segment along the corridor except for Segment 80-7
- There is one segment along the corridor with potential pavement repetitive historical investment issues: Segments 90-1
- See **Appendix D** for detailed information on contributing factors

Table 13: Final Pavement Needs

Segment #	Performance Score and Level of Need				Initial Segment Need	Hot Spots	Recently Completed Projects	Final Segment Need
	Pavement Index	Directional PSR		% Area Failure				
		NB	SB					
90-1	3.27	4.10	4.01	80%	1.60	MP290-MP292 Both; MP292-MP203 NB; MP293-MP294 Both; MP294-MP295 NB	Pavement Preservation project MP 289.66-298.09 awarded 6/17/2022 F0396	Medium
90-2	3.67	4.36	3.99	50%	0.60	MP295-MP296 Both; MP296-MP297 SB; MP298-MP304 SB	Pavement Preservation project MP 289.66-298.09 F0396 awarded 6/17/2022 Pavement Rehabilitation project MP 298.0-299.0 awarded 5/20/2022 F0356	Low
90-3	2.80	3.40	3.12	88%	2.70	MP 304-306 SB; MP 306-312 Both	Pavement Rehabilitation project MP 306.0-307.0 awarded 5/20/2022 F0356	High
90-4	3.39	3.01	3.35	30%	0.80	MP312-MP313 Both; MP313-MP314 SB	None	Low
90-5	2.96	2.93	2.89	71%	3.00	MP 317-MP318 Both; MP318-MP320 NB; MP320-MP322 Both; MP322-MP324 SB	None	High
90-6	3.68	3.45	3.39	17%	0.40	MP324-MP326 SB; MP328- MP329 Both	None	Low
80-7	4.20	3.91	3.96	0%	0.00	None	None	None
80-8	2.88	2.84	3.12	88%	2.90	MP339-MP340 Both; MP340-MP341 SB; MP341-MP344 Both; MP344-MP 345 SB	None	High
80-9	3.62	3.68	3.66	50%	0.60	MP345-MP357 SB	None	Low
80-10	3.60	3.50	3.64	50%	0.60	MP357-MP365 SB	None	Low

Need Scales for Highways (Non-Interstates)				
Level of Need (Score)	**Performance Score Need Scale**			**Segment Level Need Scale**
None* (0)	> 3.33	> 3.30	< 10%	0
Low (1)	3.07 - 3.33	3.30 - 3.10	10% - 15%	< 1.5
Medium (2)	2.53 - 3.07	3.10 - 2.70	15% - 25%	1.5 - 2.5
High (3)	< 2.53	< 2.70	> 25%	> 2.5

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Bridge Needs Refinement and Contributing Factors

- No changes were made to the level of need to account for hot spots or recently completed projects
- Two bridges are hot spots along the corridor:
  - Lewis Springs OP (#470, MP 328.85) in Segment 90-6 is a bridge hot spot due to deck and substructure ratings of 5 and it does have potential repetitive historical investment issues
  - Bridge (#235, MP 349.28) in Segment 80-9 is a bridge hot spot due to deck and substructure ratings of 5 and it does have potential repetitive historical investment issues
- There are seven bridges along the corridor with potential historical investment issues
- See **Appendix D** for detailed information on contributing factors

Table 14: Final Bridge Needs

Segment #	Performance Score and Level of Need			Initial Segment Need	Hot Spots	Recently Completed Projects	Final Segment Need
	Bridge Index	Sufficiency Rating	Lowest Bridge Rating				
90-1	No Bridges	No Bridges	No Bridges	None	No Bridges	None	None
90-2	6.49	94.36	6.00	0.0	None	None	None
90-3	6.33	94.03	6.00	0.0	None	None	None
90-4	No Bridges	No Bridges	No Bridges	None	No Bridges	None	None
90-5	No Bridges	No Bridges	No Bridges	None	No Bridges	None	None
90-6	6.60	93.22	5.00	0.2	Lewis Springs OP (#470) (MP 328.85)	None	Low
80-7	5.85	73.37	5.00	1.2	None	None	Low
80-8	5.92	71.56	5.00	1.2	None	None	Low
80-9	6.02	77.46	5.00	0.2	Bridge (#235) (MP 349.28)	None	Low
80-10	5.00	86.30	5.00	2.2	None	None	Medium

Level of Need (Score)	Performance Score Need Scale			Segment Level Need Scale
None (0)	≥ 6.0	≥ 70	> 5	0
Low (1)	5.5 - 6.0	60 - 70	5	< 1.5
Medium (2)	4.5 - 5.5	40 - 60	4	1.5 - 2.5
High (3)	≤ 4.5	≤ 40	< 4	> 2.5

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Mobility Needs Refinement and Contributing Factors

- There are two recently completed projects along the corridor in Segments 90-5 and 80-7 but no changes were made to the level of need for either segment
- See **Appendix D** for detailed information on contributing factors

Table 15: Final Mobility Needs

Segment #	Performance Score and Level of Need									Initial Segment Need	Recently Completed Projects	Final Segment Need
	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent		Directional LOTTR		% Bicycle Accommodation			
			NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB				
90-1[b]	0.32	0.36	0.21	0.20	0.00	0.00	2.00	1.69	88%	0.6	None	Low
90-2[b]	0.15	0.17	0.11	0.11	0.00	0.02	2.05	1.04	100%	0.3	None	Low
90-3[b]	0.36	0.40	0.28	0.29	0.10	0.18	1.23	1.11	96%	0.0	None	None
90-4[a]	0.26	0.29	0.17	0.17	0.00	0.12	1.10	1.11	96%	0.0	None	None
90-5[b]	0.40	0.44	0.31	0.30	0.14	0.03	1.22	1.38	26%	0.7	FY17 - Construct additional turn lanes at SR 90/ SR90 Bypass/Hatfield Street intersection at MP 317.2	Low
90-6[b]	0.31	0.34	0.25	0.25	0.15	0.05	1.10	1.10	3%	0.6	None	Low
80-7[a]	0.41	0.26	0.42	0.43	0.50	0.10	1.07	1.16	0%	0.8	FY 19- Construct edge line rumble strips or shoulder rumble strips between MP 329-329.5, Mp330-330.5, Mp334.4-335, Construct alignment delineation and lighting between MP 330- 330.5	Low
80-8[b]	0.21	0.13	0.25	0.22	0.20	0.54	1.17	1.13	43%	0.8	None	Low
80-9[a]	0.09	0.04	0.15	0.17	0.40	0.90	1.11	1.19	88%	0.0	None	Low
80-10[b]	0.10	0.07	0.13	0.13	0.00	0.05	1.21	1.07	97%	0.0	None	None

Level of Need (Score)	Performance Score Need Scale				Segment Level Need Scale
None* (0)	≤ 0.77 (Urban) ≤ 0.63 (Rural)	< 0.35	< 1.27[a] < 1.27[b]	> 80%	0
Low (1)	0.77 - 0.83 (Urban) 0.63 - 0.69 (Rural)	0.35 - 0.49	1.27 - 1.38[a] 1.27 - 1.38[b]	70% - 80%	< 1.5
Medium (2)	0.83 - 0.95 (Urban) 0.69 - 0.83 (Rural)	0.49 - 0.75	1.38 - 1.62[a] 1.38 - 1.62[b]	50% - 70%	1.5 - 2.5
High (3)	≥ 0.95 (Urban) ≥ 0.83 (Rural)	> 0.75	> 1.62[a] > 1.62[b]	< 50%	> 2.5

a: Uninterrupted Flow
b: Interrupted Flow

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Safety Needs Refinements and Contributing Factors

- Segments 90-3 and 80-10 had insufficient data to generate reliable performance scores
- Safety hot spots were identified in segments 90-3 and 90-5
- Segment 90-5 has a high initial level of need due to a high percentage of suspected serious injury crashes at intersections
- At the overall corridor level, over 78% of the crashes identified in segment 90-5 involved a collision with Motor Vehicle
- There are a few recently completed projects along the corridor but they did not substantially affect the overall segment performance so no changes were made to the level of need
- See **Appendix D** for detailed information on contributing factors

Table 16: Final Safety Needs

Segment #	Performance Score and Level of Need								Initial Segment Need	Hot Spots	Recently Completed Projects	Final Segment Need
	Safety Index	Directional Safety Index		% of Fatal + Suspected Serious Injury Crashes at Intersections	% of Fatal + Suspected Serious Injury Crashes Involving Lane Departures	% of Fatal + Suspected Serious Injury Crashes Involving Pedestrians	% of Fatal + Suspected Serious Injury Crashes Involving Trucks	% of Fatal + Suspected Serious Injury Crashes Involving Bicycles				
		NB/EB	SB/WB									
90-1[a]	0.77	0.08	1.45	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.3	0	None	Low
90-2[a]	0.04	0.04	0.04	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.0	0	None	None
90-3[a]	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.0	MP 308-309	None	N/A
90-4[b]	0.04	0.08	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.0	0	None	None
90-5[b]	1.63	0.93	2.32	61%	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	4.0	MP 319-323	Construct shoulder improvements (both directions) on four segments between MP 323-332 and MP 334-336.5.	High
90-6[c]	0.18	0.16	0.21	43%	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.6	0	Construct edge line rumble strips or shoulder rumble strips between MP 329-329.5, MP 330-330.5, MP 334.5-335. Construct alignment delineation and lighting between MP 330-330.5. Construct shoulder improvements (both directions) on four segments between MP 323-332 and MP 334-336.5.	Low
80-7[c]	1.93	1.95	1.92	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	3.6	0	None	High

Table 16: Final Safety Needs (continued)

Segment #	Performance Score and Level of Need								Initial Segment Need	Hot Spots	Recently Completed Projects	Final Segment Need
	Safety Index	Directional Safety Index		% of Fatal + Suspected Serious Injury Crashes at Intersections	% of Fatal + Suspected Serious Injury Crashes Involving Lane Departures	% of Fatal + Suspected Serious Injury Crashes Involving Pedestrians	% of Fatal + Suspected Serious Injury Crashes Involving Trucks	% of Fatal + Suspected Serious Injury Crashes Involving Bicycles				
		NB/EB	SB/WB									
80-8[c]	1.82	1.81	1.83	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	3.6	0	Mule Pass Tunnel lighting MP 339-339.5	High
80-9[c]	0.00	0.00	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.0	0	None	None
80-10[a]	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.0	0	None	N/A

Level of Need (Score)		Performance Score Needs Scale						Segment Level Need Scale
None* (0)	a	≤ 0.94	≤ 25%	≤ 59%	≤ 3%	≤ 6%	≤ 1%	0
	b	≤ 0.93	≤ 46%	≤ 25%	≤ 10%	≤ 2%	≤ 2%	
	c	≤ 0.97	≤ 13%	≤ 69%	≤ 5%	≤ 5%	≤ 1%	
Low (1)	a	0.94 - 1.07	25% - 27%	59% - 62%	3% - 3%	6% - 8%	1% - 2%	≤ 1.5
	b	0.93 - 1.08	46% - 48%	25% - 29%	10% - 12%	2% - 4%	2% - 3%	
	c	0.97 - 1.02	13% - 14%	69% - 72%	5% - 6%	5% - 6%	1% - 2%	
Medium (2)	a	1.07 - 1.32	27% - 31%	62% - 68%	3% - 4%	8% - 12%	2% - 3%	1.5 - 2.5
	b	1.08 - 1.37	48% - 52%	29% - 36%	12% - 15%	4% - 7%	3% - 5%	
	c	1.02 - 1.13	14% - 17%	72% - 77%	6% - 8%	6% - 9%	2% - 4%	
High (3)	a	≥ 1.33	≥ 31%	≥ 68%	≥ 4%	≥ 12%	≥ 3%	≥ 2.5
	b	≥ 1.37	≥ 52%	≥ 36%	≥ 15%	≥ 7%	≥ 5%	
	c	≥ 1.13	≥ 17%	≥ 77%	≥ 8%	≥ 9%	≥ 4%	

a: 2 or 3 or 4 Lane Divided Highway
b: 4 or 5 Lane Undivided Highway
c: 2 or 3 Lane Undivided Highway

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Freight Needs Refinements and Contributing Factors

- Half of the corridor's segments have freight indexes indicating "High" levels of need for freight, all of which are due to travel time reliability - not closure or bridge issues. Of the remaining segments, only 90-6 has an initial need of "None".
- There are three bridge vertical clearance hot spots on the corridor all within Segment 80-8: Mule Pass Tunnel (#538, MP 339.06), Lowell RR UP ((#269, MP 343.01), and Lowell UP RR (#1033, MP 343.01)
- See **Appendix D** for detailed information on contributing factors

Table 17: Final Freight Needs

Segment #	Performance Score and Level of Need						Initial Segment Need*	Hot Spots	Relevant Recently Completed or Under Construction Projects (which supersede performance data)*	Final Segment Need*
	Freight Index	Directional TTTR		Closure Duration		Bridge Clearance				
		NB/WB	SB/EB	NB/WB	SB/EB					
90-1[a]	5.06	2.75	7.37	0.00	0.00	No UP	High	None	None	High
90-2[a]	4.85	8.62	1.08	0.00	1.33	No UP	High	None	None	High
90-3[a]	1.69	1.87	1.52	10.25	20.33	No UP	Low	None	None	Low
90-4[b]	1.34	1.42	1.25	0.00	14.76	No UP	Medium	None	None	Medium
90-5[a]	2.05	1.86	2.23	12.00	6.83	No UP	High	None	**FY17 MP 317.2** - Construct additional turn lanes at SR 90/ SR90 Bypass/Hatfield Street intersection	High
90-6[a]	1.35	1.40	1.30	10.00	3.00	No UP	None	None	None	None
80-7[b]	1.45	1.25	1.65	156.07	15.57	No UP	High	None	**FY 19 MP 330- 330.5** - Construct edge line rumble strips or shoulder rumble strips between MP 329-329.5, Mp330-330.5, Mp334.4-335, Construct alignment delineation and lighting	High
80-8[a]	1.45	1.48	1.42	36.77	109.34	13.95	Low	Mule Pass Tunnel (14.0 ft.); Lowell RR UP (both directions,13.95 ft. and 14.89 ft.)	None	Low
80-9[b]	1.92	1.37	2.48	95.00	102.20	No UP	High	None	None	High
80-10[a]	1.84	2.38	1.29	0.00	3.00	No UP	Medium	None	None	Medium

Level of Need (Score)		Performance Score Need Scale			Segment Level Need Scale
None* (0)	a	< 1.58	≤ 71.07	≥ 16.33	0
	b	≤ 1.22			
Low (1)	a	1.58 – 1.72	71.07 - 97.97	16.17 - 16.33	≤ 1.5
	b	1.22 – 1.28			
Medium (2)	a	1.72 – 1.98	97.97 - 151.75	15.83 - 16.17	1.5 - 2.5
	b	1.28 – 1.42			
High (3)	a	≥ 1.98	≥ 151.75	≤ 15.83	≥ 2.5
	b	≥ 1.42			

a: Interrupted Flow
b: Uninterrupted Flow

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Segment Review

The needs for each segment were combined to numerically estimate the average level of need for each segment of the corridor. **Table 18** provides a summary of needs for each segment across all performance areas, with the average need score for each segment presented in the last row of the table. A weighting factor of 1.5 is applied to the need scores of the performance areas identified as emphasis areas (Pavement, Safety, and Freight for the SR 90/SR 80 corridor). There is one segment with a High average need, five segments with a Medium average need and four segments with a Low average need.

Table 18: Summary of Needs by Segment

Performance Area	Segment Number and Mileposts (MP)									
	90-1	**90-2**	**90-3**	**90-4**	**90-5**	**90-6**	**80-7**	**80-8**	**80-9**	**80-10**
	MP 290-295	**MP 295-304**	**MP 304-312**	**MP 312-317**	**MP 317-324**	**MP 324-336**	**MP 333-339**	**MP 339-345**	**MP 345-357**	**MP 357-365**
Pavement*	Medium	Low	High	Low	High	Low	None	High	Low	Low
Bridge	None	None	None	None	None	Low	Low	Low	Low	Medium
Mobility	Low	Low	None	None	Low	Low	Low	Low	None	None
Safety*	Low	None	N/A	None	High	Low	High	High	None	N/A
Freight*	High	High	Low	Medium	High	None	High	Low	High	Medium
Average Need	**1.31**	**1.08**	**0.92**	**0.69**	**2.23**	**0.77**	**1.69**	**1.92**	**1.08**	**1.00**

* Identified as Emphasis Area
# N/A indicates insufficient or no data available to determine level of need
+ A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study

Level of Need	Average Need Range
None+	< 0.1
Low	0.1 - 1.0
Medium	1.0 - 2.0
High	> 2.0

Summary of Corridor Needs

The needs in each performance area are shown in **Figure 21** and summarized below:

Pavement Needs

- Nine segments (90-1 through 90-6 and 80-8 through 80-10) contain Pavement hot spots
- Segments 90-3, 90-5 and 80-8 have final needs of High; Segment 90-1 has a final need of Medium; Segments 90-2, 90-4, 90-6, 80-9 and 80-10 have final needs of Low; Segment 80-7 has a final need of None
- Segments 90-1 was identified as having potential pavement repetitive historical investment issues

Bridge Needs

- Two segments (90-6 and 80-9) have bridge hot spots and they both have potential repetitive historical investment issues
- Segments 90-1, 90-4, and 90-5 do not contain any bridges
- Segment 80-10 has a final need of Medium; Segments 90-6 through 80-9 have final needs of Low; all other segments on the corridor have a final need of None

Mobility Needs

- Segments 90-3 and 90-4 have a final segment need of None; all other segments on the corridor have a final segment need of Low
- Mobility needs are primarily related to high directional LOTTR, closure extent and lack of bicycle accommodation

Safety Needs

- Segments 90-5, 80-7 and 80-8 have final segment needs of High; Segment 90-3 and 80-10 have a final segment need of N/A due to insufficient data to generate reliable ratings; Segments 90-2, 90-4, and 80-9 has final segment needs of None; all other segments on the corridor have a final need of Low
- Safety hot spots exist in Segments 90-3 and 90-5
- There is insufficient data to generate reliable ratings for the secondary measures including Strategic Traffic Safety Plan Emphasis Area crashes involving lane departures, pedestrians, trucks, and bicycles

Freight Needs

- There are three bridge vertical clearance hot spots along the corridor: Mule Pass Tunnel and Lowell RR UP (both directions)
- Segments 90-1, 90-2, 90-5, 80-7 and 80-9 have a final segment need of High while Segments 90-4 and 80-10 have a final segment need of Medium; all other segments on the corridor have a final segment need of Low or None

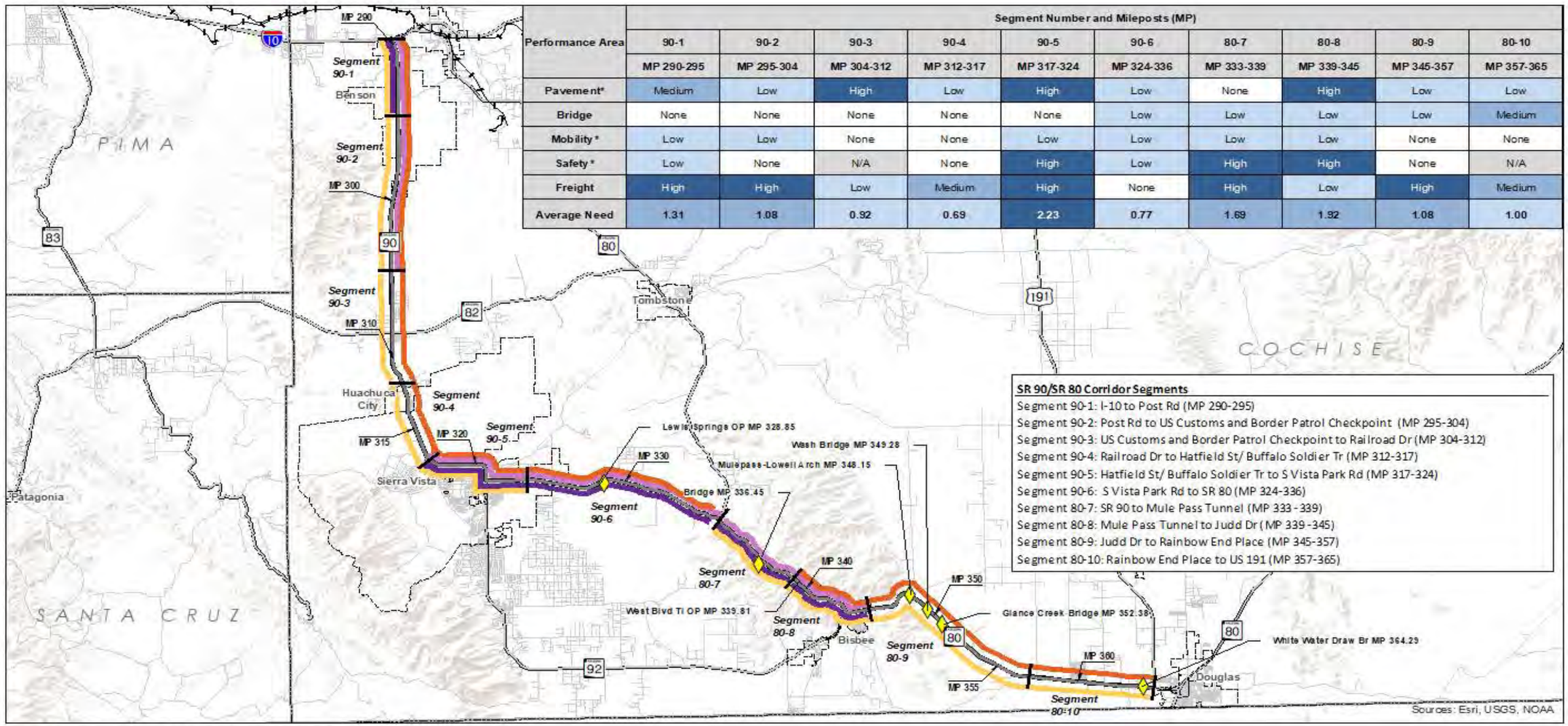
Overlapping Needs

This section identifies overlapping performance needs on the SR 90/SR 80 corridor, which provides guidance to develop strategic solutions that address more than one performance area with elevated levels of need (i.e., Medium or High). Completing projects that address multiple needs presents the opportunity to more effectively improve overall performance. A summary of the overlapping needs that relate to locations with elevated levels of need is provided below:

- Segment 90-1 contains elevated needs in the Pavement and Freight performance areas
- Segment 90-5 contains elevated needs in the Pavement, Safety and Freight performance areas
- Segment 80-7 contains elevated needs in the Safety and Freight performance areas
- Segment 80-8 contains elevated needs in the Pavement and Safety performance areas
- Segment 80-10 contains elevated needs in the Bridge and Freight performance areas

Figure 21: Corridor Needs Summary

Performance Area	Segment Number and Mileposts (MP)									
	90-1	90-2	90-3	90-4	90-5	90-6	80-7	80-8	80-9	80-10
	MP 290-295	MP 295-304	MP 304-312	MP 312-317	MP 317-324	MP 324-336	MP 333-339	MP 339-345	MP 345-357	MP 357-365
Pavement*	Medium	Low	High	Low	High	Low	None	High	Low	Low
Bridge	None	None	None	None	None	Low	Low	Low	Low	Medium
Mobility*	Low	Low	None	None	Low	Low	Low	Low	None	None
Safety*	Low	None	N/A	None	High	Low	High	High	None	N/A
Freight	High	High	Low	Medium	High	None	High	Low	High	Medium
Average Need	1.31	1.08	0.92	0.69	2.23	0.77	1.69	1.92	1.08	1.00



SR 90/SR 80 Corridor Segments

Segment 90-1: I-10 to Post Rd (MP 290-295)
Segment 90-2: Post Rd to US Customs and Border Patrol Checkpoint (MP 295-304)
Segment 90-3: US Customs and Border Patrol Checkpoint to Railroad Dr (MP 304-312)
Segment 90-4: Railroad Dr to Hatfield St/ Buffalo Soldier Tr (MP 312-317)
Segment 90-5: Hatfield St/ Buffalo Soldier Tr to S Vista Park Rd (MP 317-324)
Segment 90-6: S Vista Park Rd to SR 80 (MP 324-336)
Segment 80-7: SR 90 to Mule Pass Tunnel (MP 333 - 339)
Segment 80-8: Mule Pass Tunnel to Judd Dr (MP 339 - 345)
Segment 80-9: Judd Dr to Rainbow End Place (MP 345-357)
Segment 80-10: Rainbow End Place to US 191 (MP 357-365)

* Identified as Emphasis Areas for SR 90/SR 80 Corridor
# N/A indicates insufficient or no data available to determine level of need
* A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study

Miles
0 5 10
N

Corridor Segment
County Boundary
Interstate/Highway
City Boundary
Railroad

Performance Area Needs
Pavement
Mobility
Safety
Freight
Bridge

Level of Need	Average Need Range
None*	< 0.1
Low	0.1 - 1.0
Medium	1.0 - 2.0
High	> 2.0

SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Corridor Needs Summary

4.0 STRATEGIC SOLUTIONS

The principal objective of the CPS is to identify strategic solutions (investments) that are performance-based to ensure that available funding resources are used to maximize the performance of the State's key transportation corridors. One of the first steps in the development of strategic solutions is to identify areas of elevated levels of need (i.e., Medium or High). Addressing areas of Medium or High need will have the greatest effect on corridor performance and are the focus of the strategic solutions. Segments with Medium or High needs and specific locations of hot spots are considered strategic investment areas for which strategic solutions should be developed. Segments with lower levels of need or without identified hot spots are not considered candidates for strategic investment and are expected to be addressed through other ADOT programming processes. The SR 90/SR 80 strategic investment areas (resulting from the elevated needs) are shown in **Figure 22**.

4.1 Screening Process

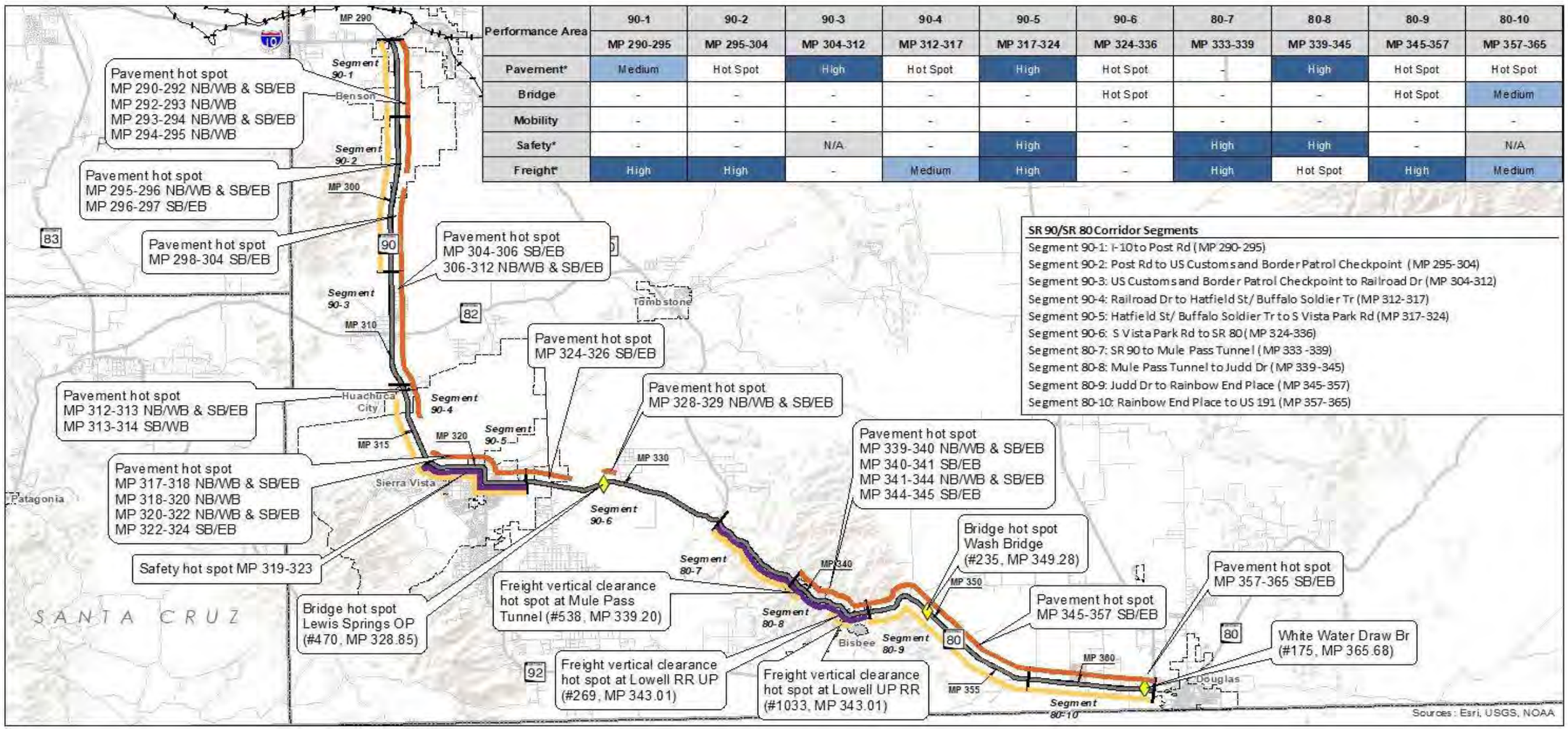
This section examines qualifying strategic needs and determines if the needs in those locations require action. In some cases, needs that are identified do not advance to solutions development and are screened out from further consideration because they have been or will be addressed through other measures, including:

- A project is programmed to address this need
- The need is a result of a Pavement or Bridge hot spot that does not show historical investment or rating issues; these hot spots will likely be addressed through other ADOT programming means
- A bridge is not a hot spot but is located within a segment with a Medium or High level of need; this bridge will likely be addressed through current ADOT bridge maintenance and preservation programming processes
- The need is determined to be non-actionable (i.e., cannot be addressed through an ADOT project)
- The conditions/characteristics of the location have changed since the performance data was collected that was used to identify the need

Table 19 notes if each potential strategic need advanced to solution development, and if not, the reason for screening the potential strategic need out of the process. Locations advancing to solutions development are marked with Yes (Y); locations not advancing are marked with No (N) and highlighted. This screening table provides specific information about the needs in each segment that will be considered for strategic investment. The table identifies the level of need – either Medium or High segment needs, or segments without Medium or High level of need that have a hot spot. Each area of need is assigned a location number in the screening table to help document and track locations considered for strategic investment.

Figure 22: Strategic Investment Areas

Performance Area	90-1	90-2	90-3	90-4	90-5	90-6	80-7	80-8	80-9	80-10
	MP 290-295	MP 295-304	MP 304-312	MP 312-317	MP 317-324	MP 324-336	MP 333-339	MP 339-345	MP 345-357	MP 357-365
Pavement*	Medium	Hot Spot	High	Hot Spot	High	Hot Spot	-	High	Hot Spot	Hot Spot
Bridge	-	-	-	-	-	Hot Spot	-	-	Hot Spot	Medium
Mobility	-	-	-	-	-	-	-	-	-	-
Safety*	-	-	N/A	-	High	-	High	High	-	N/A
Freight*	High	High	-	Medium	High	-	High	Hot Spot	High	Medium



SR 90/SR 80 Corridor Segments
Segment 90-1: I-10 to Post Rd (MP 290-295)
Segment 90-2: Post Rd to US Customs and Border Patrol Checkpoint (MP 295-304)
Segment 90-3: US Customs and Border Patrol Checkpoint to Railroad Dr (MP 304-312)
Segment 90-4: Railroad Dr to Hatfield St/ Buffalo Soldier Tr (MP 312-317)
Segment 90-5: Hatfield St/ Buffalo Soldier Tr to S Vista Park Rd (MP 317-324)
Segment 90-6: S Vista Park Rd to SR 80 (MP 324-336)
Segment 80-7: SR 90 to Mule Pass Tunnel (MP 333 -339)
Segment 80-8: Mule Pass Tunnel to Judd Dr (MP 339-345)
Segment 80-9: Judd Dr to Rainbow End Place (MP 345-357)
Segment 80-10: Rainbow End Place to US 191 (MP 357-365)

* Identified as Emphasis Areas for SR 90/SR 80 Corridor

Note: Figure shows strategic investment areas, which are segments with Medium and High levels of need and locations of hot spots. A "-" symbol indicates a segment level of need of Low or None, which is not considered strategic

Miles 0 5 10 N

Corridor Segment
County Boundary
Interstate/Highway
City Boundary
Railroad

Performance Area Needs
Pavement
Mobility
Safety
Freight
Bridge

Level of Need
Low
Medium
High

SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Strategic Investment Areas

Table 19: Strategic Investment Area Screening

Segment # and MP	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
90-1 (MP 290-295)	Medium	-	-	-	High	L1	Pavement	MP 290-295 has a Medium level of need due to fair performance scores for Pavement Index and poor % Area Failure ratings Hot spots MP 290-292,293-294, NB/WB MP 292-293, MP 293-294 and NB/WB MP 294-295	Y	Pavement hot spots show high historical investment so considered a strategic investment; likely will not be addressed by current ADOT processes
						L2	Freight	MP 290-295 has a High level of need based on the overall Freight Index and both directions of directional TTTR ratings	N	Need considered non-actionable because high Freight Index and TTTR scores are likely a result of travel times being skewed due to the vehicles and trucks parking at businesses adjacent to the roadway
90-2 (MP 295-304)	Hot Spot	-	-	-	High	L3	Pavement	Hot spot MP 295-296, SB/EB MP 296-297 and SB/EB MP 298-304	N	No high historical investment so not considered a strategic investment; will likely be addressed by current ADOT processes
						L4	Freight	MP 295-304 has a has a High level of need due to poor performance scores for Freight Index and NB/WB directional TTTR	N	This hot spot is considered unactionable (segment contains United States Customs and Border Patrol Checkpoint)
90-3 (MP 304-312)	High	-	-	N/A	-	L5	Pavement	MP 304-312 has a High level of need due to fair performance scores for Pavement Index and directional PSR; segment also has poor % Area Failure ratings Hot spots MP 306-312 and SB/EB MP 304-306	N	No high historical investment so not considered a strategic investment; will likely be addressed by current ADOT processes

Legend: Strategic investment area screened out from further consideration

Table 19: Strategic Investment Area Screening (continued)

Segment # and MP	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
90-4 (MP 312-317)	Hot Spot	-	-	-	Medium	L6	Pavement	Hot spot MP 312-313 and SB/EB MP 313-314	N	No high historical investment so not considered a strategic investment; will likely be addressed by current ADOT processes
						L7	Freight	MP 312-317 has a Medium level of need due to fair performance scores for Freight Index and poor performance scores for NB/WB directional TTTR	N	Nonactionable as it is suspected that the poor TTTR is related to the fact that the northbound TMC location contains the Swire Coca-Cola factory in segment 90-4. Additionally, the existing DMS sign at NB MP 309.9 satisfies the signage needed at this state route intersection according to the statewide DMS plan.
90-5 (MP 317-324)	High	-	-	High	High	L8	Pavement	MP 317-324 has a High level of need due to fair performance scores for Pavement Index and Directional PSR measures; segment also has poor % Area Failure ratings Hot spots MP 317-318, MP 320-322, NB/WB MP 318-320 and SB/EB MP 322-324	N	No high historical investment so not considered a strategic investment
						L9	Safety	Hot spot MP 319-323 MP 317-324 has an overall Safety Index, SB/WB direction of Directional Safety Index and percentage of F+I crashes at intersections above the statewide average 5 fatal crashes and 13 suspected serious injury crashes in segment; 1 fatal crash involved a pedestrian; crash data analysis for the total crashes in the segment indicate 44% involve failure to yield-right-of-way while 33% involve driver under the influence of drugs or alcohol, 11% involve first unit event of ran off road left, 11% occur in dawn conditions and 11% involve a first unit event of crossed centerline	Y	No programmed project to address Safety need
						L10	Freight	MP 317-324 has a High level of need due to poor performance scores for Freight Index and for both directions of directional TTTR	N	Mule Pass Tunnel Lighting Project programmed for FY 2023 will address need

Legend: Strategic investment area screened out from further consideration

Table 19: Strategic Investment Area Screening (continued)

Segment # and MP	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
90-6 (MP 324-336)	Hot Spot	Hot Spot	-	-	-	L11	Pavement	Hot spot MP 328-329 and SB/EB MP 324-326	N	Not identified in historical review; will likely be addressed by current ADOT processes
						L12	Bridge	Hot spot, Lewis Springs OP (#470, MP 328.85) has substructure and deck ratings of 5	N	Not identified in historical review; will likely be addressed by current ADOT processes
80-7 (MP 333-339)	-	-	-	High	High	L13	Safety	MP 333-339 has an overall Safety Index and both directions of Directional Safety Index above the statewide average 2 fatal crashes and 2 suspected serious injury crashes in segment; crash data analysis indicates 25% involve speed too fast for conditions, 50% involve collision with a fixed object and 50% involve first unit event of- ran off the road (right)	Y	No programmed project to address Safety need
						L14	Freight	MP 333-339 has a has a High level of need due to poor performance scores for Freight Index, SB/EB directional TTTR, and NB/WB closure duration	N	Climbing lane construction project programmed for construction FY 2022 will address need
80-8 (MP 339-345)	High	-	-	High	Hot Spot	L15	Pavement	MP 339-345 has a High level of need due to fair performance scores for Pavement Index and Directional PSR measures; segment also has poor % Area Failure ratings Hot spots MP 339-340, MP 341-344, SB/EB MP 340-341 and SB/EB MP 344-345	N	No high historical investment so not considered a strategic investment; will likely be addressed by current ADOT processes
						L16	Safety	MP 339-345 has an overall Safety Index and both directions of Directional Safety Index above the statewide average 2 fatal crashes in segment; crash data analysis indicates 50% involve overturning and 50% under the influence of drugs or alcohol	N	Need considered non-actionable because all fatal crashes involved drug/alcohol
						L17	Freight	Vertical clearance hot spot at Mule Pass Tunnel (#538, MP 339.20) has low vertical clearance of 14.00 feet and cannot be ramped around	Y	No programmed project to address Freight need
						L18	Freight	Vertical clearance hot spot at Lowell RR UP (#269, MP 343.01) has low vertical clearance of 14.89 feet and cannot be ramped around	Y	No programmed project to address Freight need
						L19	Freight	Vertical clearance hot spot at Lowell UP RR (#1033, MP 343.01) has low vertical clearance of 13.95 feet and cannot be ramped around	Y	No programmed project to address Freight need

Legend: Strategic investment area screened out from further consideration

Table 19: Strategic Investment Area Screening (continued)

Segment # and MP	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
80-9 (MP 345-357)	Hot Spot	Hot Spot	-	-	High	L20	Pavement	Hot spot SB/EB MP 345-357	N	Not identified in historical review; will likely be addressed by current ADOT processes
						L21	Bridge	Hot spot, Bridge (#235, MP 349.28) has substructure and deck ratings of 5	N	Not identified in historical review; will likely be addressed by current ADOT processes
						L22	Freight	MP 345-357 has a High level of need due to poor performance scores for Freight Index and for both directions of directional TTTR; segment also has fair closure duration in ratings for both directions	Y	Recently completed project in FY 21 likely will not address freight need. No programmed project to address freight
80-10 (MP 357-365)	Hot Spot	Medium	-	N/A	Medium	L23	Pavement	Hot spot SB/EB MP 357-365	N	Not identified in historical review; will likely be addressed by current ADOT processes
						L24	Bridge	White Water Draw Bridge has a deck rating of 5	N	Not identified in historical review; will likely be addressed by current ADOT processes
						L25	Freight	MP 357-365 has a Medium level of need due to fair performance scores for Freight Index and poor performance scores for NB/WB directional TTTR	N	Nonactionable as it is suspected the poor TTTR is related to the fact that the westbound TMC is located just west of the Paul Spur Douglas Quarry in segment 80-9 and attributable to trucks entering/exiting the quarry. Segment 80-9 solutions are anticipated to address this need.

Legend: Strategic investment area screened out from further consideration

4.2 Candidate Solutions

For each elevated need within a strategic investment area that is not screened out, a candidate solution is developed to address the identified need. Each candidate solution is assigned to one of the following three P2P investment categories based on the scope of the solution:

- Preservation
- Modernization
- Expansion

Documented performance needs serve as the foundation for developing candidate solutions for corridor preservation, modernization, and expansion. Candidate solutions are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT's traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the SR 90/SR 80 corridor will be considered along with other candidate projects in the ADOT statewide programming process.

Characteristics of Strategic Solutions

Candidate solutions should include some or all of the following characteristics:

- Do not recreate or replace results from normal programming processes
- May include programs or initiatives, areas for further study, and infrastructure projects
- Address elevated levels of need (High or Medium) and hot spots
- Focus on investments in modernization projects (to optimize current infrastructure)
- Address overlapping needs
- Reduce costly repetitive maintenance
- Extend operational life of system and delay expansion
- Leverage programmed projects that can be expanded to address other strategic elements
- Provide measurable benefit

Candidate Solutions

A set of 7 candidate solutions are proposed to address the identified needs on the SR 90/SR 80 corridor.

Table 20 identifies each strategic location that has been assigned a candidate solution with a number (e.g., CS90.1, CS80.2, etc.). Each candidate solution is comprised of one or more components to address the identified needs. The assigned candidate solution numbers are linked to the location number and provide tracking capability through the rest of the process. The locations of proposed solutions are shown on the map in **Figure 23**.

Candidate solutions developed to address an elevated need in the Pavement or Bridge performance area will include two options: rehabilitation or full replacement. These solutions are initially evaluated through a Life-Cycle Cost Analysis (LCCA) to provide insights into the cost-effectiveness of these options so a recommended approach can be identified. Candidate solutions developed to address an elevated need in the Mobility, Safety, or Freight performance areas are advanced directly to the Performance Effectiveness Evaluation. In some cases, there may be multiple solutions identified to address the same area of need.

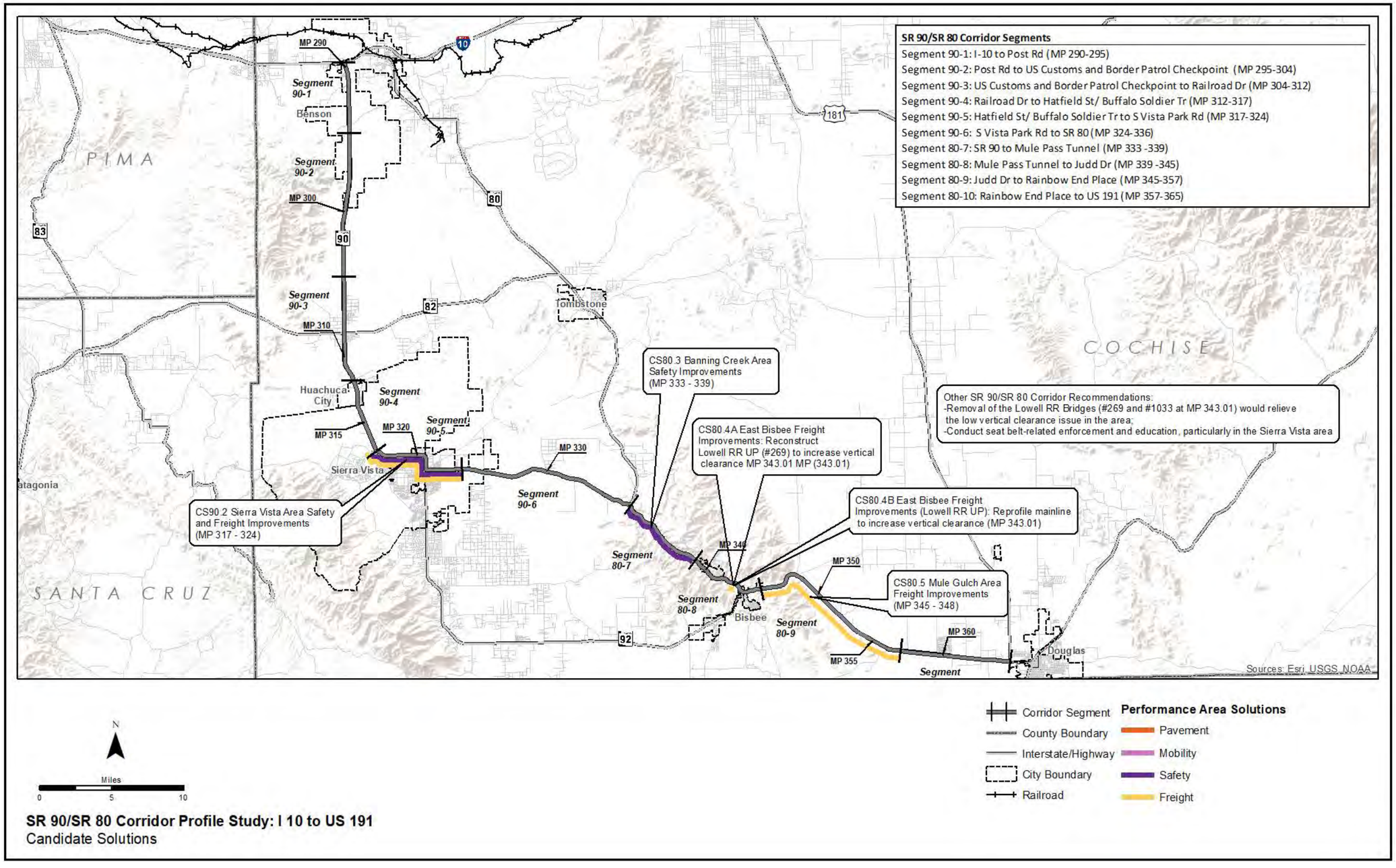
Candidate solutions that are recommended to expand or modify the scope of an already programmed project are noted and are not advanced to solution evaluation and prioritization. These solutions are directly recommended for programming.

Table 20: Candidate Solutions

Candidate Solution #	Segment #	Location #	Beginning Milepost	Ending Milepost	Candidate Solution Name	Option*	Scope	Investment Category (Preservation [P], Modernization [M], Expansion [E])
CS90.1	90-1	L1	290	295	North Benson Pavement Preservation	A	Rehabilitate/repair pavement	P
						B	Replace pavement	M
CS90.2	90-5	L9/L10	317	324	Sierra Vista Safety and Freight Improvements	-	-Install speed feedback and signal ahead signs, MP 318 EB and MP 320 WB -Construct raised median, MP 317-323.7	M
CS80.3	80-7	L13	333	339	Banning Creek Area Safety Improvements	-	-Construct edge line rumble strips or shoulder rumble strips between MP 333-339 EB -Construct centerline rumble strips between MP 333-339 -Widen Shoulder MP 333-339 WB	M
CS80.4	80-8	L18	343.01	343.01	East Bisbee Freight Improvements	A	Reconstruct Lowell RR UP (#269) to increase vertical clearance	E
						B	Reprofile mainline to increase vertical clearance	M
CS80.5	80-9	L22	345	357	Mule Gulch Area Freight Improvements	-	-Construct passing lane WB, MP 346.9-347.6 -Construct passing lane EB, MP 345.6-346.1 -Construct acceleration and deceleration lanes at entrance to Paul Spur Douglas quarry	M

* '-': Indicates only one solution is being proposed and no options are being considered

Figure 23: Candidate Solutions



SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Candidate Solutions

5.0 SOLUTION EVALUATION AND PRIORITIZATION

Candidate solutions are evaluated using the following steps: LCCA (where applicable), Performance Effectiveness Evaluation, Solution Risk Analysis, and Candidate Solution Prioritization. The methodology and approach to this evaluation are shown in **Figure 24** and described more fully below.

Life-Cycle Cost Analysis

All Pavement and Bridge candidate solutions have two options: rehabilitation/repair or reconstruction. These options are evaluated through an LCCA to determine the best approach for each location where a Pavement or Bridge solution is recommended. The LCCA can eliminate options from further consideration and identify which options should be carried forward for further evaluation.

When multiple independent candidate solutions are developed for Mobility, Safety, or Freight strategic investment areas, these candidate solution options advance directly to the Performance Effectiveness Evaluation without an LCCA.

Performance Effectiveness Evaluation

After completing the LCCA process, all remaining candidate solutions are evaluated based on their performance effectiveness. This process includes determining a Performance Effectiveness Score (PES) based on how much each solution impacts the existing performance and needs scores for each segment. This evaluation also includes a Performance Area Risk Analysis to help differentiate between similar solutions based on factors that are not directly addressed in the performance system.

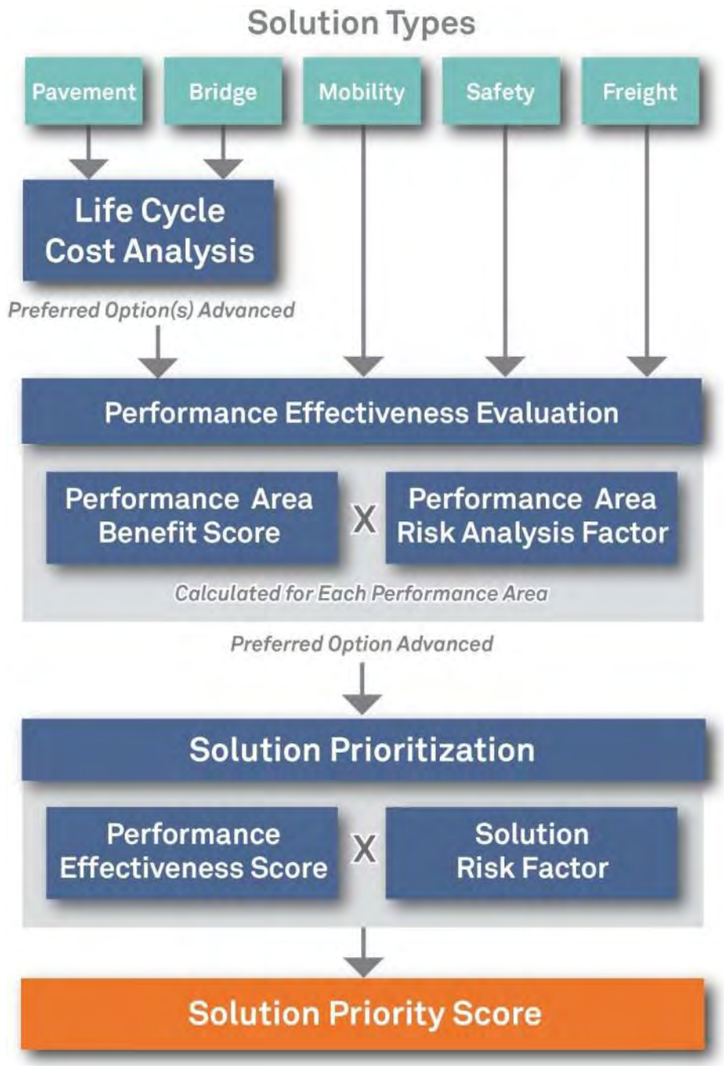
Solution Risk Analysis

All candidate solutions advanced through the Performance Effectiveness Evaluation are also evaluated through a Solution Risk Analysis process. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of performance failure.

Candidate Solution Prioritization

The PES, weighted risk factor, and segment average need score are combined to create a prioritization score. The candidate solutions are ranked by prioritization score from highest to lowest. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process.

Figure 24: Candidate Solution Evaluation Process



5.1 Life-Cycle Cost Analysis

LCCA is conducted for any candidate solution that is developed as a result of a need in the Pavement or Bridge performance area. The intent of the LCCA is to determine which options warrant further investigation and eliminate options that would not be considered strategic.

LCCA is an economic analysis that compares cost streams over time and presents the results in a common measure, the present value of all future costs. The cost stream occurs over an analysis period that is long enough to provide a reasonably fair comparison among alternatives that may differ significantly in scale of improvement actions over shorter time periods. For both bridge and pavement LCCA, the costs are focused on agency (ADOT) costs for corrective actions to meet the objective of keeping the bridge or pavement serviceable over a long period of time.

LCCA is performed to provide a more complete holistic perspective on asset performance and agency costs over the life of an investment stream. This approach helps ADOT look beyond initial and short-term costs, which often dominate the considerations in transportation investment decision making and programming.

Bridge LCCA

For the bridge LCCA, three basic strategies are analyzed that differ in timing and scale of improvement actions to maintain the selected bridges, as described below:

- Bridge replacement (large upfront cost but small ongoing costs afterwards)
- Bridge rehabilitation until replacement (moderate upfront costs then small to moderate ongoing costs until replacement)
- On-going repairs until replacement (low upfront and ongoing costs until replacement)

The bridge LCCA model developed for the CPS reviews the characteristics of the candidate bridges including bridge ratings and deterioration rates to develop the three improvement strategies (full replacement, rehabilitation until replacement, and repair until replacement). Each strategy consists of a set of corrective actions that contribute to keeping the bridge serviceable over the analysis period. Cost and effect of these improvement actions on the bridge condition are essential parts of the model. Other considerations in the model include bridge age, elevation, pier height, length-to-span ratio, skew angle, and substandard characteristics such as shoulders and vehicle clearance. The following assumptions are included in the bridge LCCA model:

- The bridge LCCA only addresses the structural condition of the bridge and does not address other issues or costs
- The bridge will require replacement at the end of its 75-year service life regardless of current condition
- The bridge elevation, pier height, skew angle, and length-to-span ratio can affect the replacement and rehabilitation costs
- The current and historical ratings are used to estimate a rate of deterioration for each candidate bridge
- Following bridge replacement, repairs will be needed every 20 years
- Different bridge repair and rehabilitation strategies have different costs, expected service life, and benefit to the bridge rating
- The net present value of future costs is discounted at 3% and all dollar amounts are in 2023 dollars
- If the LCCA evaluation recommends rehabilitation or repair, the solution is not considered strategic and the rehabilitation or repair will be addressed by normal programming processes
- Because this LCCA is conducted at a planning level, and due to the variabilities in costs and improvement strategies, the LCCA net present value results that are within 15% should be considered equally; in such a case, the solution should be carried forward as a strategic replacement project – more detailed scoping will confirm if replacement or rehabilitation is needed

Based on the candidate solutions presented in **Table 20**, LCCA was not conducted for any bridges on the SR 90/SR 80 corridor, as shown in **Table 21**. Additional information regarding the bridge LCCA is included in **Appendix E**.

Pavement LCCA

The LCCA approach to pavement is very similar to the process used for bridges. For the pavement LCCA, three basic strategies are analyzed that differ in timing and scale of improvement actions to maintain the selected pavement, as described below:

- Pavement replacement (large upfront cost but small ongoing costs afterwards – could be replacement with asphalt or concrete pavement)
- Pavement major rehabilitation until replacement (moderate upfront costs then small to moderate ongoing costs until replacement)
- Pavement minor rehabilitation until replacement (low upfront and ongoing costs until replacement)

The pavement LCCA model developed for the CPS reviews the characteristics of the candidate paving locations including the historical rehabilitation frequency to develop potential improvement strategies (full replacement, major rehabilitation until replacement, and minor rehabilitation until replacement, for either concrete or asphalt, as applicable). Each strategy consists of a set of corrective actions that contribute to keeping the pavement serviceable over the analysis period. The following assumptions are included in the pavement LCCA model:

- The pavement LCCA only addresses the condition of the pavement and does not address other issues or costs
- The historical pavement rehabilitation frequencies at each location are used to estimate future rehabilitation frequencies
- Different pavement replacement and rehabilitation strategies have different costs and expected service life

- The net present value of future costs is discounted at 3% and all dollar amounts are in 2023 dollars
- If the LCCA evaluation recommends rehabilitation or repair, the solution is not considered strategic and the rehabilitation will be addressed by normal programming processes
- Because this LCCA is conducted at a planning level, and due to the variabilities in costs and improvement strategies, the LCCA net present value results that are within 15% should be considered equally; in such a case, the solution should be carried forward as a strategic replacement project – more detailed scoping will confirm if replacement or rehabilitation is needed

Based on the candidate solutions presented in **Table 20**, LCCA was conducted for one pavement solution on the SR 90/SR 80 corridor, as noted in **Table 22**. Additional information regarding the pavement LCCA is contained in **Appendix E**.

As shown in **Table 21** and **Table 22**, the following conclusions were determined based on the LCCA:

- Rehabilitation or repair was determined to be the most effective approach for CS90.1A/B (MP 290-295), and this location does not have other Needs. Therefore, it is assumed that these will be addressed by normal programming processes and these candidate solutions will be dropped from further consideration

Table 21: Bridge Life-Cycle Cost Analysis Results

Candidate Solution	Present Value at 3% Discount Rate ($)			Ratio of Present Value Compared to Lowest Present Value			Other Needs	Results
	Replace	Rehab	Repair	Replace	Rehab	Repair		
No LCCA conducted for any bridge candidate solution on the SR 90/SR 80 corridor								

Table 22: Pavement Life-Cycle Cost Analysis Results

Candidate Solution	Present Value at 3% Discount Rate ($)				Ratio of Present Value Compared to Lowest Present Value				Other Needs	Results
	Concrete Reconstruction	Asphalt Reconstruction	Asphalt Medium Rehabilitation	Asphalt Light Rehabilitation	Concrete Reconstruction	Asphalt Reconstruction	Asphalt Medium Rehabilitation	Asphalt Light Rehabilitation		
North Benson Pavement Preservation (CS90.1, MP 290-295)	$79,144,138	$82,908,058	$64,836,882	$73,518,670	1.22	1.28	1.00	1.13	N	Reconstruction is not within 15% of lowest cost - Rehabilitation is recommended

5.2 Performance Effectiveness Evaluation

The results of the Performance Effectiveness Evaluation are combined with the results of a Performance Area Risk Analysis to determine PES as defined in Section 5.0. The objectives of the Performance Effectiveness Evaluation include:

- Measure the benefit to the performance system versus the cost of the solution
- Include risk factors to help differentiate between similar solutions
- Apply to each performance area that is affected by the candidate solution
- Account for emphasis areas identified for the corridor

The Performance Effectiveness Evaluation includes the following steps:

- Estimate the post-solution performance for each of the five performance areas (Pavement, Bridge, Mobility, Safety, and Freight)
- Use the post-solution performance scores to calculate a post-solution level of need for each of the five performance areas
- Compare the pre-solution level of need to the post-solution level of need to determine the reduction in level of need (potential solution benefit) for each of the five performance areas
- Calculate performance area risk weighting factors for each of the five performance areas
- Use the reduction in level of need (benefit) and risk weighting factors to calculate the PES

Post-Solution Performance Estimation

For each performance area, a slightly different approach is used to estimate the post-solution performance. This process is based on the following assumptions:

- Pavement:
  - The IRI rating would decrease (to 30 for replacement or 45 for rehabilitation)
  - The Cracking rating would decrease (to 0 for replacement or rehabilitation)
- Bridge:
  - The structural ratings would increase (+1 for repair, +2 for rehabilitation, or increase to 8 for replacement)
  - The Sufficiency Rating would increase (+10 for repair, +20 for rehabilitation, or increase to 98 for replacement)
- Mobility:
  - Additional lanes would increase the capacity and therefore affect the Mobility Index and associated secondary measures
  - Other improvements (e.g., ramp metering, parallel ramps, variable speed limits) would also increase the capacity (to a lesser extent than additional lanes) and therefore would affect the Mobility Index and associated secondary measures
  - Changes in the Mobility Index (due to increased capacity) would have a direct effect on the LOTTR secondary measure
  - Changes in the Safety Index (due to crash reductions) would have a direct effect on the Closure Extent secondary measure
- Safety:
  - Crash modification factors were developed that would be applied to estimate the reduction in crashes (for additional information see **Appendix F**)
- Freight:
  - Changes in the Mobility Index (due to increased capacity) and Safety Index (due to crash reductions) would have a direct effect on the Freight Index and the TTTR secondary measure
  - Changes in the Safety Index (due to crash reductions) would have a direct effect on the Closure Duration secondary measure

Performance Area Risk Analysis

The Performance Area Risk Analysis is intended to develop a numeric risk weighting factor for each of the five performance areas (Pavement, Bridge, Mobility, Safety, and Freight). This risk analysis addresses other considerations for each performance area that are not directly included in the performance system. A risk weighting factor is calculated for each candidate solution based on the specific characteristics at the solution location. For example, the Pavement Risk Factor is based on factors such as the elevation, daily traffic volumes, and amount of truck traffic. Additional information regarding the Performance Area Risk Factors is included in **Appendix G**.

Following the calculation of the reduction in level of need (benefit) and the Performance Area Risk Factors, these values are used to calculate the PES. In addition, the reduction in level of need in each emphasis area is also included in the PES.

Net Present Value Factor

The benefit (reduction in need) is measured as a one-time benefit. However, different types of solutions will have varying service lives during which the benefits will be obtained. For example, a preservation solution would likely have a shorter stream of benefits over time when compared to a modernization or expansion solution. To address the varying lengths of benefit streams, each solution is classified as a 10-year, 20-year, 30-year, or 75-year benefit stream, or the net present value (NPV) factor (F_{NPV}). A 3% discount rate is used to calculate F_{NPV} for each classification of solution. The service lives and respective factors are described below:

- A 10-year service life is generally reflective of preservation solutions such as pavement and bridge preservation; these solutions would likely have a 10-year stream of benefits; for these solutions, a F_{NPV} of 8.8 is used in the PES calculation
- A 20-year service life is generally reflective of modernization solutions that do not include new infrastructure; these solutions would likely have a 20-year stream of benefits; for these solutions, a F_{NPV} of 15.3 is used in the PES calculation

- A 30-year service life is generally reflective of expansion solutions or modernization solutions that include new infrastructure; these solutions would likely have a 30-year stream of benefits; for these solutions, a F_{NPV} of 20.2 is used in the PES calculation
- A 75-year service life is used for bridge replacement solutions; these solutions would likely have a 75-year stream of benefits; for these solutions, a F_{NPV} of 30.6 is used in the PES calculation

Vehicle-Miles Travelled Factor

Another factor in assessing benefits is the number of travelers who would benefit from the implementation of the candidate solution. This factor varies between candidate solutions depending on the length of the solution and the magnitude of daily traffic volumes. Multiplying the solution length by the daily traffic volume results in vehicle-miles travelled (VMT), which provides a measure of the amount of traffic exposure that would receive the benefit of the proposed solution. The VMT is converted to a VMT factor (known as F_{VMT}), which is on a scale between 0 and 5, using the equation below:

$$F_{VMT} = 5 - (5 \times e^{VMT \times -0.0000139})$$

Performance Effectiveness Score

The PES is calculated using the following equation:

PES = ((Sum of all Risk Factored Benefit Scores + Sum of all Risk Factored Emphasis Area Scores) / Cost) x F_{VMT} x F_{NPV}

Where:

Risk Factored Benefit Score = Reduction in Segment-Level Need (benefit) x Performance Area Risk Weighting Factor (calculated for each performance area)

Risk Factored Emphasis Area Score = Reduction in Corridor-Level Need x Performance Area Risk Factors x Emphasis Area Factor (calculated for each emphasis area)

*Cost = estimated cost of candidate solution in millions of dollars (see **Appendix H**)*

F_{VMT} = Factor between 0 and 5 to account for VMT at location of candidate solution based on existing daily volume and length of solution

F_{NPV} = Factor (ranging from 8.8 to 30.6 as previously described) to address anticipated longevity of service life (and duration of benefits) for each candidate solution

The resulting PES values are shown in **Table 23**. Additional information regarding the calculation of the PES is contained in **Appendix I**.

For candidate solutions with multiple options to address Mobility, Safety, or Freight needs, the PES should be compared to help identify the best performing option. If one option clearly performs better than the other options (e.g., more than twice the PES value and a difference in magnitude of at least 20 points), the other options can be eliminated from further consideration. If multiple options have similar PES values, or there are other factors not accounted for in the performance system that could significantly influence the ultimate selection of an option (e.g., potential environmental concerns, potential adverse economic impacts), those options should all be advanced to the prioritization process. On the SR 90/SR 80 corridor, the following candidate solution has options to address Safety needs:

- CS80.5 (Options A and B) – West Bisbee Freight Improvements
- CS80.6 (Options A and B) – East Bisbee Freight Improvements

Based on a review of the PES values for solutions CS80.5 and CS80.6, both Option A and Option B advanced to the candidate solution prioritization process and received a prioritization score.

Table 23: Performance Effectiveness Scores

Candidate Solution #	Segment #	Option	Candidate Solution Name	Milepost Location	Estimated Cost* (in millions)	Risk Factored Benefit Score					Risk Factored Emphasis Area Scores			Total Factored Benefit Score	F_{VMT}	F_{NPV}	Performance Effectiveness Score
						Pavement	Bridge	Mobility	Safety	Freight	Pavement	Safety	Freight				
CS90.2	90-5	-	Sierra Vista Safety and Freight Improvements	317-324	$10.6	0.000	0.000	0.161	6.345	0.000	0.000	0.131	0.000	6.637	3.31	15.3	31.7
CS80.3	80-7	-	Banning Creek Area Safety Improvements	333-339	$3.4	0.000	0.000	0.076	8.137	3.589	0.000	0.118	0.162	12.082	1.75	15.3	91.3
CS80.4A	80-8	A	East Bisbee Freight Improvements	343.01	$8.0	0.000	0.000	0.000	0.000	1.773	0.000	0.000	0.004	1.777	1.63	20.2	7.3
CS80.4B	80-8	B	East Bisbee Freight Improvements	343.01	$0.2	0.000	0.000	0.000	0.000	0.028	0.000	0.000	0.004	0.032	1.63	20.2	5.1
CS80.5	80-9	-	Mule Gulch Area Freight Improvements	345-357	$8.9	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.007	2.56	20.2	0.0

*: See Table 24 for total construction costs

5.3 Solution Risk Analysis

Following the calculation of the PES, an additional step is taken to develop the prioritized list of solutions. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of performance failure. **Figure 25** shows the risk matrix used to develop the risk weighting factors.

Figure 25: Risk Matrix

		Severity/Consequence				
		Insignificant	**Minor**	**Significant**	**Major**	**Catastrophic**
Frequency/ Likelihood	**Very Rare**	Low	Low	Low	Moderate	Major
	Rare	Low	Low	Moderate	Major	Major
	Seldom	Low	Moderate	Moderate	Major	Severe
	Common	Moderate	Moderate	Major	Severe	Severe
	Frequent	Moderate	Major	Severe	Severe	Severe

Using the risk matrix in **Figure 25**, numeric values were assigned to each category of frequency and severity. The higher the risk, the higher the numeric factor that was assigned. The risk weight for each area of the matrix was calculated by multiplying the severity factor times the frequency factor. These numeric factors are shown in **Figure 26**.

Figure 26: Numeric Risk Matrix

			Severity/Consequence				
			Insignificant	**Minor**	**Significant**	**Major**	**Catastrophic**
		Weight	1.00	1.10	1.20	1.30	1.40
Frequency/ Likelihood	**Very Rare**	1.00	1.00	1.10	1.20	1.30	1.40
	Rare	1.10	1.10	1.21	1.32	1.43	1.54
	Seldom	1.20	1.20	1.32	1.44	1.56	1.68
	Common	1.30	1.30	1.43	1.56	1.69	1.82
	Frequent	1.40	1.40	1.54	1.68	1.82	1.96

Using the values in **Figure 26**, risk weighting factors were calculated for each of the following four risk categories: low, moderate, major, and severe. These values are simply the average of the values in **Figure 26** that fall within each category. The resulting average risk weighting factors are:

Low	Moderate	Major	Severe
1.14	1.36	1.51	1.78

The risk weighting factors listed above are assigned to the five performance areas as follows:

- Safety = 1.78
  - The Safety performance area quantifies the likelihood of fatal or incapacitating injury crashes; therefore, it is assigned the Severe (1.78) risk weighting factor
- Bridge = 1.51
  - The Bridge performance area focuses on the structural adequacy of bridges; a bridge failure may result in crashes or traffic being detoured for long periods of time resulting in significant travel time increases; therefore, it is assigned the Major (1.51) risk weighting factor
- Mobility and Freight = 1.36
  - The Mobility and Freight performance areas focus on capacity and congestion; failure in either of these performance areas would result in increased travel times but would not have significant effect on safety (crashes) that would not already be addressed in the Safety performance area; therefore, they are assigned the Moderate (1.36) risk weighing factor
- Pavement = 1.14
  - The Pavement performance area focuses on the ride quality of the pavement; failure in this performance area would likely be a spot location that would not dramatically affect drivers beyond what is already captured in the Safety performance area; therefore, it is assigned the Low (1.14) risk weighting factor

The benefit in each performance area is calculated for each candidate solution as part of the Performance Effectiveness Evaluation. Using this information on benefits and the risk factors listed above, a weighted (based on benefit) solution-level numeric risk factor is calculated for each candidate solution. For example, a solution that has 50% of its benefit in Safety and 50% of its benefit in Mobility has a weighted risk factor of 1.57 (0.50 x 1.36 + 0.50 x 1.78 = 1.57).

5.4 Candidate Solution Prioritization

The PES, weighted risk factor, and segment average need score are combined to create a prioritization score as follows:

Prioritization Score = PES x Weighted Risk Factor x Segment Average Need Score

Where:

*PES = Performance Effectiveness Score as shown in **Table 23***

Weighted Risk Factor = Weighted factor to address risk of not implementing a solution based on the likelihood and severity of the performance failure

*Segment Average Need Score = Segment average need score as shown in **Table 17***

Table 24 shows the prioritization scores for the candidate solutions subjected to the solution evaluation and prioritization process. Solutions that address multiple performance areas tend to score higher in this process. A prioritized list of candidate solutions is provided in the subsequent section. See **Appendix J** for additional information on the prioritization process.

Table 24: Prioritization Scores

Candidate Solution #	Segment #	Option	Candidate Solution Name	Milepost Location	Estimated Cost (in millions)	Performance Effectiveness Score	Weighted Risk Factor	Segment Average Need Score	Prioritization Score	Percentage by which Solution Reduces Performance Area Segment Needs				
										Pavement	Bridge	Mobility	Safety	Freight
CS90.2	90-5	-	Sierra Vista Safety and Freight Improvements	317-324	$10.6	31.7	1.770	2.23	**125.3**	-	-	6%	29%	8%
CS80.3	80-7	-	Banning Creek Area Safety Improvements	333-339	$3.4	91.3	1.647	1.69	**254.0**	-	-	1%	30%	14%
CS80.4A	80-8	A	East Bisbee Freight Improvements	343.01	$8.0	7.3	1.360	1.92	**19.0**	-	-	0%	0%	47%
CS80.4B	80-8	B	East Bisbee Freight Improvements	343.01	$0.2	5.1	1.360	1.92	**13.3**	-	-	0%	0%	1%
CS80.5	80-9	-	Mule Gulch Area Freight Improvements	345-357	$8.9	0.0	1.383	1.08	**0.1**	-	-	1%	-	0%

6.0 SUMMARY OF CORRIDOR RECOMMENDATIONS

6.1 Prioritized Candidate Solution Recommendations

Table 25 and **Figure 27** show the prioritized candidate solutions recommended for the SR 90/SR 80 corridor in ranked order of priority. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Implementation of these solutions is anticipated to improve performance of the SR 90/SR 80 corridor. The following observations were noted about the prioritized solutions:

- Most of the anticipated improvements in performance are in the Mobility, Safety, and Freight performance areas
- The highest ranking solutions tend to have overlapping benefits in the Mobility, Safety, and Freight performance areas
- The highest priority solutions address needs in the Banning Creek area (SR 80 MP 313-317), East Bisbee area (SR 80 MP 339-345) and near the Sierra Vista area (SR 90 MP 317-324)

6.2 Other Corridor Recommendations

As part of the investigation of strategic investment areas and candidate solutions, other corridor recommendations can also be identified. These recommendations could include modifications to the existing Statewide Construction Program, areas for further study, or other corridor-specific recommendations that are not related to construction or policy. The list below identifies other corridor recommendations for the SR 90/SR 80 corridor:

- Removal of the Lowell RR UP Bridges (#269 and #1033 at MP 343.01) would relieve the low vertical clearance issue in the area; however, the Mule Pass Tunnel would still be a vertical clearance hot spot at MP 339.20
- Conduct seat belt-related enforcement and education, particularly in the Sierra Vista area

6.3 Policy and Initiative Recommendations

In addition to location-specific needs, general corridor and system-wide needs have also been identified through the CPS process. While these needs are more overarching and cannot be individually evaluated through this process, it is important to document them. A list of recommended policies and initiatives was developed for consideration when programming future projects not only on SR 90/SR 80, but across the entire state highway system where the conditions are applicable. The following list, which is in no particular order of priority, was derived from the four CPS rounds:

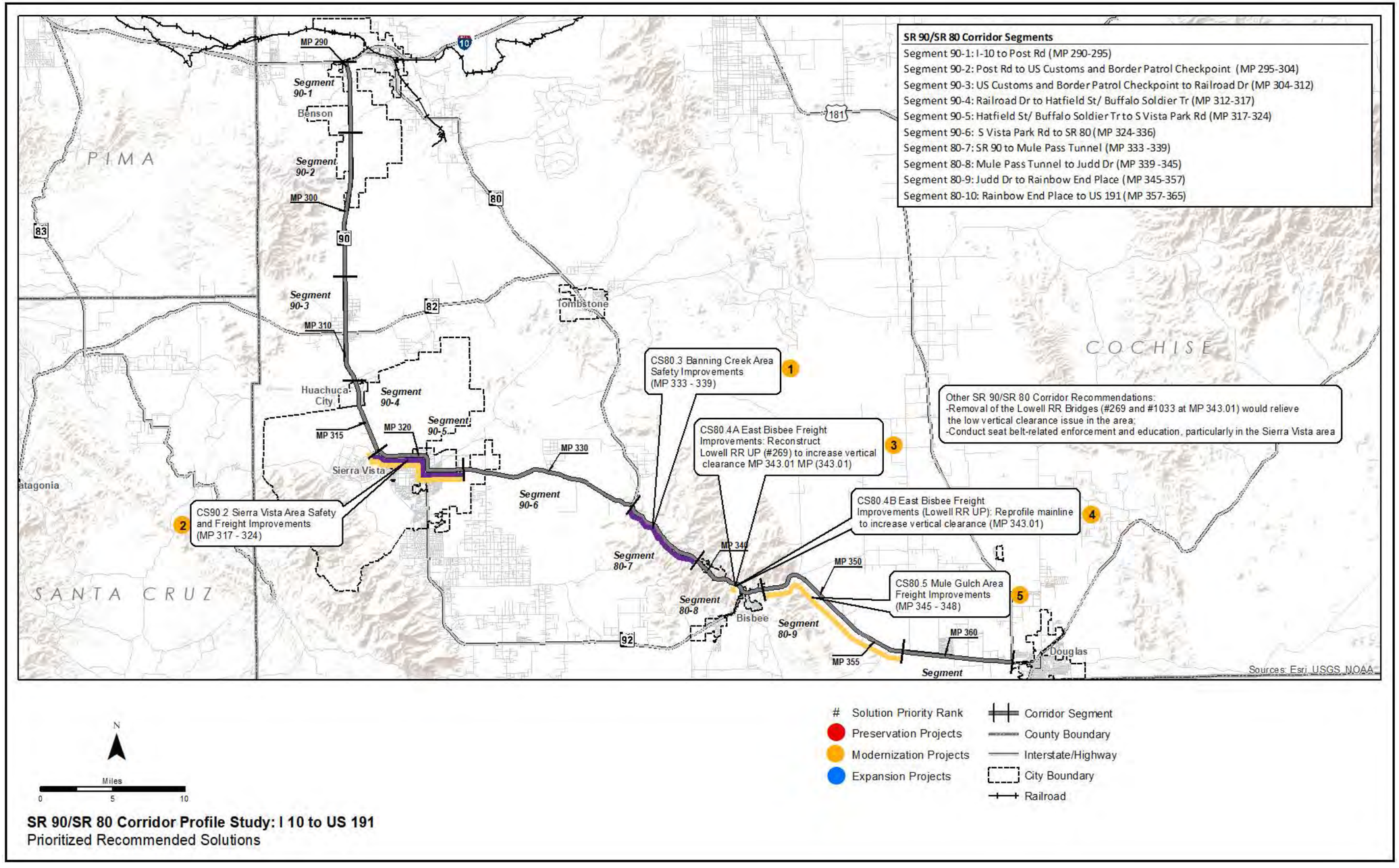
- Install Intelligent Transportation System (ITS) conduit with all new infrastructure projects
- Prepare strategic plans for Closed Circuit Television (CCTV) camera and Road Weather Information System (RWIS) locations statewide
- Leverage power and communication at existing weigh-in-motion (WIM), dynamic message signs (DMS), and call box locations to expand ITS applications across the state
- Consider solar power for lighting and ITS where applicable
- Investigate ice formation prediction technology where applicable
- Conduct highway safety manual evaluation for all future programmed projects
- Develop infrastructure maintenance and preservation plans (including schedule and funding) for all pavement and bridge infrastructure replacement or expansion projects
- Develop standardized bridge maintenance procedures so districts can do routine maintenance work
- Review historical ratings and level of previous investment during scoping of pavement and bridge projects. In pavement locations that warrant further investigation, conduct subsurface investigations during project scoping to determine if full replacement is warranted
- For pavement rehabilitation projects, enhance the amount/level of geotechnical investigations to address issues specific to the varying conditions along the project
- Expand programmed and future pavement projects as necessary to include shoulders
- Expand median cable barrier guidelines to account for safety performance
- Install CCTV cameras with all DMS
- In locations with limited communications, use CCTV cameras to provide still images rather than streaming video
- Develop statewide program for pavement replacement
- Install additional continuous permanent count stations along strategic corridors to enhance traffic count data
- When reconstruction or rehabilitation activities will affect existing bridge vertical clearance, the dimension of the new bridge vertical clearance should be a minimum of 16.25 feet where feasible
- All new or reconstructed roadway/shoulder edges adjacent to an unpaved surface should be constructed with a Safety Edge
- Expand data collection devices statewide to measure freight delay
- Evaluate and accommodate potential changes in freight and goods movement trends that may result from improvements and expansions to the state roadway network
- At traffic interchanges with existing communication connectivity to the ADOT Traffic Operations Center, consideration should be given to adding thermal detection cameras for vehicle detection with the capability for wrong way vehicle detection
- Improved vehicle detection systems, as recommended by ADOT Systems Technology group, should be deployed at traffic interchanges for improved traffic control

Table 25: Prioritized Recommended Solutions

Rank	Candidate Solution #	Option	Candidate Solution Name	Candidate Solution Scope	Estimated Cost (in millions)	Investment Category (Preservation [P], Modernization [M], Expansion [E])	Prioritization Score
1	CS80.3	-	Banning Creek Area Safety Improvements	-Construct edge line rumble strips or shoulder rumble strips between MP 333-339 EB -Construct centerline rumble strips between MP 333-339 -Widen Shoulders MP 333-339 WB	$3.5	M	254.0
2	CS90.2	-	Sierra Vista Safety and Freight Improvements	-Install speed feedback and signal ahead signs, MP 318 EB and MP 320 WB -Construct raised median, MP 317-323.7	$10.6	M	125.3
3	CS80.4	A	East Bisbee Freight Improvements	Reconstruct Lowell RR UP (#269) to increase vertical clearance	$8.0	E	19.0
4	CS80.4	B	East Bisbee Freight Improvements	Reprofile mainline to increase vertical clearance	$0.2	M	13.3
5	CS80.5	-	Mule Gulch Area Freight Improvements	-Construct passing lane WB, MP 346.9-347.6 -Construct passing lane EB, MP 345.6-346.1 -Construct acceleration and deceleration lanes at entrance to Paul Spur Douglas quarry	$8.9	M	0.1

Note: Candidate solutions shown in *italics* represent the lowest prioritization score among the options evaluated.

Figure 27: Prioritized Recommended Solutions



SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Prioritized Recommended Solutions

6.4 Next Steps

The candidate solutions recommended in this study are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT's traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the SR 90/SR 80 corridor will be considered along with other candidate projects in the ADOT statewide programming process.

It is important to note that the candidate solutions are intended to represent strategic solutions to address existing performance needs related to the Pavement, Bridge, Mobility, Safety, and Freight performance areas. Therefore, the strategic solutions are not intended to preclude recommendations related to the ultimate vision for the corridor that may have been defined in the context of prior planning studies and/or design concept reports. Recommendations from such studies are still relevant to addressing the ultimate corridor objectives.

These results will be incorporated into a summary document comparing all corridors that is expected to provide a performance-based review of statewide needs and candidate solutions.

Appendices

Appendix A: Corridor Performance Maps

This appendix contains maps of each primary and secondary measure associated with the five performance areas for the SR 260/US 60 corridor. The following are the areas and maps included:
Pavement Performance Area:

- Pavement Index and Hot Spots
- Pavement Serviceability (directional)
- Percentage of Pavement Area Failure

Bridge Performance Area:

- Bridge Index and Hot Spots
- Bridge Sufficiency
- Lowest Bridge Rating

Mobility Performance Area:

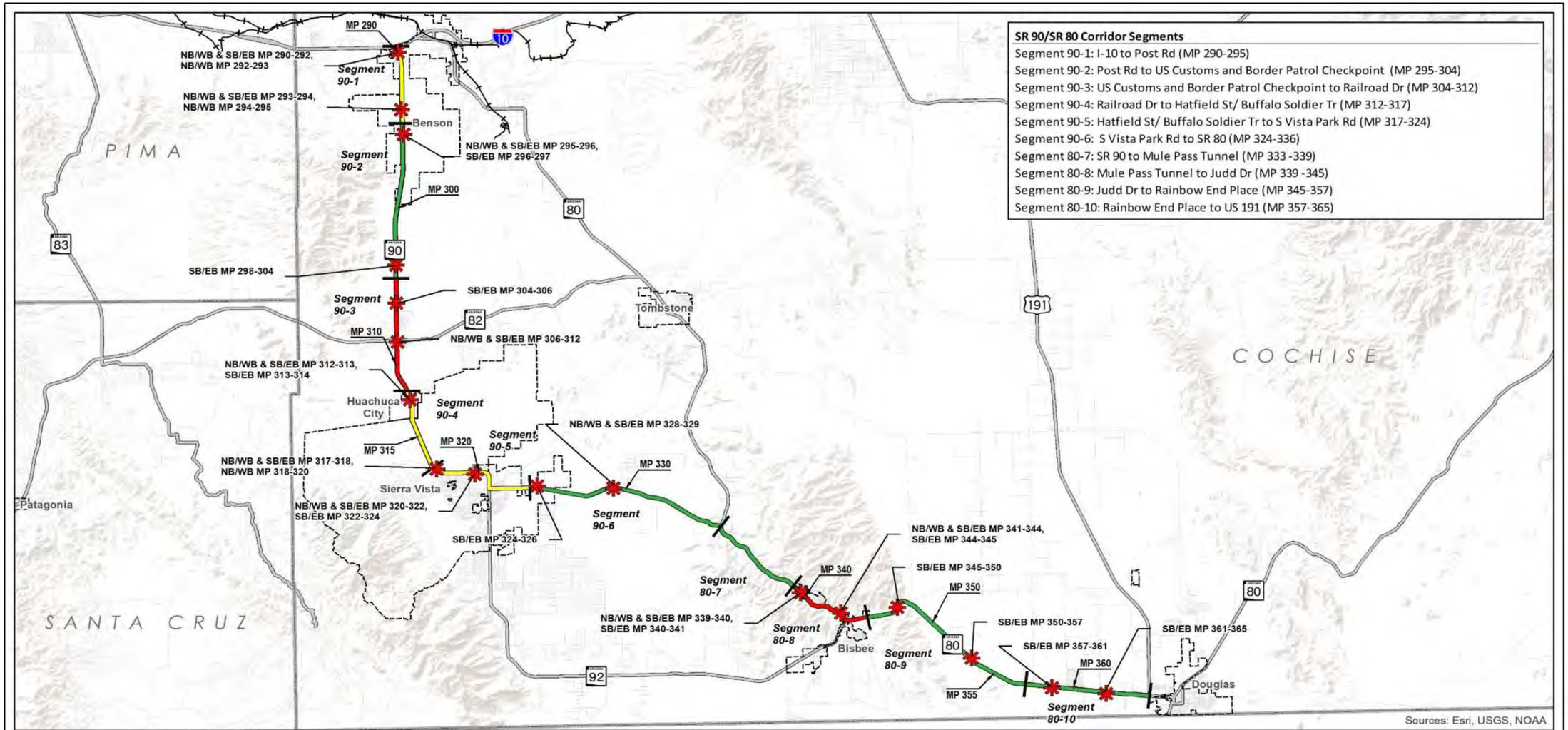
- Mobility Index
- Future Daily V/C Ratio
- Existing Peak Hour V/C Ratio (directional)
- Closure Frequency (directional)
- Level of Travel Time Reliability (directional)
- Multimodal Opportunities
- Percentage of Bicycle Accommodation

Safety Performance Area:

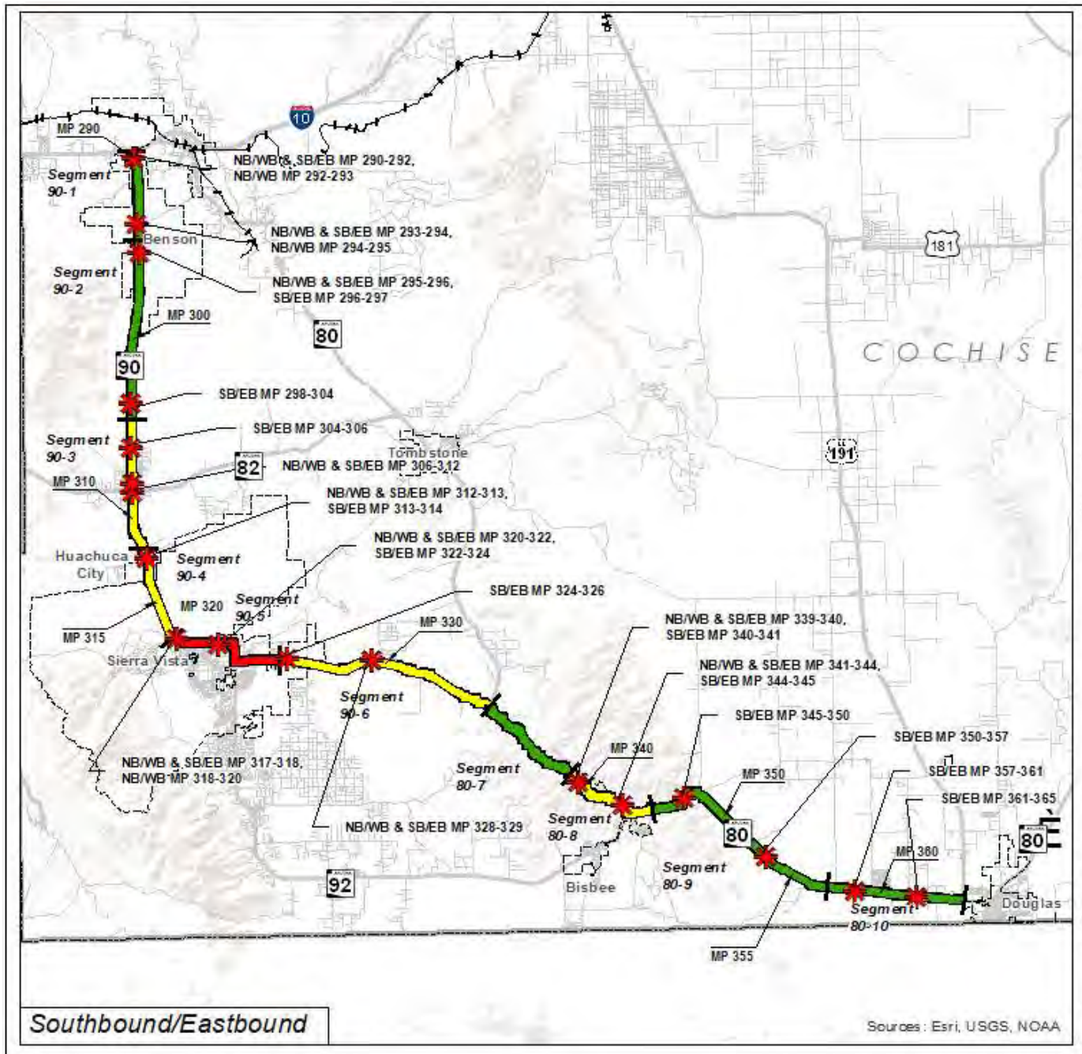
- Safety Index and Hot Spots
- Safety Index and Hot Spots (directional)
- Relative Frequency of Fatal + Suspected Serious Injury Crashes Involving Intersection Crashes Compared to the Statewide Average for Similar Segments (insufficient data – not included)
- Relative Frequency of Fatal + Suspected Serious Injury Crashes Involving Lane Departures Compared to the Statewide Average for Similar Segments
- Relative Frequency of Fatal + Suspected Serious Injury Crashes Involving Pedestrians Compared to the Statewide Average for Similar Segments (insufficient data – not included)
- Relative Frequency of Fatal + Suspected Serious Injury Crashes Involving Trucks Compared to the Statewide Average for Similar Segments (insufficient data – not included)
- Relative Frequency of Fatal + Suspected Serious Injury Crashes Involving Bicycles Compared to the Statewide Average for Similar Segments (insufficient data – not included)

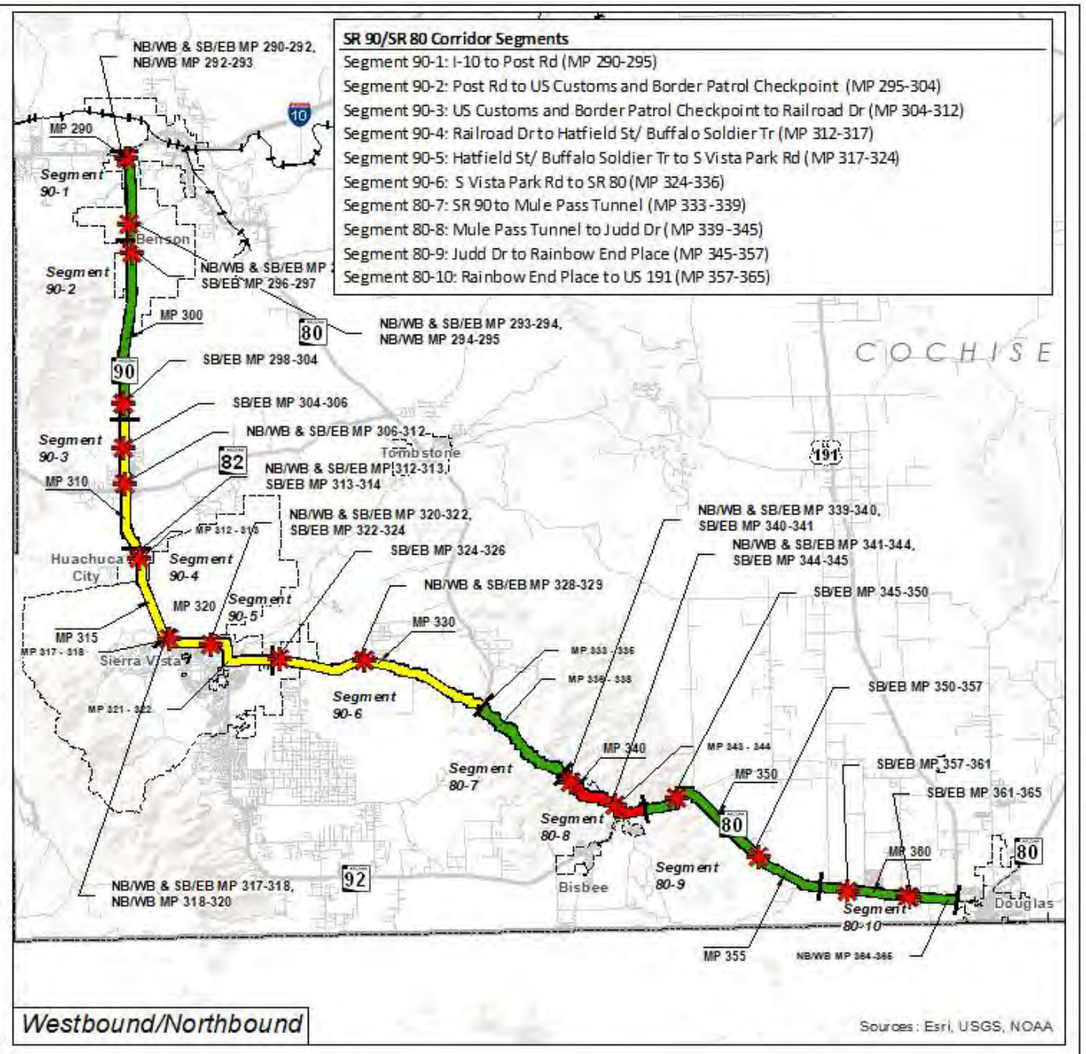
Freight Performance Area:

- Freight Index and Hot Spots
- Truck Travel Time Reliability (directional)
- Closure Duration (directional)
- Bridge Vertical Clearance



SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Pavement Index and Hot Spots
2020-2021 Data





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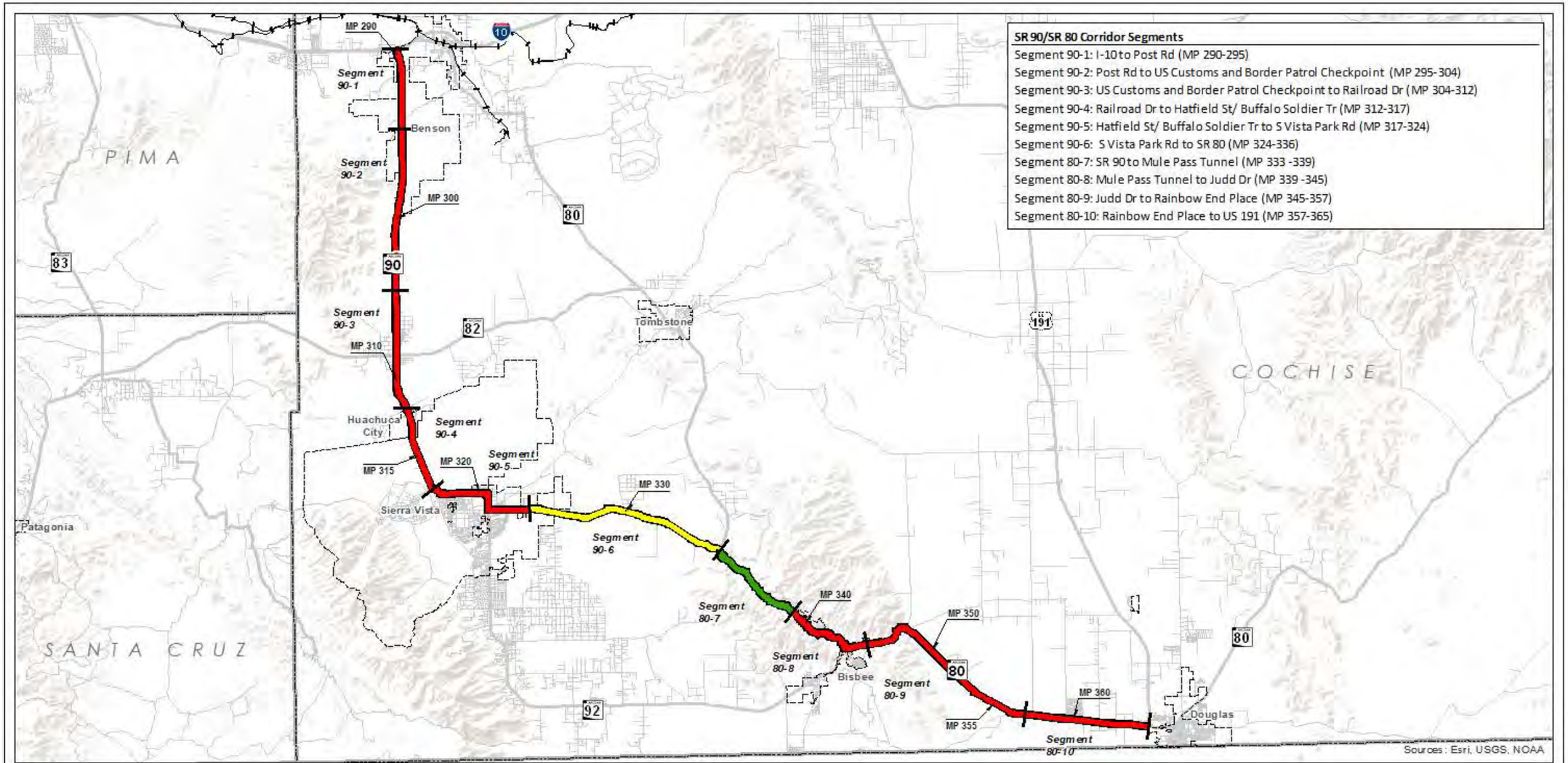
SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Pavement Serviceability and Hot Spots
2019-2020 Data

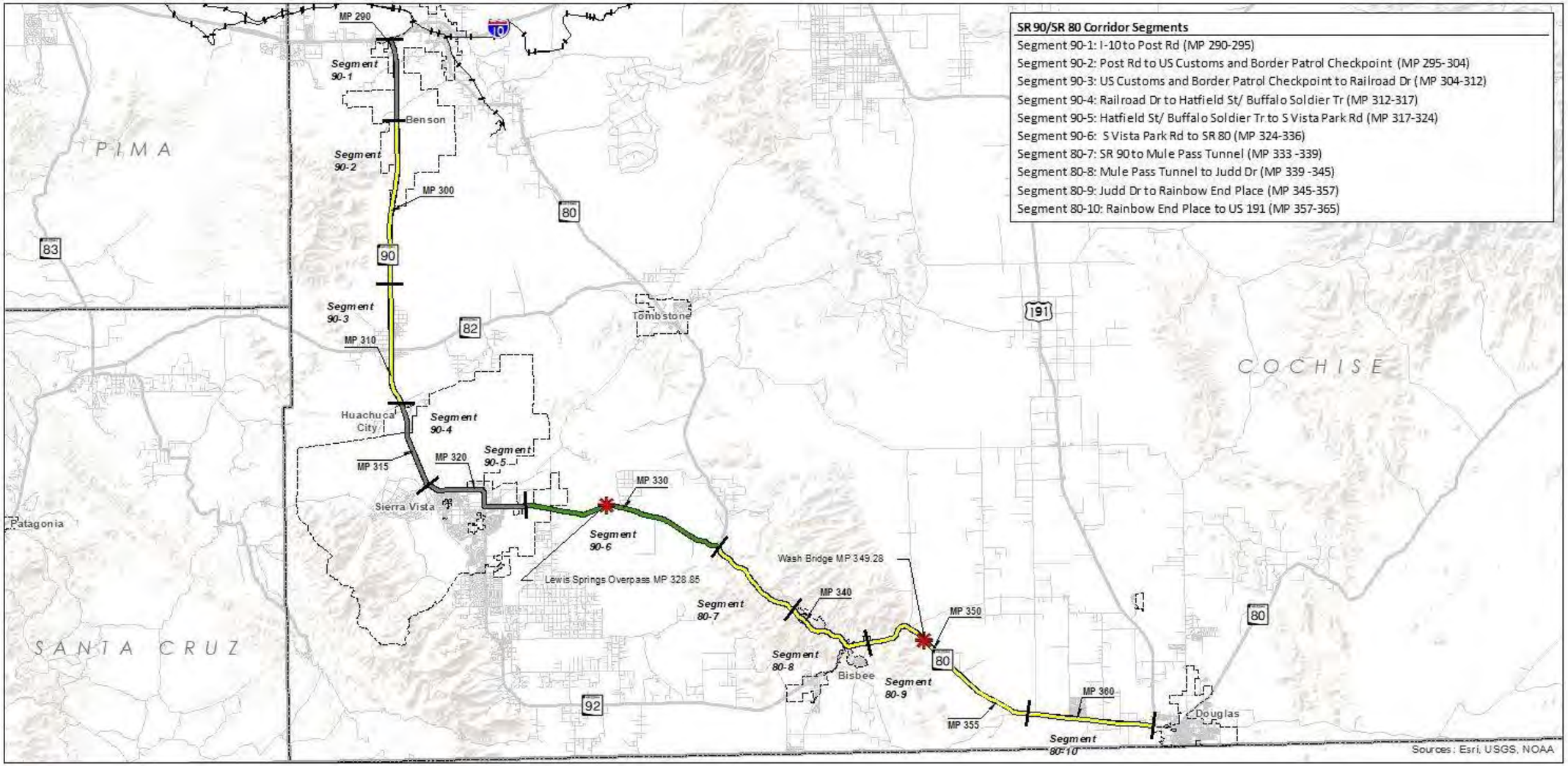
Corridor Segment
County Boundary
Interstate/Highway
City Boundary
Railroad

PAVEMENT SERVICEABILITY
POOR (<2.9)
FAIR (2.9 -3.5)
GOOD (>3.5)

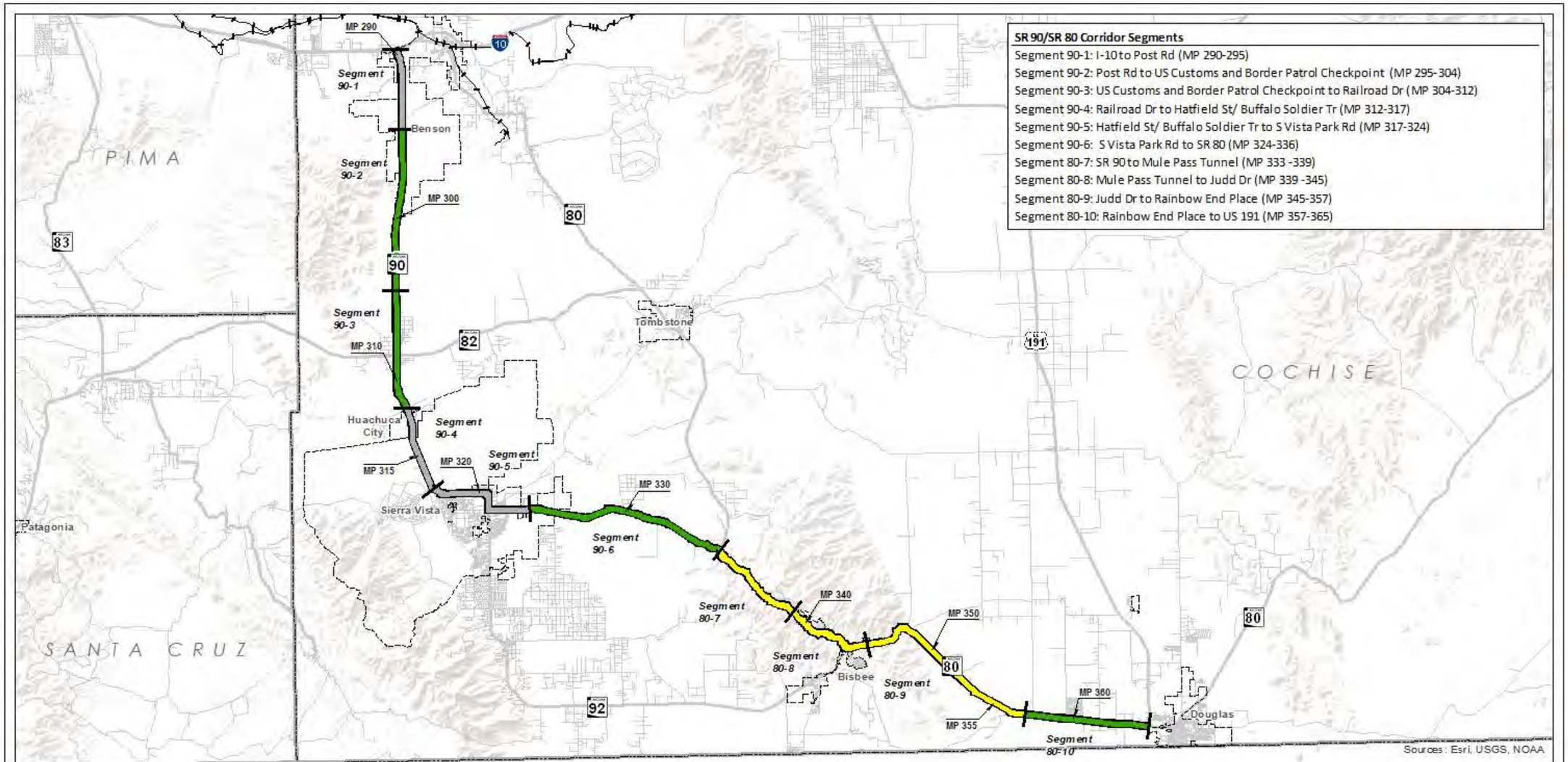
PAVEMENT HOT SPOT
LOCATIONS OF PAVEMENT FAILURE



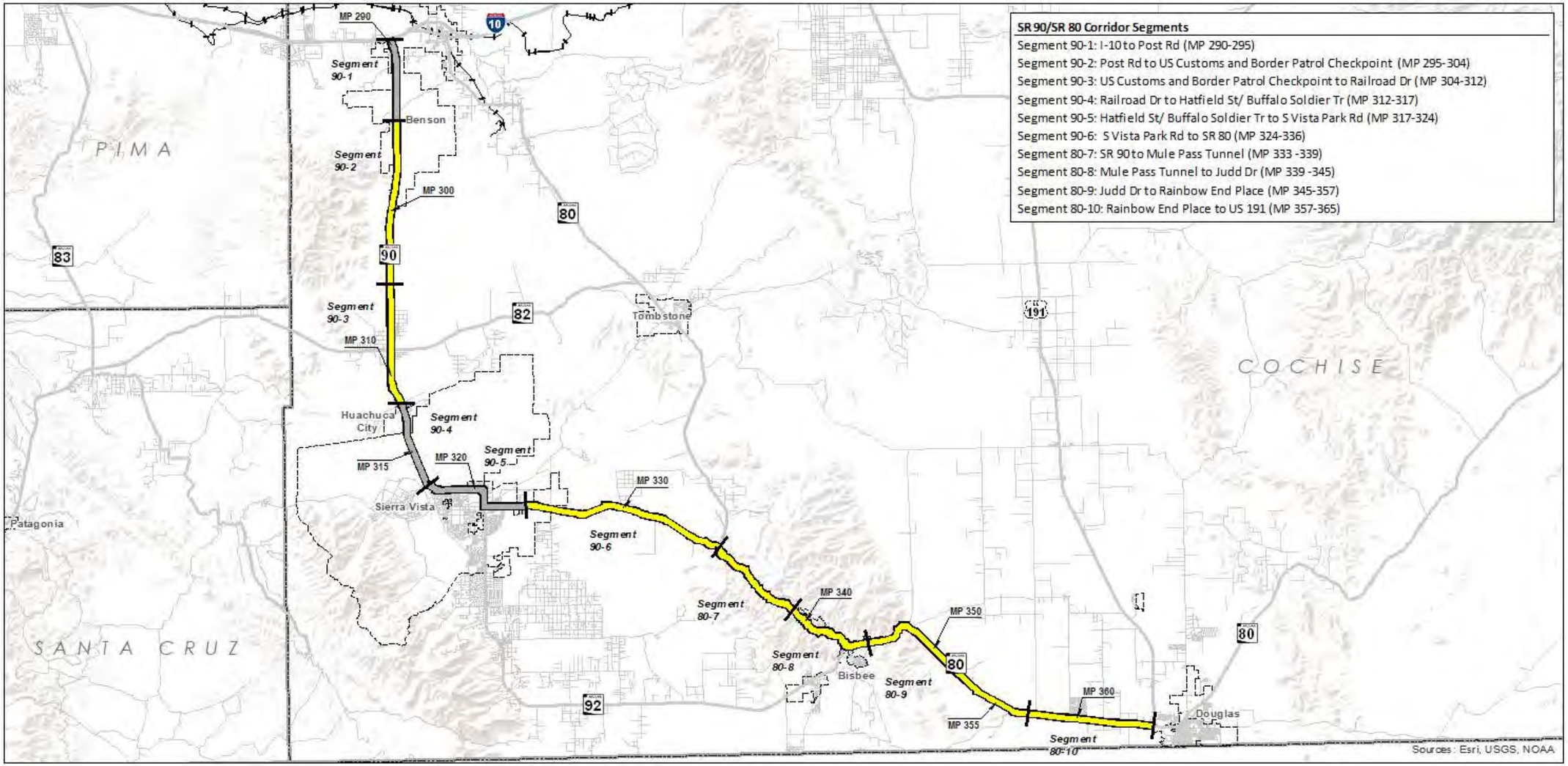
SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Percentage of Pavement Area Failure
2019-2020 Data



SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Bridge Index and Hot Spots
2017-2020 Data



SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Bridge Sufficiency
2018 - 2021 Data

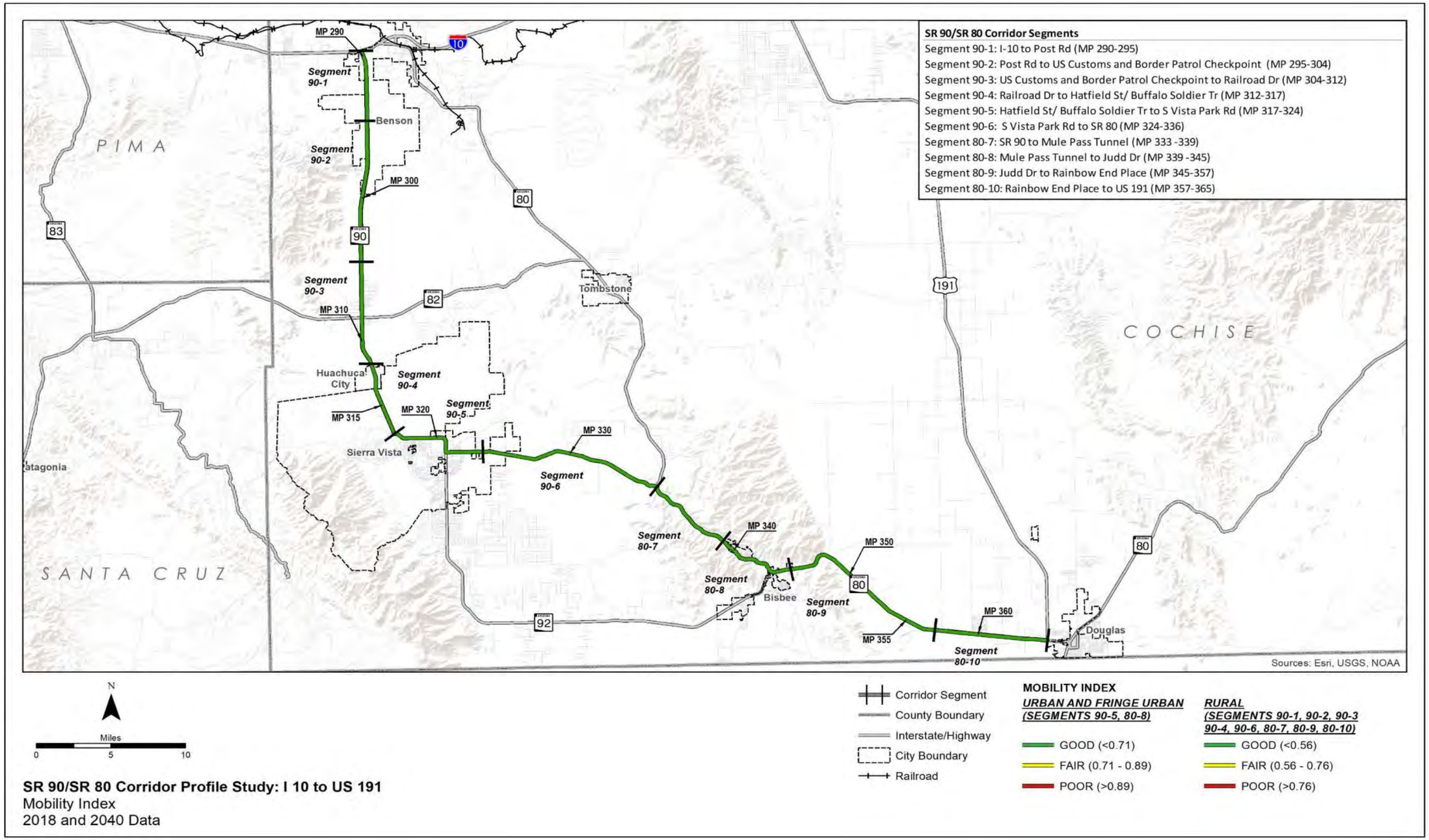


SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Bridge Rating
2018 - 2021 Data

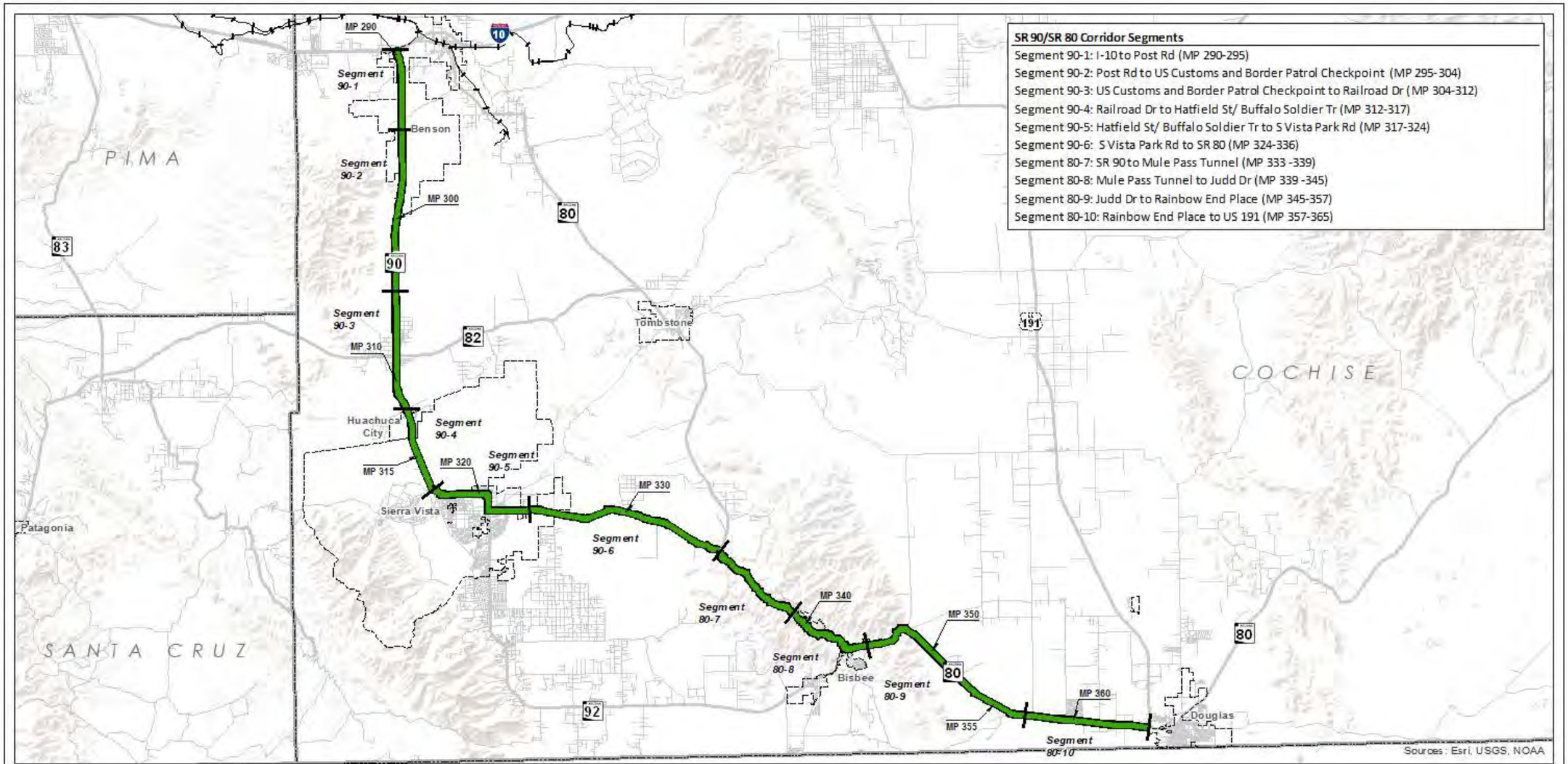
N
Miles
0 5 10

Corridor Segment
County Boundary
Interstate/Highway
City Boundary
Railroad

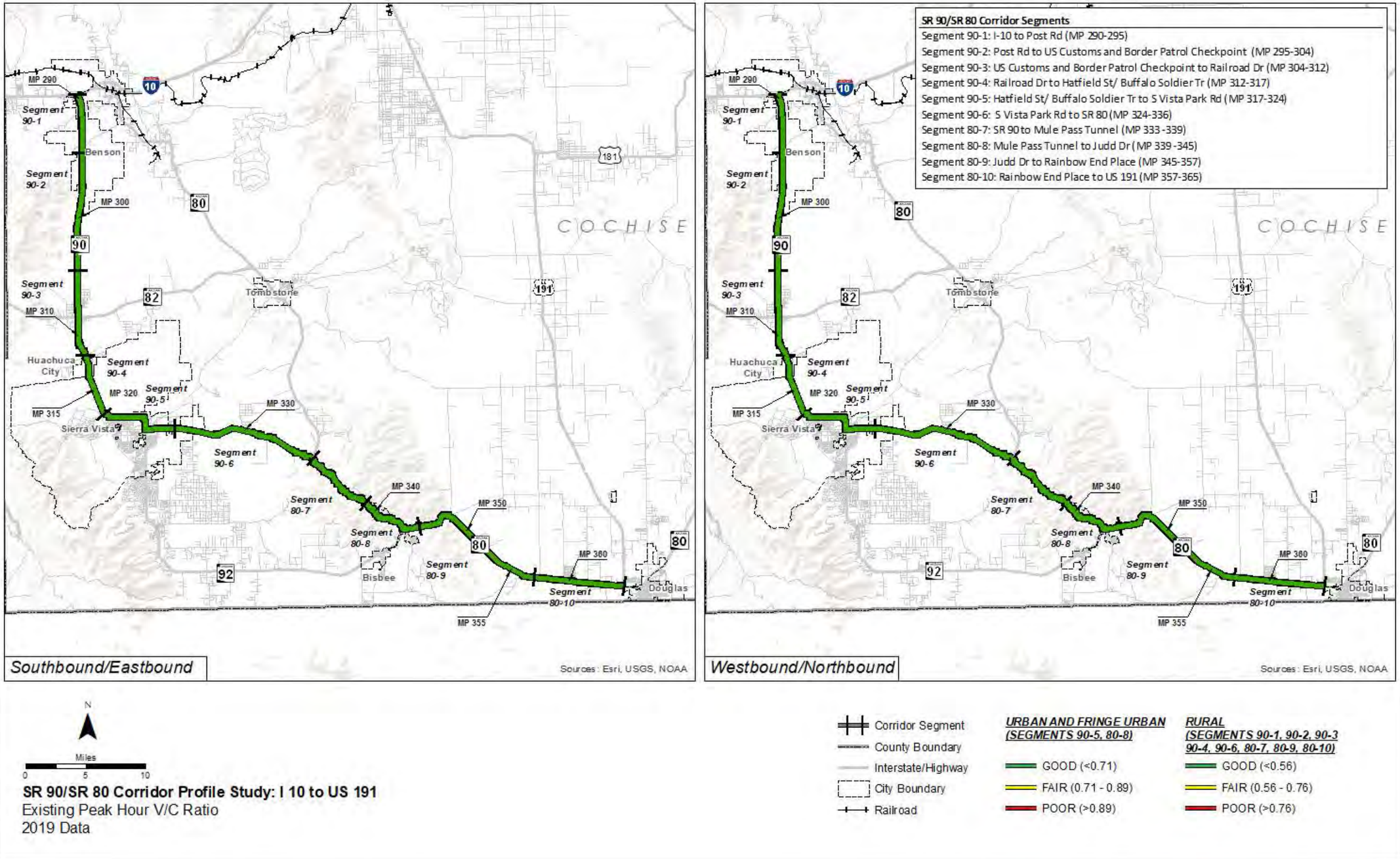
BRIDGE RATING
GOOD (>6)
FAIR (5-6)
POOR (<5)
NO BRIDGE



SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Mobility Index
2018 and 2040 Data



SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Future Daily Volume/Capacity (V/C) Ratio
2040 Data


SR 90/SR 80 Corridor Segments
Segment 90-1: I-10 to Post Rd (MP 290-295)
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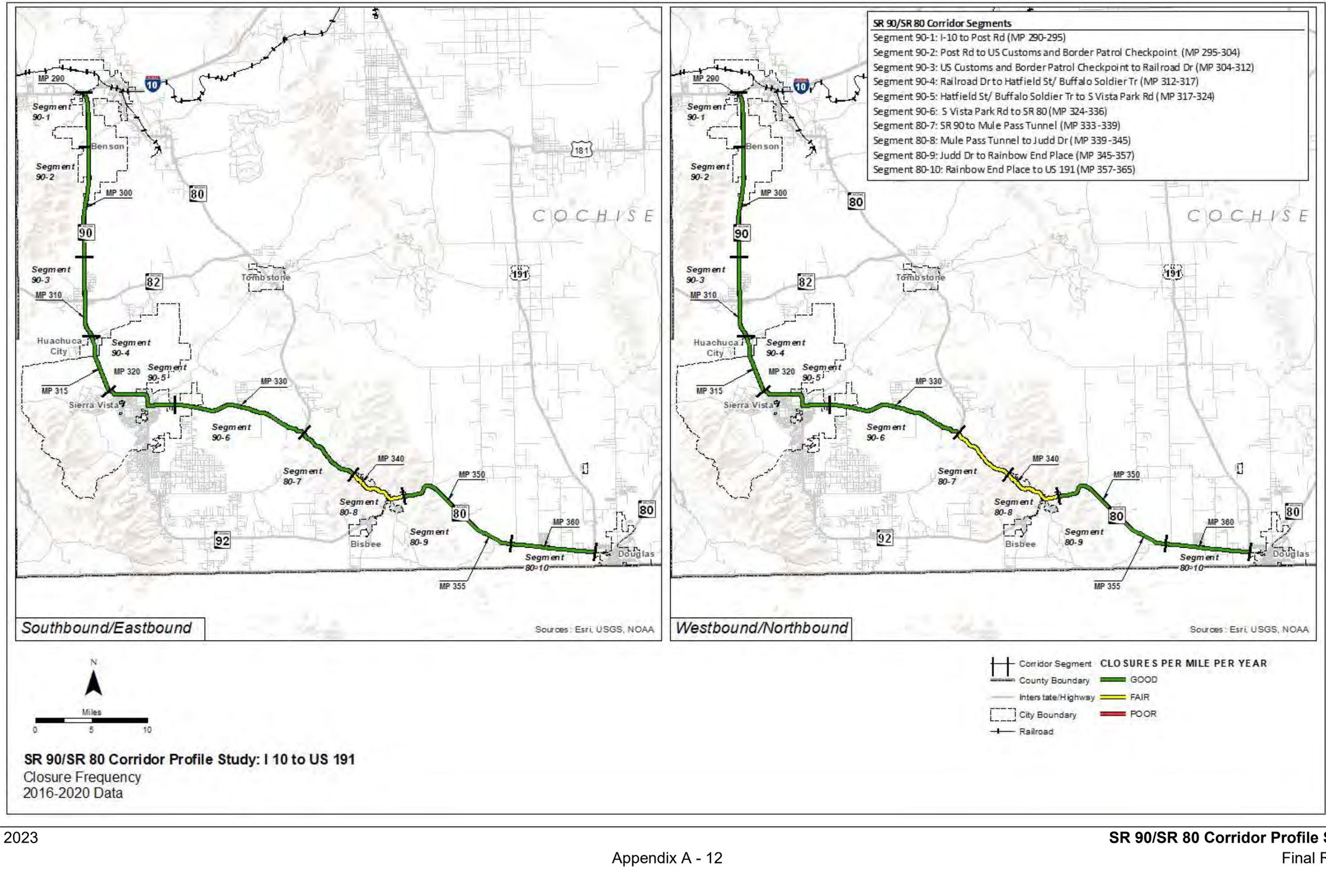
Segment 80-7: SR 90 to Mule Pass Tunnel (MP 333-339)
Segment 80-8: Mule Pass Tunnel to Judd Dr (MP 339-345)
Segment 80-9: Judd Dr to Rainbow End Place (MP 345-357)
Segment 80-10: Rainbow End Place to US 191 (MP 357-365)
MP 290
Segment 90-1
Benson
Segment 90-2
MP 300
MP 310
Segment 90-3
Huachuca City
Segment 90-4
MP 315
MP 320
Segment 90-5
Sierra Vista
MP 330
Segment 90-6
MP 340
Segment 80-7
Segment 80-8
Bisbee
MP 350
Segment 80-9
MP 355
Segment 80-10
MP 360
Douglas
Tombstone
COCHISE
10
181
80
90
82
191
92
Southbound/Eastbound
Westbound/Northbound
Sources: Esri, USGS, NOAA
N
Miles
0 5 10
SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Existing Peak Hour V/C Ratio
2019 Data
Corridor Segment
County Boundary
Interstate/Highway
City Boundary
Railroad
URBAN AND FRINGE URBAN (SEGMENTS 90-5, 80-8)
GOOD (<0.71)
FAIR (0.71 - 0.89)
POOR (>0.89)
RURAL (SEGMENTS 90-1, 90-2, 90-3 90-4, 90-6, 80-7, 80-9, 80-10)
GOOD (<0.56)
FAIR (0.56 - 0.76)
POOR (>0.76)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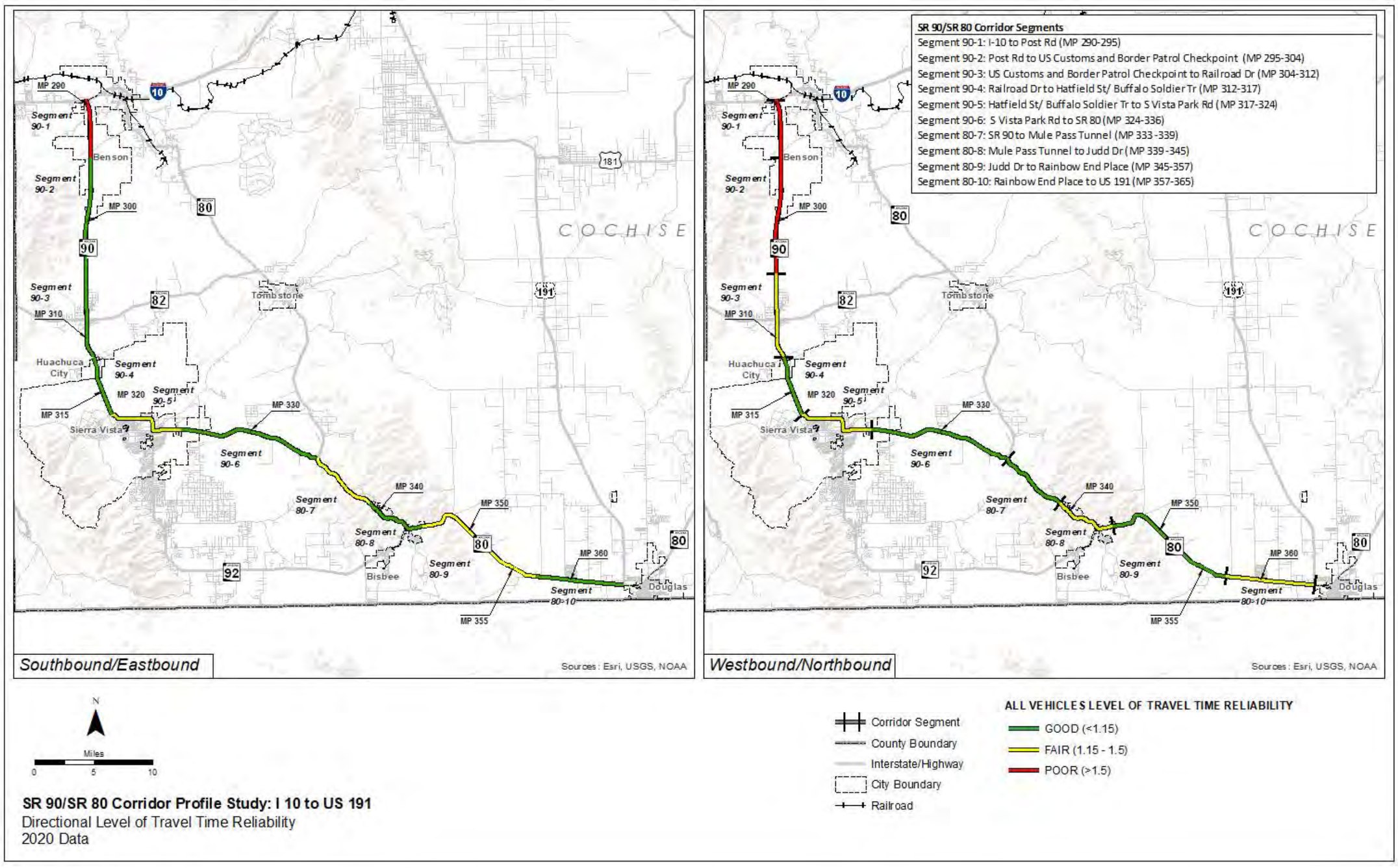
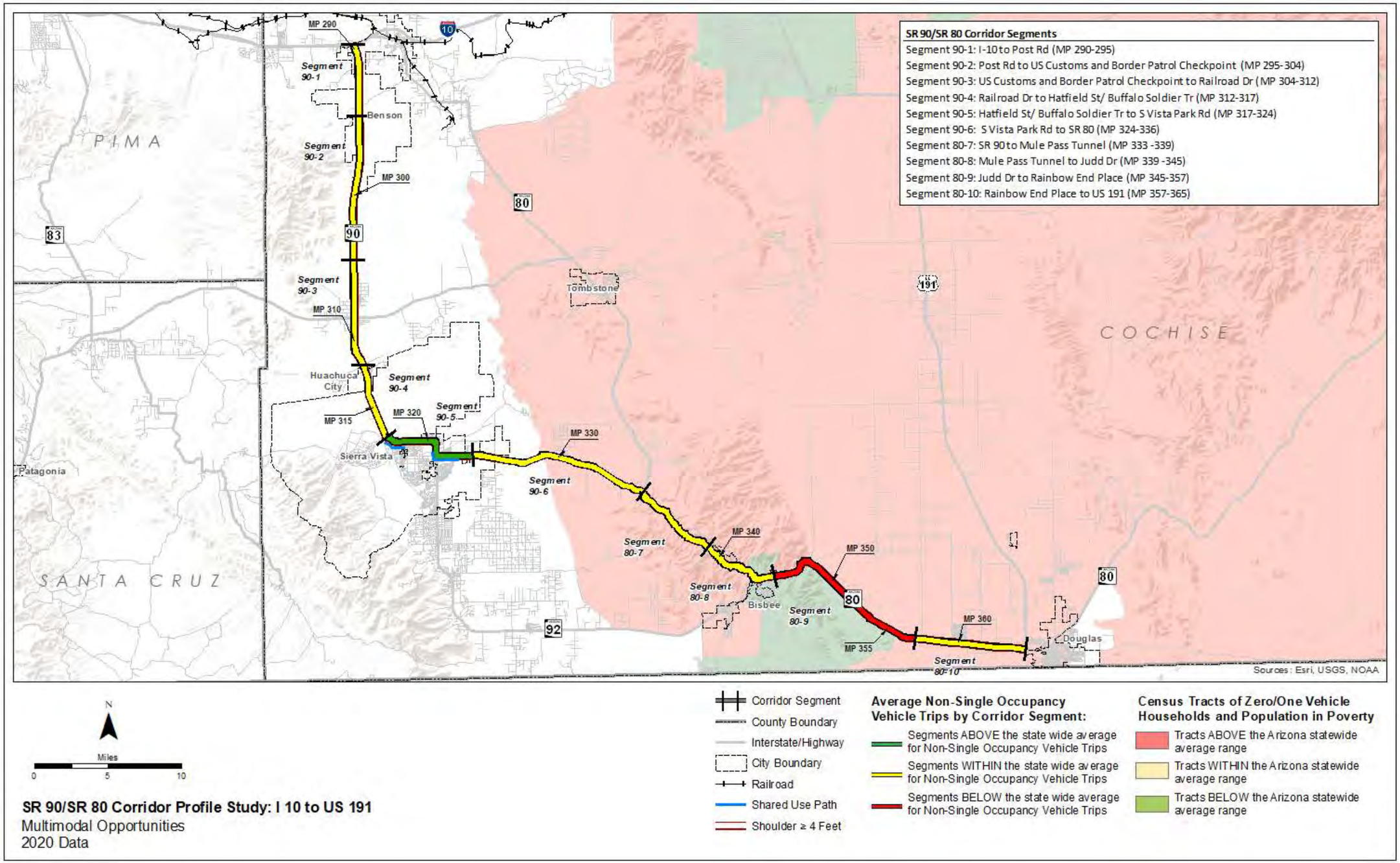
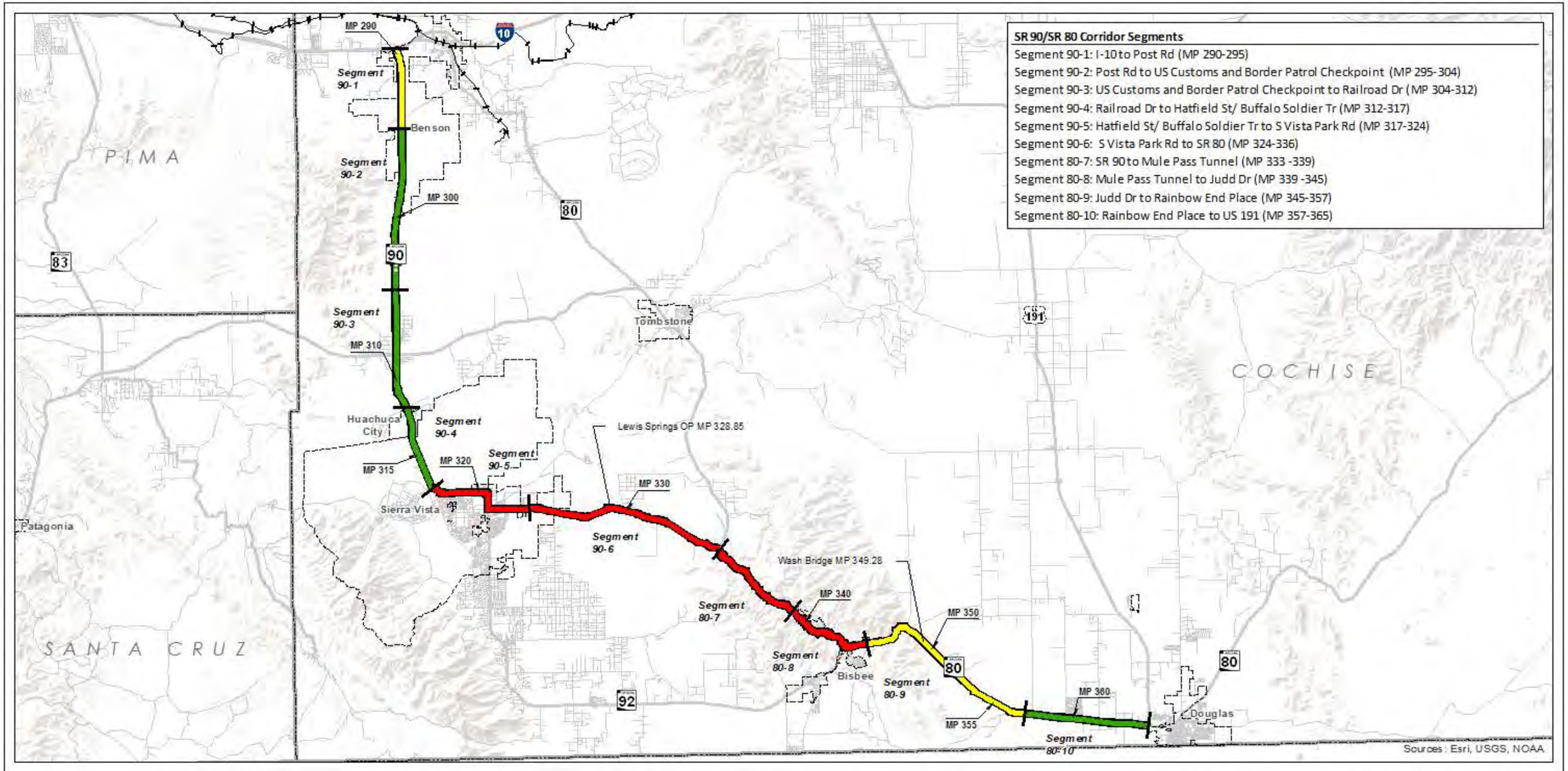
MP 290
Segment 90-1
Benson
Segment 90-2
MP 300
MP 310
Segment 90-3
Tombstone
Huachuca City
Segment 90-4
MP 315
MP 320
Segment 90-5
Sierra Vista
MP 330
Segment 90-6
MP 340
Segment 80-7
MP 350
Segment 80-8
Bisbee
Segment 80-9
MP 355
MP 360
Segment 80-10
Douglas
COCHISE
10
181
191
80
82
90
92
Southbound/Eastbound
Westbound/Northbound
Sources: Esri, USGS, NOAA
N
Miles
0
5
10
Corridor Segment
County Boundary
Interstate/Highway
City Boundary
Railroad
CLOSURES PER MILE PER YEAR
GOOD
FAIR
POOR
SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Closure Frequency
2016-2020 Data



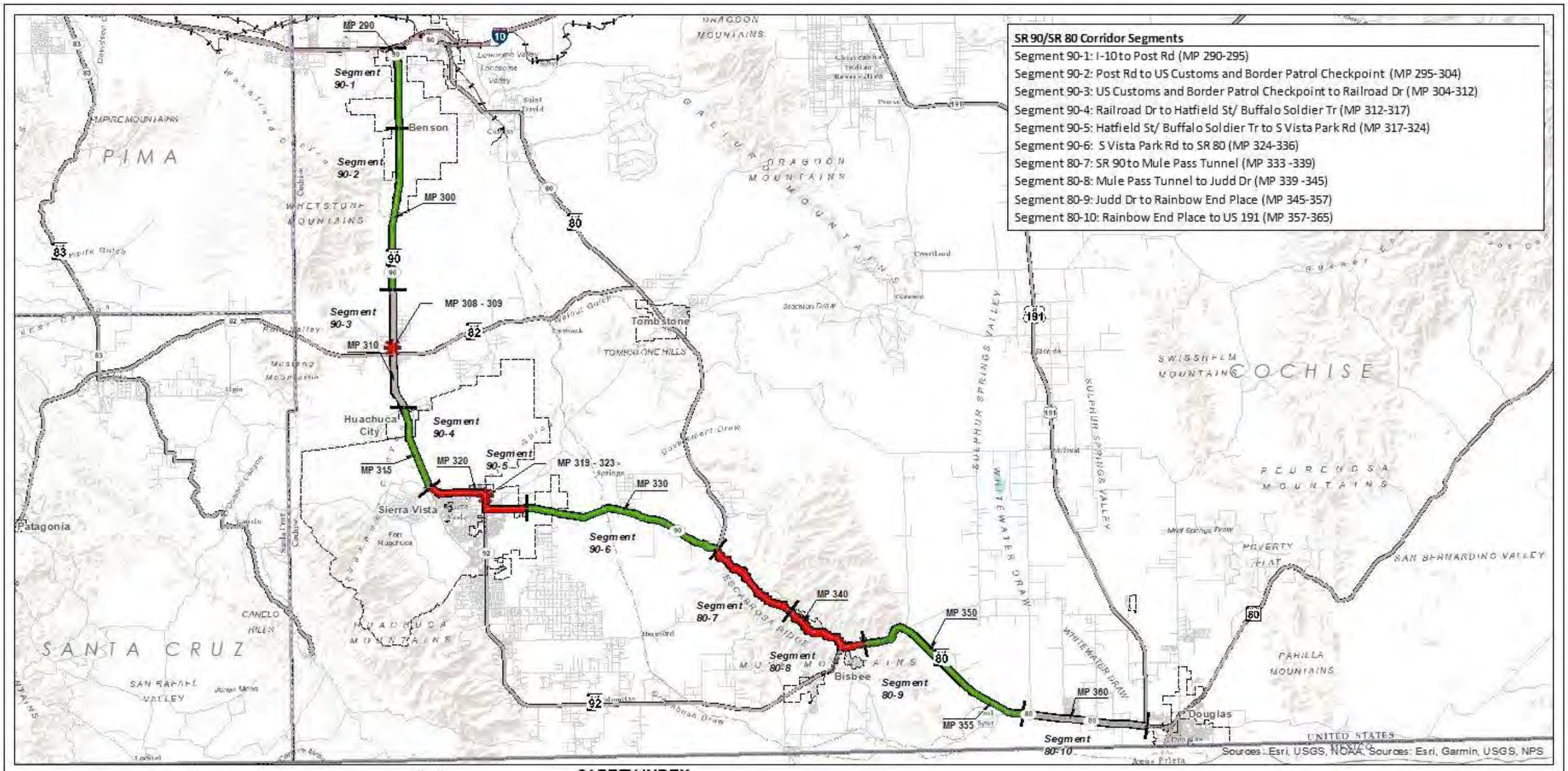
SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Directional Level of Travel Time Reliability
2020 Data



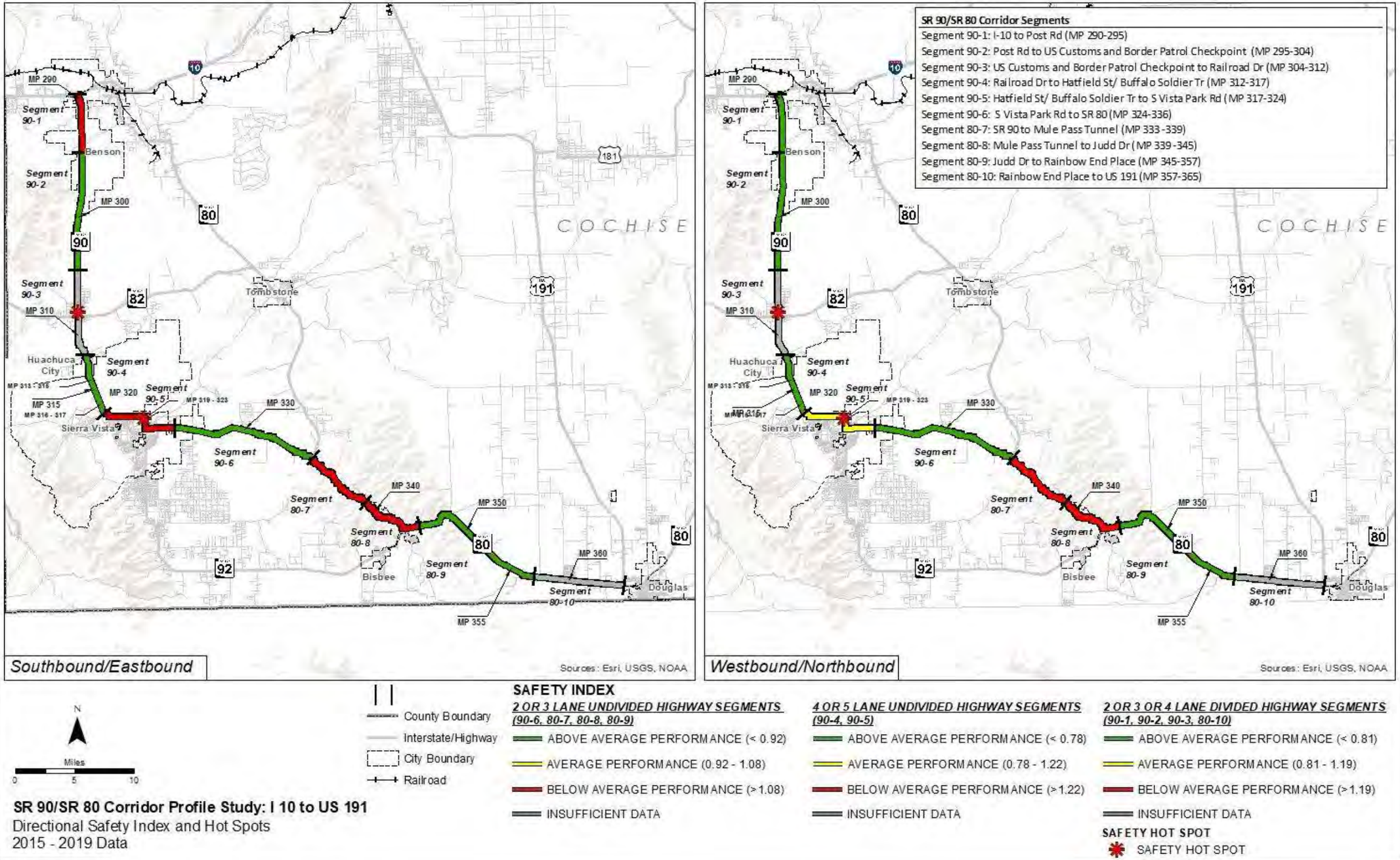
SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Multimodal Opportunities
2020 Data



SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Percentage of Bicycle Accommodation
2019 Data



SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Safety Index and Hot Spots
2015 - 2019 Data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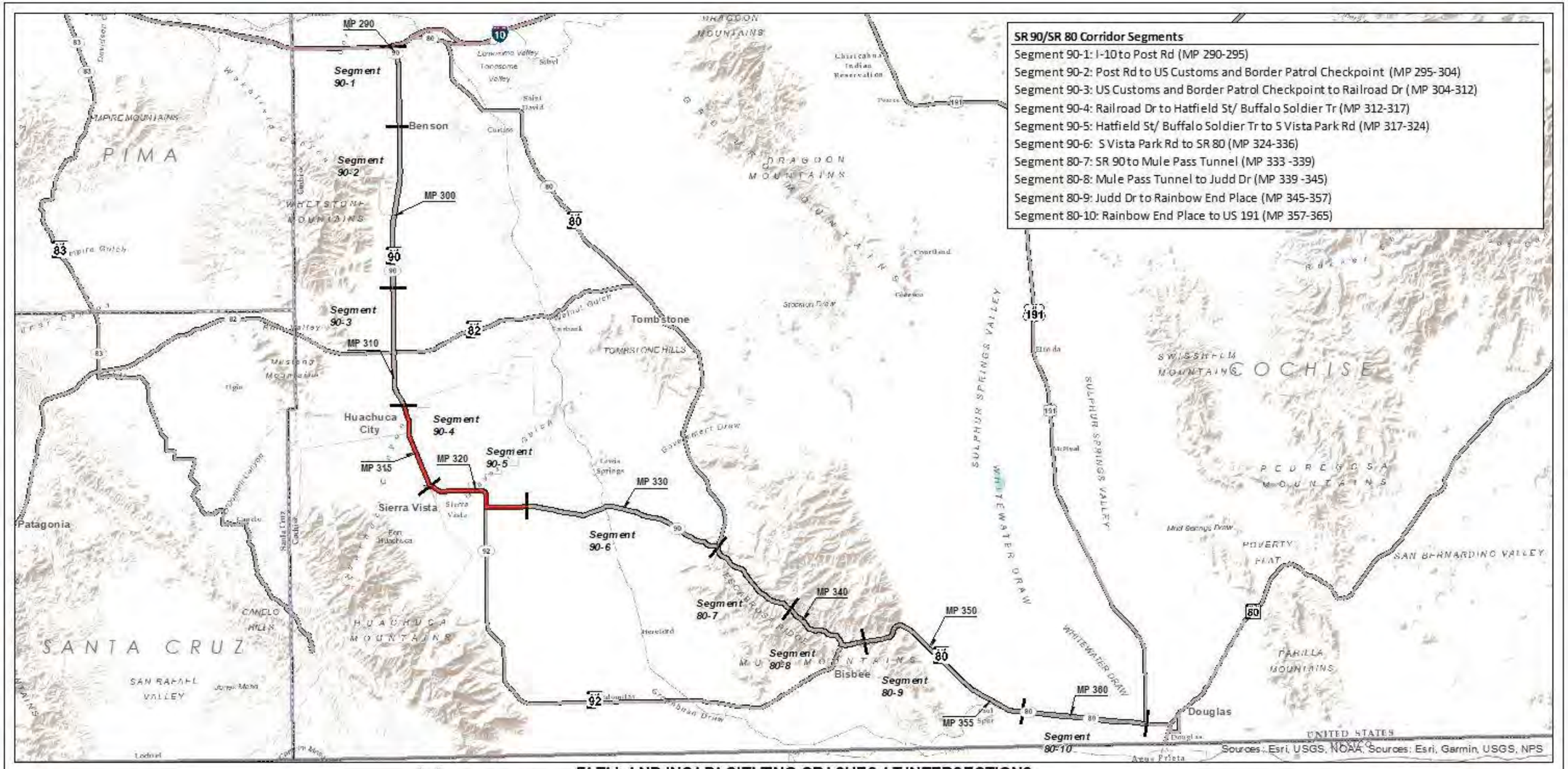
Segment 80-9: Judd Dr to Rainbow End Place (MP 345-357)
Segment 80-10: Rainbow End Place to US 191 (MP 357-365)
MP 290
Segment 90-1
Benson
Segment 90-2
MP 300
MP 310
Segment 90-3
Huachuca City
MP 313 - 315
MP 315
MP 316 - 317
Segment 90-4
MP 320
Segment 90-5
MP 319 - 323
Sierra Vista
MP 330
Segment 90-6
MP 340
Segment 80-7
Segment 80-8
Bisbee
MP 350
Segment 80-9
MP 355
Segment 80-10
MP 360
Douglas
Tombstone
COCHISE
10
181
80
90
82
191
92
Southbound/Eastbound
Westbound/Northbound
Sources: Esri, USGS, NOAA
N
Miles
0
5
10
County Boundary
Interstate/Highway
City Boundary
Railroad
SAFETY INDEX
2 OR 3 LANE UNDIVIDED HIGHWAY SEGMENTS (90-6, 80-7, 80-8, 80-9)
ABOVE AVERAGE PERFORMANCE (< 0.92)
AVERAGE PERFORMANCE (0.92 - 1.08)
BELOW AVERAGE PERFORMANCE (>1.08)
INSUFFICIENT DATA
4 OR 5 LANE UNDIVIDED HIGHWAY SEGMENTS (90-4, 90-5)
ABOVE AVERAGE PERFORMANCE (< 0.78)
AVERAGE PERFORMANCE (0.78 - 1.22)
BELOW AVERAGE PERFORMANCE (>1.22)
INSUFFICIENT DATA
2 OR 3 OR 4 LANE DIVIDED HIGHWAY SEGMENTS (90-1, 90-2, 90-3, 80-10)
ABOVE AVERAGE PERFORMANCE (< 0.81)
AVERAGE PERFORMANCE (0.81 - 1.19)
BELOW AVERAGE PERFORMANCE (>1.19)
INSUFFICIENT DATA
SAFETY HOT SPOT
SAFETY HOT SPOT
SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Directional Safety Index and Hot Spots
2015 - 2019 Data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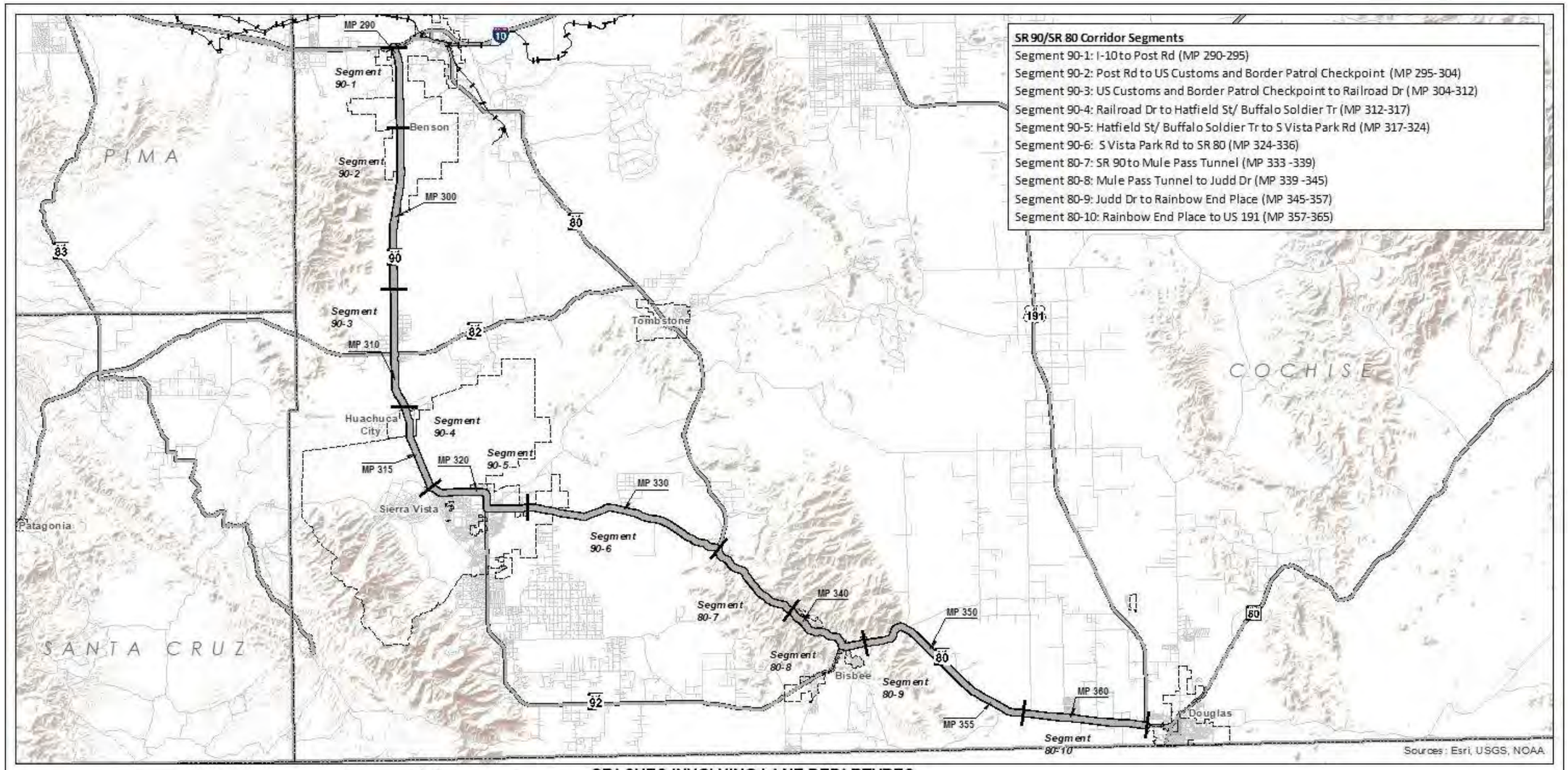
MP 290
Segment 90-1
Benson
Segment 90-2
MP 300
Segment 90-3
MP 310
Tombstone
Huachuca City
Segment 90-4
MP 315
MP 320
Segment 90-5
Sierra Vista
MP 330
Segment 90-6
Patagonia
Segment 80-7
MP 340
MP 350
Segment 80-8
Bisbee
Segment 80-9
MP 355
MP 360
Douglas
Segment 80-10
PIMA
SANTA CRUZ
COCHISE
DRAGOON MOUNTAINS
WHETSTONE MOUNTAINS
HUACHUCA MOUNTAINS
TOMBSTONE HILLS
SULPHUR SPRINGS VALLEY
WHITEWATER DRAW
SAN BERNARDINO VALLEY
PERILLA MOUNTAINS
PEDREGOSA MOUNTAINS
SWISSHELM MOUNTAINS
Sources: Esri, USGS, NOAA; Sources: Esri, Garmin, USGS, NPS
N
Miles
0
5
10
Corridor Segment
County Boundary
Interstate/Highway
City Boundary
Railroad
FATAL AND INCAPACITATING CRASHES AT INTERSECTIONS
2 OR 3 LANE UNDIVIDED HIGHWAY SEGMENTS (90-6, 80-7, 80-8, 80-9)
ABOVE AVERAGE PERFORMANCE (< 11.2%)
AVERAGE PERFORMANCE (11.2% - 15.6%)
BELOW AVERAGE PERFORMANCE (>15.6%)
INSUFFICIENT DATA
4 OR 5 LANE UNDIVIDED HIGHWAY SEGMENTS (90-4, 90-5)
ABOVE AVERAGE PERFORMANCE (< 43.8%)
AVERAGE PERFORMANCE (43.8% - 49.5%)
BELOW AVERAGE PERFORMANCE (> 49.5%)
INSUFFICIENT DATA
2 OR 3 OR 4 LANE DIVIDED HIGHWAY SEGMENTS (90-1, 90-2, 90-3, 80-10)
ABOVE AVERAGE PERFORMANCE (< 23.4%)
AVERAGE PERFORMANCE (23.4% - 29.3%)
BELOW AVERAGE PERFORMANCE (>29.3%)
INSUFFICIENT DATA
SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Fatal and Incapacitating Crashes
of 2015 - 2019 Intersections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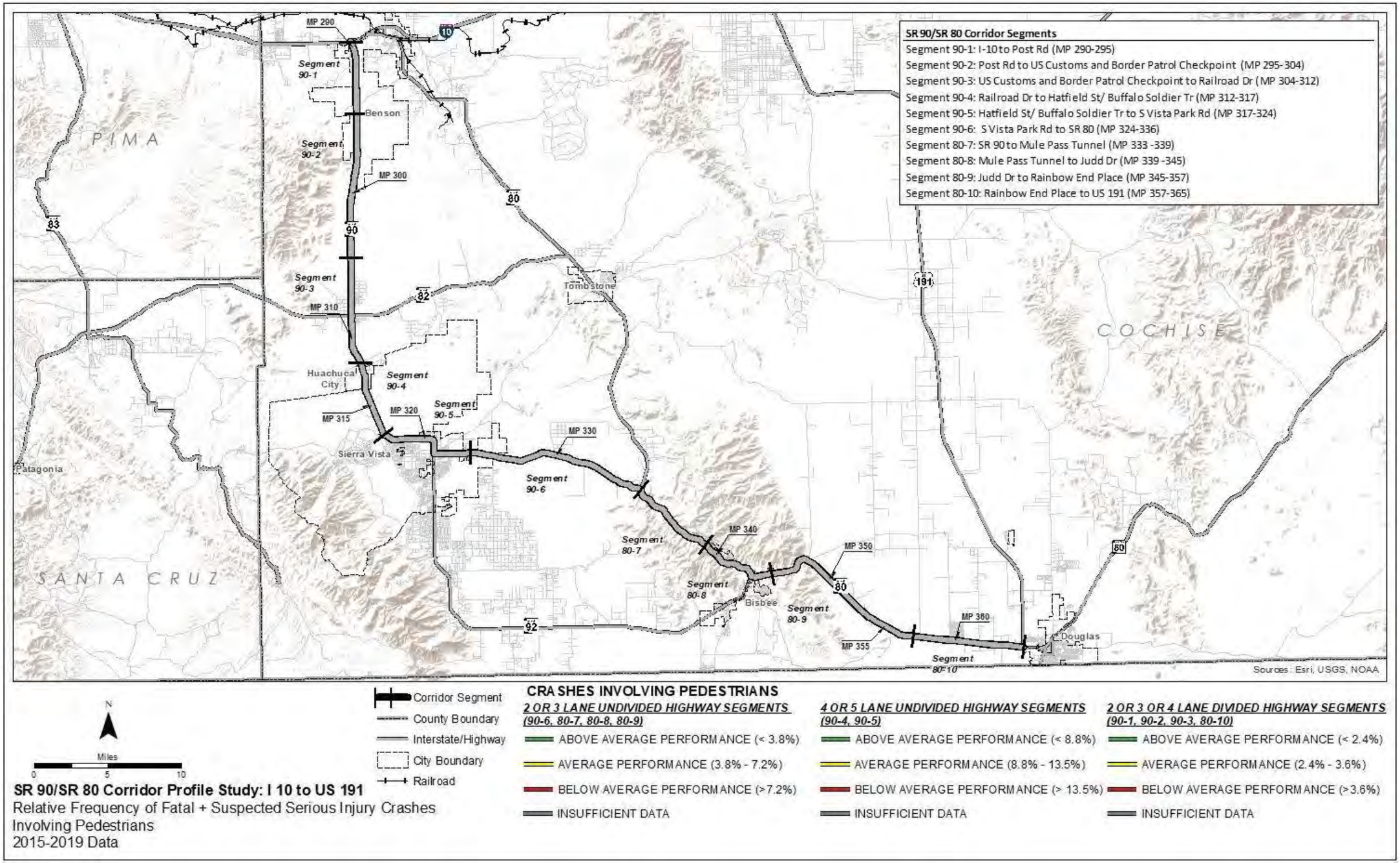
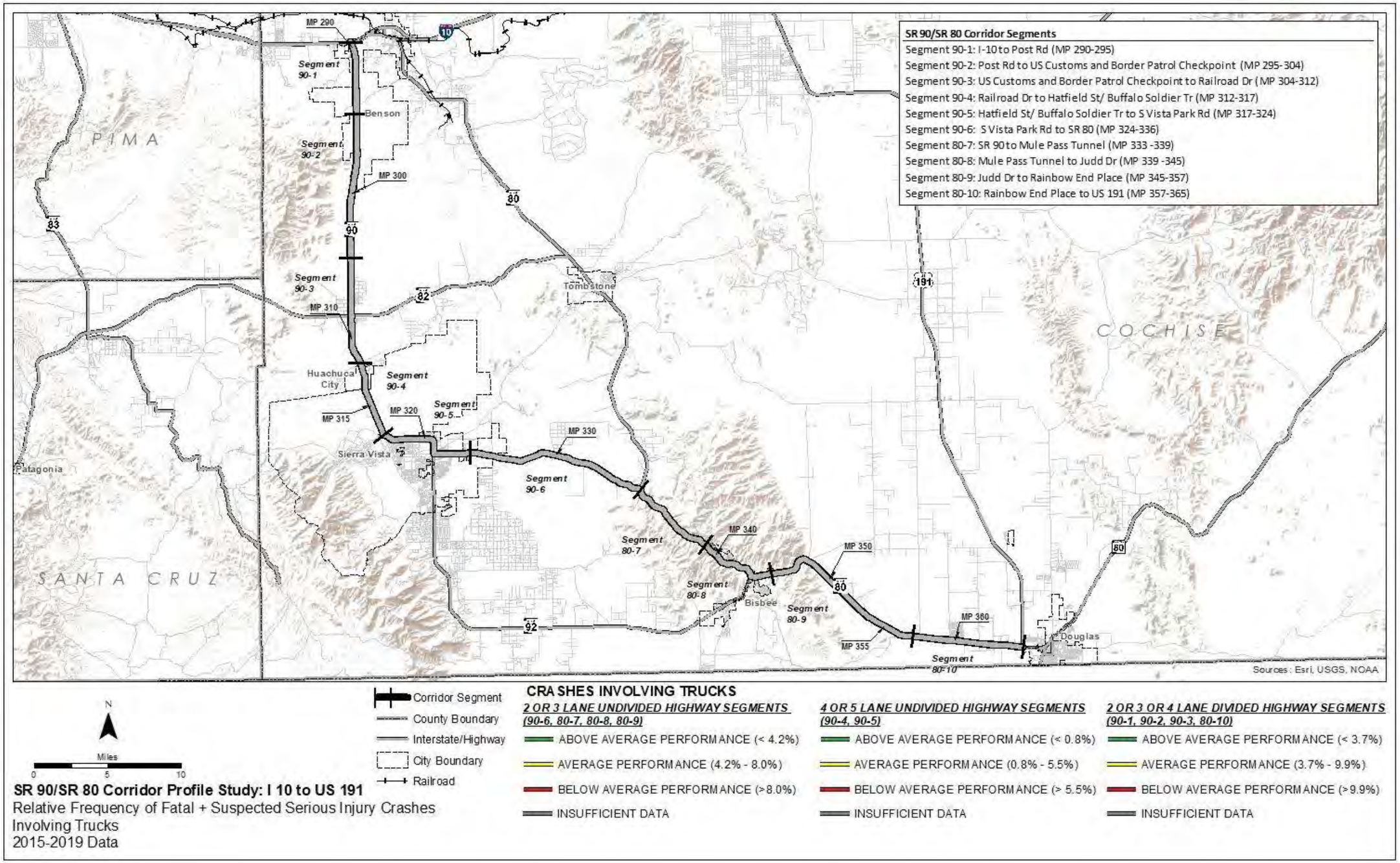
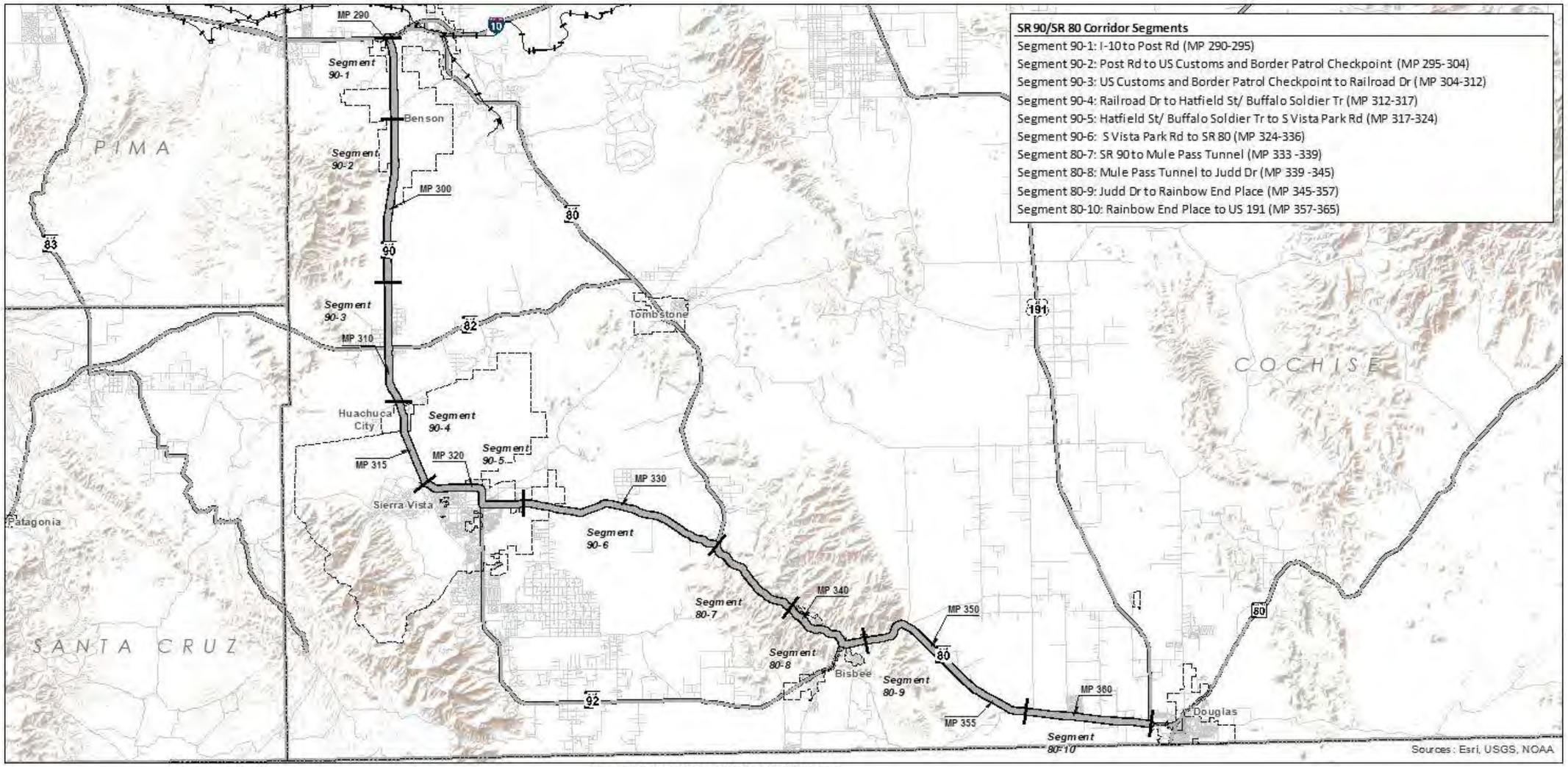
Segment 80-9: Judd Dr to Rainbow End Place (MP 345-357)
Segment 80-10: Rainbow End Place to US 191 (MP 357-365)
PIMA
SANTA CRUZ
COCHISE
MP 290
MP 300
MP 310
MP 315
MP 320
MP 330
MP 340
MP 350
MP 355
MP 360
Segment 90-1
Segment 90-2
Segment 90-3
Segment 90-4
Segment 90-5
Segment 90-6
Segment 80-7
Segment 80-8
Segment 80-9
Segment 80-10
Benson
Tombstone
Huachuca City
Sierra Vista
Patagonia
Bisbee
Douglas
10
83
90
80
82
92
191
Sources: Esri, USGS, NOAA
N
Miles
0
5
10
Corridor Segment
County Boundary
Interstate/Highway
City Boundary
Railroad
CRASHES INVOLVING LANE DEPARTURES
2 OR 3 LANE UNDIVIDED HIGHWAY SEGMENTS (90-6, 80-7, 80-8, 80-9)
ABOVE AVERAGE PERFORMANCE (< 66.9%)
AVERAGE PERFORMANCE (66.9% - 74.5%)
BELOW AVERAGE PERFORMANCE (>74.5%)
INSUFFICIENT DATA
4 OR 5 LANE UNDIVIDED HIGHWAY SEGMENTS (90-4, 90-5)
ABOVE AVERAGE PERFORMANCE (< 21.1%)
AVERAGE PERFORMANCE (21.1% - 32.1%)
BELOW AVERAGE PERFORMANCE (> 32.1%)
INSUFFICIENT DATA
2 OR 3 OR 4 LANE DIVIDED HIGHWAY SEGMENTS (90-1, 90-2, 90-3, 80-10)
ABOVE AVERAGE PERFORMANCE (< 56.4%)
AVERAGE PERFORMANCE (56.4% - 65.0%)
BELOW AVERAGE PERFORMANCE (>65.0%)
INSUFFICIENT DATA
SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Relative Frequency of Fatal + Suspected Serious Injury Crashes Involving Lane Departures
2015-2019 Data



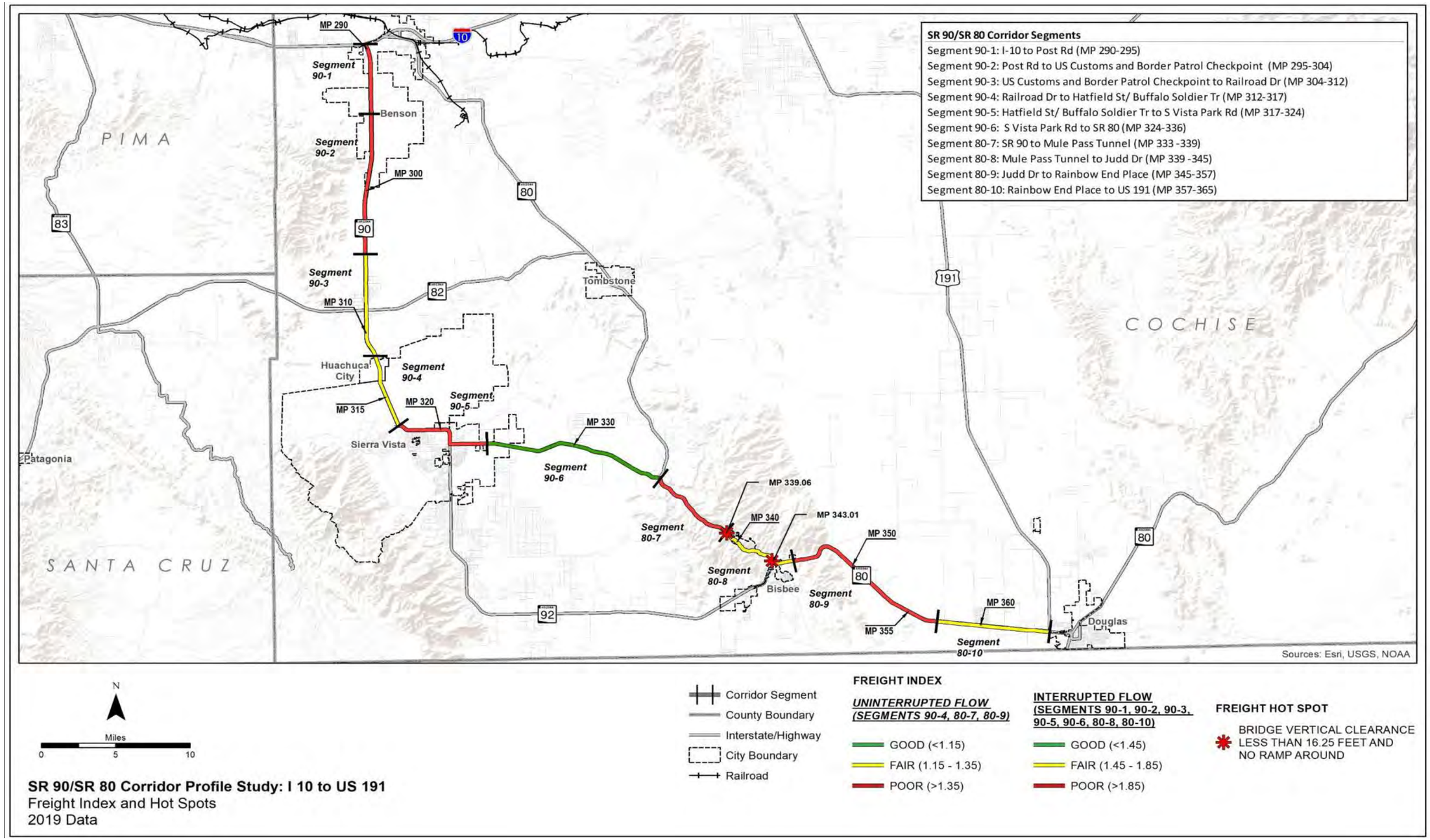
SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Relative Frequency of Fatal + Suspected Serious Injury Crashes Involving Pedestrians
2015-2019 Data



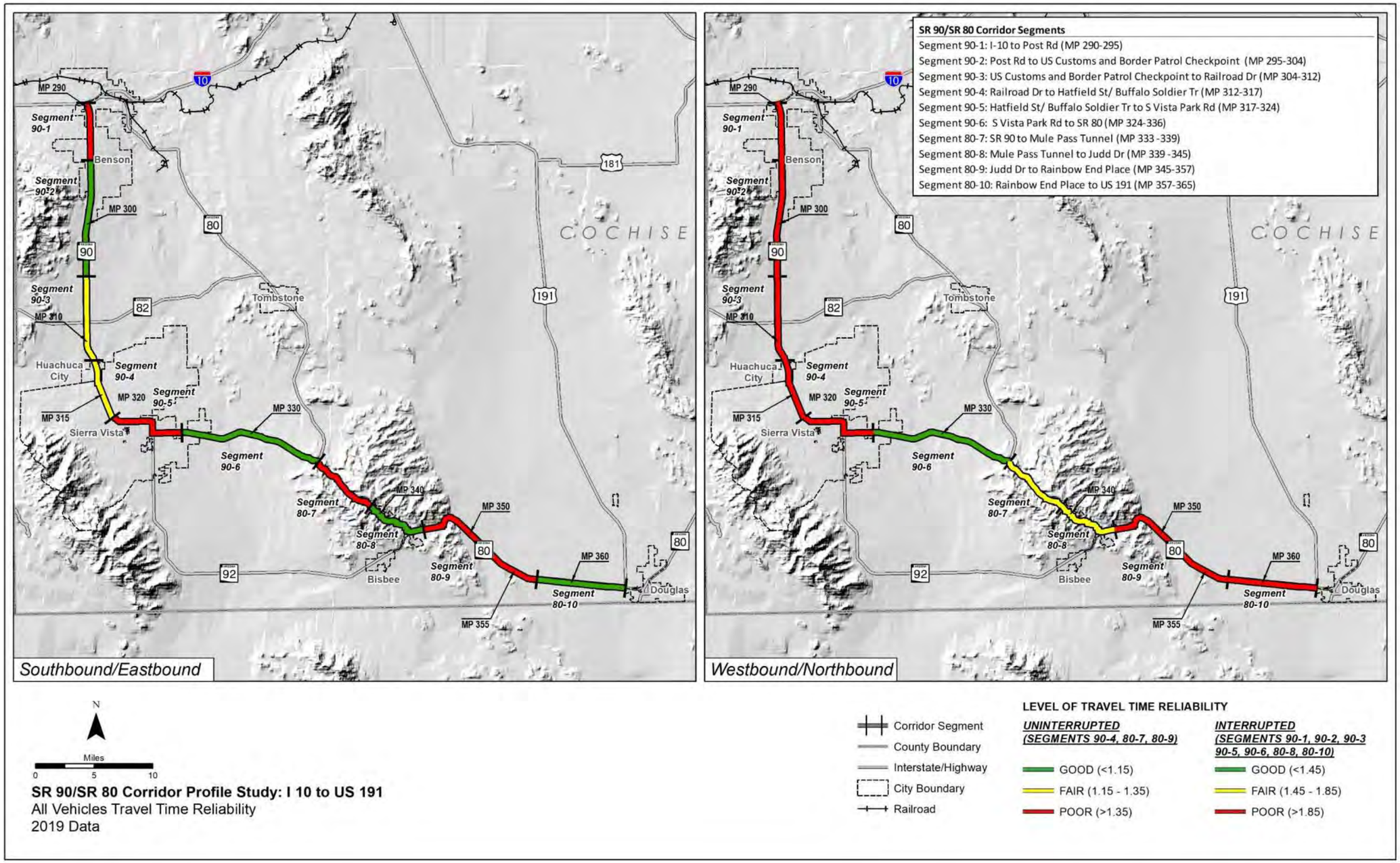
SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Relative Frequency of Fatal + Suspected Serious Injury Crashes Involving Trucks
2015-2019 Data



SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Relative Frequency of Fatal + Suspected Serious Injury Crashes Involving Bicycles
2015-2019 Data



SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Freight Index and Hot Spots
2019 Data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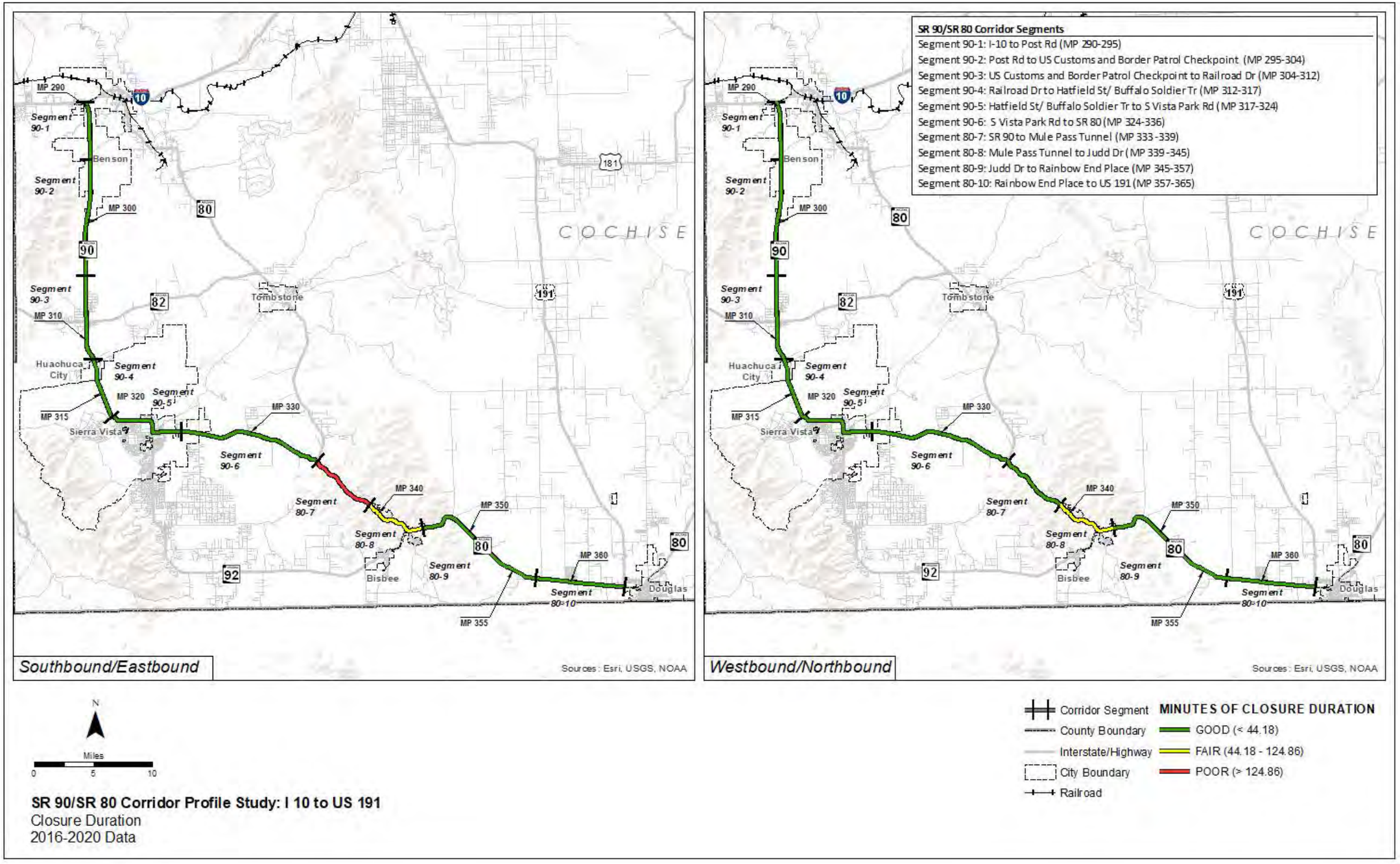
Segment 90-1
Benson
Segment 90-2
MP 300
MP 310
Segment 90-3
Tombstone
Huachuca City
Segment 90-4
MP 315
MP 320
Segment 90-5
Sierra Vista
MP 330
Segment 90-6
MP 340
Segment 80-7
MP 350
Segment 80-8
Segment 80-9
MP 355
MP 360
Segment 80-10
Bisbee
Douglas
COCHISE
10
181
191
80
82
90
92
Southbound/Eastbound
Westbound/Northbound
N
Miles
0 5 10
SR 90/SR 80 Corridor Profile Study: I 10 to US 191
All Vehicles Travel Time Reliability
2019 Data
Corridor Segment
County Boundary
Interstate/Highway
City Boundary
Railroad
LEVEL OF TRAVEL TIME RELIABILITY
UNINTERRUPTED (SEGMENTS 90-4, 80-7, 80-9)
GOOD (<1.15)
FAIR (1.15 - 1.35)
POOR (>1.35)
INTERRUPTED (SEGMENTS 90-1, 90-2, 90-3 90-5, 90-6, 80-8, 80-10)
GOOD (<1.45)
FAIR (1.45 - 1.85)
POOR (>1.85)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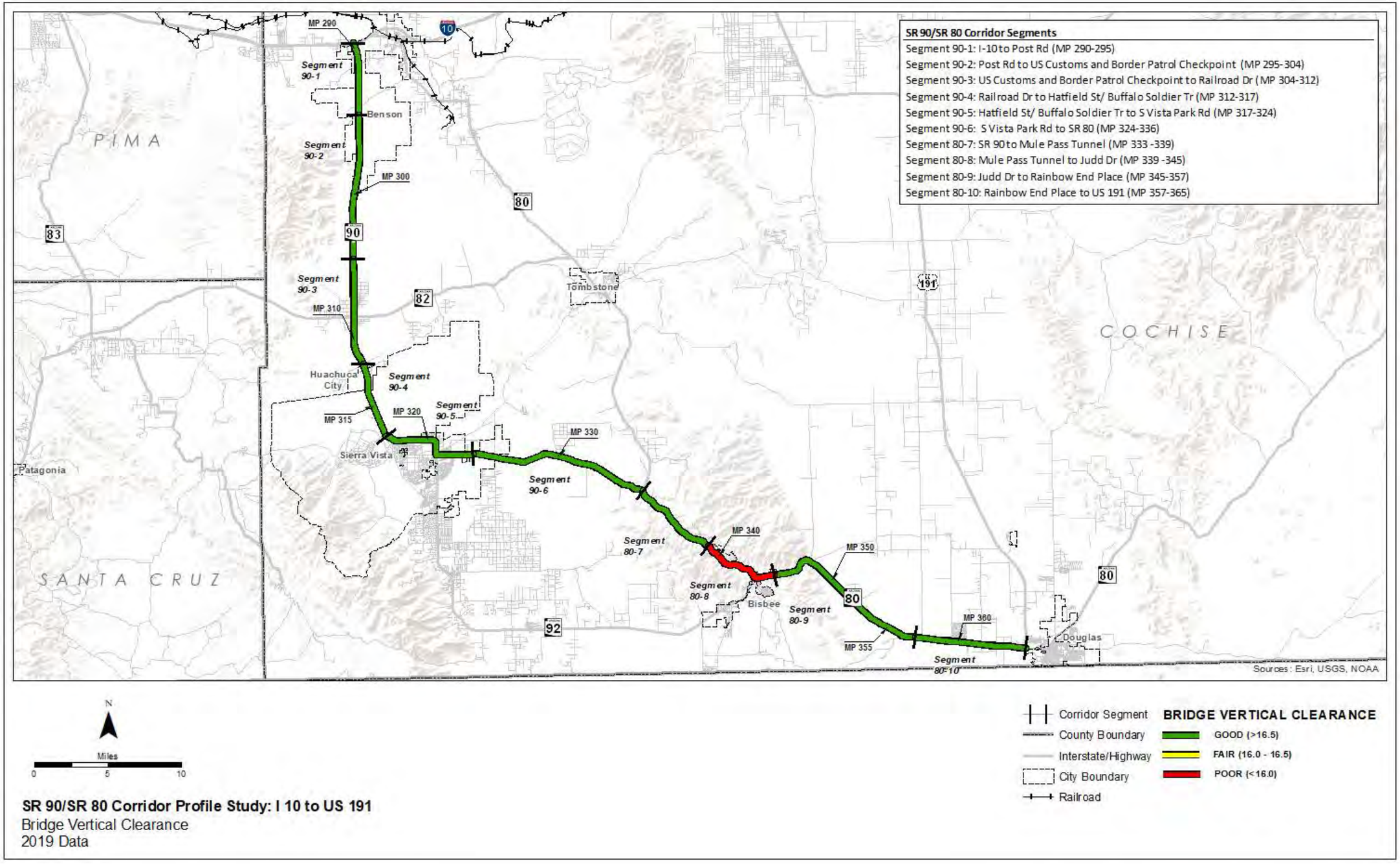
Segment 90-4
MP 315
MP 320
Segment 90-5
Sierra Vista
MP 330
Segment 90-6
MP 340
Segment 80-7
MP 350
Segment 80-8
Bisbee
Segment 80-9
MP 355
MP 360
Segment 80-10
Douglas
COCHISE
Southbound/Eastbound
Westbound/Northbound
Sources: Esri, USGS, NOAA
N
Miles
0
5
10
Corridor Segment
County Boundary
Interstate/Highway
City Boundary
Railroad
MINUTES OF CLOSURE DURATION
GOOD (< 44.18)
FAIR (44.18 - 124.86)
POOR (> 124.86)
SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Closure Duration
2016-2020 Data

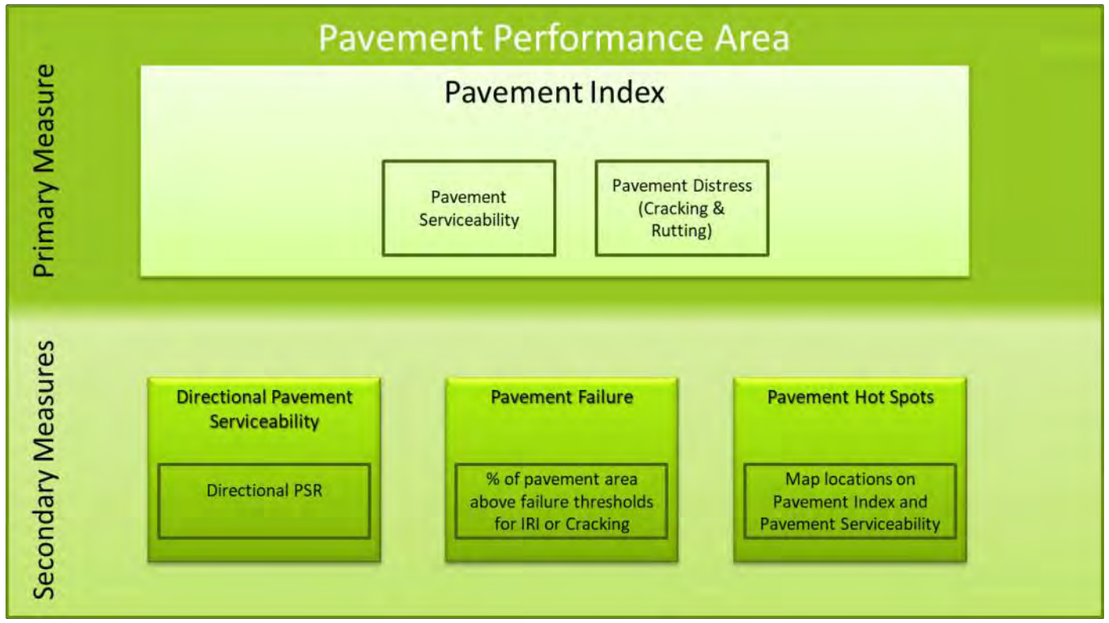


SR 90/SR 80 Corridor Profile Study: I 10 to US 191
Bridge Vertical Clearance
2019 Data

Appendix B: Performance Area Detailed Calculation Methodologies

Pavement Performance Area Calculation Methodologies

This section summarizes the approach for developing the primary and secondary performance measures in the Pavement performance area as shown in the following graphic:



This performance area is used to evaluate mainline pavement condition. Pavement condition data for ramps, frontage roads, crossroads, etc. was not included in the evaluation.

Primary Pavement Index

The Pavement Index is calculated based on the use of three pavement condition ratings from the ADOT Pavement Database. The three ratings are the International Roughness Index (IRI), the Cracking rating, and the Rutting rating. The calculation of the Pavement Index uses a combination of these two ratings.

The IRI is a measurement of the pavement roughness based on field-measured longitudinal roadway profiles. To facilitate the calculation of the index, the IRI rating was converted to a Pavement Serviceability Rating (PSR) using the following equation:

$$PSR = 5 * e^{-0.0038*IRI}$$

The Cracking Rating is a measurement of the amount of surface cracking based on a field-measured area of 1,000 square feet that serves as a sample for each mile. The Rutting rating is a measurement of the depth of pavement rutting based on field measurements. To facilitate the calculation of the index, the Cracking Rating and Rutting Rating were combined and converted to a Pavement Distress Index (PDI) using the following equation:

$$PDI = 5 - \left[(0.345 * C^{0.66}) + \left(0.01428 * \left(\frac{R}{2} * 100 \right)^{1.32} \right) - \left(0.0823 * C^{0.18} * \left(\frac{R}{2} * 100 \right)^{0.50} \right) \right]$$

Both the PSR and PDI use a 0 to 5 scale with 0 representing the lowest performance and 5 representing the highest performance. The performance thresholds for interstates and non-interstates shown in the tables below were used for the PSR and PDI.

Performance Level for Interstates	IRI (PSR)	Cracking & Rutting (PDI)
Good	<75 (>3.75)	Cracking <5.75 Rutting < 0.35
Fair	75 - 102 (3.40 - 3.75)	Cracking 5.75 - 12 Rutting 0.35 – 0.55
Poor	>102(<3.40)	Cracking >12 Rutting > 0.55

Performance Level for Non-Interstates	IRI (PSR)	Cracking & Rutting (PDI)
Good	<94 (>3.5)	Cracking < 5.75 Rutting < 0.35
Fair	94 - 142 (2.90 - 3.5)	Cracking 5.75 - 12 Rutting 0.35 – 0.55
Poor	>142 (<2.90)	Cracking >12 Rutting > 0.55

The PSR and PDI are calculated for each 1-mile section of roadway. If PSR or PDI falls into a poor rating (<3.4 for PSR for interstates, for example) for a 1-mile section, then the score for that 1-mile section is entirely (100%) based on the lower score (either PSR or PDI). If neither PSR or PDI fall into a poor rating for a 1-mile section, then the score for that 1-mile section is based on a combination of the lower rating (70% weight) and the higher rating (30% weight). The result is a score between 0 and 5 for each direction of travel of each mile of roadway based on a combination of both the PSR and the PDI.

The project corridor has been divided into segments. The Pavement Index for each segment is a weighted average of the directional ratings based on the number of travel lanes. Therefore, the condition of a section with more travel lanes will have a greater influence on the resulting segment Pavement Index than a section with fewer travel lanes.

Secondary Pavement Measures

Three secondary measures are evaluated::

- Directional Pavement Serviceability
- Pavement Failure
- Pavement Hot Spots

Directional Pavement Serviceability: Similar to the Pavement Index, the Directional Pavement Serviceability is calculated as a weighted average (based on number of lanes) for each segment. However, this rating only utilizes the PSR and is calculated separately for each direction of travel. The PSR uses a 0 to 5 scale with 0 representing the lowest performance and 5 representing the highest performance.

Pavement Failure: The percentage of pavement area rated above the failure thresholds for IRI, Cracking, or Rutting is calculated for each segment. In addition, the Standard score (z-score) is calculated for each segment.

The Standard score (z-score) is the number of standard deviations above or below the mean. Therefore, a Standard score between -0.5 and +0.5 is “average”, less than -0.5 is lower (better) than average, and higher than +0.5 is above (worse) than average.

Pavement Hot Spots: The Pavement Index map identifies locations that have an IRI rating, Cracking rating, or Rutting rating that fall above the failure threshold as identified by ADOT Pavement Group. For interstates, an IRI rating above 105, a Cracking rating above 10, or a Rutting rating above 0.4 will be used as the thresholds which are slightly different than the ratings shown previously. For non-interstates, an IRI rating above 142, a Cracking rating above 10, or a Rutting rating above 0.4 will be used as the thresholds.

Performance Level	% Pavement Failure
Good	< 5%
Fair	5% – 20%
Poor	>20%

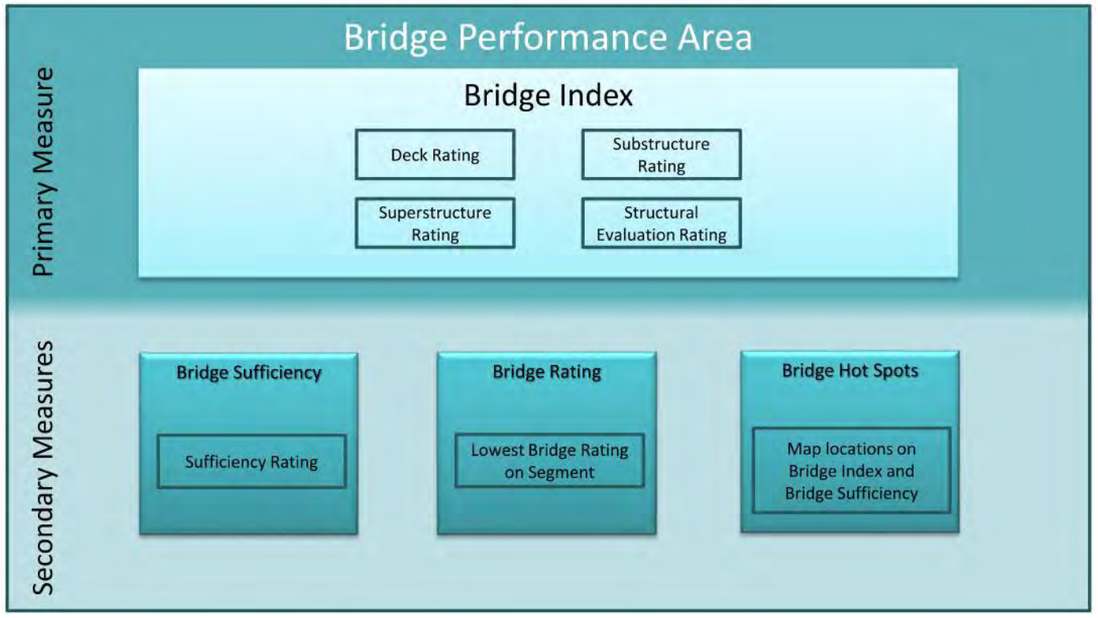
Scoring

Performance Level	Pavement Index	
	Interstates	Non-Interstates
Good	>3.75	>3.6
Fair	3.0 - 3.75	2.8 - 3.6
Poor	<3.0	<2.8

Performance Level	Directional Pavement Serviceability	
	Interstates	Non-Interstates
Good	>3.75	>3.5
Fair	3.4 - 3.75	2.9 - 3.5
Poor	<3.4	<2.9

Bridge Performance Area Calculation Methodologies

This section summarizes the approach for developing the primary and secondary performance measures in the Bridge performance area as shown in the following graphic:



This performance area is used to evaluate mainline bridges. Bridges on ramps (that do not cross the mainline), frontage roads, etc. should not be included in the evaluation. Basically, any bridge that carries mainline traffic or carries traffic over the mainline should be included and bridges that do not carry mainline traffic, run parallel to the mainline (frontage roads), or do not cross the mainline should not be included.

Primary Bridge Index

The Bridge Index is calculated based on the use of four bridge condition ratings from the ADOT Bridge Database, also known as the Arizona Bridge Information and Storage System (ABISS). The four ratings are the Deck Rating, Substructure Rating, Superstructure Rating, and Structural Evaluation Rating. The calculation of the Bridge Index uses the lowest of these four ratings.

Each of the four condition ratings use a 0 to 9 scale with 0 representing the lowest performance and 9 representing the highest performance.

The project corridor has been divided into segments and the bridges are grouped together according to the segment definitions. In order to report the Bridge Index for each corridor segment, the Bridge Index for each segment is a weighted average based on the deck area for each bridge. Therefore, the condition of a larger bridge will have a greater influence on the resulting segment Bridge Index than a smaller bridge.

Secondary Bridge Measures

Three secondary measures will be evaluated:

- Bridge Sufficiency
- Bridge Rating
- Bridge Hot Spots

Bridge Sufficiency: Similar to the Bridge Index, the Bridge Sufficiency rating is calculated as a weighted average (based on deck area) for each segment. The Bridge Sufficiency rating is a scale of 0 to 100 with 0 representing the lowest performance and 100 representing the highest performance. A rating of 80 or above represents “good” performance, a rating between 50 and 80 represents “fair” performance, and a rating below 50 represents “poor” performance.

Bridge Rating: The Bridge Rating simply identifies the lowest bridge rating on each segment. This performance measure is not an average and therefore is not weighted based on the deck area. The Bridge Index identifies the lowest rating for each bridge, as described above. Each of the four condition ratings use a 0 to 9 scale with 0 representing the lowest performance and 9 representing the highest performance.

Bridge Hot Spots: The Bridge Index map identifies individual bridge locations that are identified as hot spots. Hot spots are bridges that have a single rating of 4 in any of the four ratings, or multiple ratings of 5 in the deck, substructure or superstructure ratings.

Scoring:

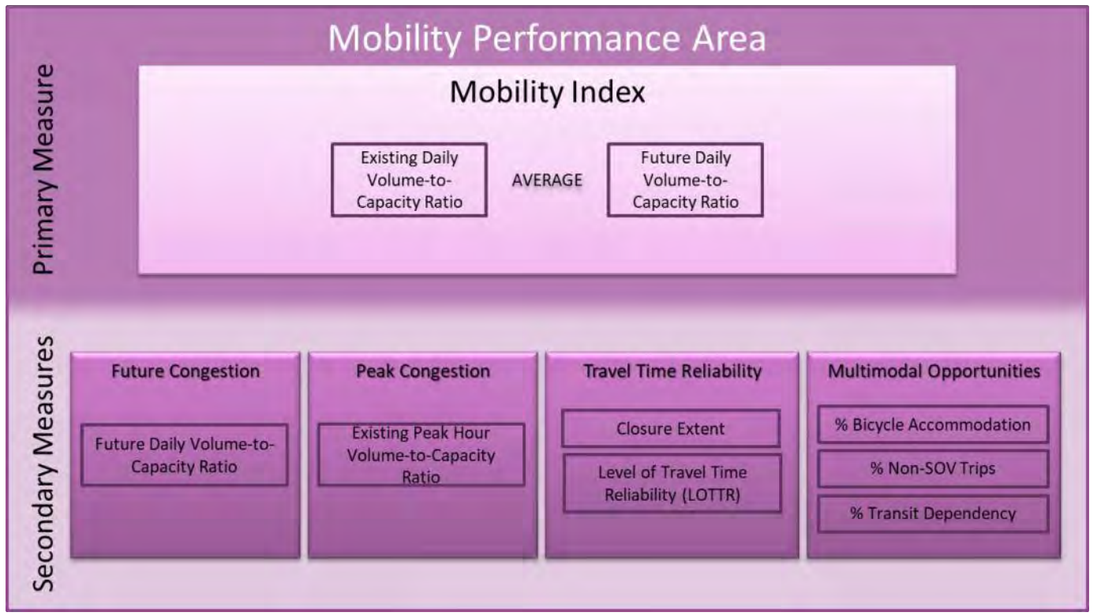
Performance Level	Bridge Index
Good	>6.5
Fair	5.0-6.5
Poor	<5.0

Performance Level	Sufficiency Rating
Good	>80
Fair	50-80
Poor	<50

Performance Level	Bridge Rating
Good	>6
Fair	5-6
Poor	<5

Mobility Performance Area Calculation Methodologies

This section summarizes the approach for developing the primary and secondary performance measures in the Mobility performance area as shown in the following graphic:



Primary Mobility Index

The primary Mobility Index is an average of the existing daily volume-to-capacity (V/C) ratio and the future daily V/C ratio for each segment of the corridor.

Existing Daily V/C: The existing daily V/C ratio for each segment is calculated by dividing the existing Annual Average Daily Traffic (AADT) volume for each segment by the total Level of Service (LOS) E capacity volume for that segment

The capacity is calculated using the HERS Procedures for Estimating Highway Capacity[1]. The HERS procedure incorporates HCM 2010 methodologies. The methodology includes capacity estimation procedures for multiple facility types including freeways, rural two-lane highways, multilane highways, and signalized and non-signalized urban sections.

The segment capacity is defined as a function of the number of mainline lanes, shoulder width, interrupted or uninterrupted flow facilities, terrain type, percent of truck traffic, and the designated urban or rural environment.

The AADT for each segment is calculated by applying a weighted average across the length of the segment based on the individual 24-hour volumes and distances associated with each HPMS count station within each segment.

The following example equation is used to determine the weighted average of a segment with two HPMS count locations within the corridor

((HPMS 1 Distance x HPMS 1 Volume) + (HPMS 2 Distance x HPMS 2 Volume))/Total Segment Length

For specific details regarding the HERS methodology used, refer to the *Procedures for Estimating Highway Capacity, draft Technical Memorandum.*

Future Daily V/C: The future daily V/C ratio for each segment is calculated by dividing the future AADT volume for each segment by the existing LOS E capacity. The capacity volume used in this calculation is the same as is utilized in the existing daily V/C equation.

The future AADT daily volumes are generated by applying an average annual compound growth rate (ACGR) to each existing AADT segment volume. The following equation is used to apply the average annual compound growth rate:

Future AADT = Existing AADT x ((1+ACGR)^(Future Year-Existing Year))

The ACGR for each segment is defined by comparing the total volumes in the existing Arizona Travel Demand Model (AZTDM2) to the future AZTDM2 traffic volumes at each existing HPMS count station location throughout the corridor. Each existing and future segment volume is defined using the same weighted average equation described in the *Existing Daily V/C* section above and then summing the directional volumes for each location. The following equation is used to determine the ACGR for each segment:

ACGR = ((Future Volume/Existing Volume)^(1/(Future Year-Existing Year))))-1

Secondary Mobility Measures

Four secondary measures are evaluated:

- Future Congestion
- Peak Congestion
- Travel Time Reliability

[1] HERS Support – 2011, Task 6: Procedures for Estimating Highway Capacity, draft Technical Memorandum. Cambridge Systematics. Prepared for the Federal Highway Administration. March 2013.

  - Closure Extent
  - Directional Level of Travel Time Reliability
- Multimodal Opportunities
  - % Bicycle Accommodation
  - % Non-Single Occupancy Vehicle (SOV) Trips

Future Congestion: The future daily V/C ratios for each segment in the corridor that are calculated and used in the Mobility Index as part of the overall average between Existing Daily V/C and Future Daily V/C are applied independently as a secondary measure. The methods to calculate the Future Daily V/C can be referenced in the Mobility Index section.

Peak Congestion: Peak Congestion has been defined as the peak hour V/C ratio in both directions of the corridor. The peak hour V/C ratio is calculated using the HERS method as described previously. The peak hour volume utilizes the directional AADT for each segment, which is calculated by applying a weighted average across the length of the segment based on the individual directional 24-hour volumes and distances associated with each HPMS count station within each segment. The segment capacity is defined based on the characteristics of each segment including number of lanes, terrain type, and environment, similar to the 24-hour volumes using the HERS method.

Travel Time Reliability: Travel time reliability is a secondary measure that includes two indicators. The two indicators are the number of times a piece of a corridor is closed for any specific reason, and the directional Level of Travel Time Reliability (LOTTR) metric.

Closure Extent: The number of times a roadway is closed is documented through the HCRS dataset. Closure Extent is defined as the average number of times a particular milepost of the corridor is closed per year per mile in a specific direction of travel. The weighted average of each occurrence takes into account the distance over which a specific occurrence spans.

Thresholds that determine levels of good, fair, and poor are based on the average number of closures per mile per year within each of the identified statewide significant corridors by ADOT. The thresholds shown at the end of this section represent statewide averages across those corridors.

Directional Level of Travel Time Reliability: In terms of overall mobility, the LOTTR is the relationship of the 80th percentile travel time to average (50th percentile) travel time for a given corridor segment in a specific direction.

Using INRIX data provided by ADOT, four time periods for each data point were collected throughout the day (AM peak, mid-day, PM peak, and off-peak). The highest value of the four time periods calculation is defined as the LOTTR for that data point. The weighted average LOTTR is calculated within each segment based on the number of data points collected and the length associated with the TMC location. The value of the weighted average LOTTR across each entry is used as the LOTTR for each respective segment within the corridor.

Multimodal Opportunities: Three multimodal opportunity indicators reflect the characteristics of the corridor that promote alternate modes to a single occupancy vehicle (SOV) for trips along the corridor. The three indicators include the percent bicycle accommodation, non-SOV trips, and transit dependency along the corridor.

Percent Bicycle Accommodation: For this secondary performance evaluation, outside shoulder widths are evaluated considering the roadway's context and conditions. This requires use of the roadway data that includes right shoulder widths, shoulder surface types, and speed limits, all of which are available in the following ADOT geographic information system (GIS) data sets:

- Right Shoulder Widths
- Left Shoulder Widths (for undivided roadways)
- Shoulder Surface Type (Both Left/Right)
- Speed Limit

Additionally, each segment's average AADT, estimated earlier in the Mobility performance area methodology, is used for the criteria to determine if the existing shoulder width meets the effective width.

The criteria for screening if a shoulder segment meets the recommended width criteria are as followed:

(1) If AADT <= 1500 OR Speed Limit <= 25 miles per hour (mph):
The segment's general purpose lane can be shared with bicyclists (no effective shoulder width required)

(2) If AADT > 1500 AND Speed Limit between (25 - 50 mph) AND Pavement Surface is Paved:
Effective shoulder width required is 4 feet or greater

(3) If AADT > 1500 AND Speed Limit >= 50 mph and Pavement Surface is Paved:
Effective shoulder width required is 6 feet or greater

The summation of the length of the shoulder sections that meet the defined effective width criteria, based on criteria above, is divided by the segment's total length to estimate the percent of the segment that accommodates bicycles as illustrated at the end of this section. If shoulder data is not available or appears erroneous, field measurements can substitute for the shoulder data.

Percent Non-SOV Trips: The percentage of non-SOV trips over distances less than 50 miles gives an indication of travel patterns along a section of the corridor that could benefit from additional multimodal options in the future.

Thresholds that determine levels of good, fair, and poor are based on the percent non-SOV trips within each of the identified statewide significant corridors by ADOT. The thresholds shown at the end of this section represent statewide averages across those corridors

Percent Transit Dependency: U.S. Census American Community Survey tract and state level geographic data and attributes from the tables B08201 (Number of Vehicles Available by Household Size) and B17001 (Population in Poverty within the Last 12 Months) were downloaded with margins of error included from the Census data retrieval application Data Ferret. Population ranges for each tract were determined by adding and subtracting the margin of error to each estimate in excel. The tract level attribute data was then joined to geographic tract data in GIS. Only tracts within a one mile buffer of each corridor are considered for this evaluation.

Tracts that have a statistically significantly larger number of either people in poverty or households with only one or no vehicles available than the state average are considered potentially transit dependent.

Example: The state average for zero or one vehicles households (HHs) is between 44.1% and 45.0%. Tracts which have the lower bound of their range above the upper bound of the state range have a greater percentage of zero/one vehicle HHs than the state average. Tracts that have their upper bound beneath the lower bound of the state range have a lesser percentage of zero/one vehicles HHs than the state average. All other tracts that have one of their bounds overlapping with the state average cannot be considered statistically significantly different because there is a chance the value is actually the same.

In addition to transit dependency, the following attributes are added to the Multimodal Opportunities map based on available data.

- Shoulder width throughout the corridor based on 'Shoulder Width' GIS dataset provided by ADOT
- Intercity bus routes
- Multiuse paths within the corridor right-of-way, if applicable

Scoring:

Volume-to-Capacity Ratios		
Urban and Fringe Urban		
Good - LOS A-C	V/C ≤ 0.71	*Note - ADOT Roadway Design Standards indicate Urban and Fringe Urban roadways should be designed to level of service C or better
Fair - LOS D	V/C > 0.71 & ≤ 0.89	
Poor - LOS E or less	V/C > 0.89	
Rural		
Good - LOS A-B	V/C ≤ 0.56	*Note - ADOT Roadway Design Standards indicate Rural roadways should be designed to level of service B or better
Fair - LOS C	V/C > 0.56 & ≤ 0.76	
Poor - LOS D or less	V/C > 0.76	

Performance Level	Closure Extent
Good	≤ 0.22
Fair	> 0.22 & ≤ 0.62
Poor	V/C > 0.62

Performance Level	LOTTR on Uninterrupted Flow Facilities
Good	< 1.15
Fair	≥ 1.15 & < 1.50
Poor	≥ 1.50

Performance Level	LOTTR on Interrupted Flow Facilities
Good	< 1.15
Fair	≥ 1.15 & < 1.50
Poor	≥ 1.50

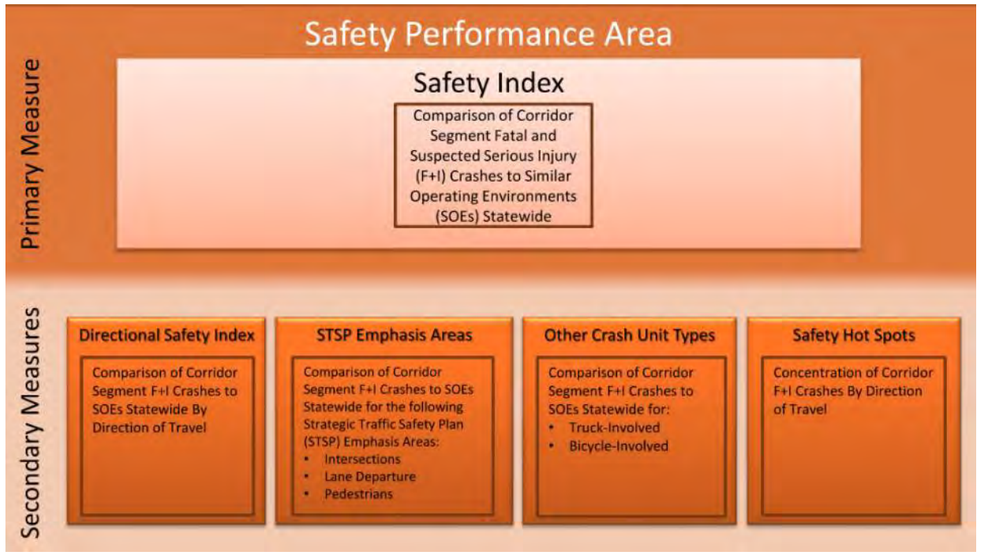
Performance Level	Percent Non-SOV Trips
Good	≥ 17%
Fair	> 11% & ≤ 17%
Poor	< 11%

Performance Level	Percent Transit Dependency
Good	Tracts with both zero and one vehicle household population in poverty percentages below the statewide average
Fair	Tracts with either zero and one vehicle household or population in poverty percentages below the statewide average
Poor	Tracts with both zero and one vehicle household and population in poverty percentages above the statewide average

Performance Level	Percent Bicycle Accommodation
Good	≥ 90%
Fair	> 60% & ≤ 90%
Poor	< 60%

Safety Performance Area Calculation Methodologies

This section summarizes the approach for developing the primary and secondary performance measures in the Safety performance area as shown in the following graphic:



Primary Safety Index

The Safety Index is a safety performance measure based on the bi-directional (i.e., both directions combined) frequency and rate of fatal and suspected serious injury crashes, the relative cost of those types of crashes, and crash occurrences on similar roadways in Arizona. According to ADOT's 2018 Highway Safety Improvement Program Application, fatal crashes have an estimated cost that is 17.3 times the estimated cost of suspected serious injury crashes ($9.5 million compared to $555,000).

The Combined Safety Score (CSS) is an interim measure that combines fatal and suspected serious injury crashes into a single value. The CSS is calculated using the following generalized formula:

*CSS = 17.3 * (Normalized Fatal Crash Rate + Frequency) + (Normalized Suspected Serious Injury Crash Rate + Frequency)*

Because crashes vary depending on the operating environment of a particular roadway, statewide CSS values were developed for similar operating environments defined by functional classification, urban vs. rural setting, number of travel lanes, and traffic volumes. To determine the Safety Index of a particular segment, the segment CSS is compared to the average statewide CSS for the similar statewide operating environment.

The Safety Index is calculated using the following formula:

Safety Index = Segment CSS / Statewide Similar Operating Environment CSS

The average annual Safety Index for a segment is compared to the statewide similar operating environment annual average, with one standard deviation from the statewide average forming the scale break points.

The more a particular segment's Safety Index value is below the statewide similar operating environment average, the better the safety performance is for that particular segment as a lower value represents fewer crashes.

Scoring:

The scale for rating the Safety Index depends on the operating environments selected, as shown in the table below.

Similar Operating Environment	Safety Index (Overall & Directional)	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	0.92	1.08
2 or 3 or 4 Lane Divided Highway	0.81	1.19
4 or 5 Lane Undivided Highway	0.78	1.22
6 Lane Highway	0.76	1.24
Rural 4 Lane Freeway with Daily Volume < 25,000	0.84	1.16
Rural 4 Lane Freeway with Daily Volume > 25,000	0.78	1.22
Urban 4 Lane Freeway	0.73	1.27
Urban or Rural 6 Lane Freeway	0.65	1.35
Urban > 6 Lane Freeway	0.89	1.11

** Lower/upper limit of Average calculated as one standard deviation below/above the Mean*

Some corridor segments may have a very low number of total fatal and suspected serious injury crashes. Low crash frequencies (i.e., a small sample size) can translate into performance ratings that can be unstable. In some cases, a change in crash frequency of one crash (one additional crash or one less crash) could result in a change in segment performance of two levels. To avoid reliance on performance ratings where small changes in crash frequency result in large changes in performance, the following two criteria were developed to identify segments with "insufficient data" for assessing performance for the Safety Index. Both of these criteria must be met for a segment to have "insufficient data" to reliably rate the Safety Index performance:

- If the crash sample size (total fatal plus suspected serious injury crashes) for a given segment is less than five crashes over the five-year analysis period; AND

- If a change in one crash results in a change in segment performance by two levels (i.e., a change from below average to above average performance or a change from above average to below average frequency), the segment has "insufficient data" and Safety Index performance ratings are unreliable.

Secondary Safety Measures

The Safety performance area has four secondary measures related to fatal and suspected serious injury crashes:

- Directional Safety Index
- Strategic Traffic Safety Plan (STSP) Emphasis Areas
- Other Crash Unit Types
- Safety Hot Spots

Directional Safety Index: The Directional Safety Index shares the same calculation procedure and thresholds as the Safety Index. However, the measure is based on the directional frequency and rate of fatal and suspected serious injury crashes.

Similar to the Safety Index, the segment CSS is compared to the average statewide CSS for the similar statewide operating environment. The Directional Safety Index follows the lead of the Safety Index in terms of "insufficient data" status. If the Safety Index meets both criteria for "insufficient data", the Directional Safety Index should also be changed to "insufficient data". If the Safety Index does not meet both criteria for "insufficient data", the Directional Safety Index would also not change to say "insufficient data"

STSP Emphasis Areas: ADOT's 2019 STSP identifies several emphasis areas for reducing fatal and suspected serious injury crashes. The three relevant STSP emphasis areas relate to crashes involving:

- Intersections
- Lane departures
- Pedestrians

To develop a performance measure that reflects these emphasis areas, the percentage of total fatal and suspected serious injury crashes that involves a given emphasis area on a particular segment is compared to the statewide average percentage of crashes involving that same emphasis area on roads with similar operating environments in a process similar to how the Safety Index is developed.

The STSP emphasis areas performance is calculated using the following formula:

% Crashes Involving STSP Emphasis Area = Segment Crashes Involving STSP Emphasis Area / Total Segment Crashes

Emphasis Area / Total Segment Crashes

The percentage of total crashes involving STSP emphasis areas for a segment is compared to the statewide percentages on roads with similar operating environments. One standard deviation from the statewide average percentage forms the scale break points.

When assessing the performance of the STSP emphasis areas, the more the frequency of crashes involving STSP emphasis areas is below the statewide average implies better levels of segment performance. Thus, lower values are better, similar to the Safety Index.

Scoring:

The scale for rating the STSP emphasis areas performance depends on the crash history on similar statewide operating environments, as shown in the tables below:

Similar Operating Environment	Crashes at Intersections	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	11.2%	15.6%
2 or 3 or 4 Lane Divided Highway	23.4%	29.3%
4 or 5 Lane Undivided Highway	43.8%	49.5%
6 Lane Highway	57.8%	73.2%
Rural 4 Lane Freeway with Daily Volume < 25,000	0.00%	0.00%
Rural 4 Lane Freeway with Daily Volume > 25,000	0.00%	0.00%
Urban 4 Lane Freeway	0.00%	0.00%
Urban or Rural 6 Lane Freeway	0.00%	0.00%
Urban > 6 Lane Freeway	0.00%	0.00%

** Lower/upper limit of Average calculated as one standard deviation below/above the Mean*

Similar Operating Environment	Crashes Involving Lane Departures	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	66.9%	74.5%
2 or 3 or 4 Lane Divided Highway	56.4%	65.0%
4 or 5 Lane Undivided Highway	21.1%	32.1%
6 Lane Highway	11.7%	38.1%
Rural 4 Lane Freeway with Daily Volume < 25,000	72.8%	76.4%
Rural 4 Lane Freeway with Daily Volume > 25,000	69.0%	77.5%
Urban 4 Lane Freeway	60.6%	78.1%
Urban or Rural 6 Lane Freeway	55.7%	62.9%
Urban > 6 Lane Freeway	40.4%	43.2%

** Lower/upper limit of Average calculated as one standard deviation below/above the Mean*

Similar Operating Environment	Crashes Involving Pedestrians	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	3.8%	7.2%
2 or 3 or 4 Lane Divided Highway	2.4%	3.6%
4 or 5 Lane Undivided Highway	8.8%	13.5%
6 Lane Highway	0.4%	11.9%
Rural 4 Lane Freeway with Daily Volume < 25,000	1.0%	3.3%
Rural 4 Lane Freeway with Daily Volume > 25,000	0.7%	4.7%
Urban 4 Lane Freeway	0.0%	4.9%
Urban or Rural 6 Lane Freeway	4.0%	7.9%
Urban > 6 Lane Freeway	1.6%	4.7%

** Lower/upper limit of Average calculated as one standard deviation below/above the Mean*

The STSP emphasis area secondary safety performance measures for the Safety performance area include proportions of specific types of crashes within the total fatal and suspected serious injury crash frequencies. This more detailed categorization of fatal and suspected serious injury crashes can result in low crash frequencies (i.e., a small sample size) that translate into performance ratings that can be unstable. In some cases, a change in crash frequency of one crash (one additional crash or one less crash) could result in a change in segment performance of two levels. To avoid reliance on performance ratings where small changes in crash frequency result in large changes in performance, the following criteria were developed to identify segments with "insufficient data" for assessing performance for the STSP emphasis area secondary safety performance measures. If any of these criteria are met for a segment, that segment has "insufficient data" to reliably rate that STSP emphasis area performance:

- If the crash sample size (total fatal plus suspected serious injury crashes) for a given segment is less than five crashes over the five-year analysis period, the segment has "insufficient data" and performance ratings are unreliable. OR
- If a change in one crash results in a change in segment performance by two levels (i.e., a change from below average to above average performance or a change from above average to below average frequency), the segment has "insufficient data" and performance ratings are unreliable. OR
- If the corridor average segment crash frequency for any of the STSP emphasis area performance measures is less than two crashes over the five-year analysis period, that entire STSP emphasis area performance measure has "insufficient data" and performance ratings are unreliable.

Other Crash Unit Types: Other crash unit types of interest are:

- Truck-involved crashes
- Bicycle-involved crashes

To develop a performance measure that reflects the aforementioned crash unit types, the percentage of total fatal and suspected serious injury crashes that involves a given crash unit type on a particular segment is compared to the statewide average percentage of crashes involving that same crash unit type on roads with similar operating environments in a process similar to how the Safety Index is developed.

The crash unit type performance is calculated using the following formula:

% Crashes Involving Crash Unit Type = Segment Crashes Involving Crash Unit Type / Total Segment Crashes

The percentage of total crashes involving each crash unit type for a segment is compared to the statewide percentages on roads with similar operating environments. One standard deviation from the statewide average percentage forms the scale break points.

When assessing the performance of the crash unit types, the more the frequency of crashes involving crash unit types is below the statewide average implies better levels of segment performance. Thus, lower values are better, similar to the Safety Index.

Scoring:

The scale for rating the unit-involved crash performance depends on the crash history on similar statewide operating environments, as shown in the following tables

Similar Operating Environment	Crashes Involving Bicycles	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	0.0%	3.3%
2 or 3 or 4 Lane Divided Highway	0.0%	2.2%
4 or 5 Lane Undivided Highway	0.5%	3.8%
6 Lane Highway	0.0%	7.2%
Rural 4 Lane Freeway with Daily Volume < 25,000	0.0%	0.9%
Rural 4 Lane Freeway with Daily Volume > 25,000	0.0%	0.0%
Urban 4 Lane Freeway	0.0%	0.0%
Urban or Rural 6 Lane Freeway	0.0%	1.3%
Urban > 6 Lane Freeway	0.0%	0.0%

** Lower/upper limit of Average calculated as one standard deviation below/above the Mean*

Similar Operating Environment	Crashes Involving Trucks	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	4.2%	8.0%
2 or 3 or 4 Lane Divided Highway	3.7%	9.9%
4 or 5 Lane Undivided Highway	0.8%	5.5%
6 Lane Highway	4.3%	7.5%
Rural 4 Lane Freeway with Daily Volume < 25,000	19.0%	22.5%
Rural 4 Lane Freeway with Daily Volume > 25,000	8.5%	18.0%
Urban 4 Lane Freeway	6.9%	12.4%
Urban or Rural 6 Lane Freeway	5.0%	12.9%
Urban > 6 Lane Freeway	1.9%	5.1%

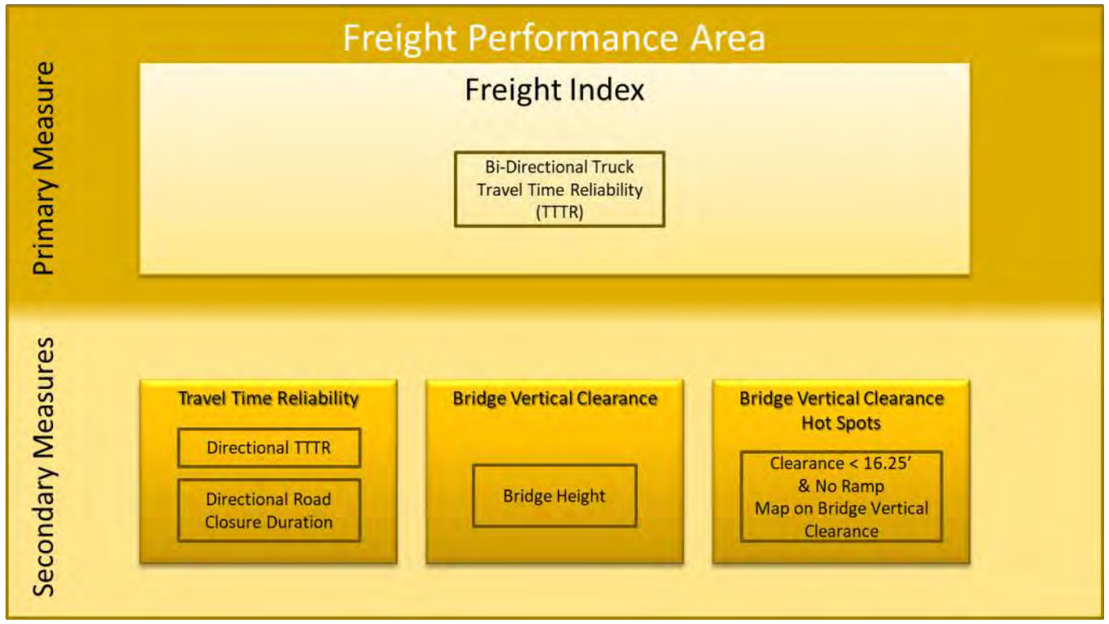
** Lower/upper limit of Average calculated as one standard deviation below/above the Mean*

The crash unit types have the same “insufficient data” criteria as the STSP emphasis areas.

Safety Hot Spots: A hot spot analysis was conducted that identified abnormally high concentrations of fatal and suspected serious injury crashes along the study corridor by direction of travel. The identification of crash concentrations involves a GIS-based function known as “kernel density analysis”. This measure is mapped for graphical display purposes with the Directional Safety Index but is not included in the Safety performance area rating calculations.

Freight Performance Area Calculation Methodologies

This section summarizes the approach for developing the primary and secondary performance measures in the Freight performance area as shown in the following graphic:



Primary Freight Index

The Freight Index is a reliability performance measure based on the bi-directional truck travel time reliability (TTTR) for truck travel. The industry standard definition for the Truck Travel Time Reliability (TTTR) is the ratio of the 95th percentile travel time to average (50th percentile) travel time for trucks.

Using INRIX data provided by ADOT, four time periods for each data point were collected throughout the day (AM peak, mid-day, PM peak, and off-peak).

The highest calculated value of the four time periods is defined as the TTTR for that data point. The weighted average TTTR is calculated within each segment based on the number of data points collected and the length associated with the TMC location. The value of the weighted average TTTR across each entry is used as the TTTR for each respective segment within the corridor.

For each corridor segment, the TTTR is calculated for each direction of travel and then averaged to create a bi-directional TTTR. The Freight Index is equal to the average bi-directional TTTR for the segment.

The scale for rating the Freight Index differs between uninterrupted and interrupted flow facilities.

Secondary Freight Measures

The Freight performance area includes three secondary measures that provide an in-depth evaluation of the different characteristics of freight performance:

- Travel Time Reliability
  - Directional Truck Travel Time Reliability
  - Closure Duration
- Bridge Vertical Clearance
- Bridge Vertical Clearance Hot Spots

Travel Time Reliability: Travel time reliability is a secondary measure that includes two indicators. The two indicators are the directional Truck Travel Time Reliability (TTTR) and the duration a piece of a corridor is closed for any specific reason.

Truck Travel Time Reliability: The performance measure for truck travel time reliability is directional TTTR. The industry standard definition for TTTR is the ratio of 95th percentile travel time to average (50th percentile) travel time for trucks for a given corridor segment in a specific direction.

Using INRIX data provided by ADOT, four time periods for each data point were collected throughout the day (AM peak, mid-day, PM peak, and off-peak). The highest value of the four time periods calculation is defined as the TTTR for that data point. The weighted average TTTR is calculated within each segment based on the number of data points collected and the length associated with the TMC location. The value of the weighted average TTTR across each entry is used as the TTTR for each respective segment within the corridor.

Closure Duration: This performance measure related to road closures is average roadway closure (i.e., full lane closure) duration time in minutes. There are three main components to full closures that affect reliability – frequency, duration, and extent. In the freight industry, closure duration is the most important component because trucks want to minimize travel time and delay.

Data on the frequency, duration, and extent of full roadway closures on the ADOT State Highway System is available in the HCRS database that is managed and updated by ADOT.

The average closure duration in a segment – in terms of the average time a milepost is closed per mile per year on a given segment – is calculated using the following formula:

*Closure Duration = Sum of Segment (Closure Clearance Time * Closure Extent) / Segment Length*

The segment closure duration time in minutes can then be compared to statewide averages for closure duration in minutes, with one-half standard deviation from the average forming the scale break points. The scale for rating closure duration in minutes is found at the end of this section.

Bridge Vertical Clearance: This performance measure uses the vertical clearance information from the ADOT Bridge Database to identify locations with low vertical clearance. The minimum vertical

clearance for all underpass structures (i.e., structures under which mainline traffic passes) is determined for each segment.

Bridge Vertical Clearance Hot Spots: This performance measure related to truck restrictions is the locations, or hot spots, where bridge vertical clearance issues restrict truck travel. Sixteen feet three inches (16.25') is the minimum standard vertical clearance value for state highway bridges over travel lanes.

Locations with lower vertical clearance values than the minimum standard are categorized by the ADOT Intermodal Transportation Department Engineering Permits Section as either locations where ramps exist that allow the restriction to be avoided or locations where ramps do not exist and the restriction cannot be avoided. The locations with vertical clearances below the minimum standard that cannot be ramped around are considered hot spots. This measure is mapped for graphical display purposes with the bridge vertical clearance map but is not included in the Freight performance area rating calculations.

Scoring:

Performance Level	Freight Index	
	Uninterrupted Flow Facilities	Interrupted Flow Facilities
Good	< 1.15	< 1.45
Fair	1.15 – 1.35	1.45 – 1.85
Poor	> 1.35	> 1.85

Performance Level	TTTR	
	Uninterrupted Flow Facilities	Interrupted Flow Facilities
Good	< 1.15	< 1.45
Fair	1.15 – 1.35	1.45 – 1.85
Poor	> 1.35	> 1.85

Performance Level	Closure Duration (minutes)
Good	< 44.18
Fair	44.18 – 124.86
Poor	> 124.86

Performance Level	Bridge Vertical Clearance
Good	> 16.5'
Fair	16.0' – 16.5'
Poor	< 16.0'

Appendix C: Performance Area Data

Pavement Performance Area Data

				Direction 1 (Northbound)			Direction 2 (Southbound)				Direction 1 (Northbound)		Direction 2 (Southbound)		Composite			% Pavement Failure	
				# of Lanes	IRI	Cracking	Rutting	# of Lanes	IRI	Cracking	Rutting	PSR	PDI	PSR	PDI	Dir 1 (NB)	Dir 2 (SB)	Pavement Index	Dir 1 (NB)	Dir 2 (SB)
Segment 1		***Interstate?***	**No**																	
Milepost	290	to 291		2	109.08	31.70	0.34	2	101.41	17.30	0.22	3.30	1.65	3.40	2.86	1.65	3.02		2	2
Milepost	291	to 292		2	45.56	16.50	0.18	2	42.61	11.60	0.16	4.21	2.96	4.25	3.40	3.33	3.66		2	2
Milepost	292	to 293		2	37.17	19.30	0.19	2	57.45	7.00	0.20	4.34	2.72	4.02	3.83	2.72	3.88		2	0
Milepost	293	to 294		2	39.98	17.20	0.17	2	46.18	13.80	0.23	4.30	2.90	4.20	3.14	3.32	3.46		2	2
Milepost	294	to 295		2	37.15	10.70	0.18	2	46.56	7.40	0.23	4.34	3.47	4.19	3.75	3.73	3.88		2	0
		Total		10				10												16
		Weighted Average										4.10	2.74	4.01	3.40	2.95	3.58			
		Factor										1.00		1.00						
		Indicator Score										4.10		4.01						**80.0%**
		Pavement Index																3.27		
Segment 2		***Interstate?***	**No**																	
Milepost	295	to 296		2	36.23	10.90	0.18	2	71.49	12.50	0.29	4.36	3.45	3.81	3.18	3.72	3.37		2	2
Milepost	296	to 297		2	37.31	8.00	0.17	2	61.04	20.45	0.36	4.34	3.75	3.96	2.42	3.92	2.42		0	2
Milepost	297	to 298		2	30.81	6.70	0.19	2	65.15	8.30	0.19	4.45	3.87	3.90	3.70	4.04	3.76		0	0
Milepost	298	to 299		2	32.30	6.80	0.18	2	114.04	25.60	0.36	4.42	3.87	3.24	2.04	4.03	2.04		0	2
Milepost	299	to 300		2	42.00	0.33	0.19	2	59.21	14.78	0.16	4.26	4.76	3.99	3.12	4.61	3.38		0	2
Milepost	300	to 301		2	37.75	1.10	0.18	2	49.68	13.90	0.18	4.33	4.63	4.14	3.17	4.54	3.46		0	2
Milepost	301	to 302		2	38.70	2.30	0.17	2	42.16	19.40	0.18	4.32	4.44	4.26	2.72	4.40	2.72		0	2
Milepost	302	to 303		2	37.02	3.20	0.17	2	38.52	17.50	0.16	4.34	4.31	4.32	2.88	4.32	3.31		0	2
Milepost	303	to 304		2	30.73	1.10	0.19	2	41.37	17.00	0.14	4.45	4.62	4.27	2.94	4.57	3.34		0	2
		Total		18				18												18
		Weighted Average										4.36	4.19	3.99	2.91	4.24	3.09			
		Factor										1.00		1.00						
		Indicator Score										4.36		3.99						**50.0%**
		Pavement Index																3.67		
Segment 3		***Interstate?***	**No**																	
Milepost	304	to 305		2	34.53	9.70	0.19	2	49.36	13.50	0.14	4.39	3.56	4.14	3.24	3.81	3.51		0	2
Milepost	305	to 306		2	36.25	3.90	0.23	2	74.66	12.20	0.18	4.36	4.15	3.76	3.33	4.21	3.46		0	2
Milepost	306	to 307		2	154.69	22.30	0.26	2	186.79	31.40	0.32	2.78	2.42	2.46	1.70	2.42	1.70		2	2
Milepost	307	to 308		2	134.00	11.90	0.20	2	199.76	37.20	0.39	3.00	3.34	2.34	1.22	3.10	1.22		2	2
Milepost	308	to 309		2	129.45	10.60	0.25	2	136.65	23.30	0.24	3.06	3.40	2.97	2.37	3.16	2.37		2	2
Milepost	309	to 310		2	82.22	10.82	0.20	2	111.13	26.55	0.19	3.66	3.44	3.28	2.17	3.51	2.17		2	2
Milepost	310	to 311		2	101.06	17.00	0.19	2	132.82	28.00	0.25	3.41	2.90	3.02	2.02	3.05	2.02		2	2
Milepost	311	to 312		2	173.81	21.70	0.28	2	135.10	20.70	0.23	2.58	2.44	2.99	2.58	2.58	2.58		2	2
		Total		16				16												28
		Weighted Average										3.40	3.21	3.12	2.33	3.23	2.38			
		Factor										1.00		1.00						
		Indicator Score										3.40		3.12						**87.5%**
		Pavement Index																2.80		

				Direction 1 (Northbound)				Direction 2 (Southbound)				Direction 1 (Northbound)		Direction 2 (Southbound)		Composite		Pavement Index	% Pavement Failure	
				# of Lanes	IRI	Cracking	Rutting	# of Lanes	IRI	Cracking	Rutting	PSR	PDI	PSR	PDI	Dir 1 (NB)	Dir 2 (SB)		Dir 1 (NB)	Dir 2 (SB)
Segment 4		***Interstate?***	**No**																	
Milepost	312	to	313	2	189.18	0.00	0.37	2	91.40	12.00	0.21	2.44	4.33	3.53	3.32	2.44	3.38		2	2
Milepost	313	to	314	2	134.70	0.00	0.21	2	119.04	11.70	0.18	3.00	4.67	3.18	3.38	3.50	3.24		0	2
Milepost	314	to	315	2	108.91	0.00	0.36	2	105.17	5.00	0.30	3.31	4.36	3.35	3.92	3.62	3.52		0	0
Milepost	315	to	316	2	114.48	0.00	0.32	2	93.10	4.30	0.32	3.24	4.45	3.51	3.97	3.60	3.65		0	0
Milepost	316	to	317	2	129.41	0.00	0.26	2	118.25	5.58	0.23	3.06	4.57	3.19	3.95	3.51	3.42		0	0
			Total	10				10												6
			Weighted Average									3.01	4.48	3.35	3.71	3.33	3.44			
			Factor									1.00		1.00						
			Indicator Score									3.01		3.35						**30.0%**
			Pavement Index															3.39		
Segment 5		***Interstate?***	**No**																	
Milepost	317	to	318	2	167.35	0.00	0.17	2	145.74	7.38	0.18	2.65	4.76	2.87	3.80	2.65	2.87		2	2
Milepost	318	to	319	2	153.84	0.00	0.28	2	128.66	4.10	0.28	2.79	4.54	3.07	4.06	2.79	3.36		2	0
Milepost	319	to	320	2	147.69	0.00	0.24	2	135.05	7.00	0.24	2.85	4.62	2.99	3.78	2.85	3.23		2	0
Milepost	320	to	321	2	145.72	0.00	0.22	2	154.49	7.60	0.20	2.87	4.66	2.78	3.77	2.87	2.78		2	2
Milepost	321	to	322	2	159.02	0.00	0.15	2	201.89	22.20	0.17	2.73	4.80	2.32	2.51	2.73	2.32		2	2
Milepost	322	to	323	2	99.10	0.00	0.15	2	133.10	21.70	0.18	3.43	4.79	3.02	2.54	3.84	2.54		0	2
Milepost	323	to	324	2	120.37	0.00	0.16	2	117.49	17.70	0.17	3.16	4.78	3.20	2.86	3.65	2.96		0	2
			Total	14				14												20
			Weighted Average									2.93	4.71	2.89	3.33	3.05	2.87			
			Factor									1.00		1.00						
			Indicator Score									2.93		2.89						**71.4%**
			Pavement Index															2.96		
Segment 6		***Interstate?***	**No**																	
Milepost	324	to	325	1	94.96	0.00	0.10	1	127.99	17.60	0.16	3.49	4.88	3.07	2.88	3.90	2.94		0	1
Milepost	325	to	326	1	104.48	0.00	0.11	1	130.80	15.40	0.14	3.36	4.87	3.04	3.07	3.81	3.05		0	1
Milepost	326	to	327	1	120.76	0.00	0.10	1	118.34	6.80	0.16	3.16	4.88	3.19	3.88	3.68	3.40		0	0
Milepost	327	to	328	1	114.50	0.00	0.14	1	122.81	3.70	0.17	3.24	4.82	3.14	4.24	3.71	3.47		0	0
Milepost	328	to	329	1	144.71	0.00	0.14	1	145.73	7.20	0.16	2.89	4.81	2.87	3.84	2.89	2.87		1	1
Milepost	329	to	330	1	101.79	0.00	0.15	1	109.61	4.10	0.21	3.40	4.80	3.30	4.15	3.82	3.55		0	0
Milepost	330	to	331	1	106.66	0.00	0.19	1	111.99	3.90	0.17	3.33	4.72	3.27	4.22	3.75	3.55		0	0
Milepost	331	to	332	1	108.86	3.09	0.17	1	106.84	8.27	0.16	3.31	4.32	3.33	3.73	3.61	3.45		0	0
Milepost	332	to	333	1	74.42	1.25	0.17	1	65.39	1.40	0.14	3.77	4.61	3.90	4.61	4.02	4.11		0	0
Milepost	333	to	334	1	60.17	0.10	0.13	1	58.43	2.24	0.11	3.98	4.89	4.00	4.50	4.25	4.35		0	0
Milepost	334	to	335	1	75.26	0.00	0.15	1	75.38	2.53	0.14	3.76	4.79	3.75	4.43	4.07	3.96		0	0
Milepost	335	to	336	1	76.25	0.00	0.18	1	75.05	2.71	0.16	3.74	4.75	3.76	4.39	4.04	3.95		0	0

				Direction 1 (Northbound)				Direction 2 (Southbound)				Direction 1 (Northbound)		Direction 2 (Southbound)		Composite			% Pavement Failure	
				# of Lanes	IRI	Cracking	Rutting	# of Lanes	IRI	Cracking	Rutting	PSR	PDI	PSR	PDI	Dir 1 (NB)	Dir 2 (SB)	Pavement Index	Dir 1 (NB)	Dir 2 (SB)
Segment 4		***Interstate?***		**No**																
Milepost	312	to	313	2	189.18	0.00	0.37	2	91.40	12.00	0.21	2.44	4.33	3.53	3.32	2.44	3.38		2	2
Milepost	313	to	314	2	134.70	0.00	0.21	2	119.04	11.70	0.18	3.00	4.67	3.18	3.38	3.50	3.24		0	2
Milepost	314	to	315	2	108.91	0.00	0.36	2	105.17	5.00	0.30	3.31	4.36	3.35	3.92	3.62	3.52		0	0
			Total	12				12												4
			Weighted Average									3.45	4.76	3.39	4.00	3.80	3.55			
			Factor									1.00		1.00						
			Indicator Score									3.45		3.39						**16.7%**
			Pavement Index															3.68		
Segment 7		***Interstate?***		**No**																
Milepost	333	to	334	1	60.17	0.10	0.13	1	58.43	2.24	0.11	3.98	4.89	4.00	4.50	4.25	4.35		0	0
Milepost	334	to	335	1	75.26	0.00	0.15	1	75.38	2.53	0.14	3.76	4.79	3.75	4.43	4.07	3.96		0	0
Milepost	335	to	336	1	76.25	0.00	0.18	1	75.05	2.71	0.16	3.74	4.75	3.76	4.39	4.04	3.95		0	0
Milepost	336	to	337	1	70.47	0.00	0.13	1	68.28	2.23	0.13	3.83	4.83	3.86	4.49	4.13	4.05		0	0
Milepost	337	to	338	1	49.13	0.00	0.09	1	40.52	0.10	0.12	4.15	4.89	4.29	4.91	4.37	4.72		0	0
Milepost	338	to	339	1	59.62	0.00	0.09	1	54.19	0.00	0.10	3.99	4.89	4.07	4.87	4.26	4.31		0	0
			Total	6				6												0
			Weighted Average									3.91	4.84	3.96	4.60	4.19	4.22			
			Factor									1.00		1.00						
			Indicator Score									3.91		3.96						**0.0%**
			Pavement Index															4.20		
Segment 8		***Interstate?***		**No**																
Milepost	339	to	340	1	188.53	0.70	0.13	1	143.78	16.00	0.08	2.44	4.75	2.90	3.03	2.44	2.90		1	1
Milepost	340	to	341	1	122.53	0.00	0.12	1	97.89	14.90	0.08	3.14	4.84	3.45	3.13	3.65	3.22		0	1
Milepost	341	to	342	2	148.22	0.00	0.14	2	111.73	18.78	0.08	2.85	4.81	3.27	2.80	2.85	2.94		2	2
Milepost	342	to	343	2	157.47	0.00	0.11	2	124.33	22.38	0.21	2.75	4.86	3.12	2.46	2.75	2.46		2	2
Milepost	343	to	344	1	202.50	0.00	0.15	1	205.10	13.00	0.14	2.32	4.79	2.29	3.28	2.32	2.29		1	1
Milepost	344	to	345	1	83.06	0.00	0.12	1	88.18	15.60	0.15	3.65	4.85	3.58	3.05	4.01	3.21		0	1
			Total	8				8												14
			Weighted Average									2.84	4.82	3.12	2.88	2.95	2.80			
			Factor									1.00		1.00						
			Indicator Score									2.84		3.12						**87.5%**
			Pavement Index															2.88		

				Direction 1 (Northbound)				Direction 2 (Southbound)				Direction 1 (Northbound)		Direction 2 (Southbound)		Composite			% Pavement Failure	
				# of Lanes	IRI	Cracking	Rutting	# of Lanes	IRI	Cracking	Rutting	PSR	PDI	PSR	PDI	Dir 1 (NB)	Dir 2 (SB)	Pavement Index	Dir 1 (NB)	Dir 2 (SB)
Segment 9		***Interstate?***	**No**																	
Milepost	345	to 346		1	87.31	0.00	0.12	1	74.36	17.20	0.12	3.59	4.84	3.77	2.93	3.96	3.18		0	1
Milepost	346	to 347		1	65.66	0.00	0.14	1	62.05	13.90	0.11	3.90	4.81	3.95	3.21	4.17	3.43		0	1
Milepost	347	to 348		1	87.50	0.00	0.17	1	89.77	10.10	0.17	3.59	4.76	3.55	3.54	3.94	3.54		0	1
Milepost	348	to 349		1	78.05	0.00	0.19	1	81.22	15.80	0.22	3.72	4.73	3.67	2.97	4.02	3.18		0	1
Milepost	349	to 350		1	58.12	0.00	0.15	1	74.72	17.00	0.20	4.01	4.79	3.76	2.89	4.24	3.15		0	1
Milepost	350	to 351		1	61.24	0.00	0.16	1	85.36	17.70	0.19	3.96	4.78	3.61	2.85	4.21	3.08		0	1
Milepost	351	to 352		1	53.65	0.00	0.12	1	72.62	18.00	0.16	4.08	4.85	3.79	2.85	4.31	3.13		0	1
Milepost	352	to 353		1	102.87	0.00	0.17	1	86.06	15.60	0.12	3.38	4.77	3.61	3.06	3.80	3.23		0	1
Milepost	353	to 354		1	88.82	0.00	0.17	1	84.19	14.30	0.17	3.57	4.75	3.63	3.15	3.92	3.30		0	1
Milepost	354	to 355		1	93.65	0.00	0.19	1	72.07	13.80	0.13	3.50	4.71	3.80	3.22	3.87	3.39		0	1
Milepost	355	to 356		1	92.85	0.00	0.18	1	88.72	15.30	0.18	3.51	4.74	3.57	3.06	3.88	3.21		0	1
Milepost	356	to 357		1	105.95	0.00	0.16	1	116.99	18.60	0.18	3.34	4.77	3.21	2.78	3.77	2.91		0	1
		Total		12				12												12
		Weighted Average										3.68	4.78	3.66	3.04	4.01	3.23			
		Factor										1.00		1.00						
		Indicator Score										3.68		3.66						**50.0%**
		Pavement Index																3.62		
Segment 10		***Interstate?***	**No**																	
Milepost	357	to 358		2	78.55	0.00	0.13	2	79.49	13.10	0.13	3.71	4.84	3.70	3.28	4.05	3.41		0	2
Milepost	358	to 359		2	89.58	0.00	0.14	2	57.19	13.50	0.14	3.56	4.81	4.02	3.24	3.93	3.48		0	2
Milepost	359	to 360		2	72.64	0.00	0.13	2	61.65	12.20	0.13	3.79	4.83	3.96	3.36	4.11	3.54		0	2
Milepost	360	to 361		2	67.98	0.00	0.15	2	91.90	11.90	0.13	3.86	4.79	3.53	3.39	4.14	3.43		0	2
Milepost	361	to 362		2	98.45	0.00	0.16	2	93.07	13.80	0.15	3.44	4.77	3.51	3.20	3.84	3.30		0	2
Milepost	362	to 363		2	114.87	0.00	0.22	2	87.82	16.70	0.14	3.23	4.67	3.58	2.96	3.66	3.15		0	2
Milepost	363	to 364		2	121.83	0.00	0.19	2	92.33	16.50	0.15	3.15	4.72	3.52	2.98	3.62	3.14		0	2
Milepost	364	to 365		2	110.30	0.00	0.22	2	111.71	16.50	0.17	3.29	4.67	3.27	2.96	3.70	3.06		0	2
		Total		16				16												16
		Weighted Average										3.50	4.76	3.64	3.17	3.88	3.31			
		Factor										1.00		1.00						
		Indicator Score										3.50		3.64						**50.0%**
		Pavement Index																3.60		

Bridge Performance Area Data

Structure Name (A209)	Structure # (N8)	Milepost (A232)	Area (A225)	Bridge Sufficiency	Bridge Index					Functionally Obsolete Bridges	Bridge Rating	Hot Spots on Bridge Index map
				Sufficiency Rating	Deck (N58)	Sub (N59)	Super (N60)	Eval (N67)	Lowest	Deck Area on Func Obsolete		
Segment 1												
N/A - No Bridges in Segment		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		
Total			#N/A									
Weighted Average				#N/A					#N/A	#N/A		
Factor				1.00					1.00	1.00		
Indicator Score				**#N/A**						**#N/A**	**#N/A**	
Bridge Index									**#N/A**			
Segment 2												
Middle Canyon Wash BR NB	2558	299.80	5645	97.60	7.00	8.00	7.00	7.00	7.0	0		
Middle Canyon Wsh Br SB	698	299.86	5966	91.30	6.00	6.00	6.00	6.00	6.0	0		
Total			11,611									
Weighted Average				94.36					6.49	0.00%		
Factor				1.00					1.00	1.00		
Indicator Score				**94.36**						**0.00%**	**6**	
Bridge Index									**6.49**			
Segment 3												
Rain Valley Wash Bridge NB	2519	309.30	10280	97.40	6.00	7.00	7.00	7.00	6.0	0		
Rain Valley Wash Br SB	914	309.40	9280	94.20	7.00	7.00	7.00	7.00	7.0	0		
Babocomari Wash Bridge	2518	311.80	8763	89.90	6.00	6.00	6.00	6.00	6.0	0		
Total			28,323									
Weighted Average				94.03					6.33	0.00%		
Factor				1.00					1.00	1.00		
Indicator Score				**94.03**						**0.00%**	**6**	
Bridge Index									**6.33**			
Segment 4												
N/A - No Bridges in Segment		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		
Total			#N/A									
Weighted Average				#N/A					#N/A	#N/A		
Factor				1.00					1.00	1.00		
Indicator Score				**#N/A**						**#N/A**	**#N/A**	
Bridge Index									**#N/A**			

Structure Name (A209)	Structure # (N8)	Milepost (A232)	Area (A225)	Bridge Sufficiency	Bridge Index					Functionally Obsolete Bridges	Bridge Rating	Hot Spots on Bridge Index map
				Sufficiency Rating	Deck (N58)	Sub (N59)	Super (N60)	Eval (N67)	Lowest	Deck Area on Func Obsolete		
Segment 5												
N/A - No Bridges in Segment		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		
Total			#N/A									
Weighted Average				#N/A					#N/A	#N/A		
Factor				1.00					1.00	1.00		
Indicator Score				**#N/A**						**#N/A**	**#N/A**	
Bridge Index									**#N/A**			
Segment 6												
San Pedro River Br	2944	328.64	16286	96.00	7.00	8.00	7.00	7.00	7.0	0		
Lewis Springs OP	470	328.85	4068	82.10	5.00	5.00	6.00	5.00	5.0	0		
Total			20,354									
Weighted Average				93.22					6.60	0.00%		
Factor				1.00					1.00	1.00		
Indicator Score				**93.22**						**0.00%**	**5**	
Bridge Index									**6.60**			
Segment 7												
Tombstone Canyon Br 1	480	333.27	3575	64.70	6.00	6.00	6.00	6.00	6.0	0		
Tombstone Canyon Br 2	481	334.19	2701	84.30	6.00	6.00	6.00	6.00	6.0	0		
Bridge	468	336.45	1092	74.70	6.00	6.00	5.00	5.00	5.0	0		
Total			7,368									
Weighted Average				73.37					5.85	0.00%		
Factor				1.00					1.00	1.00		
Indicator Score				**73.37**						**0.00%**	**5**	
Bridge Index									**5.85**			
Segment 8												
West Blvd TI OP	614	339.81	3042	72.00	6.00	7.00	5.00	5.00	5.0	0		
Brewery Gulch TI OP	670	341.42	3302	93.80	7.00	7.00	7.00	7.00	7.0	0		
Lowell RR UP	269	343.01	1378	-2.00	N	5.00	7.00	7.00	5.0	0		
Lowell UP RR	1033	343.01	824	-2.00	N	6.00	6.00	6.00	6.0	0		
Mule Pass Bridge	2557	343.98	4887	89.40	6.00	6.00	6.00	6.00	6.0	0		
Total			13,433									
Weighted Average				71.56					5.92	0.00%		
Factor				1.00					1.00	1.00		
Indicator Score				**71.56**						**0.00%**	**5**	
Bridge Index									**5.92**			

Structure Name (A209)	Structure # (N8)	Milepost (A232)	Area (A225)	Bridge Sufficiency	Bridge Index					Functionally Obsolete Bridges	Bridge Rating	Hot Spots on Bridge Index map
				Sufficiency Rating	Deck (N58)	Sub (N59)	Super (N60)	Eval (N67)	Lowest	Deck Area on Func Obsolete		
Segment 9												
Mulepass-Lowell Arch	130	348.15	3518	56.00	7.00	5.00	6.00	5.00	5.0	0		
Bridge	235	349.28	1523	53.10	5.00	5.00	6.00	5.00	5.0	0		
Bridge	236	350.72	2030	87.00	6.00	6.00	6.00	6.00	6.0	0		
Glance Creek Bridge	20114	352.38	4928	98.00	8.00	8.00	8.00	8.00	8.0	0		
Wash Bridge	238	355.05	4537	75.70	6.00	6.00	6.00	5.00	5.0	0		
Total			16,536									
Weighted Average				77.46					6.02	0.00%		
Factor				1.00					1.00	1.00		
Indicator Score				**77.46**						**0.00%**	**5**	
Bridge Index									**6.02**			
Segment 10												
White Water Draw Br	1626	364.29	24111	86.30	5.00	6.00	7.00	6.00	5.0	0		
Total			24,111									
Weighted Average				86.30					5.00	0.00%		
Factor				1.00					1.00	1.00		
Indicator Score				**86.30**						**0.00%**	**5**	
Bridge Index									**5.00**			

Mobility Performance Area Data

Segment	Begin MP	End MP	Length (mi)	Facility Type	Flow Type	Terrain	No. of Lanes	Capacity Environment Type	Lane Width (feet)	EB/NB Right Shoulder Width	WB/SB Right Shoulder Width	EB/NB Left Shoulder Width	WB/SB Left Shoulder Width	NB/EB AADT	SB/WB AADT	2020 AADT	K Factor	D Factor	T Factor	Weighted Average Posted Speed Limit (mph)	Divided or Undivided	Access Points (per mile)	% No-Passing Zone
90-1	289.3	294.54	5.29	Rural	Interrupted	Level	4	Urban/Rural Single or Multilane Signalized	12.00	9.49	10.00	N/A	N/A	4511	4352	8863	8.0%	50.9%	10.7%	60	Divided	N/A	0%
90-2	294.5	304.49	9.95	Rural	Interrupted	Level	4	Multilane Highway	12.00	10.00	10.00	10.00	4.00	4457	4351	8808	9.0%	50.6%	12.8%	63	Divided	0.67	0%
90-3	304.5	311.78	7.29	Rural	Interrupted	Level	4	Urban/Rural Single or Multilane Signalized	12.00	9.84	10.00	N/A	N/A	4793	4992	9785	9.5%	51.2%	14.5%	62	Divided	N/A	0%
90-4	311.8	317.2	5.42	Rural	Uninterrupted	Level	4	Multilane Highway	12.00	8.34	8.23	8.23	N/A	7513	7429	14942	8.0%	50.3%	9.5%	55	Undivided	2.4	0%
90-5	317.2	323.99	6.79	Urban	Interrupted	Level	4	Urban/Rural Single or Multilane Signalized	12.00	5.22	5.22	N/A	N/A	5840	5839	11679	8.9%	50.2%	10.6%	53	Undivided	N/A	0%
90-6	324	336.4	12.41	Rural	Interrupted	Level	2	Urban/Rural Single or Multilane Signalized	12.00	5.08	5.10	N/A	N/A	2371	2380	4751	9.0%	50.1%	8.0%	63	Undivided	N/A	25%
80-7	333.9	339	5.12	Rural	Uninterrupted	Mountainous	2	Rural Two-Lane, Non-Signalized	12.00	5.00	4.61	N/A	N/A	2556	2601	5157	8.0%	50.4%	7.7%	54	Undivided	1.17	50%
80-8	339	345.13	6.13	Fringe Urban	Interrupted	Mountainous	2	Urban/Rural Single or Multilane Signalized	12.00	3.02	3.30	N/A	N/A	2538	2202	4740	8.5%	55.0%	10.0%	43	Undivided	N/A	50%
80-9	345.1	357.08	11.95	Rural	Uninterrupted	Level	2	Rural Two-Lane, Non-Signalized	12.00	6.06	6.57	N/A	N/A	2066	2224	4289	11.6%	56.2%	13.8%	62	Undivided	0.59	25%
80-10	357.1	364.67	7.59	Rural	Interrupted	Level	4	Urban/Rural Single or Multilane Signalized	12.00	8.50	8.74	N/A	N/A	2151	2119	4270	10.0%	50.4%	14.4%	64	Divided	N/A	0%

LOTTR and TTTR – Northbound/Westbound

Segment	TMC [Internal ID]	Time Period	RoadNumber	Direction	Cars 50th % Travel Time (seconds) Location1	Trucks 50th % Travel Time (seconds) Location1	Cars 80th % Travel Time (seconds) Location1	Trucks 95th % Travel Time (seconds) Location1	Posted Speed limit	Assumed car free-flow speed	Assumed truck free-flow speed	LOTTR	TTTR	Peak LOTTR	Peak TTTR	TMC Weighting	Weighted LOTTR	Weighted TTTR
1	115P05861	1 AM Peak	AZ-90	N	24	38	49	85	61	61	61	2.00	2.25	2.00	2.75	100%	2.00	2.75
1	115P05861	2 Mid Day	AZ-90	N	24	34	43	85	61	61	61	1.75	2.48					
1	115P05861	3 PM Peak	AZ-90	N	23	31	43	85	61	61	61	1.87	2.75					
~~1~~	~~115P05861~~	~~4 Evening~~	AZ-90	N	28	38	49	85	~~61~~	61	61	1.71	2.25					
2	115+05861	1 AM Peak	AZ-90	N	520	608	656	5238	63	63	63	1.26	8.62	2.05	8.62	100%	2.05	8.62
2	115+05861	2 Mid Day	AZ-90	N	512	542	576	3928	63	63	63	1.13	7.25					
2	115+05861	3 PM Peak	AZ-90	N	510	525	591	3143	63	63	63	1.16	5.99					
2	115+05861	4 Evening	AZ-90	N	532	609	1093	5238	63	63	63	2.05	8.61					
3	115+06934	1 AM Peak	AZ-90	N	480	504	566	859	54	54	54	1.18	1.70	1.28	2.07	73%	1.23	1.87
3	115+06934	2 Mid Day	AZ-90	N	497	510	595	951	54	54	54	1.20	1.86					
3	115+06934	3 PM Peak	AZ-90	N	475	467	610	968	54	54	54	1.28	2.07					
3	115+06934	4 Evening	AZ-90	N	461	484	581	905	54	54	54	1.26	1.87					
3	115+07206	1 AM Peak	AZ-90	N	169	170	182	222	55	55	55	1.08	1.30	1.09	1.30	27%		
3	115+07206	2 Mid Day	AZ-90	N	170	170	183	215	55	55	55	1.08	1.26					
3	115+07206	3 PM Peak	AZ-90	N	170	170	183	209	55	55	55	1.08	1.23					
3	115+07206	4 Evening	AZ-90	N	167	169	183	214	55	55	55	1.09	1.27					
4	115+05860	1 AM Peak	AZ-90	N	563	568	608	808	54	54	54	1.08	1.42	1.10	1.42	100%	1.10	1.42
4	115+05860	2 Mid Day	AZ-90	N	564	568	602	759	54	54	54	1.07	1.34					
4	115+05860	3 PM Peak	AZ-90	N	558	573	601	709	54	54	54	1.08	1.24					
4	115+05860	4 Evening	AZ-90	N	553	563	607	755	54	54	54	1.10	1.34					
5	115+05860	1 AM Peak	AZ-90	N	563	568	608	808	45	45	45	1.08	1.42	1.10	1.42	61%	1.22	1.86
5	115+05860	2 Mid Day	AZ-90	N	564	568	602	759	45	45	45	1.07	1.34					
5	115+05860	3 PM Peak	AZ-90	N	558	573	601	709	45	45	45	1.08	1.24					
5	115+05860	4 Evening	AZ-90	N	553	563	607	755	45	45	45	1.10	1.34					
5	115+06931	1 AM Peak	AZ-90	N	175	171	261	457	55	55	55	1.49	2.67	1.72	2.93	14%		
5	115+06931	2 Mid Day	AZ-90	N	195	176	314	444	55	55	55	1.61	2.53					
5	115+06931	3 PM Peak	AZ-90	N	185	163	303	343	55	55	55	1.64	2.10					
5	115+06931	4 Evening	AZ-90	N	185	167	318	490	55	55	55	1.72	2.93					
5	115+06933	1 AM Peak	AZ-90	W	114	109	139	148	55	55	55	1.21	1.35	1.21	1.35	11%		
5	115+06933	2 Mid Day	AZ-90	W	109	109	124	144	55	55	55	1.14	1.32					
5	115+06933	3 PM Peak	AZ-90	W	109	112	124	140	55	55	55	1.14	1.26					
5	115+06933	4 Evening	AZ-90	W	105	107	122	137	55	55	55	1.16	1.27					
5	115P06931	1 AM Peak	AZ-90	W	1	1	1	1	55	55	55	1.23	1.92	1.25	1.92	0%		
5	115P06931	2 Mid Day	AZ-90	W	1	1	1	1	55	55	55	1.21	1.81					
5	115P06931	3 PM Peak	AZ-90	W	1	1	1	1	55	55	55	1.23	1.74					
5	115P06931	4 Evening	AZ-90	W	1	1	1	1	55	55	55	1.25	1.73					
5	115+06932	1 AM Peak	AZ-90	W	71	75	80	109	55	55	55	1.12	1.45	1.15	1.50	7%		
5	115+06932	2 Mid Day	AZ-90	W	73	75	83	112	55	55	55	1.13	1.50					

Segment	TMC [Internal ID]	Time Period	RoadNumber	Direction	Cars 50th % Travel Time (seconds) Location1	Trucks 50th % Travel Time (seconds) Location1	Cars 80th % Travel Time (seconds) Location1	Trucks 95th % Travel Time (seconds) Location1	Posted Speed limit	Assumed car free-flow speed	Assumed truck free-flow speed	LOTTR	TTTR	Peak LOTTR	Peak TTTR	TMC Weighting	Weighted LOTTR	Weighted TTTR
5	115+06932	2 Mid Day	AZ-90	W	73	75	83	112	55	55	55	1.13	1.50					
5	115+06932	3 PM Peak	AZ-90	W	72	76	83	109	55	55	55	1.15	1.42					
5	115+06932	4 Evening	AZ-90	W	69	73	79	103	55	55	55	1.15	1.40					
5	115+05859	1 AM Peak	AZ-90	W	108	110	144	352		0	0	1.34	3.20					
5	115+05859	2 Mid Day	AZ-90	W	120	117	168	503		0	0	1.40	4.29	1.46	4.86	7%		
5	115+05859	3 PM Peak	AZ-90	W	114	107	160	294		0	0	1.41	2.75					
5	115+05859	4 Evening	AZ-90	W	101	104	147	503		0	0	1.46	4.86					
6	115+06930	1 AM Peak	AZ-90	W	234	228	286	374	63	63	63	1.22	1.64					
6	115+06930	2 Mid Day	AZ-90	W	238	232	289	402	63	63	63	1.22	1.74	1.22	1.74	22%		
6	115+06930	3 PM Peak	AZ-90	W	222	231	265	362	63	63	63	1.19	1.57					
6	115+06930	4 Evening	AZ-90	W	213	217	241	278	63	63	63	1.13	1.28					
6	115+06929	1 AM Peak	AZ-90	W	370	379	392	476	65	65	65	1.06	1.26					
6	115+06929	2 Mid Day	AZ-90	W	376	385	402	440	65	65	65	1.07	1.14	1.07	1.30	47%		
6	115+06929	3 PM Peak	AZ-90	W	373	395	399	496	65	65	65	1.07	1.26					
6	115+06929	4 Evening	AZ-90	W	370	388	397	506	65	65	65	1.07	1.30					
6	115+06928	1 AM Peak	AZ-90	W	239	246	253	290	55	55	55	1.06	1.18					
6	115+06928	2 Mid Day	AZ-90	W	246	250	263	288	55	55	55	1.07	1.15	1.07	1.31	31%		
6	115+06928	3 PM Peak	AZ-90	W	243	259	254	324	55	55	55	1.05	1.25					
6	115+06928	4 Evening	AZ-90	W	244	253	259	330	55	55	55	1.06	1.31					
6	115P05858	1 AM Peak	AZ-90	W	4	4	5	6		0	0	1.26	1.54					
6	115P05858	2 Mid Day	AZ-90	W	4	4	6	11		0	0	1.28	2.50	1.28	2.50	0%		
6	115P05858	3 PM Peak	AZ-90	W	4	4	6	6		0	0	1.28	1.50					
6	115P05858	4 Evening	AZ-90	W	5	5	6	7		0	0	1.19	1.50					
7	115P05852	1 AM Peak	AZ-80	N	8	8	8	10	55	55	55	1.08	1.27					
7	115P05852	2 Mid Day	AZ-80	N	8	8	8	10	55	55	55	1.10	1.33	1.12	2.11	2%		
7	115P05852	3 PM Peak	AZ-80	N	8	8	9	12	55	55	55	1.12	1.49					
7	115P05852	4 Evening	AZ-80	N	8	8	9	17	55	55	55	1.12	2.11					
7	115+05852	1 AM Peak	AZ-80	W	315	317	329	377	49	49	49	1.05	1.19					
7	115+05852	2 Mid Day	AZ-80	W	318	318	336	383	49	49	49	1.06	1.20	1.07	1.23	98%		
7	115+05852	3 PM Peak	AZ-80	W	317	330	335	395	49	49	49	1.06	1.20					
7	115+05852	4 Evening	AZ-80	W	318	326	338	402	49	49	49	1.07	1.23					
8	115+06919	1 AM Peak	AZ-80	W	73	74	78	93	51	51	51	1.08	1.26					
8	115+06919	2 Mid Day	AZ-80	W	74	75	80	96	51	51	51	1.08	1.28	1.10	1.29	21%		
8	115+06919	3 PM Peak	AZ-80	W	73	78	80	101	51	51	51	1.10	1.29					
8	115+06919	4 Evening	AZ-80	W	74	77	80	94	51	51	51	1.08	1.22					
8	115P11217	1 AM Peak	AZ-80	N	21	23	23	33	41	41	41	1.11	1.45	1.11	1.45	6%		

Segment	TMC [Internal ID]	Time Period	RoadNumber	Direction	Cars 50th % Travel Time (seconds) Location1	Trucks 50th % Travel Time (seconds) Location1	Cars 80th % Travel Time (seconds) Location1	Trucks 95th % Travel Time (seconds) Location1	Posted Speed limit	Assumed car free-flow speed	Assumed truck free-flow speed	LOTTR	TTTR	Peak LOTTR	Peak TTTR	TMC Weighting	Weighted LOTTR	Weighted TTTR
8	115P11217	2 Mid Day	AZ-80	N	21	23	23	31	41	41	41	1.11	1.36					
8	115P11217	3 PM Peak	AZ-80	N	21	24	23	33	41	41	41	1.09	1.39					
8	115P11217	4 Evening	AZ-80	N	22	24	24	31	41	41	41	1.09	1.30					
8	115+11217	1 AM Peak	AZ-80	W	326	346	378	503	49	49	49	1.16	1.46	1.19	1.53	72%		
8	115+11217	2 Mid Day	AZ-80	W	332	339	396	518	49	49	49	1.19	1.53					
8	115+11217	3 PM Peak	AZ-80	W	327	360	380	525	49	49	49	1.16	1.46					
8	115+11217	4 Evening	AZ-80	W	338	363	396	532	49	49	49	1.17	1.47					
8	115P50119	1 AM Peak		W	10	13	13	21		0	0	1.20	1.67	1.23	1.79	2%		
8	115P50119	2 Mid Day		W	11	13	13	22		0	0	1.21	1.79					
8	115P50119	3 PM Peak		W	11	12	13	18		0	0	1.21	1.59					
8	115P50119	4 Evening		W	12	13	14	18		0	0	1.23	1.47					
8	115P05851	1 AM Peak		N	0	0	0	0		0	0	NO CORRESPONDING DATA	NO CORRESPONDING DATA	0.00	0.00	0%		
8	115P05851	2 Mid Day		N	0	0	0	0		0	0	NO CORRESPONDING DATA	NO CORRESPONDING DATA					
8	115P05851	3 PM Peak		N	0	0	0	0		0	0	NO CORRESPONDING DATA	NO CORRESPONDING DATA					
8	115P05851	4 Evening		N	0	0	0	0		0	0	NO CORRESPONDING DATA	NO CORRESPONDING DATA					
9	115+05851	1 AM Peak	AZ-80	W	294	311	321	432	65	65	65	1.09	1.39	1.10	1.39	51%		
9	115+05851	2 Mid Day	AZ-80	W	298	306	324	421	65	65	65	1.09	1.38					
9	115+05851	3 PM Peak	AZ-80	W	294	305	324	402	65	65	65	1.10	1.32					
9	115+05851	4 Evening	AZ-80	W	299	305	327	399	65	65	65	1.09	1.31				1.11	1.37
9	115+06918	1 AM Peak	AZ-80	W	242	241	268	296	65	65	65	1.11	1.23	1.11	1.34	49%		
9	115+06918	2 Mid Day	AZ-80	W	246	244	269	311	65	65	65	1.09	1.27					
9	115+06918	3 PM Peak	AZ-80	W	238	246	262	330	65	65	65	1.10	1.34					
9	115+06918	4 Evening	AZ-80	W	246	244	271	308	65	65	65	1.10	1.26					
9	115P06917	1 AM Peak	AZ-80	N	2	2	2	5	51	51	51	1.34	3.51	1.38	3.51	0%		
9	115P06917	2 Mid Day	AZ-80	N	2	2	2	5	51	51	51	1.38	2.94					
9	115P06917	3 PM Peak	AZ-80	N	2	2	2	5	51	51	51	1.36	3.00					
9	115P06917	4 Evening	AZ-80	N	2	2	2	4	51	51	51	1.34	2.60					
10	115+06917	1 AM Peak	AZ-80	W	548	539	672	1137	65	65	65	1.23	2.11	1.23	2.27	76%		
10	115+06917	2 Mid Day	AZ-80	W	566	571	678	1299	65	65	65	1.20	2.27					
10	115+06917	3 PM Peak	AZ-80	W	541	563	647	1102	65	65	65	1.20	1.96					
10	115+06917	4 Evening	AZ-80	W	575	562	680	1041	65	65	65	1.18	1.85				1.21	2.38
10	115+06916	1 AM Peak	AZ-80	W	178	195	202	436	63	63	63	1.13	2.24	1.17	2.71	24%		
10	115+06916	2 Mid Day	AZ-80	W	186	202	218	546	63	63	63	1.17	2.71					
10	115+06916	3 PM Peak	AZ-80	W	182	192	200	277	63	63	63	1.10	1.45					
10	115+06916	4 Evening	AZ-80	W	180	188	198	230	63	63	63	1.10	1.22					

LOTTR and TTTR – Southbound/Eastbound

Segment	TMC [Internal ID]	Time Period	RoadNumber	Direction	Cars 50th % Travel Time (seconds) Location1	Trucks 50th % Travel Time (seconds) Location1	Cars 80th % Travel Time (seconds) Location1	Trucks 95th % Travel Time (seconds) Location1	Posted Speed limit	LOTTR	TTTR	Peak LOTTR	Peak TTTR	TMC Weighting	Weighted LOTTR	Weighted TTTR
1	115N05861	1 AM Peak	AZ-90	S	14	16	23	31	61	1.67	1.91	1.67	1.91	1%	1.69	7.37
1	115N05861	2 Mid Day	AZ-90	S	15	20	24	34	61	1.64	1.70					
1	115N05861	3 PM Peak	AZ-90	S	17	21	26	34	61	1.54	1.60					
1	115N05861	4 Evening	AZ-90	S	16	20	26	34	~~61~~	1.62	1.70					
1	115-06934	~~1 AM Peak~~	AZ-90	S	513	547	559	2416		1.09	4.41	1.69	7.43	99%		
1	115-06934	~~2 Mid Day~~	AZ-90	S	515	572	604	3988		1.17	6.97					
1	115-06934	~~3 PM Peak~~	AZ-90	S	526	594	804	4172		1.53	7.02					
1	115-06934	~~4 Evening~~	AZ-90	S	533	604	902	4487		1.69	7.43					
2	115-07206	~~1 AM Peak~~	AZ-90	S	402	410	414	444	63	1.03	1.08	1.04	1.08	100%	1.04	1.08
2	115-07206	~~2 Mid Day~~	AZ-90	S	400	410	412	444	63	1.03	1.08					
2	115-07206	~~3 PM Peak~~	AZ-90	S	404	410	416	444	63	1.03	1.08					
2	115-07206	~~4 Evening~~	AZ-90	S	404	410	419	444	63	1.04	1.08					
3	115-06933	1 AM Peak	AZ-90	S	575	596	614	912	54	1.07	1.53	1.11	1.56	76%	1.11	1.52
3	115-06933	2 Mid Day	AZ-90	S	574	596	618	911	54	1.08	1.53					
3	115-06933	3 PM Peak	AZ-90	S	574	603	634	939	54	1.11	1.56					
3	115-06933	4 Evening	AZ-90	S	563	591	620	911	54	1.10	1.54					
3	115-05860	1 AM Peak	AZ-90	S	168	169	180	226	55	1.07	1.34	1.11	1.40	24%		
3	115-05860	2 Mid Day	AZ-90	S	168	169	182	229	55	1.08	1.35					
3	115-05860	3 PM Peak	AZ-90	S	168	170	183	224	55	1.09	1.31					
3	115-05860	4 Evening	AZ-90	S	165	168	183	234	55	1.11	1.40					
4	115-06932	1 AM Peak	AZ-90	E	103	107	115	135	54	1.11	1.25	1.11	1.25	100%	1.11	1.25
4	115-06932	2 Mid Day	AZ-90	E	103	107	114	130	54	1.11	1.21					
4	115-06932	3 PM Peak	AZ-90	E	103	109	113	137	54	1.09	1.25					
4	115-06932	4 Evening	AZ-90	E	100	105	109	130	54	1.10	1.24					
5	115-06932	1 AM Peak	AZ-90	E	103	107	115	135	45	1.11	1.25	1.11	1.25	18%	1.38	2.23
5	115-06932	2 Mid Day	AZ-90	E	103	107	114	130	45	1.11	1.21					
5	115-06932	3 PM Peak	AZ-90	E	103	109	113	137	45	1.09	1.25					
5	115-06932	4 Evening	AZ-90	E	100	105	109	130	45	1.10	1.24					
5	115-05859	1 AM Peak	AZ-90	S	174	159	253	508	55	1.46	3.19	1.80	3.64	23%		
5	115-05859	2 Mid Day	AZ-90	S	213	196	361	623	55	1.69	3.18					
5	115-05859	3 PM Peak	AZ-90	S	219	196	387	623	55	1.76	3.18					
5	115-05859	4 Evening	AZ-90	S	191	167	343	608	55	1.80	3.64					
5	115-06931	1 AM Peak	AZ-90	E	70	73	80	109	55	1.14	1.48	1.15	1.53	12%		
5	115-06931	2 Mid Day	AZ-90	E	71	75	82	106	55	1.15	1.41					
5	115-06931	3 PM Peak	AZ-90	E	71	76	82	117	55	1.15	1.53					
5	115-06931	4 Evening	AZ-90	E	68	72	78	103	55	1.15	1.43					
5	115N06931	1 AM Peak	AZ-90	E	0	0	1	1	55	1.20	1.96	1.35	1.96	0%		

Segment	TMC [Internal ID]	Time Period	RoadNumber	Direction	Cars 50th % Travel Time (seconds) Location1	Trucks 50th % Travel Time (seconds) Location1	Cars 80th % Travel Time (seconds) Location1	Trucks 95th % Travel Time (seconds) Location1	Posted Speed limit	LOTTR	TTTR	Peak LOTTR	Peak TTTR	TMC Weighting	Weighted LOTTR	Weighted TTTR
5	115N06931	2 Mid Day	AZ-90	E	0	1	1	1	55	1.24	1.84					
5	115N06931	3 PM Peak	AZ-90	E	1	1	1	1	55	1.35	1.84					
5	115N06931	4 Evening	AZ-90	E	0	0	1	1	55	1.29	1.76					
5	115N05859	1 AM Peak		E	1	2	3	7	55	2.18	3.41					
5	115N05859	2 Mid Day		E	2	2	4	8	55	2.16	4.00	2.57	4.00	0%		
5	115N05859	3 PM Peak		E	2	2	4	6	55	2.18	2.67					
5	115N05859	4 Evening		E	2	2	5	6	55	2.57	2.67					
5	115-06930	1 AM Peak	AZ-90	E	103	101	139	185		1.35	1.84					
5	115-06930	2 Mid Day	AZ-90	E	119	104	168	271		1.42	2.62	1.61	4.00	12%		
5	115-06930	3 PM Peak	AZ-90	E	118	110	169	440		1.43	4.00					
5	115-06930	4 Evening	AZ-90	E	110	104	176	185		1.61	1.79					
5	115-06929	1 AM Peak	AZ-90	E	221	231	264	344		1.19	1.49					
5	115-06929	2 Mid Day	AZ-90	E	228	226	271	338		1.19	1.49	1.26	1.49	36%		
5	115-06929	3 PM Peak	AZ-90	E	231	224	290	304		1.26	1.36					
5	115-06929	4 Evening	AZ-90	E	209	220	236	293		1.13	1.33					
6	115-06928	1 AM Peak	AZ-90	E	376	382	402	485	63	1.07	1.27					
6	115-06928	2 Mid Day	AZ-90	E	376	376	402	475	63	1.07	1.26	1.09	1.27	60%		
6	115-06928	3 PM Peak	AZ-90	E	376	392	409	485	63	1.09	1.24					
6	115-06928	4 Evening	AZ-90	E	370	379	395	475	63	1.07	1.25				1.10	1.30
6	115-05858	1 AM Peak	AZ-90	E	253	263	271	345	65	1.07	1.31					
6	115-05858	2 Mid Day	AZ-90	E	257	259	277	337	65	1.08	1.30	1.08	1.36	40%		
6	115-05858	3 PM Peak	AZ-90	E	257	272	279	371	65	1.08	1.36					
6	115-05858	4 Evening	AZ-90	E	254	268	274	328	65	1.08	1.23					
6	115N05858	1 AM Peak	AZ-90	E	7	0	10	0	55	1.36	NO CORRESPONDING DATA					
6	115N05858	2 Mid Day	AZ-90	E	5	0	7	0	55	1.30	NO CORRESPONDING DATA	2.75	0.00	1%		
6	115N05858	3 PM Peak	AZ-90	E	5	0	14	0	55	2.75	NO CORRESPONDING DATA					
6	115N05858	4 Evening	AZ-90	E	6	0	7	0	55	1.15	NO CORRESPONDING DATA					
7	115N05852	1 AM Peak	AZ-80	S	8	8	8	10	55	1.10	1.25					
7	115N05852	2 Mid Day	AZ-80	S	8	8	8	9	55	1.06	1.24	1.10	1.30	2%		
7	115N05852	3 PM Peak	AZ-80	S	7	8	8	9	55	1.09	1.16					
7	115N05852	4 Evening	AZ-80	S	8	8	8	10	55	1.08	1.30				1.16	1.65
7	115-06919	1 AM Peak	AZ-80	E	335	371	369	607	49	1.10	1.64					
7	115-06919	2 Mid Day	AZ-80	E	335	355	363	584	49	1.08	1.65	1.14	1.66	81%		
7	115-06919	3 PM Peak	AZ-80	E	335	370	374	532	49	1.12	1.44					
7	115-06919	4 Evening	AZ-80	E	337	377	385	624	49	1.14	1.66					
7	115-11217	1 AM Peak	AZ-80	E	77	92	89	135		1.16	1.48	1.26	1.68	17%		
7	115-11217	2 Mid Day	AZ-80	E	77	82	87	137		1.14	1.68					

Segment	TMC [Internal ID]	Time Period	RoadNumber	Direction	Cars 50th % Travel Time (seconds) Location1	Trucks 50th % Travel Time (seconds) Location1	Cars 80th % Travel Time (seconds) Location1	Trucks 95th % Travel Time (seconds) Location1	Posted Speed limit	LOTTR	TTTR	Peak LOTTR	Peak TTTR	TMC Weighting	Weighted LOTTR	Weighted TTTR
7	115-11217	3 PM Peak	AZ-80	E	77	96	92	133		1.20	1.38					
7	115-11217	4 Evening	AZ-80	E	77	99	97	135		1.26	1.37					
8	115N11217	1 AM Peak	AZ-80	S	21	23	23	29	51	1.09	1.29	1.12	1.31	3%	1.13	1.42
8	115N11217	2 Mid Day	AZ-80	S	21	22	23	29	51	1.07	1.31					
8	115N11217	3 PM Peak	AZ-80	S	21	23	23	29	51	1.09	1.22					
8	115N11217	4 Evening	AZ-80	S	21	24	24	29	51	1.12	1.23					
8	115-05851	1 AM Peak	AZ-80	E	314	345	360	498	41	1.15	1.44	1.18	1.48	44%		
8	115-05851	2 Mid Day	AZ-80	E	320	336	377	498	41	1.18	1.48					
8	115-05851	3 PM Peak	AZ-80	E	316	349	364	481	41	1.15	1.38					
8	115-05851	4 Evening	AZ-80	E	325	347	384	484	41	1.18	1.40					
8	115N05851	1 AM Peak		E	13	15	16	26	49	1.21	1.67	1.23	1.79	1%		
8	115N05851	2 Mid Day		E	13	15	16	27	49	1.23	1.79					
8	115N05851	3 PM Peak		E	14	15	16	24	49	1.17	1.55					
8	115N05851	4 Evening		E	14	15	17	27	49	1.23	1.79					
8	115-06918	1 AM Peak	AZ-80	E	279	283	302	389		1.08	1.38	1.08	1.38	51%		
8	115-06918	2 Mid Day	AZ-80	E	283	283	305	370		1.08	1.31					
8	115-06918	3 PM Peak	AZ-80	E	280	287	299	362		1.07	1.26					
8	115-06918	4 Evening	AZ-80	E	286	286	309	362		1.08	1.27					
9	115-06917	1 AM Peak	AZ-80	E	242	246	279	367	65	1.15	1.49	1.15	1.59	30%	1.19	2.48
9	115-06917	2 Mid Day	AZ-80	E	247	246	283	351	65	1.15	1.43					
9	115-06917	3 PM Peak	AZ-80	E	246	250	280	388	65	1.14	1.55					
9	115-06917	4 Evening	AZ-80	E	250	250	284	399	65	1.13	1.59					
9	115N06917	1 AM Peak	AZ-80	S	2	2	3	7	65	1.84	3.76	1.99	3.85	0%		
9	115N06917	2 Mid Day	AZ-80	S	2	2	3	7	65	1.99	3.76					
9	115N06917	3 PM Peak	AZ-80	S	2	2	3	7	65	1.80	3.85					
9	115N06917	4 Evening	AZ-80	S	2	2	3	6	65	1.80	3.13					
9	115-06916	1 AM Peak	AZ-80	E	541	553	654	1416	51	1.21	2.56	1.21	2.86	70%		
9	115-06916	2 Mid Day	AZ-80	E	557	557	653	1349	51	1.17	2.42					
9	115-06916	3 PM Peak	AZ-80	E	549	559	650	1355	51	1.18	2.42					
9	115-06916	4 Evening	AZ-80	E	557	566	653	1618	51	1.17	2.86					
10	115-05850	1 AM Peak	AZ-80	E	173	173	182	224	65	1.05	1.29	1.07	1.29	100%	1.07	1.29
10	115-05850	2 Mid Day	AZ-80	E	173	173	185	205	65	1.07	1.19					
10	115-05850	3 PM Peak	AZ-80	E	173	176	185	202	65	1.07	1.15					
10	115-05850	4 Evening	AZ-80	E	170	176	182	210	65	1.07	1.19					
10		2 Mid Day	-	-	#N/A	#N/A	#N/A	#N/A	63	-	-					
10		3 PM Peak	-	-	#N/A	#N/A	#N/A	#N/A	63	-	-					
10		4 Evening	-	-	#N/A	#N/A	#N/A	#N/A	63	-	-					

Closure Data

			Total miles of closures		Average Occurrences/Mile/Year	
Segment	Length (miles)	# of closures	SB (or EB)	NB (or WB)	SB (or EB)	NB (or WB)
90-1	5	0	0.0	0.0	0.00	0.00
90-2	9	1	1.0	0.0	0.02	0.00
90-3	8	11	7.0	4.0	0.18	0.10
90-4	5	3	3.0	0.0	0.12	0.00
90-5	7	5	1.0	5.0	0.03	0.14
90-6	12	6	3.0	9.0	0.05	0.15
80-7	6	10	3.0	15.0	0.10	0.50
80-8	6	13	16.3	8.0	0.54	0.27
80-9	12	13	9.0	4.0	0.90	0.40
80-10	9	2	2.0	0.0	0.05	0.00

	ITIS Category Description											
	Closures		Incidents/Accidents		Incidents/Crashes		Obstruction Hazards		Winds		Winter Storm Codes	
Segment	SB (or EB)	NB (or WB)	SB (or EB)	NB (or WB)	SB (or EB)	NB (or WB)	SB (or EB)	NB (or WB)	SB (or EB)	NB (or WB)	SB (or EB)	NB (or WB)
90-1	0	0	0	0	0	0	0	0	0	0	0	0
90-2	1	0	0	0	1	0	0	0	0	0	0	0
90-3	7	4	1	2	6	1	0	1	0	0	0	0
90-4	3	0	0	0	2	0	0	0	0	0	0	0
90-5	1	4	0	0	0	3	0	0	0	0	0	0
90-6	3	3	0	0	2	2	0	0	0	0	0	1
80-7	3	7	0	1	2	3	1	1	0	0	0	2
80-8	7	6	2	0	5	3	0	0	0	0	0	3
80-9	9	4	3	1	3	2	2	1	0	0	0	0
80-10	2	0	0	0	2	0	0	0	0	0	0	0

HPMS Data

SEGMENT	MP_FROM	MP_TO	WEIGHTED AVERAGE NB/WB AADT	WEIGHTED AVERAGE SB/EB AADT	WEIGHTED AVERAGE AADT	NB/WB AADT	SB/EB AADT	2020 AADT	K Factor	D-Factor	T-Factor
90-1	290	295	4734	4489	9223	4511	4352	8863	8	51	11
90-2	295	304	4740	4667	9407	4457	4351	8808	9	51	13
90-3	304	312	5299	5468	10767	4793	4992	9785	9	51	14
90-4	312	317	8450	8929	17378	7513	7429	14942	8	50	10
90-5	317	324	6495	6501	12996	5840	5839	11679	9	50	11
90-6	324	336	2496	2503	4999	2371	2380	4751	9	50	8
80-7	333	339	2461	2564	5025	2556	2601	5157	8	50	8
80-8	339	345	2583	2459	5041	2538	2202	4740	8	55	10
80-9	345	357	2249	2259	4508	2066	2224	4289	12	56	14
80-10	357	365	2304	2277	4581	2151	2119	4270	10	50	14

SEGMENT	Loc ID	BMP	EMP	Length	Pos Dir AADT	Neg Dir AADT	Corrected Pos Dir AADT	Corrected Neg Dir AADT	2015 AADT	K Factor	D-Factor	D-Factor Adjusted	T-Factor
90-1	101069	289.54	298.50	8.96	4511	4352	4511	4352	8863	8	50	51	11
90-2	101069	289.54	298.50	8.96	4511	4352	4511	4352	8863	8	50	51	11
	101070	298.50	308.39	9.89	4408	4350	4408	4350	8758	10	56	50	15
90-3	101070	298.50	308.39	9.89	4408	4350	4408	4350	8758	10	56	50	15
	101071	308.39	311.96	3.57	5861	6769	5861	6769	12630	8	61	54	14
90-4	101072	311.96	313.60	1.64	7811	7777	7811	7777	15588	8	57	50	11
	101074	313.60	317.20	3.60	7377	7270	7377	7270	14647	8	58	50	9
90-5	101076	317.20	318.60	1.40	6862	6787	6862	6787	13649	9	60	50	10
	101078	318.60	319.60	1.00	6892	6827	6892	6827	13719	9	59	50	9
	101080	319.60	321.25	1.65	6298	6276	6298	6276	12574	9	54	50	13
	101082	321.25	321.52	0.27	8288	8804	8288	8804	17092	9	52	52	8
	101084	321.52	322.48	0.96	7604	7675	7604	7675	15279	8	52	50	11
	101086	322.48	325.51	3.03	3994	3990	3994	3990	7984	9	65	50	10
90-6	101086	322.48	325.51	3.03	3994	3990	3994	3990	7984	9	65	50	10
	101087	325.51	336.40	10.89	1920	1932	1920	1932	3852	9	56	50	7
80-7	100865	332.89	339.81	6.92	2556	2601	2556	2601	5157	8	53	50	8
80-8	100866	339.81	341.49	1.68	2239	759	2239	759	2998	8	74	75	11
	100867	341.49	343.30	1.81	3521	2454	3521	2454	5975	9	64	59	9
	100868	343.30	345.38	2.08	1867	1819	1867	1819	3686	10	53	51	18
	100865	332.89	339.81	6.92	2556	2601	2556	2601	5157	8	53	50	8
80-9	100869	345.38	348.06	2.68	3492	2245	3492	2245	5737	9	71	61	8
	100870	348.06	356.47	8.41	1528	2319	1528	2319	3847	14	54	60	15
	100871	356.47	364.67	8.20	2151	2119	2151	2119	4270	10	71	50	14
80-10	100871	356.47	364.67	8.20	2151	2119	2151	2119	4270	10	71	50	14

Bicycle Accommodation Data

Segment	BMP	EMP	Divided or Non	NB/EB Right Shoulder Width	SB/WB Right Shoulder Width	NB/EB Left Shoulder Width	SB/WB Left Shoulder Width	NB/EB Effective Length of Shoulder	SB/WB Effective Length of Shoulder	% Bicycle Accommodation
90-1	289.25	294.54	Divided	9.5	10.0	4.9	4.0	5.3	4.0	88%
90-2	294.54	304.49	Divided	10.0	10.0	4.0	4.0	9.9	9.9	100%
90-3	304.49	311.78	Divided	9.8	10.0	4.3	4.0	7.3	6.7	96%
90-4	311.78	317.2	Undivided	8.3	8.2	N/A	N/A	5.3	5.1	96%
90-5	317.2	323.99	Undivided	5.2	5.2	N/A	N/A	1.7	1.7	26%
90-6	323.99	336.4	Undivided	5.1	5.1	N/A	N/A	0.4	0.3	3%
80-7	333.88	339	Undivided	5.0	4.6	N/A	N/A	0.0	0.0	0%
80-8	339	345.13	Undivided	3.0	3.3	N/A	N/A	2.8	2.4	43%
80-9	345.13	357.08	Undivided	6.1	6.6	N/A	N/A	9.7	11.4	88%
80-10	357.08	364.67	Divided	8.5	8.7	5.4		7.3	7.4	97%

AZTDM Data

SEGMENT	Growth Rate	% Non-SOV
90-1	1.27%	11.2%
90-2	1.26%	11.9%
90-3	1.15%	15.0%
90-4	1.12%	15.4%
90-5	0.88%	18.5%
90-6	0.75%	15.0%
80-7	-3.42%	14.6%
80-8	-3.47%	15.8%
80-9	-5.22%	10.9%
80-10	-3.20%	14.0%

HERS Capacity Calculation Data

Segment	Capacity Environment Type	Facility Type	Terrain	Lane Width	NB/EB Rt. Shoulder	SB/WB Rt. Shoulder	F_{lw} or f_w or f_{LS}	NB/EB F_{lc}	SB/WB F_{lc}	Total Ramp Density	PHF	E_T	f_{HV}	f_M	f_A	g/C	f_G	f_{NP}	Nm	f_p	NB/EB FFS	SB/WB FFS	NB/EB Peak-Hour Capacity	SB/WB Peak-Hour Capacity	Major Direction Peak-Hour Capacity	Daily Capacity
90-1	3	Rural	Level	12.00	9.49	10.00	1.0	N/A	N/A	N/A	0.9	2	0.903	N/A	N/A	0.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1699.07	32,363
90-2	2	Rural	Level	12.00	10.00	10.00	0.0	0	0.4	N/A	0.88	1.5	0.940	0	0.17	N/A	N/A	N/A	N/A	N/A	62.83	62.43	3639	3639	N/A	69,318
90-3	3	Rural	Level	12.00	9.84	10.00	1.0	N/A	N/A	N/A	0.9	2	0.873	N/A	N/A	0.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1643.04	31,296
90-4	2	Rural	Level	12.00	8.34	8.23	0.0	0	0	N/A	0.88	1.5	0.955	1.6	0.6	N/A	N/A	N/A	N/A	N/A	52.80	52.80	3454	3454	N/A	65,792
90-5	3	Urban	Level	12.00	5.22	5.22	1.0	N/A	N/A	N/A	0.9	2	0.904	N/A	N/A	0.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1700.83	32,397
90-6	3	Rural	Level	12.00	5.08	5.10	1.0	N/A	N/A	N/A	0.9	2	0.926	N/A	N/A	0.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	870.57	16,582
80-7	4	Rural	Mountainous	12.00	5.00	4.61	0.0	N/A	N/A	N/A	0.88	7.2	0.676	N/A	0.29	N/A	0.62	3.30	N/A	N/A	63.71	63.71	N/A	N/A	484.83	9,235
80-8	3	Fringe Urban	Mountainous	12.00	3.02	3.30	1.0	N/A	N/A	N/A	0.9	2	0.909	N/A	N/A	0.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	854.67	16,280
80-9	4	Rural	Level	12.00	6.06	6.57	0.0	N/A	N/A	N/A	0.88	1.4	0.948	N/A	0.15	N/A	1	2.75	N/A	N/A	71.85	71.85	N/A	N/A	1563.67	29,784
80-10	3	Rural	Level	12.00	8.50	8.74	1.0	N/A	N/A	N/A	0.9	2	0.874	N/A	N/A	0.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1644.86	31,331

Safety Performance Area Data

Segment	Operating Environment	Segment Length (miles)	NB/WB Fatal Crashes 2011-2015	SB/EB Fatal Crashes 2011-2015	NB/WB Incapacitating Injury Crashes	SB/EB Incapacitating Injury Crashes	Fatal + Suspected Serious Injury Crashes at Intersections
90-1	2 or 3 or 4 Lane Divided Highway	5.29	0	1	1	1	2
90-2	2 or 3 or 4 Lane Divided Highway	9.95	0	0	1	1	0
90-3	2 or 3 or 4 Lane Divided Highway	7.29	1	0	2	0	1
90-4	4 or 5 Lane Undivided Highway	5.42	0	0	2	0	0
90-5	4 or 5 Lane Undivided Highway	6.79	1	4	11	2	11
90-6	2 or 3 Lane Undivided Highway	12.41	0	0	3	4	3
80-7	2 or 3 Lane Undivided Highway	5.12	1	1	1	1	2
80-8	2 or 3 Lane Undivided Highway	6.13	1	1	0	0	0
80-9	2 or 3 Lane Undivided Highway	11.95	0	0	0	0	0
80-10	2 or 3 or 4 Lane Divided Highway	7.59	0	1	2	1	2

Segment	Operating Environment	Fatal + Suspected Serious Injury Crashes Involving Lane Departures	Fatal + Suspected Serious Injury Crashes Involving Pedestrians	Fatal + Suspected Serious Injury Crashes Involving Trucks	Fatal + Suspected Serious Injury Crashes Involving Bicycles	Weighted Average NB/WB AADT	Weighted Average SB/EB AADT	Weighted Average Total AADT
90-1	2 or 3 or 4 Lane Divided Highway	0	0	0	0	4789	4576	9364
90-2	2 or 3 or 4 Lane Divided Highway	2	0	1	0	4804	4744	9548
90-3	2 or 3 or 4 Lane Divided Highway	3	0	0	0	5415	5531	10946
90-4	4 or 5 Lane Undivided Highway	1	0	0	0	8510	9006	17517
90-5	4 or 5 Lane Undivided Highway	5	1	1	0	6591	6770	13361
90-6	2 or 3 Lane Undivided Highway	3	0	1	0	2531	2537	5069
80-7	2 or 3 Lane Undivided Highway	3	0	0	0	2460	2579	5039
80-8	2 or 3 Lane Undivided Highway	1	0	0	0	2614	2529	5143
80-9	2 or 3 Lane Undivided Highway	0	0	0	0	2321	2298	4619
80-10	2 or 3 or 4 Lane Divided Highway	1	1	0	0	2338	2312	4650

HPMS Data

2015-2020 Weighted Average						2020			2019			2018			2017			2016		
SEGMENT	MP_FROM	MP_TO	WEIGHTED AVERAGE NB/WB AADT	WEIGHTED AVERAGE SB/EB AADT	WEIGHTED AVERAGE AADT	NB/WB AADT	SB/EB AADT	2020 AADT	NB/WB AADT	SB/EB AADT	2019 AADT	NB/WB AADT	SB/EB AADT	2018 AADT	NB/WB AADT	SB/EB AADT	2017 AADT	NB/WB AADT	SB/EB AADT	2016 AADT
90-1	290	295	4734	4489	9223	4511	4352	8863	4913	4734	9647	5050	4266	9316	4730	4730	9460	4466	4365	8830
90-2	295	304	4740	4667	9407	4457	4351	8808	4954	4969	9922	4836	4644	9480	4832	4832	9663	4620	4540	9161
90-3	304	312	5299	5468	10767	4793	4992	9785	5511	5948	11459	5348	5601	10948	5476	5476	10951	5366	5322	10690
90-4	312	317	8450	8929	17378	7513	7429	14942	8131	10425	18556	9127	9412	18539	8830	8830	17659	8648	8549	17197
90-5	317	324	6495	6501	12996	5840	5839	11679	6893	6734	13627	6709	6905	13614	6511	6513	13023	6521	6517	13039
90-6	324	336	2496	2503	4999	2371	2380	4751	2613	2623	5236	2726	2745	5471	2412	2412	4823	2356	2356	4713
80-7	333	339	2461	2564	5025	2556	2601	5157	2175	2641	4816	2408	2414	4822	2631	2631	5261	2534	2534	5068
80-8	339	345	2583	2459	5041	2538	2202	4740	2443	2500	4943	2594	2681	5276	2717	2499	5217	2621	2411	5032
80-9	345	357	2249	2259	4508	2066	2224	4289	2242	2116	4358	2252	2287	4540	2373	2373	4746	2311	2297	4609
80-10	357	365	2304	2277	4581	2151	2119	4270	2366	2309	4675	2302	2285	4587	2365	2365	4730	2337	2305	4643

Freight Performance Area Data

			Total minutes of closures		Avg Mins/Mile/Year	
Segment	Length (miles)	# of closures	NB (or WB)	SB (or EB)	0.00	0.00
90-1	5	0	0.0	0.0	0.00	1.33
90-2	9	4	0.0	60.0	10.25	20.33
90-3	8	10	410.0	813.0	0.00	14.76
90-4	5	7	0.0	369.0	12.00	6.83
90-5	7	4	420.0	239.0	10.00	3.00
90-6	12	15	600.0	180.0	156.07	15.57
80-7	6	8	4682.0	467.0	36.77	109.34
80-8	6	3	1934.0	3302.2	95.00	102.20
80-9	12	8	950.0	1022.0	0.00	3.00
80-10	9	3	0.0	120.0	31.31	29.75

	ITIS Category Description											
	Closures		Incidents/Accidents		Incidents/Crashes		Obstruction Hazards		Winds		Winter Storm Codes	
Segment	SB (or EB)	NB (or WB)	SB (or EB)	NB (or WB)	SB (or EB)	NB (or WB)	SB (or EB)	NB (or WB)	SB (or EB)	NB (or WB)	SB (or EB)	NB (or WB)
90-1	0	0	0	0	0	0	0	0	0	0	0	0
90-2	0	0	0	0	1	0	0	0	0	0	0	0
90-3	0	0	1	2	6	1	0	1	0	0	0	0
90-4	0	0	0	0	2	0	0	0	0	0	0	0
90-5	0	0	0	0	0	3	0	0	0	0	0	0
90-6	1	0	0	0	2	2	0	0	0	0	0	1
80-7	0	0	0	1	2	3	1	1	0	0	0	2
80-8	0	0	2	0	5	3	0	0	0	0	0	3
80-9	1	0	3	1	3	2	2	1	0	0	0	0
80-10	0	0	0	0	2	0	0	0	0	0	0	0

See the **Mobility Performance Area Data** section for other Freight Performance Area related data.

Appendix D: Needs Analysis Contributing Factors and Scores

Pavement Needs Assessment Methodology (Steps 1-3)

This section documents the approach for conducting the first three steps of a 5-step needs assessment process for the Pavement Performance Area. After completion of Step 3 for all performance areas (Pavement, Bridge, Mobility, Safety, and Freight), Step 4 will review each corridor segment to quantify a total level of need that combines all performance areas. Corridor needs are then identified in Step 5 of the process. The 5-step process is listed below:

- Step 1: Initial Needs
- Step 2: Final Needs
- Step 3: Contributing Factors
- Step 4: Segment Review
- Step 5: Corridor Needs

Step 1: Initial Needs

The input required to populate the Step 1 template includes transferring the existing performance score for each segment to the appropriate “Performance Score” columns. This includes the primary and secondary measures for Pavement. As each performance score is input into the template, the Initial Need will populate based on the weighted scoring system for each measure.

The Level of Need for each performance measure has levels of “None” (score = 0), “Low” (score = 1), “Medium” (score = 2), and “High” (score = 3). The assignment of these levels to individual performance measures for segments is determined by the table entitled “Needs Assessment Scales” within the Step 1 template.

To develop an aggregate Initial Need for each segment, the primary and secondary measures are combined by summing the weighted scored, with the primary measure having a weight of 1.0 while each secondary measure has a weight of 0.2 (0.1 each direction if directional). The Initial Need for each segment (combining the primary and secondary measures) has levels of “None” (score < 0.01), “Low” (score $\geq$ 0.01 and < 1.5), “Medium” (score $\geq$ 1.5 and < 2.5), and “High” (score $\geq$ 2.5).

The steps include:

Step 1.1

Enter the appropriate segment information into the columns titled “Segment”, “Segment Length”, “Segment Mileposts” and “Facility Type”.

Step 1.2

Populate the Step 1 template with the existing (baseline) performance scores for all primary and secondary performance measures from Existing Performance Analysis into the appropriate “Performance Score” columns. Copy the performance score for each segment to the appropriate “Performance Score” column. Paste only the “values” and do not overwrite the formatting.

Step 1.3

Indicate if Pavement is an Emphasis Area by selecting “Yes” or “No” in the row immediately below the segment information.

Step 1.4

Confirm that that the Step 1 template is generating the appropriate “Level of Need” for each primary and secondary measure by reviewing the relationship of baseline performance score to level of need.

Step 2: Final Needs

The Initial Need will be carried over to Step 2. The steps required to complete Step 2 are as follows:

Step 2.1

Confirm that the template has properly populated the segment information and the initial needs from the Step 1 template to the “Initial Need” column of the Step 2 template.

Step 2.2

Note in the “Hot Spots” column any pavement failure hot spots identified as part of the baseline corridor performance. For each entry, include the milepost limits of the hot spot. Hot spots are identified in the Pavement Index spreadsheet by the red cells in the columns titled “% Pavement Failure”. These locations are based on the following criteria:

Interstates: IRI > 105 or Cracking > 10 or Rutting > 0.4

Non-Interstates: IRI > 142 or Cracking > 10 or Rutting > 0.4

Every segment that has a % Pavement Failure greater than 0% will have at least one hot spot. Hot spot locations should be described as extending over consecutive miles. For example, if there is a pavement failure location that extends 5 consecutive miles, it should be identified as one hot spot, not 5 separate hot spots.

Step 2.3

Identify recently completed or under construction paving projects in the “Previous Projects” column. Include only projects that were completed after the pavement condition data period (check dates in pavement condition data provided by ADOT) that would supersede the results of the performance system.

Step 2.5

Update the “Final Need” column using the following criteria:

- If "None" but have a hot spot (or hot spots), the Final Need = Low, and note the reason for the change in the “Comments” column (column H).
- If a recent project has superseded the performance rating data, change the Final Need to “None” and note the reason for the change in the “Comments” column.

Example Scales for Level of Need

Pavement Index (Interstates) Performance Thresholds		Initial Need	Description (Non-Emphasis Area)
3.75	Good	None	All of Good Performance and upper third of Fair Performance (>3.50)
	Good		
	Good		
	Fair		
	Fair	Low	Middle third of Fair Perf. (3.25 - 3.5)
3.0	Fair	Medium	Lower third of Fair and top third of Poor Performance (2.75-3.25)
	Poor		
	Poor	High	Lower two-thirds of Poor Performance (<2.75)
	Poor		

Need Scale for Interstates

Measure	None >=	Low >=	> Medium <		High <=
Pavement Index (corridor non-emphasis area)	3.5	3.25	3.25	2.75	2.75
Pavement Index (corridor emphasis area)	4.0	3.5	3.5	3.00	3.00
Pavement Index (segments)	3.5	3.25	3.25	2.75	2.75
Directional PSR	3.63	3.52	3.52	3.28	3.28
%Pavement Failure	10%	15%	15%	25%	25%

Need Scale for Highways (Non-Interstates)

Measure	None >=	Low >=	> Medium <		High <=
Pavement Index (corridor non-emphasis area)	3.33	3.07	3.07	2.53	2.53
Pavement Index (corridor emphasis area)	3.87	3.33	3.33	2.80	2.80
Pavement Index (segments)	3.33	3.07	3.07	2.53	2.53
Directional PSR	3.30	3.10	3.10	2.70	2.70
%Pavement Failure	10%	15%	15%	25%	25%

Step 2.6

Note any programmed projects that could have the potential to mitigate pavement needs in in the “Comments” column. Programmed projects are provided as information and do not impact the need rating. The program information can be found in ADOT’s 5-year construction program. If there are other comments relevant to the needs analysis (such as information from previous reports), they can be entered in the “Comments” column. However, only include information related to needs that have been identified through this process. Do not add or create needs from other sources.

Step 3: Contributing Factors

The Final Need ratings from Step 2 will populate into the Step 3 tab. The steps to complete Step 3 include:

Step 3.1

Input the level of historical investment for each segment. This will be determined from the numeric score from the Pavement History Table based on the following thresholds:

- Low = < 4.60
- Medium = 4.60 – 6.60
- High = > 6.60

If the PeCoS data shows a high level of maintenance investment, increase the historical investment rating by one level.

Step 3.2

Note the milepost ranges of pavement failure hot spots into the column titled “Contributing Factors and Comments.”

Step 3.3

Note any other information that may be contributing to the deficiency, or supplemental information, in the “Contributing Factors and Comments” column. This could come from discussions with ADOT District staff, ADOT Materials/Pavement Group, previous reports, or the historical investment data.

Step 3.4

Include any programmed projects from ADOT’s 5-year construction program in the “Contributing Factors and Comments” column.

Bridge Needs Assessment Methodology (Steps 1-3)

This section documents the approach for conducting the first three steps of a 5-step needs assessment process for the Bridge Performance Area. After completion of Step 3 for all performance areas (Pavement, Bridge, Mobility, Safety, and Freight), Step 4 will review each corridor segment to quantify a total level of need that combines all performance areas. Corridor needs are then identified in Step 5 of the process. The 5-step process is listed below:

- Step 1: Initial Needs
- Step 2: Final Needs
- Step 3: Contributing Factors
- Step 4: Segment Review
- Step 5: Corridor Needs

Step 1: Initial Needs

The input required to populate the Step 1 template includes transferring the existing performance score for each segment to the appropriate "Performance Score" columns. This includes the primary and secondary measures for Bridge. As each performance score is input into the template, the Initial Need will populate based on the weighted scoring system for each measure.

The Level of Need for each performance measure has levels of "None" (score = 0), "Low" (score = 1), "Medium" (score = 2), and "High" (score = 3). The assignment of these levels to individual performance measures for segments is determined by the table entitled "Needs Assessment Scales" within the Step 1 template.

To develop an aggregated Initial Need for each segment, the primary and secondary measures are combined by summing the weighted scored, with the primary measure having a weight of 1.0 while each secondary measure has a weight of 0.2 (0.1 each direction if directional). The Initial level of need for each segment (combining the primary and secondary measures) has levels of "None" (score < 0.01), "Low" (score $\geq$ 0.01 and < 1.5), "Medium" (score $\geq$ 1.5 and < 2.5), and "High" (score $\geq$ 2.5).

The steps include:

Step 1.1

Enter the appropriate segment information into the columns titled "Segment", "Segment Length", "Segment Mileposts" and "Number of Bridges."

Step 1.2

Populate the Step 1 template with the existing (baseline) performance scores for all primary and secondary performance measures from Existing Performance Analysis into the appropriate "Performance Score" columns. Copy the performance score for each segment to the appropriate "Performance Score" column. Paste only the "values" and do not overwrite the formatting.

Step 1.3

Indicate if Bridge is an Emphasis Area by selecting "Yes" or "No" in the row immediately below the segment information.

Step 1.4

Confirm that that the Step 1 template is generating the appropriate "Level of Need" for each primary and secondary measure by reviewing the relationship of baseline performance score to level of need.

Step 2: Final Needs

The Initial Need will be carried over to Step 2. The steps required to complete Step 2 are as follows:

Step 2.1

Confirm that the template has properly populated the initial needs from the Step 1 template to the "Initial Need" column of the Step 2 template.

Step 2.2

Note in the column titled "Hot Spots" any bridge hot spots identified as part of the baseline corridor performance. For each entry, note the specific location. Hot spots are identified as having any bridge rating of 4 or less, or multiple ratings of 5 in the deck, substructure, or superstructure ratings.

Step 2.3

Identify recently completed or under construction bridge projects in the "Previous Projects" column. Include only projects that were completed after the bridge condition data period (check dates in bridge condition data provided by ADOT) that would supersede the results of the performance system.

Step 2.4

Update the Final Need on each segment based on the following criteria:

- If the Initial Need is "None" and there is at least one hot spot located on the segment, change the Final Need to "Low".
- If a recent project has superseded the performance rating data, the performance data should be adjusted to increase the specific ratings and the resulting need should be reduced to account for the project.
- Note the reason for any change in the "Comments" column.

Step 2.5

Historical bridge rating data was tabulated and graphed to find any bridges that had fluctuations in the ratings. Note in the “Historical Review” column any bridge that was identified as having a potential historical rating concern based on the following criteria:

- Ratings increase or decrease (bar chart) more than 2 times
- Sufficiency rating drops more than 20 points

This is for information only and does not affect the level of need.

Step 2.6

Note the number of functionally obsolete bridges in each segment in the column titled “# Functionally Obsolete Bridges”. This is for information only and does not affect the level of need.

Step 2.7

Identify each bridge “of concern” in the “Comments” column. Note any programmed projects that could have the potential to mitigate bridge needs. Programmed projects are provided as information and do not impact the need rating. The program information can be found in ADOT’s 5-year construction program. If there are other comments relevant to the needs analysis (such as information from previous reports), they can be entered in the “Comments” column. However, only include information related to needs that have been identified through this process. Do not add or create needs from other sources.

Example Scales for Level of Need

Bridge Index Performance Thresholds	Level of Need		Description (Non-Emphasis Area)
6.5	Good	None	All of Good Performance and upper third of Fair Performance (>6.0)
	Good		
	Good		
	Fair		
	Fair	Low	Middle third of Fair Performance (5.5-6.0)
5.0	Fair	Medium	Lower third of Fair and top third of Poor Performance (4.5-5.5)
	Poor		
	Poor	High	Lower two-thirds of Poor Performance (<4.5)
	Poor		

Need Scale

Measure	None >=	Low >=	> Medium <		High <=
Bridge Index (corridor non-emphasis area)	6.0	5.5	5.5	4.5	4.5
Bridge Index (corridor emphasis area)	7.0	6.0	6.0	5.0	5.0
Bridge Index (segments)	6.0	5.5	5.5	4.5	4.5
Bridge Sufficiency	70	60	60	40	40
Bridge Rating	6.0	5.0	4.0	4.0	3.0

Step 3: Contributing Factors

The Final Need ratings from Step 2 will populate into the Step 3 tab. The steps to compete Step 3 include:

Step 3.1

Input the bridge name, structure number, and milepost information for each bridge “of concern” resulting from Step 2.

Step 3.2

For bridges that have a current rating of 5 or less, enter the specific rating, or state “No current ratings less than 6”.

Step 3.3

For bridges that were identified for a historical review (step 2.5), state “Could have a repetitive investment issue”. If a bridge was not identified for a historical review, state “This structure was not identified in historical review”.

Step 3.4

Input any programmed projects from ADOT’s 5-year construction program. Note any other information that may be contributing to the deficiency, or supplemental information. This could come from discussions with ADOT District staff, ADOT Bridge Group, or previous reports.

Mobility Needs Assessment Methodology (Steps 1-3)

This section documents the approach for conducting the first three steps of a 5-step needs assessment process for the Mobility Performance Area. After completion of Step 3 for all performance areas (Pavement, Bridge, Mobility, Safety, and Freight), Step 4 will review each corridor segment to quantify a total level of need that combines all performance areas. Corridor needs are then identified in Step 5 of the process. The 5-step process is listed below:

- Step 1: Initial Needs
- Step 2: Refined Needs
- Step 3: Contributing Factors
- Step 4: Segment Review
- Step 5: Corridor Needs

Step 1: Initial Needs

The input required to populate the Step 1 template includes transferring the existing performance score for each segment to the appropriate “Performance Score” columns from Existing Performance Analysis. This includes the primary and secondary measures for Mobility. As each performance score is input into the template, the Initial Need will populate based on the weighted scoring system for each measure.

The Level of Need for each performance measure has levels of “None” (score = 0), “Low” (score = 1), “Medium” (score = 2), and “High” (score = 3). The assignment of these levels to individual performance measures for segments is determined by the table entitled “Needs Assessment Scales” in the Step 1 tab.

To develop an aggregated Initial Need for each segment, the primary and secondary measures are combined by summing the weighted scores, with the primary measure having a weight of 1.0 while each secondary measure has a weight of 0.2 (0.1 each direction if directional). The Initial Need for each segment (combining the primary and secondary measures) has levels of “None” (score < 0.01), “Low” (score ≥ 0.01 and < 1.5), “Medium” (score ≥ 1.5 and < 2.5), and “High” (score ≥ 2.5).

The steps include:

Step 1.1

Input the accurate number of segments for your corridor in the column titled ‘Segment’ and the appropriate segment milepost limits and segment lengths in adjacent columns.

Step 1.2

Select the appropriate ‘Environment Type’ and ‘Facility Operation Type’ from the drop-down menus as defined in Existing Performance Analysis.

Step 1.3

Select ‘Yes’ or ‘No’ from the drop-down list to not if the Mobility Performance Area is an Emphasis Area for your corridor.

Step 1.4

Populate the Step 1 template with the existing (baseline) performance scores for all primary and secondary performance measures from Existing Performance Analysis. Copy the performance score for each segment to the appropriate “Performance Score” column.

Step 1.5

Confirm that that the Step 1 template is generating the appropriate “Level of Need” for each primary and secondary measure by reviewing the relationship of baseline performance score to level of need.

Step 2: Final Needs

The Initial Need will be carried over to Step 2 The steps required to complete Step 2 are as follows:

Step 2.1

Confirm that the template has properly populated the initial deficiencies from the Step 1 template to the Step 2 template.

Step 2.2

Identify recently completed or under construction projects that would be considered relevant to mobility performance. Include only projects that were constructed after the date for which the HPMS data used for traffic volumes would not include. Any completed or under construction roadway project after the HPMS data date that has the potential to mitigate a mobility issue on a corridor segment should be listed in the template. Such projects should include the construction of new travel lanes or speed limit changes on the main corridor only. Do not include projects involving frontage roads or crossings as they would not impact the corridor level performance.

Step 2.3

Update the Final Need using the following criteria:

- If a recent project has superseded the performance rating data and it is certain the project addressed the deficiency, change the need rating to “None”.
- If a recent project has superseded the performance rating data but it is uncertain that a project addressed the need, maintain the current deficiency rating and note the uncertainty as a comment.

Step 2.4

Note any programmed or planned projects that have the potential to mitigate any mobility needy on the segment. Programmed and Planned projects are provided as information and do not impact the deficiency rating. Future projects will be reviewed in the development of solution sets for identified needs and deficiencies. The source of future projects can be found in ADOT's 5-year construction program or other planning documents. Other comments relevant to the needs analysis can be entered.

Example Scales for Level of Need

Mobility Index (Urban and Fringe Urban) Performance Thresholds	Initial Need		Description (Non-Emphasis Area)
0.71	Good	None	All of Good Performance and upper third of Fair Performance (<0.77)
	Good		
	Good		
	Fair		
	Fair	Low	Middle third of Fair Performance (0.77 - 0.83)
0.89	Fair	Medium	Lower third of Fair and top third of Poor Performance (0.83-0.95)
	Poor		
	Poor	High	Lower two-thirds of Poor Performance (>0.95)
	Poor		

Needs Scale

Measure		None <=	Low <=	> Medium <		High >=
Mobility Index (Corridor Emphasis Area)		Weighted calculation for the segment totals in corridor (urban vs. rural)				
Mobility Index (Corridor Non-Emphasis Area)		Weighted calculation for the segment totals in corridor (urban vs. rural)				
Mobility Index (Segment)	Urban	0.77	0.83	0.83	0.95	0.95
	Rural	0.63	0.69	0.69	0.83	0.83
Future Daily V/C	Urban	0.77	0.83	0.83	0.95	0.95
	Rural	0.63	0.69	0.69	0.83	0.83
Existing Peak Hour V/C	Urban	0.77	0.83	0.83	0.95	0.95
	Rural	0.63	0.69	0.69	0.83	0.83
Closure Extent		0.35	0.49	0.49	0.75	0.75
Directional LOTTR	Uninterrupted	1.27	1.38	1.38	1.62	1.62
	Interrupted	1.27	1.38	1.38	1.62	1.62
Bicycle Accommodation		80%	70%	70%	50%	50%

Step 3: Contributing Factors

The Final Need ratings from Step 2 will populate into the Step 3 tab. The steps to compete Step 3 include:

Step 3.1

Input data from Mobility Index worksheet and corridor observations in appropriate columns for Roadway Variables.

Step 3.2

Input traffic variable data in appropriate columns as indicated, Buffer Index scores will auto populate.

Step 3.3

Input relevant mobility related infrastructure located within each segment as appropriate

Step 3.4

Input the Closure Extents that have occurred along the study corridor. Road closure information can be detailed out by the reason for the closure as documented in Highway Condition Reporting System (HCRS) data analyzed as part of the baseline corridor performance. Closure reasons include incident/accidents, winter storms, obstruction hazards, and undefined closures. Statewide average percentages for the various closure reasons have been calculated for most recent five-year period on ADOT's designated strategic corridors. Compare these statewide average percentages to the corridor percentages for the various closure reasons to identify higher than average percentages of one or more closure reasons on any given segment. Input the closures as follows and use red text to indicate that the segment percentage exceeds statewide averages:

- Total Number of Closures
- % Incidents/Accidents
- % Obstructions/Hazards
- % Weather Related

Step 3.5

List the non-actionable conditions that are present within each segment by milepost if possible. Non-Actionable conditions are conditions that exist within the environment of each segment that cannot be improved through an engineered solution. For example, the border patrol check point in Segment 3 of I-19 is a non-actionable condition.

Step 3.6

Considering all information input, identify and list the contributing factors to the Final Need score.

. Safety Needs Assessment Methodology (Steps 1-3)

This section documents the approach for conducting the first three steps of a 5-step needs assessment process for the Safety Performance Area. After completion of Step 3 for all performance areas (Pavement, Bridge, Mobility, Safety, and Freight), Step 4 will review each corridor segment to quantify a total level of need that combines all performance areas. Corridor needs are then identified in Step 5 of the process. The 5-step process is listed below:

- Step 1: Initial Needs
- Step 2: Final Needs
- Step 3: Contributing Factors
- Step 4: Segment Review
- Step 5: Corridor Needs

Step 1: Initial Needs

The input required to populate the Step 1 template includes transferring the corridor characteristics and existing performance score for each segment to the appropriate "Performance Score" columns. This includes the primary and secondary measures for safety. As each performance score is input into the template, the Level of Need will populate based on the weighted scoring system for each measure.

The Level of Need for each performance measure has levels of "None" (score = 0), "Low" (score = 1), "Medium" (score = 2), and "High" (score = 3). The assignment of these levels to individual performance measures for segments is determined by the table entitled "Needs Scale" within the Step 1 template.

To develop an aggregated Initial Need for each segment, the primary and secondary measures are combined by summing the weighted scored, with the primary measure having a weight of 1.0 while each secondary measure has a weight of 0.2 (0.1 each direction if directional). The Initial Need for each segment (combining the primary and secondary measures) has levels of "None" (score < 0.01), "Low" (score ≥ 0.01 and < 1.5), "Medium" (score ≥ 1.5 and < 2.5), and "High" (score ≥ 2.5).

The steps include:

Step 1.1

Populate the Step 1 template with the corridor characteristics information. This includes segment operating environments and segment length. Also, specify if the safety performance area is an emphasis area as determined in Goals and Objectives. The "Level of Need" is dependent on the input of the operating environment and "Emphasis Area" as the thresholds dynamically update accordingly.

Input the existing (baseline) performance scores for all primary and secondary performance measures from Existing Performance Analysis. Copy the performance score (paste values only) for each segment to the appropriate "Performance Score" column and conditional formatting should color each cell green, yellow, or red based on the corresponding performance thresholds.

Step 1.2

The thresholds for the corridor safety index are based on the segments' operating environments. To ensure that the correct corridor safety index threshold is applied, input the unique segment operating environments that exist with the corridor. Once the input is complete, the average of the Good/Fair and Fair/Poor thresholds for each of the operating environments is calculated and the "Level of Need" thresholds will be derived and applied to the main Step 1 Table.

Step 1.3

Confirm that the following criteria for "Insufficient Data" have been applied and that the resulting Level of Need has been shown as "N/A" where applicable.

- Crash frequency for a segment is less than 5 crashes over the 5-year crash analysis period.
- The change in +/- 1 crash results in the change of need level of 2 levels (i.e., changes from Above Average to Below Average or changes from Below Average to Above Average).
- The average segment crash frequency for the overall corridor (total fatal plus suspected serious injury crash frequency divided by the number of corridor segments) is less than 2 per segment over the 5-year crash analysis period.

Step 1.4

Confirm that the Step 1 template is generating the appropriate "Level of Need" for each primary and secondary measure by reviewing the relationship of baseline performance score to level of need.

Step 2: Final Needs

The Initial Need will be carried over to Step 2. The steps required to complete Step 2 are as follows:

Step 2.1

Confirm that the template has properly populated the initial needs from the Step 1 template to the Step 2 template.

Step 2.2

Using the crash concentration (hot spot) map developed as part of the baseline corridor performance, note the direction of travel and approximate milepost limits of each hot spot.

Step 2.3

Identify recently completed or under construction projects that would be considered relevant to safety performance. Include only projects that were not taken into account during the five-year crash data analysis period. Any completed or under construction roadway project after the crash analysis period that has the potential to mitigate a safety issue on a corridor segment should be listed in the template. Sources of recent or current project activity can include ADOT MPD staff, ADOT public notices, and ADOT District staff.

Step 2.4

Update the Final Need based on the following criteria:

- If there is a crash hot spot concentration on a “None” segment, upgrade the need rating to “Low.”

Step 2.5

Note any programmed projects that could have the potential to mitigate any safety need on the segment. Programmed projects are provided as information and do not impact the need rating. Programmed projects will be reviewed in the development of solution sets for identified needs. The source of the programming information can be found in ADOT’s 5-year construction program. Any other relevant issues identified in previous reports should also be reported.

Example Scales for Level of Need

Safety Index (6 Lane Highway) Performance Thresholds	Initial Need		Description (Non-Emphasis Area)
0.76	Good	None	All of Above Average Performance and upper third of Average Performance (<0.92)
	Good		
	Good		
	Fair		
	Fair	Low	Middle third of Average Performance (0.92 - 1.08)
1.24	Fair	Medium	Lower third of Average and top third of Below Average Performance (1.08-1.40)
	Poor		
	Poor	High	Lower two-thirds of Below Average Performance (>1.40)

Measure		None <=	Low <=	< Medium >		High >=	Good/Fair Threshold	Fair/Poor Threshold
Corridor Safety Index (Emphasis Area)		Weighted average based on operating environment type						
Corridor Safety Index (Non-Emphasis Area)		# Weighted average based on operating environment type					0.92	1.08
Safety Index and Directional Safety Index (Segment)	2 or 3 Lane Undivided Highway	0.97	1.02	1.02	1.13	1.13	0.92	1.08
	2 or 3 or 4 Lane Divided Highway	0.94	1.07	1.07	1.32	1.32	0.81	1.19
	4 or 5 Lane Undivided Highway	0.93	1.08	1.08	1.37	1.37	0.78	1.22
	6 Lane Highway	0.92	1.08	1.08	1.4	1.4	0.76	1.24
	Rural 4 Lane Freeway with Daily Volume < 25,000	0.95	1.06	1.06	1.27	1.27	0.84	1.16
	Rural 4 Lane Freeway with Daily Volume > 25,000	0.93	1.08	1.08	1.37	1.37	0.78	1.22
	Urban 4 Lane Freeway	0.91	1.09	1.09	1.45	1.45	0.73	1.27
	Urban or Rural 6 Lane Freeway	0.88	1.11	1.11	1.58	1.58	0.65	1.35
	Urban > 6 Lane Freeway	0.96	1.03	1.03	1.18	1.18	0.89	1.11
% of Fatal + Susp. Serious Injury Crashes at Intersections	2 or 3 Lane Undivided Highway	13%	14%	14%	17%	17%	11%	16%
	2 or 3 or 4 Lane Divided Highway	25%	27%	27%	31%	31%	23%	29%
	4 or 5 Lane Undivided Highway	46%	48%	48%	52%	52%	44%	50%
	6 Lane Highway	63%	68%	68%	78%	78%	58%	73%
	Rural 4 Lane Freeway with Daily Volume < 25,000	0%	0%	0%	0%	0%	0%	0%
	Rural 4 Lane Freeway with Daily Volume > 25,000	0%	0%	0%	0%	0%	0%	0%
	Urban 4 Lane Freeway	0%	0%	0%	0%	0%	0%	0%
	Urban or Rural 6 Lane Freeway	0%	0%	0%	0%	0%	0%	0%
	Urban > 6 Lane Freeway	0%	0%	0%	0%	0%	0%	0%
% of Fatal + Susp. Serious Injury Crashes Involving Lane Departures	2 or 3 Lane Undivided Highway	69%	72%	72%	77%	77%	67%	75%
	2 or 3 or 4 Lane Divided Highway	59%	62%	62%	68%	68%	56%	65%
	4 or 5 Lane Undivided Highway	25%	29%	29%	36%	36%	21%	32%
	6 Lane Highway	21%	30%	30%	47%	47%	12%	38%
	Rural 4 Lane Freeway with Daily Volume < 25,000	74%	75%	75%	78%	78%	73%	76%
	Rural 4 Lane Freeway with Daily Volume > 25,000	72%	75%	75%	81%	81%	69%	78%
	Urban 4 Lane Freeway	66%	72%	72%	84%	84%	61%	78%
	Urban or Rural 6 Lane Freeway	58%	60%	60%	65%	65%	56%	63%
	Urban > 6 Lane Freeway	41%	42%	42%	44%	44%	40%	43%
% of Fatal + Susp. Serious Injury Crashes Involving Pedestrians	2 or 3 Lane Undivided Highway	5%	6%	6%	8%	8%	4%	7%
	2 or 3 or 4 Lane Divided Highway	3%	3%	3%	4%	4%	2%	4%
	4 or 5 Lane Undivided Highway	10%	12%	12%	15%	15%	9%	14%
	6 Lane Highway	4%	8%	8%	16%	16%	0%	12%
	Rural 4 Lane Freeway with Daily Volume < 25,000	2%	3%	3%	4%	4%	1%	3%
	Rural 4 Lane Freeway with Daily Volume > 25,000	2%	3%	3%	6%	6%	1%	5%
	Urban 4 Lane Freeway	2%	4%	4%	7%	7%	0%	5%
	Urban or Rural 6 Lane Freeway	5%	6%	6%	9%	9%	4%	8%
	Urban > 6 Lane Freeway	3%	4%	4%	6%	6%	2%	5%

Measure		None <=	Low <=	< Medium >		High >=	Good/Fair Threshold	Fair/Poor Threshold
Corridor Safety Index (Emphasis Area)		Weighted average based on operating environment type						
Corridor Safety Index (Non-Emphasis Area)		# Weighted average based on operating environment type					0.92	1.08
% of Fatal + Susp. Serious Injury Crashes Involving Trucks	2 or 3 Lane Undivided Highway	5%	6%	6%	9%	9%	4%	8%
	2 or 3 or 4 Lane Divided Highway	6%	8%	8%	12%	12%	4%	10%
	4 or 5 Lane Undivided Highway	2%	4%	4%	7%	7%	1%	6%
	6 Lane Highway	5%	6%	6%	8%	8%	4%	8%
	Rural 4 Lane Freeway with Daily Volume < 25,000	20%	21%	21%	24%	24%	19%	23%
	Rural 4 Lane Freeway with Daily Volume > 25,000	12%	15%	15%	22%	22%	9%	18%
	Urban 4 Lane Freeway	9%	11%	11%	15%	15%	7%	12%
	Urban or Rural 6 Lane Freeway	8%	11%	11%	16%	16%	5%	13%
	Urban > 6 Lane Freeway	3%	4%	4%	6%	6%	2%	5%
% of Fatal + Susp. Serious Injury Crashes Involving Bicycles	2 or 3 Lane Undivided Highway	1%	2%	2%	4%	4%	0%	3%
	2 or 3 or 4 Lane Divided Highway	1%	2%	2%	3%	3%	0%	2%
	4 or 5 Lane Undivided Highway	2%	3%	3%	5%	5%	1%	4%
	6 Lane Highway	2%	4%	4%	9%	9%	0%	7%
	Rural 4 Lane Freeway with Daily Volume < 25,000	0%	0%	0%	1%	1%	0%	1%
	Rural 4 Lane Freeway with Daily Volume > 25,000	0%	0%	0%	0%	0%	0%	0%
	Urban 4 Lane Freeway	0%	0%	0%	0%	0%	0%	0%
	Urban or Rural 6 Lane Freeway	0%	0%	0%	1%	1%	0%	1%
	Urban > 6 Lane Freeway	0%	0%	0%	0%	0%	0%	0%

Step 3: Contributing Factors

The Final Need ratings from Step 2 will populate into the Step 3 tab.

Table 3 - Step 3 Template

A separate *Crash Summary Sheet* file contains summaries for 8 crash attributes for the entire corridor, for each corridor segment, and for statewide roadways with similar operating environments (the database of crashes on roadways with similar operating environments was developed in Existing Performance Analysis (the baseline corridor performance)). The crash attribute summaries are consistent with the annual ADOT Publication, *Crash Facts*. The 8 crash attribute summaries consist of the following:

- First Harmful Event (FHET)
- Crash Type (CT)
- Violation or Behavior (VB)
- Lighting Condition (LC)
- Roadway Surface Type (RST)
- First Unit Event (FUE)
- Driver Physical Condition (Impairment)
- Safety Device Usage (Safety Device)

Non-colored tabs in this spreadsheet auto-populate with filtered crash attributes. Each tab is described below:

- **Step_3_Summary** – This tab contains the filtered summary of crashes that exceed statewide thresholds for crashes on roadways with similar operating environments. Data in this tab are copied into the Step 3 template.
- **Statewide** – This tab contains a summary of statewide crashes from roadways with similar operating environments filtered by the 8 crash type summaries listed above. The crash type summaries calculate statewide crash thresholds (% total for fatal plus incapacitating crashes). The crash thresholds were developed to provide a statewide expected proportion of crash attributes against which the corridor segments' crash attributes can be compared. The crash thresholds were developed using the *Probability of Specific Crash Types Exceeding a Threshold Proportion* as shown in the Highway Safety Manual, Volume 1 (2010). The thresholds are automatically calculated within the spreadsheet. The threshold proportion was calculated as follows:

$$p*_i = \frac{\sum N_{Observed,i}}{\sum N_{Observed,i(total)}}$$

Where:

$p*_i$ = Threshold proportion

$\sum N_{Observed,i}$ = Sum of observed target crash frequency within the population

$\sum N_{Observed,i(total)}$ = Sum of total observed crash frequency within the population

A minimum crash sample size of 5 crashes over the 5-year crash analysis period is required for a threshold exceedance to be displayed in the Step 3 template. The probability of exceeding the crash threshold was not calculated to simplify the process.

- **Corridor** – A summary of corridor-wide crashes filtered by the 8 crash attribute summaries listed above.
- **Segment FHET** – A segment-by-segment summary of crashes filtered by first harmful event attributes.
- **Segment CT** – A segment-by-segment summary of crashes filtered by crash type attributes.
- **Segment VB** - A segment-by-segment summary of crashes filtered by violation or behavior attributes.
- **Segment LC** – A segment-by-segment summary of crashes filtered by lighting condition attributes.
- **Segment RST** – A segment-by-segment summary of crashes filtered by roadway surface attributes.
- **Segment FUE** – A segment-by-segment summary of crashes filtered by first unit event attributes.
- **Segment Impairment** – A segment-by-segment summary of crashes filtered by driver physical condition attributes related to impairment.
- **Segment Safety Device** – A segment-by-segment summary of crashes filtered by safety device usage attributes.

The steps to compete Step 3 include:

Step 3.1

Using the Crash_Summary_Sheet.xlsx, go to the "Step_3_Summary" tab. Input the operating environments for each segment in the table.

Step 3.2

Filter data from the ADOT database for the "CORRIDOR_DATA" tab by inserting the following data in the appropriate columns that are highlighted in gray for the "INPUT_CORRIDOR_DATA" tab:

- Incident ID
- Incident Crossing Feature (MP)
- Segment Number (Non-native ADOT data – must be manually assigned based on the location of the crash)
- Operating Environment (Non-native ADOT data – should already be assigned but if for some reason it isn't, it will need to be manually assigned)
- Incident Injury Severity
- Incident First Harmful Description

- Incident Collision Manner
- Incident Lighting Condition Description
- Unit Body Style
- Surface Condition
- First Unit Event Sequence
- Person Safety Equipment
- Personal Violation or Behavior
- Impairment

Note that columns highlighted in yellow perform a calculated input to aggregate specific crash descriptions. For example, crashes can contain various attributes for animal-involved crashes. The crash attributes that involve an animal were combined into a common attribute, such as “ANIMAL”. This will allow the summaries to be consistent with the ADOT *Crash Facts*.

The data in the Impairment category contains blank descriptions if it was found that there was “No Apparent Influence” or if it was “Unknown”. Using the crash data fields “PersonPhysicalDescription” 0 - 99, fill in the blank columns to reflect if the physical description is described as “No Apparent Influence” or “Unknown”. Note that the native physical description data from the ADOT database may need to be combined to a single column.

Step 3.3

Confirm that the crash database is being properly filtered by comparing crash frequencies from the summary tables with the frequencies developed in Existing Performance Analysis. For example, the lookup function will fail if the filter is for “NO IMPROPER ACTION” if the database has the attribute of “NO_IMPROPER_ACTION”.

Step 3.4

Copy and paste the Step_3_Summary into the Safety Needs Assessment spreadsheet in the Step 3 tab. Paste values only and remove the summaries with “0%s” for a clean display. Where duplicate values exist, go to the "Calcs" tab in the Crash_Summary_Sheet file to determine which categories have the same %. If there are more crash types with the same % than there is space in the table, select the crash type with the highest difference between the segment % and the statewide average %

Step 3.5

The Step 3 table in the Safety Needs Assessment spreadsheet should be similar to the Step 3 template. In the Segment Crash Summaries row, the top three crash attributes are displayed. Change the font color of the crash attributes that exceed the statewide crash threshold to red for emphasis. The attributes with a red font in the “Calcs” tab have exceeded statewide crash thresholds. Note that corridor-wide values are not compared to statewide values as corridor-wide values are typically a blend of multiple similar operating environments while the statewide values apply to one specific similar operating environment.

Step 3.6

Provide a summary of any observable patterns found within the crash Hot Spots, if any exist in the segments.

Step 3.7

Input any historic projects (going no further back than 2000) that can be related to improving safety. Projects more than five years old may have exceeded their respective design life and could be contributing factors to safety performance needs.

Step 3.8

Input key points from District interviews or any important information from past discussions with District staff that is consistent with needs and crash patterns identified as part of the performance and needs assessment as this may be useful in identifying contributing causes. This information may be obtained from District Maintenance personnel by requesting the mile post locations that may be considered safety issues.

Step 3.9

For segments with one or more of the following characteristics, review crashes of all severity levels (not just fatal and incapacitating injury crashes). Identify likely contributing factors and compare that to the above statewide average comparison findings already calculated for fatal and incapacitating injury crashes. Refine the contributing factors list accordingly.

- Segments with Medium or High need
- Segments with a crash hot spot concentration (but only review crashes at the concentration areas)
- Segments with no apparent predominant contributing factors based on the comparison of fatal and incapacitating crashes to statewide averages if the segment has a Medium or High need.

Step 3.10

Considering all information in Steps 1-3, list the contributing factors using engineering judgment and the information on contributing factors available in Section 6.2 of the 2010 Highway Safety Manual. Additional sources for determining contributing factors may include aerial, “street view”, and/or ADOT photologs. Other documents such as Design Concept Reports (DCR) or Road Safety Assessments can provide insight into the study corridor’s contributing factors.

Add comments as needed on additional information related to contributing factors that may have been provided by input from ADOT staff.

Freight Needs Assessment Methodology (Steps 1-3)

This section documents the approach for conducting the first three steps of a 5-step needs assessment process for the Freight Performance Area. After completion of Step 3 for all performance areas (Pavement, Bridge, Mobility, Safety, and Freight), Step 4 will review each corridor segment to quantify a total level of need that combines all performance areas. Corridor needs are then identified in Step 5 of the process. The 5-step process is listed below:

- Step 1: Initial Needs
- Step 2: Final Needs
- Step 3: Contributing Factors
- Step 4: Segment Review
- Step 5: Corridor Needs

Step 1: Initial Needs

The input required to populate the Step 1 template includes transferring the existing performance score and color for each segment to the appropriate "Performance Score" columns. This includes the primary and secondary measures for Freight. As each performance score is input into the template, the Initial Need will populate based on the weighted scoring system for each measure.

The Level of Need for each performance measure has levels of "None" (score = 0), "Low" (score = 1), "Medium" (score = 2), and "High" (score = 3). The assignment of these levels to individual performance measures for segments is determined by the table entitled "Needs Assessment Scale" within the Step 1 template.

To develop an aggregated Initial Need for each segment, the primary and secondary measures are combined by summing the weighted score, with the primary measure having a weight of 1.0 while each secondary measure has a weight of 0.2 (0.1 each direction if directional). The Initial Need for each segment (combining the primary and secondary measures) has levels of "None" (score < 0.01), "Low" (score ≥ 0.01 and < 1.5), "Medium" (score ≥ 1.5 and < 2.5), and "High" (score ≥ 2.5).

The steps include:

Step 1.1

Populate the Step 1 template with the existing (baseline) performance scores for all primary and secondary performance measures from Existing Performance Analysis. Copy the performance score for each segment to the appropriate "Performance Score" column. Select the *Facility Operations* for each segment from the drop-down list and input whether or not the performance area is an emphasis area. The corridor needs assessment scales will be updated automatically.

Step 1.2

Confirm that that the Step 1 template is generating the appropriate "Level of Need" for each primary and secondary measure by reviewing the relationship of baseline performance score to level of need.

Step 2: Final Needs

The Initial Need will be carried over to Step 2. The steps required to complete Step 2 are as follows:

Step 2.1

Confirm that the template has properly populated the initial need from the Step 1 template to the Step 2 template.

Step 2.2

Note any truck height restriction hot spots (clearance < 16.25') identified as part of the baseline corridor performance. For each entry, note the milepost of the height restriction and if the height restriction can be detoured by ramping around the obstruction. If it is not possible for a truck to ramp around the height restriction, note the existing height as well.

Step 2.3

Identify recently completed or under construction projects that would be considered relevant to freight performance. Include only projects that were not taken into account during the freight data analysis period. Any completed or under construction roadway project after the date of the data that has the potential to mitigate a freight issue on a corridor segment should be listed in the template. Such projects can include the construction of climbing lanes or Dynamic Message Signs (DMS) installation. Sources of recent or current project activity can be ADOT MPD staff, ADOT public notices, and ADOT District staff.

Step 2.4

Update the Final Need using the following criteria:

- If there is at least one truck height restriction hot spot where a truck cannot ramp around on a 'None' segment, increase (i.e., worsen) the need rating to 'Low'.
- If a recent project has superseded the performance rating data and it is certain the project addressed the need, change the need rating to "None".
- If a recent project has superseded the performance rating data but it is uncertain that a project addressed the need, maintain the current need rating and note the uncertainty as a comment.

Step 2.5

Note any programmed projects that could have the potential to mitigate any freight need on the segment. Programmed projects are provided as information and do not impact the need rating. Programmed projects will be reviewed in the development of solution sets for identified needs. The source of the programming information can be found in ADOT's 5-year construction program. If there are other comments relevant to the needs analysis, they can be entered in the right-most column.

Example Scales for Level of Need

Freight Index (Interrupted) Performance Score Thresholds	Performance Level	Initial Performance Level of Need	Description (Non-emphasis Area)
1.45	Good	None	All levels of Good and the top third of Fair (<1.58)
	Good		
	Good		
	Fair		
	Fair	Low	Middle third of Fair (1.58-1.72)
1.85	Fair	Medium	Lower third of Fair and top third of Poor (1.72-1.98)
	Poor		
	Poor	High	Lower two-thirds of Poor (>1.98)
	Poor		

Needs Scale

Measure	None <=	Low <=		> Medium <		High >=
Corridor Freight Index (Emphasis Area)	Dependent on weighted average of interrupted vs. uninterrupted segments					
Corridor Freight Index (Non-Emphasis Area)	Dependent on weighted average of interrupted vs. uninterrupted segments					
Freight Index (Segment)						
Measure	**None >=**	**> Low <**		**> Medium <**		**High <=**
Interrupted	1.58	1.72	1.72	1.98	1.98	1.58
Uninterrupted	1.22	1.28	1.28	1.42	1.42	1.22
Measure	**None <=**	**< Low >**		**< Medium >**		**High >=**
Directional TTTR						
Interrupted	1.58	1.72	1.72	1.98	1.98	1.58
Uninterrupted	1.22	1.28	1.28	1.42	1.42	1.22
Closure Duration						
All Facility Operations	71.07	97.97	97.97	151.75	151.75	71.07
Measure	**None >=**	**> Low <**		**> Medium <**		**High <=**
Bridge Clearance (feet)						
All Bridges	16.33	16.17	16.17	15.83	15.83	16.33

Step 3: Contributing Factors

The Final Need ratings from Step 2 will populate into the Step 3 tab.

The steps to compete Step 3 include:

Step 3.1

Input all roadway variable data that describe each segment into the appropriate columns. Note that this data can be copied from the Mobility Needs Assessment spreadsheet for Needs Assessment.

Step 3.2

Input all traffic variables for each segment into the appropriate columns. Note that this data can be copied from the Mobility Needs Assessment spreadsheet for Needs Assessment.

Step 3.3

Input any freight-related infrastructure that currently exists on the corridor for each segment. The relevant infrastructure can include DMS locations, weigh stations, Ports of Entry (POE), rest areas, parking areas, and climbing lanes. Include the mileposts of the listed infrastructure. This data can be extracted from the most recent Highway Log and the 2015 Climbing and Passing Lane Prioritization Study..

Step 3.4

Input the Closure Extents that have occurred along the study corridor. Road closure information can be detailed out by the reason for the closure as documented in Highway Condition Reporting System (HCRS) data analyzed as part of the baseline corridor performance. Closure reasons include incident/accidents, winter storms, obstruction hazards, and undefined closures. Statewide average percentages for the various closure reasons have been calculated for the analysis period on ADOT's designated strategic corridors. Compare these statewide average percentages to the corridor percentages for the various closure reasons to identify higher than average percentages of one or more closure reasons on any given segment. Note that this data can be copied from the Mobility Needs Assessment spreadsheet for Needs Assessment. Input the closures as follows and use red text to indicate that the segment percentage exceeds statewide averages:

- Total Number of Closures
- % Closures (No Reason)
- % Incidents/Accidents
- % Obstructions/Hazards
- % Weather Related

Step 3.5

List the non-actionable conditions that are present within each segment by milepost if possible. Non-Actionable conditions are conditions that exist within the environment of each segment that cannot be improved through an engineered solution. Examples of Non-Actionable conditions can include border patrol check points and other closures/restrictions not controlled by ADOT. Note that this data can be copied from the Mobility Needs Assessment spreadsheet for Needs Assessment.

Step 3.6

Input any programmed and planned projects or issues that have been identified from previous documents or studies that are relevant to the Final Need. Sources for this data include the current Highway Log, the 2015 Climbing and Passing Lane Prioritization Study, and ADOT's 5-year construction program.

Step 3.7

Considering all information in Steps 1-3, identify the contributing factors to the Final Need column. Potential contributing factors to freight performance needs include roadway vertical grade, number of lanes, traffic volume-to-capacity ratios, presence/lack of a climbing lanes, and road closures. Also, identify higher than average percentages of one or more closure reasons on any given segment

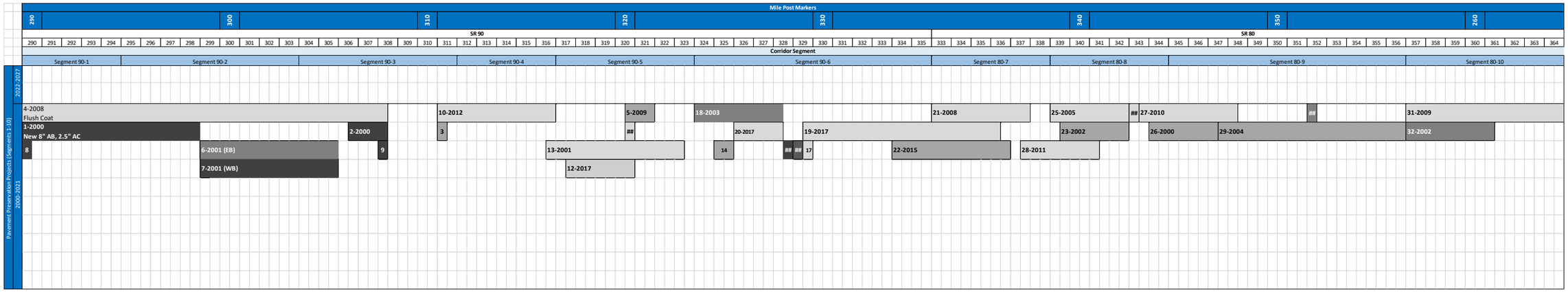
Pavement Performance Area - Need Analysis Step 1

Segment #	Segment Length (miles)	Segment Mileposts (MP)	Facility Type	Pavement Index			Index and Directional PSR Need Scales			Directional PSR					% Area Failure			% Pavement Failure Need Scales			Initial Need
				Performance Score	Performance Objective	Level of Need	None	Low	High	Performance Score		Performance Objective	Level of Need		Performance Score	Performance Objective	Level of Need	None	Low	High	
										NB	SB		NB	SB							
90-1	5	290 - 295	Highway	3.27	Fair or Better	Low	3.3	3.1	2.7	4.10	4.01	Fair or Better	None	None	80.00%	Fair or Better	High	10%	15%	25%	Medium
90-2	9	295 - 304	Highway	3.67	Fair or Better	None	3.3	3.1	2.7	4.36	3.99	Fair or Better	None	None	50.00%	Fair or Better	High	10%	15%	25%	Low
90-3	8	304 - 312	Highway	2.80	Fair or Better	Medium	3.3	3.1	2.7	3.40	3.12	Fair or Better	None	Low	88.00%	Fair or Better	High	10%	15%	25%	High
90-4	5	312 - 317	Highway	3.39	Fair or Better	None	3.3	3.1	2.7	3.01	3.35	Fair or Better	Medium	None	30.00%	Fair or Better	High	10%	15%	25%	Low
90-5	7	317 - 324	Highway	2.96	Fair or Better	Medium	3.3	3.1	2.7	2.93	2.89	Fair or Better	Medium	Medium	71.00%	Fair or Better	High	10%	15%	25%	High
90-6	12	324 - 336	Highway	3.68	Fair or Better	None	3.3	3.1	2.7	3.45	3.39	Fair or Better	None	None	17.00%	Fair or Better	Medium	10%	15%	25%	Low
80-7	6	333 - 339	Highway	4.20	Fair or Better	None	3.3	3.1	2.7	3.91	3.96	Fair or Better	None	None	0.00%	Fair or Better	None	10%	15%	25%	None
80-8	6	339 - 345	Highway	2.88	Fair or Better	Medium	3.3	3.1	2.7	2.84	3.12	Fair or Better	Medium	Low	88.00%	Fair or Better	High	10%	15%	25%	High
80-9	12	345 - 357	Highway	3.62	Fair or Better	None	3.3	3.1	2.7	3.68	3.66	Fair or Better	None	None	50.00%	Fair or Better	High	10%	15%	25%	Low
80-10	8	357 - 365	Highway	3.60	Fair or Better	None	3.3	3.1	2.7	3.50	3.64	Fair or Better	None	None	50.00%	Fair or Better	High	10%	15%	25%	Low
Emphasis Area?	Yes	Weighted Average		3.44	Fair or Better	None															

Pavement Performance Area - Need Analysis Step 2

Segment #	Segment Length (miles)	Segment Mileposts (MP)	Initial Need	Need Adjustments		Final Need	Comments (may include programmed projects or issues from previous reports)
				Hot Spots	Previous Projects (which supersede condition data)		
90-1	5	290 - 295	Medium	MP290-MP292 Both; MP292-MP203 NB; MP293-MP294 Both; MP294-MP295 NB	Pavement Preservation project MP 289.66-298.09 awarded 6/17/2022 F0396	Medium	
90-2	9	295 - 304	Low	MP295-MP296 Both; MP296-MP297 SB; MP298-MP304 SB	Pavement Preservation project MP 289.66-298.09 F0396 awarded 6/17/2022 Pavement Rehabilitation project MP 298.0-299.0 awarded 5/20/2022 F0356	Low	Pavement Rehabilitation project MP 298-300 F035601D, 01C FY 2022
90-3	8	304 - 312	High	MP 304-306 SB; MP 306-312 Both	Pavement Rehabilitation project MP 306.0-307.0 awarded 5/20/2022 F0356	High	Pavement Rehabilitation project MP 307-308 F035601D, 01C FY 2022 Pavement Preservation project MP 304.4-325.9 FY 2023 F0453/F0593
90-4	5	312 - 317	Low	MP312-MP313 Both; MP313-MP314 SB	None	Low	Pavement Preservation project MP 304.4-325.9 FY 2023 F0453/F0593
90-5	7	317 - 324	High	MP 317-MP318 Both; MP318-MP320 NB; MP320-MP322 Both; MP322-MP324 SB	None	High	Pavement Preservation project MP 304.4-325.9 FY 2023 F0453/F0593
90-6	12	324 - 336	Low	MP324-MP326 SB; MP328- MP329 Both	None	Low	Pavement Preservation project MP 304.4-325.9 FY 2023 F0453/F0593
80-7	6	333 - 339	None	None	None	None	
80-8	6	339 - 345	High	MP339-MP340 Both; MP340-MP341 SB; MP341-MP344 Both; MP344-MP 345 SB	None	High	
80-9	12	345 - 357	Low	MP345-MP357 SB	None	Low	
80-10	8	357 - 365	Low	MP357-MP365 SB	None	Low	

Pavement History



Pavement Treatment Reference Numbers		
1. 2000 (EB/WB): 8" AB, 2.5" AC, 0.5" FR	**14. 2007 (EB/WB):** Remove 0.5" AC, 0.5" AR-ACFC	**27. 2010 (EB/WB):** 0.5" Double Chip Seal
2. 2000 (EB/WB): 6" AB, 6" AC, 0.5" AR-ACFC	**15. 2014 (EB/WB):** 8" AB, 6" AC, 0.5" FT	**28. 2011 (EB/WB):** 0.5" Double Chip Seal
3. 2010 (EB/WB): Remove 3" AC, 2.5" AC, 0.5" ACFC	**16. 2014 (EB/WB):** 0.5" FT	**29. 2004 (EB/WB):** Remove 0.5" AC, 0.5" AR-ACFC
4. 2008 (EB/WB): Flush Coat	**17. 2003 (EB/WB):** 0.3" Seal Coat	**30. 2003 (EB/WB)**: 2" AC
5. 2009 (EB/WB): Remove 0.5" AC, 0.5" AR-ACFC	**18. 2003 (EB/WB):** 2" AC, 0.5" AR-ACFC	**31. 2009 (EB/WB):** Flush Coat
6. 2001 (EB): Remove 2" AC, 3" AC, 0.5" AR-ACFC	**19. 2017 (EB/WB):** 0.6" Double Chip Seal	**32. 2002 (EB/WB):** 2" AR-AC, 0.5" AR-ACFC
7. 2001 (WB): 6" AB, 5" AC, 0.5" AR-ACFC	**20. 2017 (EB/WB):** 0.6" Double Chip Seal	
8. 2012 (EB/WB): 5" AB, 4" AC, Flush Coat	**21. 2008 (EB/WB):** 0.3" Seal Coat	
9. 2000 (EB/WB): 5" AB, 6" AC, 0.5 FR	**22. 2015 (EB/WB):** Remove 3", 2.5" AC, 0.5" FR	
10. 2012 (EB/WB): Double Chip Seal	**23. 2002 (EB/WB):** Remove 2" AC, 2" AR-AC	
11. 2009 (EB): Remove 0.5", 0.5" FC	**24. 2011 (EB/WB):** Micro Seal	
12. 2017 (EB/WB): Double Chip Seal	**25. 2005 (EB/WB):** 0.5" AR-ACFC	
13. 2001 (EB/WB): 0.5" FR	**26. 2000 (EB/WB):** Remove 2" AC, 2" AR-AC	

Legend	
New Paving or Reconstruction	PCCP Pavement Border
Mill and Overlay (Adding Structural Thickness)	AC Pavement Border
Mill and Replace (No Change Structural Thickness)	
Fog Coat or Thin Overlay Treatments	

Pavement History

Value	Level	Segment Number																															
		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
		Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir
1	L1		100%		100%		56%		100%		50%		54%		83%		66%		29%		100%														
1							13%		10%		93%		4%		58%		8%																		
1											7%		21%		25%		25%																		
1																	41%																	
3	L2						6%				28%		8%		66%		58%		20%																
3													17%				16%		80%																
3																																			
3																																			
3																																			
3																																			
4	L3			55%		25%							4%						4%		56%														
4													38%																						
4																																			
4																																			
6	L4		100%	55%	44%	25%	25%						4%																						
6			10%				6%																												
6																																			
6																																			
6																																			
6																																			
Sub-Total		0.0	7.6	5.5	3.6	2.5	2.7	0.0	1.1	0.0	2.3	0.0	3.5	0.0	3.6	0.0	3.6	0.0	3.5	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total		**7.6**		**6.4**		**4.0**		**1.1**		**2.3**		**3.5**		**3.6**		**3.6**		**3.5**		**3.2**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**		**0.0**	

Pavement Historical Investment

Route	Segment	Pavement History Value (bid projects)	Pavement History (bid projects)	Resulting Historical Investment
90	1	7.6	High	High
90	2	6.4	Medium	Medium
90	3	4.0	Low	Low
90	4	1.1	Low	Low
90	5	2.3	Low	Low
90	6	3.5	Low	Low
80	7	3.6	Low	Low
80	8	3.6	Low	Low
80	9	3.5	Low	Low
80	10	3.2	Low	Low

Pavement Performance Area – Need Analysis Step 3

Segment #	Segment Length (miles)	Segment Mileposts (MP)	Final Need	Bid History Investment	PeCos History Investment	Resulting Historical Investment	Contributing Factors and Comments
90-1	5	MP290-MP295	Medium	High	High	High	Hot Spots: MP290-MP292 Both; MP292-MP203 NB; MP293-MP294 Both; MP294-MP295 NB
90-2	9	MP295-MP304	Low	Medium	Medium	Medium	Hot Spots: MP295-MP296 Both; MP296-MP297 SB; MP298-MP304 SB
90-3	8	MP304-MP312	High	Low	Low	Low	Hot Spots: MP 304-306 SB; MP 306-312 Both
90-4	5	MP312-MP317	Low	Low	Low	Low	Hot Spots: MP312-MP313 Both; MP313-MP314 SB
90-5	7	MP317-MP324	High	Low	Medium	Low	Hot Spots: MP 317-MP318 Both; MP318-MP320 NB; MP320-MP322 Both; MP322-MP324 SB
90-6	12	MP324-MP336	Low	Low	Low	Low	Hot Spots: MP324-MP326 SB; MP328- MP329 Both
80-7	6	MP333-MP339	None	Low	Low	Low	
80-8	6	MP339-MP345	High	Low	Low	Low	Hot Spots: MP339-MP340 Both; MP340-MP341 SB; MP341-MP344 Both; MP344-MP 345 SB
80-9	12	MP345-MP357	Low	Low	Low	Low	Hot Spots: MP345-MP357 SB
80-10	8	MP257-MP365	Low	Low	Low	Low	Hot Spots: MP357-MP365 SB

Bridge Performance Area - Needs Analysis Step 1

Segment #	Segment Length (miles)	Segment Mileposts (MP)	Number of Bridges in Segment	Bridge Index			Lowest Bridge Rating			Sufficiency Rating			<Insert Secondary Criteria As Needed>			Initial Need
				Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	
90-1	5	MP290-MP295	0	No Bridges	Fair or Better	N/A	No Bridges	Fair or Better	N/A	No Bridges	Fair or Better	N/A	No Bridges			N/A
90-2	9	MP295-MP304	2	6.49	Fair or Better	None	6	Fair or Better	None	94.4	Fair or Better	None				None
90-3	8	MP304-MP312	3	6.33	Fair or Better	None	6	Fair or Better	None	94.0	Fair or Better	None				None
90-4	5	MP312-MP317	0	No Bridges	Fair or Better	N/A	No Bridges	Fair or Better	N/A	No Bridges	Fair or Better	N/A	No Bridges			N/A
90-5	7	MP317-MP324	0	No Bridges	Fair or Better	N/A	No Bridges	Fair or Better	N/A	No Bridges	Fair or Better	N/A	No Bridges			N/A
90-6	12	MP324-MP336	2	6.60	Fair or Better	None	5	Fair or Better	Low	93.2	Fair or Better	None				Low
80-7	6	MP333-MP339	3	5.85	Fair or Better	Low	5	Fair or Better	Low	73.4	Fair or Better	None				Low
80-8	6	MP339-MP345	5	5.92	Fair or Better	Low	5	Fair or Better	Low	71.6	Fair or Better	None				Low
80-9	12	MP345-MP357	5	6.02	Fair or Better	None	5	Fair or Better	Low	77.5	Fair or Better	None				Low
80-10	8	MP357-MP365	1	5.00	Fair or Better	Medium	5	Fair or Better	Low	86.3	Fair or Better	None				Medium
Emphasis Area?	No	Weighted Avg		6.07	Fair or Better	None										

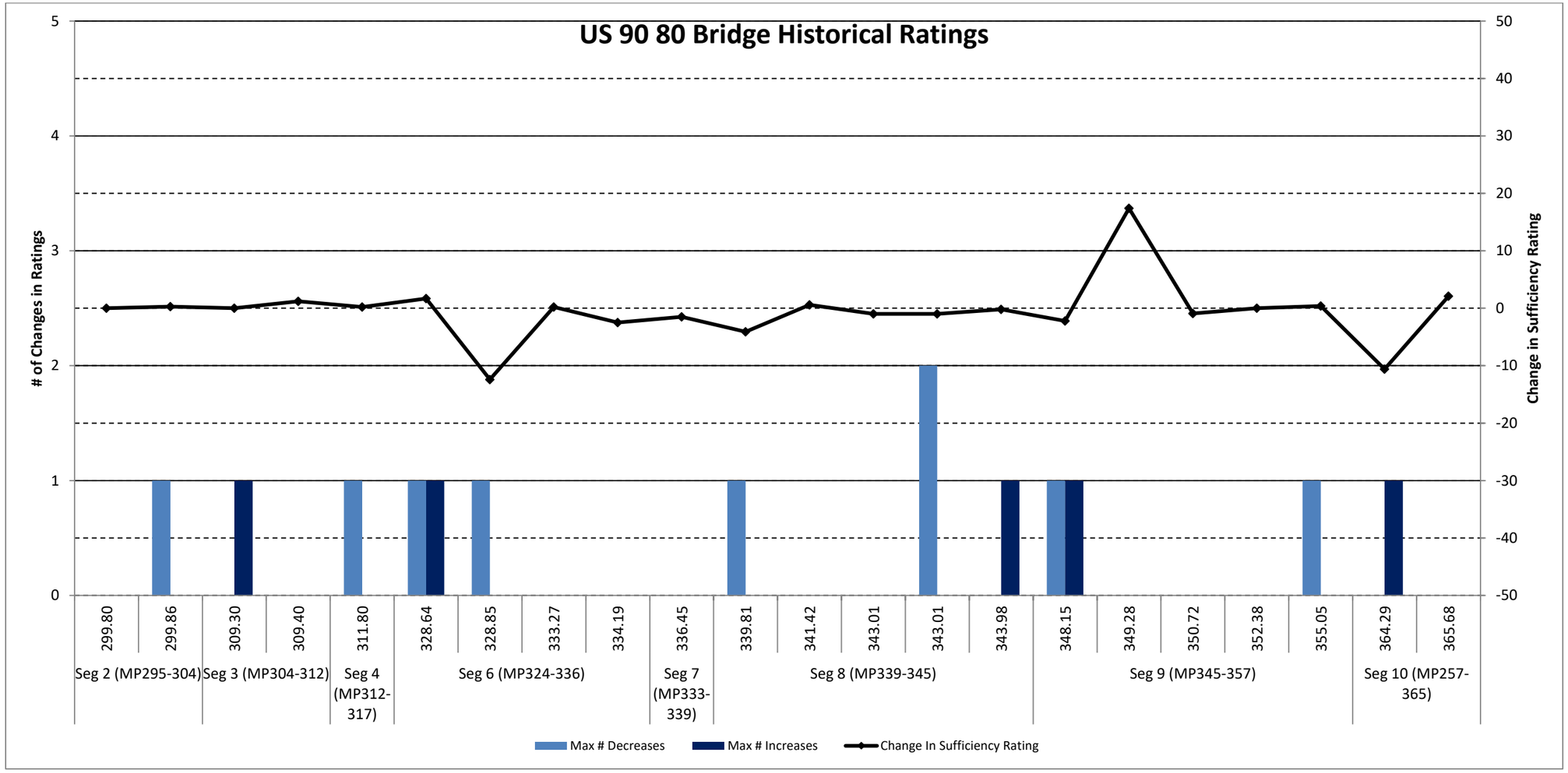
Bridge Performance Area - Needs Analysis Step 2

Segment #	Segment Length (miles)	Segment Mileposts (MP)	Number of Bridges in Segment	Initial Need	Need Adjustments		Final Need	Historical Review	Comments
					Hot Spots (Rating of 4 or multiple 5's)	Previous Projects (which supersede condition data)			
90-1	5	MP290-MP295	0	N/A	No Bridges	None	None	None	
90-2	9	MP295-MP304	2	None	None	None	None	None	
90-3	8	MP304-MP312	3	None	None	None	None	None	
90-4	5	MP312-MP317	0	N/A	No Bridges	None	None	None	
90-5	7	MP317-MP324	0	N/A	No Bridges	None	None	None	
90-6	12	MP324-MP336	2	Low	Lewis Springs OP (#470) (MP 328.85)	None	Low	None	
80-7	6	MP333-MP339	3	Low	None	None	Low	None	
80-8	6	MP339-MP345	5	Low	None	None	Low	None	
80-9	12	MP345-MP357	5	Low	Bridge (#235) (MP 349.28)	None	Low	None	
80-10	8	MP357-MP365	1	Medium	None	None	Medium	None	

Bridge Performance Area - Needs Analysis Step 3

Segment #	Segment Length (Miles)	Segment Mileposts (MP)	Number of Bridges in Segment	Final Need	Contributing Factors			Comments
					Bridge	Current Ratings	Historical Review	
90-1	5	MP290-MP295	0	None	No Bridges	No Bridges	No Bridges	
90-2	9	MP295-MP304	2	None	None	None	No Historical Issues	
90-3	8	MP304-MP312	3	None	None	None	No Historical Issues	
90-4	5	MP312-MP317	0	None	No Bridges	No Bridges	No Bridges	
90-5	7	MP317-MP324	0	None	No Bridges	No Bridges	No Bridges	
90-6	12	MP324-MP336	2	Low	Lewis Springs OP	Deck and Substructure of 5	Lewis Springs OP (#470)(MP 328.85)	
80-7	6	MP333-MP339	3	Low	Bridge #468	Superstructure of 5	Bridge (#468) (MP 336.45)	
80-8	6	MP339-MP345	5	Low	West Boulevard TI OP	Superstructure of 5	West Blvd TI OP (#614)(MP 339.81)	
80-9	12	MP345-MP357	5	Low	Mulepass-Lowell Arch Bridge # 235	Substructure of 5 Deck and substructure of 5	Bridge (#235)(MP 349.28) Glance Creek Bridge (#237)(MP 352.38) Mulepass-Lowell Arch (#130)(MP 348.15)	
80-10	8	MP357-MP365	1	Medium	White Water Draw Br	Deck of 5	White Water Draw Br (#175)(MP 365.68)	

Bridge Ratings History



O identifies the bridge indicated is of concern from a historical ratings perspective

Maximum # of Decreases: Maximum number of times that the Deck Rating, Substructure Rating, or Superstructure Rating decreased from 1997 to 2014. (Higher number could indicate a more dramatic decline in the performance of the bridge)

Maximum # of Increases: Maximum number of times that the Deck Rating, Substructure Rating, or Superstructure Rating increased from 1997 to 2014. (Higher number could indicate a higher level of investment)

Change in Sufficiency Rating: Cumulative change in Sufficiency Rating from 1997 to 2014. (Bigger negative number could indicate a more dramatic decline in the performance of the bridge)

Mobility Performance Area - Needs Analysis Step 1

Segment #	Segment Mileposts	Segment Length (miles)	Environment Type	Facility Operation	Mobility Index			Future Daily V/C			Existing Peak Hour V/C					Closure Extent (occurrences/year/mile)				
					Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	Performance Score		Performance Objective	Level of Need		Performance Score		Performance Objective	Level of Need	
											NB	SB		NB	SB	NB	SB		NB	SB
90-1	290 - 295	5.29	Rural	Interrupted	0.32	Fair or Better	None	0.36	Fair or Better	None	0.21	0.20	Fair or Better	None	None	0.00	0.00	Fair or Better	None	None
90-2	295 - 304	9.95	Rural	Interrupted	0.15	Fair or Better	None	0.17	Fair or Better	None	0.11	0.11	Fair or Better	None	None	0.00	0.02	Fair or Better	None	None
90-3	304 - 312	7.29	Rural	Interrupted	0.36	Fair or Better	None	0.40	Fair or Better	None	0.28	0.29	Fair or Better	None	None	0.10	0.18	Fair or Better	None	None
90-4	312 - 317	5.42	Rural	Uninterrupted	0.26	Fair or Better	None	0.29	Fair or Better	None	0.17	0.17	Fair or Better	None	None	0.00	0.12	Fair or Better	None	None
90-5	317 - 324	6.79	Urban	Interrupted	0.40	Fair or Better	None	0.44	Fair or Better	None	0.31	0.30	Fair or Better	None	None	0.14	0.03	Fair or Better	None	None
90-6	324 - 336	12.41	Rural	Interrupted	0.31	Fair or Better	None	0.34	Fair or Better	None	0.25	0.25	Fair or Better	None	None	0.15	0.05	Fair or Better	None	None
80-7	333 - 339	5.12	Rural	Uninterrupted	0.41	Fair or Better	None	0.26	Fair or Better	None	0.42	0.43	Fair or Better	None	None	0.50	0.10	Fair or Better	Medium	None
80-8	339 - 345	6.13	Urban	Interrupted	0.21	Fair or Better	None	0.13	Fair or Better	None	0.25	0.22	Fair or Better	None	None	0.20	0.54	Fair or Better	None	Medium
80-9	345 - 357	11.95	Rural	Uninterrupted	0.09	Fair or Better	None	0.04	Fair or Better	None	0.15	0.17	Fair or Better	None	None	0.40	0.90	Fair or Better	Low	High
80-10	357 - 365	7.59	Rural	Interrupted	0.10	Fair or Better	None	0.07	Fair or Better	None	0.13	0.13	Fair or Better	None	None	0.00	0.05	Fair or Better	None	None

Segment Mileposts	Segment Length (miles)	Environment Type	Facility Operation	Directional LOTTR (all vehicles)					Bicycle Accommodation			Initial Need
				Performance Score		Performance Objective	Level of Need		Performance Score	Performance Objective	Level of Need	
				NB	SB		NB	SB				
290 - 295	5.29	Rural	Interrupted	2.00	1.69	Fair or Better	High	High	88%	Fair or Better	None	Low
295 - 304	9.95	Rural	Interrupted	2.05	1.04	Fair or Better	High	None	100%	Fair or Better	None	Low
304 - 312	7.29	Rural	Interrupted	1.23	1.11	Fair or Better	None	None	96%	Fair or Better	None	None
312 - 317	5.42	Rural	Uninterrupted	1.10	1.11	Fair or Better	None	None	96%	Fair or Better	None	None
317 - 324	6.79	Urban	Interrupted	1.22	1.38	Fair or Better	None	Low	26%	Fair or Better	High	Low
324 - 336	12.41	Rural	Interrupted	1.10	1.10	Fair or Better	None	None	3%	Fair or Better	High	Low
333 - 339	5.12	Rural	Uninterrupted	1.07	1.16	Fair or Better	None	None	0%	Fair or Better	High	Low
339 - 345	6.13	Urban	Interrupted	1.17	1.13	Fair or Better	None	None	43%	Fair or Better	High	Low
345 - 357	11.95	Rural	Uninterrupted	1.11	1.19	Fair or Better	None	None	88%	Fair or Better	None	Low
357 - 365	7.59	Rural	Interrupted	1.21	1.07	Fair or Better	None	None	97%	Fair or Better	None	None

Mobility Performance Area - Needs Analysis Step 2

Segment	Segment Mileposts (MP)	Segment Length (miles)	Initial Need	Need Adjustments Recent Projects Since 2019	Final Need	Planned and Programmed Future Projects
90-1	290 - 295	5.29	Low	None	Low	**Programmed:** None **Planned:** None
90-2	295 - 304	9.95	Low	None	Low	**Programmed:** None **Planned:** None
90-3	304 - 312	7.29	None	None	None	**Programmed:** None **Planned:** None
90-4	312 - 317	5.42	None	None	None	**Programmed:** None **Planned:** None
90-5	317 - 324	6.79	Low	FY17 - Construct additional turn lanes at SR 90/ SR90 Bypass/Hatfield Street intersection at MP 317.2	Low	**Programmed:** None **Planned:** None
90-6	324 - 336	12.41	Low	None	Low	**Programmed:** None **Planned:** None
80-7	333 - 339	5.12	Low	FY 19- Construct edge line rumble strips or shoulder rumble strips between MP 329-329.5, Mp330-330.5, Mp334.4-335, Construct alignment delineation and lighting between MP 330- 330.5	Low	**Programmed:** None **Planned:** FY 22- Construct climbing lane on SR 90 from MP 335 to 337 (336 is extent of SR90 in corridor
80-8	339 - 345	6.13	Low	None	Low	**Programmed:** None **Planned:** None
80-9	345 - 357	11.95	Low	None	Low	**Programmed:** None **Planned: FY 21- Construct left and right turn lanes at the SR 80/Paul Spur Road intersection**
80-10	357 - 365	7.59	None	None	None	**Programmed:** None **Planned:** None

Mobility Performance Area - Needs Analysis Step 3

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Roadway Variables								Traffic Variables			Relevant Mobility Related Existing Infrastructure
				Functional Classification	Environmental Type (Urban/Rural)	Terrain	# of Lanes/ Direction	Weighted Average Speed Limit	Aux Lanes	Divided/ Non-Divided	% No Passing	Existing LOS	Future 2040 LOS	% Trucks	
90-1	290 - 295	5.29	Low	State Highway	Rural	Level	4	60	No	Divided	0%	A/B	A/B	11%	Grade separated traffic interchange I-10/SR 90 & Traffic Signal at S Village Loop & Hwy 90
90-2	295 - 304	9.95	Low	State Highway	Rural	Level	4	63	No	Divided	0%	A/B	A/B	13%	United States Customs and Border Patrol MP 304.5
90-3	304 - 312	7.29	None	State Highway	Rural	Level	4	62	No	Divided	0%	A/B	A/B	14%	Traffic Signal at the SR 90/SR 82; United States Customs and Border Patrol MP 304.5 DMS NB MP 309.9 and SB MP 306.4
90-4	312 - 317	5.42	None	State Highway	Rural	Level	4	55	No	Non-Divided	0%	A/B	A/B	10%	Traffic Signal at Hatfield St/SR 90
90-5	317 - 324	6.79	Low	State Highway	Urban	Level	4	53	No	Non-Divided	0%	A/B	A-C	11%	Eight Traffic Signals
90-6	324 - 336	12.41	Low	State Highway	Rural	Level	2	63	No	Non-Divided	25%	A/B	A/B	8%	Traffic Signal at Moson Road
80-7	333 - 339	5.12	Low	State Highway	Rural	Mountainous	2	54	No	Non-Divided	50%	A/B	A/B	8%	Passing lane MP 337-338
80-8	339 - 345	6.13	Low	State Highway	FringeUrban	Mountainous	2	43	No	Non-Divided	50%	A/B	A-C	10%	Traffic Roundabout and passing lane MP 340-341
80-9	345 - 357	11.95	Low	State Highway	Rural	Level	2	62	No	Non-Divided	25%	A/B	A/B	14%	
80-10	357 - 365	7.59	None	State Highway	Rural	Level	4	64	No	Divided	0%	A/B	A/B	14%	Traffic Signal at US 191 Intersection

Mobility Performance Area - Needs Analysis Step 3 (continued)

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Closure Extent							Non-Actionable Conditions	Programmed and Planned Projects or Issues from Previous Documents Relevant to Final Need
				Total Number of Closures	# Incidents/ Accidents	% Incidents/ Accidents	# Obstructions/ Hazards	% Obstructions/ Hazards	# Weather Related	% Weather Related		
90-1	290 - 295	5.29	Low	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!		**Programmed:** None **Planned:** None
90-2	295 - 304	9.95	Low	1	0	0%	0	0%	0	0%	US Customs and Border Patrol Checkpoint	**Programmed:** None **Planned:** None
90-3	304 - 312	7.29	None	11	3	27%	1	9%	0	0%	US Customs and Border Patrol Checkpoint	**Programmed:** None **Planned:** None
90-4	312 - 317	5.42	None	3	0	0%	0	0%	0	0%		**Programmed:** None **Planned:** None
90-5	317 - 324	6.79	Low	5	0	0%	0	0%	0	0%		**Programmed:** None **Planned:** None
90-6	324 - 336	12.41	Low	6	0	0%	0	0%	1	17%		**Programmed:** None **Planned:** None
80-7	333 - 339	5.12	Low	10	1	10%	2	20%	2	20%		**Programmed:** None **Planned:** FY 22- Construct climbing lane on SR 90 from MP 335 to 337 (336 is extent of SR90 in corridor
80-8	339 - 345	6.13	Low	13	2	15%	0	0%	3	23%		**Programmed:** None **Planned:** None
80-9	345 - 357	11.95	Low	13	4	31%	3	23%	0	0%		**Programmed:** None **Planned: FY 21- Construct left and right turn lanes at the SR 80/Paul Spur Road intersection**
80-10	357 - 365	7.59	None	2	0	0%	0	0%	0	0%		**Programmed:** None **Planned:** None

Safety Performance Area - Needs Analysis Step 1

Segment	Operating Environment	Offset	Segment Length (miles)	Segment Mileposts (MP)	Safety Index			Directional Safety Index					% of Fatal + Suspected Serious Injury Crashes at Intersections		
					Performance Score	Performance Objective	Level of Need	NB/EB Performance Score	SB/WB Performance Score	Performance Objective	NB/EB Level of Need	SB/WB Level of Need	Performance Score	Performance Objective	Level of Need
90-1	2 or 3 or 4 Lane Divided Highway	1	5.29	290 - 295	0.77	Average or Better	None	0.08	1.45	Average or Better	None	High	*Insufficient Data*	Average or Better	N/A
90-2	2 or 3 or 4 Lane Divided Highway	1	9.95	295 - 304	0.04	Average or Better	None	0.04	0.04	Average or Better	None	None	*Insufficient Data*	Average or Better	N/A
90-3	2 or 3 or 4 Lane Divided Highway	1	7.29	304 - 312	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	*Insufficient Data*	Average or Better	N/A	N/A	*Insufficient Data*	Average or Better	N/A
90-4	4 or 5 Lane Undivided Highway	2	5.42	312 - 317	0.04	Average or Better	None	0.08	0.00	Average or Better	None	None	*Insufficient Data*	Average or Better	N/A
90-5	4 or 5 Lane Undivided Highway	2	6.79	317 - 324	1.63	Average or Better	High	0.93	2.32	Average or Better	Low	High	61%	Average or Better	High
90-6	2 or 3 Lane Undivided Highway	0	12.41	324 - 336	0.18	Average or Better	None	0.16	0.21	Average or Better	None	None	43%	Average or Better	High
80-7	2 or 3 Lane Undivided Highway	0	5.12	333 - 339	1.93	Average or Better	High	1.95	1.92	Average or Better	High	High	*Insufficient Data*	Average or Better	N/A
80-8	2 or 3 Lane Undivided Highway	0	6.13	339 - 345	1.82	Average or Better	High	1.81	1.83	Average or Better	High	High	*Insufficient Data*	Average or Better	N/A
80-9	2 or 3 Lane Undivided Highway	0	11.95	345 - 357	0.00	Average or Better	None	0.00	0.00	Average or Better	None	None	*Insufficient Data*	Average or Better	N/A
80-10	2 or 3 or 4 Lane Divided Highway	1	7.59	357 - 365	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	*Insufficient Data*	Average or Better	N/A	N/A	*Insufficient Data*	Average or Better	N/A
Safety Emphasis Area?			**Yes**	**Weighted Average**	0.50	Above Average	None								

Safety Performance Area - Needs Analysis Step 1 (continued)

Segment	Operating Environment		Segment Length (miles)	Segment Mileposts (MP)	% of Fatal + Suspected Serious Injury Crashes Involving Lane Departures			% of Fatal + Suspected Serious Injury Crashes Involving Pedestrians			% of Fatal + Suspected Serious Injury Crashes Involving Trucks			Initial Need
					Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	
90-1	2 or 3 or 4 Lane Divided Highway		5.29	290 - 295	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	Low
90-2	2 or 3 or 4 Lane Divided Highway		9.95	295 - 304	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	None
90-3	2 or 3 or 4 Lane Divided Highway		7.29	304 - 312	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	None
90-4	4 or 5 Lane Undivided Highway		5.42	312 - 317	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	None
90-5	4 or 5 Lane Undivided Highway		6.79	317 - 324	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	High
90-6	2 or 3 Lane Undivided Highway		12.41	324 - 336	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	Low
80-7	2 or 3 Lane Undivided Highway		5.12	333 - 339	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	High
80-8	2 or 3 Lane Undivided Highway		6.13	339 - 345	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	High
80-9	2 or 3 Lane Undivided Highway		11.95	345 - 357	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	None
80-10	2 or 3 or 4 Lane Divided Highway		7.59	357 - 365	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	*Insufficient Data*	Average or Better	N/A	None

Safety Performance Area - Needs Analysis Step 2

Segment	Segment Length (miles)	Segment Mileposts (MP)	Initial Need	Hot Spots	Relevant Recently Completed or Under Construction Projects (which supersede performance data)*	Final Need	Comments (may include tentatively programmed projects with potential to address need or other relevant issues identified in previous reports)
90-1	5.29	290 - 295	Low		None	Low	None
90-2	9.95	295 - 304	None		None	None	Kartchner Caverns to Caming De Pampas - Pavement Rehab (MP 298-300)
90-3	7.29	304 - 312	N/A	MP 308-309	None	N/A	Kartchner Caverns to Caming De Pampas - Pavement Rehab (MP 307-308)
90-4	5.42	312 - 317	None		None	None	None
90-5	6.79	317 - 324	High	MP 319-323	Construct shoulder improvements (both directions) on four segments between MP 323-332 and MP 334-336.5.	High	None
90-6	12.41	324 - 336	Low		Construct edge line rumble strips or shoulder rumble strips between MP 329-329.5, MP 330-330.5, MP 334.5-335. Construct alignment delineation and lighting between MP 330-330.5. Construct shoulder improvements (both directions) on four segments between MP 323-332 and MP 334-336.5.	Low	None
80-7	5.12	333 - 339	High		None	High	Rockfall Mitigation - Pintek Ranch Rd, Bisbee (MP 333-334)
80-8	6.13	339 - 345	High		None	High	None
80-9	11.95	345 - 357	None		None	None	None
80-10	7.59	357 - 365	N/A		None	N/A	None

Safety Performance Area - Needs Analysis Step 3

Segment Number		**90-1**	**90-2**	**90-3**	**90-4**	**90-5**	**90-6**	**80-7**	**80-8**	**80-9**	**80-10**	**Corridor-Wide Crash Characteristics**
Segment Length (miles)		**5.29**	**9.95**	**7.29**	**5.42**	**6.79**	**12.41**	**5.12**	**6.13**	**11.95**	**7.59**	
Segment Milepost (MP)		**290 - 295**	**295 - 304**	**304 - 312**	**312 - 317**	**317 - 324**	**324 - 336**	**333 - 339**	**339 - 345**	**345 - 357**	**357 - 365**	
Final Need		Low	None	N/A	None	High	Low	High	High	None		
Segment Crash Overview		1 Crashes were fatal 2 Crashes had suspected serious injuries 2 Crashes at intersections 0 Crashes involve lane departures 0 Crashes involve pedestrians 0 Crashes involve trucks 0 Crashes involve bicycles	0 Crashes were fatal 2 Crashes had suspected serious injuries 0 Crashes at intersections 2 Crashes involve lane departures 0 Crashes involve pedestrians 1 Crashes involve trucks 0 Crashes involve bicycles	1 Crashes were fatal 2 Crashes had suspected serious injuries 1 Crashes at intersections 3 Crashes involve lane departures 0 Crashes involve pedestrians 0 Crashes involve trucks 0 Crashes involve bicycles	0 Crashes were fatal 2 Crashes had suspected serious injuries 0 Crashes at intersections 1 Crashes involve lane departures 0 Crashes involve pedestrians 0 Crashes involve trucks 0 Crashes involve bicycles	5 Crashes were fatal 13 Crashes had suspected serious injuries 11 Crashes at intersections 5 Crashes involve lane departures 1 Crashes involve pedestrians 1 Crashes involve trucks 0 Crashes involve bicycles	0 Crashes were fatal 7 Crashes had suspected serious injuries 3 Crashes at intersections 3 Crashes involve lane departures 0 Crashes involve pedestrians 1 Crashes involve trucks 0 Crashes involve bicycles	2 Crashes were fatal 2 Crashes had suspected serious injuries 2 Crashes at intersections 3 Crashes involve lane departures 0 Crashes involve pedestrians 0 Crashes involve trucks 0 Crashes involve bicycles	2 Crashes were fatal 0 Crashes had suspected serious injuries 0 Crashes at intersections 1 Crashes involve lane departures 0 Crashes involve pedestrians 0 Crashes involve trucks 0 Crashes involve bicycles	0 Crashes were fatal 0 Crashes had suspected serious injuries 0 Crashes at intersections 0 Crashes involve lane departures 0 Crashes involve pedestrians 0 Crashes involve trucks 0 Crashes involve bicycles	1 Crashes were fatal 3 Crashes had suspected serious injuries 2 Crashes at intersections 1 Crashes involve lane departures 1 Crashes involve pedestrians 0 Crashes involve trucks 0 Crashes involve bicycles	12 Crashes were fatal 33 Crashes had suspected serious injuries 21 Crashes at intersections 19 Crashes involve lane departures 2 Crashes involve pedestrians 3 Crashes involve trucks 0 Crashes involve bicycles
Segment Crash Summaries (fatal and Suspected Serious Injury Crashes)	**First Harmful Event Type**	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	78% Involve Collision with Motor Vehicle 17% Involve Collision with Fixed Object 6% Involve Collision with Pedestrian	86% Involve Collision with Motor Vehicle 14% Involve Collision with Fixed Object	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	55% Involve Collision with Motor Vehicle 18% Involve Collision with Fixed Object 16% Involve Overturning
	Collision Type	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	33% Involve Left Turn 22% Involve Angle 17% Involve Single Vehicle	43% Involve Rear End 29% Involve Head On 14% Involve Single Vehicle	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	37% Involve Single Vehicle 15% Involve Angle 12% Involve Left Turn
	Violation or Behavior	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	44% Involve Failure to Yield Right-of-Way 22% Involve Speed too Fast for Conditions 11% Involve Drove in Opposing Lane	43% Involve Speed too Fast for Conditions 29% Involve Failure to Yield Right-of-Way 14% Involve No Improper Action	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	24% Involve Failure to Yield Right-of-Way 21% Involve Speed too Fast for Conditions 12% Involve Unknown
	Lighting Conditions	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	56% Occur in Daylight Conditions 22% Occur in Dark-Lighted Conditions 11% Occur in Dawn Conditions	86% Occur in Daylight Conditions 14% Occur in Dark-Unlighted Conditions	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	55% Occur in Daylight Conditions 22% Occur in Dark-Unlighted Conditions 9% Occur in Dark-Lighted Conditions
	Surface Conditions	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	94% Involve Dry Conditions 6% Involve Wet Conditions	86% Involve Dry Conditions 14% Involve Wet Conditions	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	91% Involve Dry Conditions 4% Involve Wet Conditions 1% Involve Snow Conditions
	First Unit Event	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	67% Involve a first unit event of Motor Vehicle in Transport 11% Involve a first unit event of Crossed Centerline 11% Involve a first unit event of Ran Off the Road (Left)	86% Involve a first unit event of Motor Vehicle in Transport 14% Involve a first unit event of Overturn	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	48% Involve a first unit event of Motor Vehicle in Transport
	Driver Physical Condition	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	39% No Apparent Influence 33% Under the Influence of Drugs or Alcohol 22% Unknown	86% No Apparent Influence 14% Unknown	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	52% No Apparent Influence 21% Under the Influence of Drugs or Alcohol 21% Under the Influence of Drugs or Alcohol
	Safety Device Usage	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	44% Shoulder And Lap Belt Used 28% Air Bag Deployed/Shoulder-Lap Belt 11% Unknown	57% Shoulder And Lap Belt Used 14% Air Bag Deployed 14% Air Bag Deployed/Shoulde	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	N/A - Sample size too small	45% Shoulder And Lap Belt Used 19% None Used 13% Unknown

Freight Performance Area - Needs Analysis Step 1

Segment	Facility Operations	Segment Mileposts (MP)	Segment Length (miles)	Freight Index			Directional TTTR (trucks only)				
				Performance Score	Performance Objective	Level of Need	Performance Score		Performance Objective	Level of Need	
							NB/WB	SB/EB		NB/WB	SB/EB
90-1	Interrupted	290-295	5.29	5.06	Fair or Better	High	2.75	7.37	Fair or Better	High	High
90-2	Interrupted	295-304	9.95	4.85	Fair or Better	High	8.62	1.08	Fair or Better	High	None
90-3	Interrupted	304-312	7.29	1.69	Fair or Better	Low	1.87	1.52	Fair or Better	Medium	None
90-4	Uninterrupted	312-317	5.42	1.34	Fair or Better	Medium	1.42	1.25	Fair or Better	High	Low
90-5	Interrupted	317-324	6.79	2.05	Fair or Better	High	1.86	2.23	Fair or Better	Medium	High
90-6	Interrupted	324-336	12.41	1.35	Fair or Better	None	1.40	1.30	Fair or Better	None	None
80-7	Uninterrupted	333-339	5.12	1.45	Fair or Better	High	1.25	1.65	Fair or Better	Low	High
80-8	Interrupted	339-345	6.13	1.45	Fair or Better	None	1.48	1.42	Fair or Better	None	None
80-9	Uninterrupted	345-357	11.95	1.92	Fair or Better	High	1.37	2.48	Fair or Better	Medium	High
80-10	Interrupted	357-365	7.59	1.84	Fair or Better	Medium	2.38	1.29	Fair or Better	High	None
Emphasis Area?	Yes	Weighted Corridor Average		2.29	Good	High					

Segment	Facility Operations	Segment Mileposts (MP)	Segment Length (miles)	Closure Duration (minutes/mile/year)					Bridge Clearance (feet)			Initial Need
				Performance Score		Performance Objective	Level of Need		Performance Score	Performance Objective	Level of Need	
				NB/WB	SB/EB		NB/WB	SB/EB				
90-1	Interrupted	290-295	5.29	0.00	0.00	Fair or Better	None	None	No UP	Fair or Better	None	High
90-2	Interrupted	295-304	9.95	0.00	1.33	Fair or Better	None	None	No UP	Fair or Better	None	High
90-3	Interrupted	304-312	7.29	10.25	20.33	Fair or Better	None	None	No UP	Fair or Better	None	Low
90-4	Uninterrupted	312-317	5.42	0.00	14.76	Fair or Better	None	None	No UP	Fair or Better	None	Medium
90-5	Interrupted	317-324	6.79	12.00	6.83	Fair or Better	None	None	No UP	Fair or Better	None	High
90-6	Interrupted	324-336	12.41	10.00	3.00	Fair or Better	None	None	No UP	Fair or Better	None	None
80-7	Uninterrupted	333-339	5.12	156.07	15.57	Fair or Better	High	None	No UP	Fair or Better	None	High
80-8	Interrupted	339-345	6.13	36.77	109.34	Fair or Better	None	Medium	13.95	Fair or Better	High	Low
80-9	Uninterrupted	345-357	11.95	95.00	102.20	Fair or Better	Low	Medium	No UP	Fair or Better	None	High
80-10	Interrupted	357-365	7.59	0.00	3.00	Fair or Better	None	None	No UP	Fair or Better	None	Medium

Freight Performance Area - Needs Analysis Step 2

Segment	Segment Length (miles)	Segment Mileposts (MP)	Initial Need	Truck Height Restriction Hot Spots (Clearance < 16.25')	Relevant Recently Completed or Under Construction Projects (which supersede performance data)*	Final Need	Comments (may include tentatively programmed projects with potential to address needs or other relevant issues identified in previous reports)
90-1	5.29	290-295	High	None	None	High	None
90-2	9.95	295-304	High	None	None	High	None
90-3	7.29	304-312	Low	None	None	Low	None
90-4	5.42	312-317	Medium	None	None	Medium	None
90-5	6.79	317-324	High	None	FY17 - Construct additional turn lanes at SR 90/ SR90 Bypass/Hatfield Street intersection at MP 317.2	High	None
90-6	12.41	324-336	None	None	None	None	None
80-7	5.12	333-339	High	None	FY 19- Construct edge line rumble strips or shoulder rumble strips between MP 329-329.5, Mp330-330.5, Mp334.4-335, Construct alignment delineation and lighting between MP 330- 330.5	High	FY 22- Construct climbing lane on SR 90 from MP 335 to 337 (336 is extent of SR90 in corridor
80-8	6.13	339-345	Low	Mule Pass Tunnel (14.0 ft.); Lowell RR UP (both directions,13.95 ft. and 14.89 ft.)	None	Low	None
80-9	11.95	345-357	High	None	None	High	FY 21- Construct left and right turn lanes at the SR 80/Paul Spur Road intersection
80-10	7.59	357-365	Medium	None	None	Medium	None

Freight Performance Area - Needs Analysis Step 3

Segment	Segment Mileposts (MP)	Segment Length (miles)		Roadway Variables								Traffic Variables			Relevant Freight Related Existing Infrastructure
			Final Need	Functional Classification	Environmental Type (Urban/Rural)	Terrain	# of Lanes/ Direction	Weighted Average Speed Limit	Aux Lanes	Divided/ Non-Divided	% No Passing	Existing LOS	Future 2040 LOS	% Trucks	
90-1	290-295	5.29	High	State Highway	Urban/Rural Single or Multilane Signalized	Level	4	60	No	Divided	0%	A/B	A/B	11%	
90-2	295-304	9.95	High	State Highway	Multilane Highway	Level	4	63	No	Divided	0%	A/B	A/B	13%	United States Customs and Border Patrol MP 304
90-3	304-312	7.29	Low	State Highway	Urban/Rural Single or Multilane Signalized	Level	4	62	No	Divided	0%	A/B	A/B	14%	
90-4	312-317	5.42	Medium	State Highway	Multilane Highway	Level	4	55	No	Undivided	0%	A/B	A/B	10%	
90-5	317-324	6.79	High	State Highway	Urban/Rural Single or Multilane Signalized	Level	4	53	No	Undivided	0%	A/B	A-C	11%	
90-6	324-336	12.41	None	State Highway	Urban/Rural Single or Multilane Signalized	Level	2	63	No	Undivided	25%	A/B	A/B	8%	
80-7	333-339	5.12	High	State Highway	Rural Two-Lane, Non-Signalized	Mountainous	2	54	No	Undivided	50%	A/B	A/B	8%	Informal pull-off areas throughout the segment
80-8	339-345	6.13	Low	State Highway	Urban/Rural Single or Multilane Signalized	Mountainous	2	43	No	Undivided	50%	A/B	A-C	10%	Informal pull-off areas throughout the segment
80-9	345-357	11.95	High	State Highway	Rural Two-Lane, Non-Signalized	Level	2	62	No	Undivided	25%	A/B	A/B	14%	Informal pull-off areas throughout the segment
80-10	357-365	7.59	Medium	State Highway	Urban/Rural Single or Multilane Signalized	Level	4	64	No	Divided	0%	A/B	A/B	14%	

Freight Performance Area - Needs Analysis Step 3 (continued)

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Closure Extent							Non-Actionable Conditions	Programmed and Planned Projects or Issues from Previous Documents Relevant to Final Need	Contributing Factors
				Total Number of Closures	# Incidents/ Accidents	% Incidents/ Accidents	# Obstructions/ Hazards	% Obstructions/ Hazards	# Weather Related	% Weather Related			
90-1	290-295	5.29	High	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	None	None	High level of need due to poor TTR
90-2	295-304	9.95	High	1	0	0%	0	0%	0	0%	United States Customs and Border Patrol MP 304	None	High level of need due to poor TTR
90-3	304-312	7.29	Low	11	3	27%	1	9%	0	0%	None	None	10 out of 11 closures due to crashes or accidents; remaining one due to obstruction
90-4	312-317	5.42	Medium	3	0	0%	0	0%	0	0%	None	None	Infrequent closures all due to crashes. Medium level of need due to TTR.
90-5	317-324	6.79	High	5	0	0%	0	0%	0	0%	None	FY17 - Construct additional turn lanes at SR 90/ SR90 Bypass/Hatfield Street intersection at MP 317.2	High level of need due to poor TTR
90-6	324-336	12.41	None	6	0	0%	0	0%	1	17%	None	None	5 of 6 closures due to crashes, and one weather-related closure in 5 years.
80-7	333-339	5.12	High	10	1	10%	2	20%	2	20%	None	FY 19- Construct edge line rumble strips or shoulder rumble strips between MP 329-329.5, Mp330-330.5, Mp334.4-335, Construct alignment delineation and lighting between MP 330- 330.5	6 closures due to crashes and accidents; two each related to obstructions and weather. High level of need due to poor TTR
80-8	339-345	6.13	Low	13	2	15%	0	0%	3	23%	None	None	High closure rate inflated by long weather events in 2016 & 2018.
80-9	345-357	11.95	High	13	4	31%	3	23%	0	0%	None	None	10 out of 13 closures due to crashes or accidents; remaining 3 due to obstruction. High level of need due to poor TTR
80-10	357-365	7.59	Medium	2	0	0%	0	0%	0	0%	None	None	Medium level of need due to TTR.

Needs Summary Table

Performance Area	Segment Number and Mileposts (MP)									
	90-1	90-2	90-3	90-4	90-5	90-6	80-7	80-8	80-9	80-10
	MP 290-295	MP 295-304	MP 304-312	MP 312-317	MP 317-324	MP 324-336	MP 333-339	MP 339-345	MP 345-357	MP 357-365
Pavement*	Medium	Low	High	Low	High	Low	None	High	Low	Low
Bridge	None	None	None	None	None	Low	Low	Low	Low	Medium
Mobility	Low	Low	None	None	Low	Low	Low	Low	None	None
Safety*	Low	None	N/A	None	High	Low	High	High	None	N/A
Freight*	High	High	Low	Medium	High	None	High	Low	High	Medium
Average Need	**1.31**	**1.08**	**0.92**	**0.69**	**2.23**	**0.77**	**1.69**	**1.92**	**1.08**	**1.00**

Level of Need	Average Need Range
None*	< 0.1
Low	0.1 - 1.0
Medium	1.0 - 2.0
High	> 2.0

[+] Identified as Emphasis Areas for SR 90/SR 80 Corridor
[#] N/A indicates insufficient or no data available to determine level of need
* A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study

Appendix E: Life-Cycle Cost Analysis

Pavement Life-Cycle Cost Analysis Worksheet

Project Details			
Project title	North Benson Pavement Preservation		
Route	US90		
Milepost begin	290		
Milepost end	295		
Existing Roadway Characteristics			
Surface type (Asphalt or Concrete)	=	Asphalt	*<<Select from Pull-down List>>*
# of directions of travel (1 = one-way; 2 = two-way)	=	2	
# of lanes (in one direction)	=	2	
Width of typical lane (ft)	=	12	
Left shoulder width (ft)	=	4.45	
Right shoulder width (ft)	=	9.75	
Total roadway analysis segment length (centerline miles)	=	5	
Current year	=	2022	
Elevation (> 4,000 ft or < 4,000 ft)?	=	> 4,000 ft	*<<Select from Pull-down List>>*
Roadway width (ft) [each direction lanes & shoulders]	=	38.2	
Total lane-miles [total traffic direction lanes & shoulders]	=	31.8	
Total square feet [total traffic direction lanes & shoulders]	=	2,016,960	
Total square yards [total traffic direction lanes & shoulders]	=	224,107	
LCCA Parameters			
Analysis period (years)	=	40	
Year of net present value	=	2023	
First year of improvements	=	2027	
Discount rate (%) - low	=	3%	
Discount rate (%) - high	=	7%	

Design Alternatives (DA)

Characteristics			Pavement Material Cost ($)		
Treatment Type	*Pavement Thickness*	*Typical Service Life (years)*	*Lane-miles*	*Square Feet*	*Square Yards*
Concrete Reconstruction	8"-12"	26-30	$609,000	$9.6	$87
Asphalt Reconstruction	8"-12"	22-26	$487,000	$7.7	$69
Concrete Medium Rehab	1"-3"	20-24	$131,000	$2.1	$19
Concrete Light Rehab	<1"	14-18	$87,000	$1.4	$12
Asphalt Medium Rehab	3"-8"	16-20	$183,000	$2.9	$26
Asphalt Light Rehab	<3"	10-14	$122,000	$1.9	$17

Reconstruction: Other Materials Cost Factor: 1.60

Rehab: Other Materials Cost Factor: 1.20

Total Cost Factor (e.g., includes design, mobilization, traffic control, contingency, etc.): 2.44

			Total Unit Cost ($) [includes material costs and indirect costs]			Total Bi-Directional Cost ($)
Treatment Type	Pavement Thickness	Typical Service Life (years)	Lane-miles	Square Feet	Square Yards	Total Cost
Concrete Reconstruction	8"-12"	26-30	$2,377,536	$37.5	$338	$75,684,896
Asphalt Reconstruction	8"-12"	22-26	$1,901,248	$30.0	$270	$60,523,061
Concrete Medium Rehab	1"-3"	20-24	$383,568	$6.1	$54	$12,210,248
Concrete Light Rehab	<1"	14-18	$254,736	$4.0	$36	$8,109,096
Asphalt Medium Rehab	3"-8"	16-20	$535,824	$8.5	$76	$17,057,064
Asphalt Light Rehab	<3"	10-14	$357,216	$5.6	$51	$11,371,376

Pavement Service Life, Intervals, and Sequence of Improvements

US90 MP 290 - MP 295

Design Alternative	Typical Service Life Value	Typical Service Life Range	Average Historical Interval Value	Interval to Use in LCCA Before Reconstruction	Interval to Use in LCCA After Reconstruction
Concrete Reconstruction	28	26-30	0	-	14
Asphalt Reconstruction	24	22-26	12	-	12
Concrete Medium Rehab	22	20-24	0	11	11
Concrete Light Rehab	16	14-18	0	8	8
Asphalt Medium Rehab	18	16-20	0	9	9
Asphalt Light Rehab	12	10-14	0	6	6
None	0	0	-	-	-

Note: The typical service life values and ranges are determined based on the elevation of the roadway segment using the reference tables below. The typical service life values should be used as the intervals between improvements in the design alternatives except when historical frequency values are available based on the frequency and type of improvements in the past at this location. Historical frequency values should only be used if they are lower than the typical values and only up until reconstruction is implemented, after which typical service life values should be used.

Elevation Below 4000' (Desert Environment)

Design Alternative	Typical Service Life Value	Typical Service Life Range
Concrete Reconstruction	32	30-34
Asphalt Reconstruction	28	26-30
Concrete Medium Rehab	26	24-28
Concrete Light Rehab	20	18-22
Asphalt Medium Rehab	22	20-24
Asphalt Light Rehab	16	14-18
None	0	0

Elevation Above 4000' (Mountain Environment)

Design Alternative	Typical Service Life Value	Typical Service Life Range
Concrete Reconstruction	28	26-30
Asphalt Reconstruction	24	22-26
Concrete Medium Rehab	22	20-24
Concrete Light Rehab	16	14-18
Asphalt Medium Rehab	18	16-20
Asphalt Light Rehab	12	10-14
None	0	0

Assumed LCCA Sequence of Improvements Based on the Initial Design Alternative Improvement	
Concrete Reconstruction (CR):	CR, CLR, CMR, CLR, CR, CLR, CMR. . .
Asphalt Reconstruction (AR):	AR, ALR, AMR, ALR, AR, ALR, AMR. . .
Concrete Medium Rehab (CMR):	CMR, CLR, CR, CLR, CMR, CLR, CR. . .
Concrete Light Rehab (CLR):	CLR, CR, CLR, CMR, CLR, CR, CLR. . .
Asphalt Medium Rehab (AMR):	AMR, ALR, AR, ALR, AMR, ALR, AR. . .
Asphalt Light Rehab (ALR):	ALR, AR, ALR, AMR, ALR, AR, ALR. . .

Pavement Improvement Project History

US90 MP 290 - MP 295

Year	Project Number	Tracs No.	Direction of Improvement	Treatment Type	Improvement Description	Thickness (inches)	Beg. MP	End MP	Length (miles)
2000	013-1(13)	H313903C	EB/WB	Asphalt Reconstruction	AB	8	290	298	8
				Asphalt Reconstruction	AC	2.5	290	298	8
				Asphalt Reconstruction	FR	0.5	290	298	8
2008	-	H735801C	EB/WB	Asphalt Light Rehab	Flush Coat	0	290	307.5	17.5
2012	NH-010-E(200)N	H650401C	EB/WB	Asphalt Reconstruction	AB	5	290	291	1
				Asphalt Reconstruction	AC	4	290	291	1
				Asphalt Reconstruction	Flush Coat	0	290	291	1
									0
									0
									0
									0

Interval between Improvements in Years		Treatment Type Options	Estimated Historical Interval Value between Improvements in Years
After Asphalt Reconstruction:	12	Concrete Reconstruction	
After Asphalt Light Rehab:		Asphalt Reconstruction	12
		Concrete Medium Rehab	
		Concrete Light Rehab	
		Asphalt Medium Rehab	
		Asphalt Light Rehab	

Design Alternative # 1 - Concrete Reconstruction

US90 MP 290 - MP 295

Enter Name of Design Alternative

Number of Years	Year	Concrete Reconstruction	Agency Cost ($)	Net Present Value @ 3%	Net Present Value @ 7%
0	2022	None	$0	$0	$0
1	2023	None	$0	$0	$0
2	2024	None	$0	$0	$0
3	2025	None	$0	$0	$0
4	2026	None	$0	$0	$0
5	2027	Concrete Reconstruction	$75,684,896	$67,245,050	$57,739,645
6	2028	None	$0	$0	$0
7	2029	None	$0	$0	$0
8	2030	None	$0	$0	$0
9	2031	None	$0	$0	$0
10	2032	None	$0	$0	$0
11	2033	None	$0	$0	$0
12	2034	None	$0	$0	$0
13	2035	None	$0	$0	$0
14	2036	None	$0	$0	$0
15	2037	None	$0	$0	$0
16	2038	None	$0	$0	$0
17	2039	None	$0	$0	$0
18	2040	None	$0	$0	$0
19	2041	Concrete Light Rehab	$8,109,096	$4,763,239	$2,399,189
20	2042	None	$0	$0	$0
21	2043	None	$0	$0	$0
22	2044	None	$0	$0	$0
23	2045	None	$0	$0	$0
24	2046	None	$0	$0	$0
25	2047	None	$0	$0	$0
26	2048	None	$0	$0	$0
27	2049	Concrete Medium Rehab	$12,210,248	$5,661,828	$2,102,550
28	2050	None	$0	$0	$0
29	2051	None	$0	$0	$0
30	2052	None	$0	$0	$0
31	2053	None	$0	$0	$0
32	2054	None	$0	$0	$0
33	2055	None	$0	$0	$0
34	2056	None	$0	$0	$0
35	2057	None	$0	$0	$0
36	2058	None	$0	$0	$0
37	2059	None	$0	$0	$0
38	2060	Concrete Light Rehab	$8,109,096	$2,716,409	$663,396
39	2061	None	$0	$0	$0
40	2062	None	$0	$0	$0
41	2063	None	$0	$0	$0
42	2064	None	$0	$0	$0
43	2065	None	$0	$0	$0
44	2066	None	$0	$0	$0
45	2067	None	$0	$0	$0
Pick Last Used DA treatment type to calculate Remaining Service Life ››		Concrete Light Rehab	$4,561,367	$1,242,388	$232,385
Enter Year of Last Used DA Improvement ››		2060	Remaining Service Life Cost ^^		

	Net Present Value ($) @ 3%	Net Present Value ($) @ 7%
NET PRESENT VALUE	$79,144,138	$62,672,394
AGENCY COST	$99,551,970	

Design Alternative # 2 - Asphalt Reconstruction

US90 MP 290 - MP 295

Enter Name of Design Alternative

Number of Years	Year	Asphalt Reconstruction	Agency Cost ($)	Net Present Value @ 3%	Net Present Value @ 7%
0	2022	None	$0	$0	$0
1	2023	None	$0	$0	$0
2	2024	None	$0	$0	$0
3	2025	None	$0	$0	$0
4	2026	None	$0	$0	$0
5	2027	Asphalt Reconstruction	$60,523,061	$53,773,956	$46,172,754
6	2028	None	$0	$0	$0
7	2029	None	$0	$0	$0
8	2030	None	$0	$0	$0
9	2031	None	$0	$0	$0
10	2032	None	$0	$0	$0
11	2033	None	$0	$0	$0
12	2034	None	$0	$0	$0
13	2035	None	$0	$0	$0
14	2036	None	$0	$0	$0
15	2037	None	$0	$0	$0
16	2038	None	$0	$0	$0
17	2039	Asphalt Light Rehab	$11,371,376	$7,086,266	$3,851,878
18	2040	None	$0	$0	$0
19	2041	None	$0	$0	$0
20	2042	None	$0	$0	$0
21	2043	None	$0	$0	$0
22	2044	None	$0	$0	$0
23	2045	Asphalt Medium Rehab	$17,057,064	$8,901,954	$3,850,004
24	2046	None	$0	$0	$0
25	2047	None	$0	$0	$0
26	2048	None	$0	$0	$0
27	2049	None	$0	$0	$0
28	2050	None	$0	$0	$0
29	2051	None	$0	$0	$0
30	2052	None	$0	$0	$0
31	2053	None	$0	$0	$0
32	2054	Asphalt Light Rehab	$11,371,376	$4,548,404	$1,396,098
33	2055	None	$0	$0	$0
34	2056	None	$0	$0	$0
35	2057	None	$0	$0	$0
36	2058	None	$0	$0	$0
37	2059	None	$0	$0	$0
38	2060	Asphalt Reconstruction	$60,523,061	$20,274,193	$4,951,321
39	2061	None	$0	$0	$0
40	2062	None	$0	$0	$0
41	2063	None	$0	$0	$0
42	2064	None	$0	$0	$0
43	2065	None	$0	$0	$0
44	2066	None	$0	$0	$0
45	2067	None	$0	$0	$0
Pick Last Used DA treatment type to calculate Remaining Service Life ››		Asphalt Reconstruction	$42,870,502	$11,676,715	$2,184,099
Enter Year of Last Used DA Improvement ››		2060	Remaining Service Life Cost ^^		

	Net Present Value ($) @ 3%	Net Present Value ($) @ 7%
NET PRESENT VALUE	$82,908,058	$58,037,956
AGENCY COST	$117,975,437	

Design Alternative # 3 - Asphalt Medium Rehab

US90 MP 290 - MP 295

Enter Name of Design Alternative

Number of Years	Year	Asphalt Medium Rehab Focus	Agency Cost ($)	Net Present Value @ 3%	Net Present Value @ 7%
0	2022	None	$0	$0	$0
1	2023	None	$0	$0	$0
2	2024	None	$0	$0	$0
3	2025	None	$0	$0	$0
4	2026	None	$0	$0	$0
5	2027	Asphalt Medium Rehab	$17,057,064	$15,154,980	$13,012,752
6	2028	None	$0	$0	$0
7	2029	None	$0	$0	$0
8	2030	None	$0	$0	$0
9	2031	None	$0	$0	$0
10	2032	None	$0	$0	$0
11	2033	None	$0	$0	$0
12	2034	None	$0	$0	$0
13	2035	None	$0	$0	$0
14	2036	Asphalt Light Rehab	$11,371,376	$7,743,354	$4,718,717
15	2037	None	$0	$0	$0
16	2038	None	$0	$0	$0
17	2039	None	$0	$0	$0
18	2040	None	$0	$0	$0
19	2041	None	$0	$0	$0
20	2042	Asphalt Reconstruction	$60,523,061	$34,515,456	$16,735,131
21	2043	None	$0	$0	$0
22	2044	None	$0	$0	$0
23	2045	None	$0	$0	$0
24	2046	None	$0	$0	$0
25	2047	None	$0	$0	$0
26	2048	None	$0	$0	$0
27	2049	None	$0	$0	$0
28	2050	None	$0	$0	$0
29	2051	None	$0	$0	$0
30	2052	None	$0	$0	$0
31	2053	None	$0	$0	$0
32	2054	Asphalt Light Rehab	$11,371,376	$4,548,404	$1,396,098
33	2055	None	$0	$0	$0
34	2056	None	$0	$0	$0
35	2057	None	$0	$0	$0
36	2058	None	$0	$0	$0
37	2059	None	$0	$0	$0
38	2060	Asphalt Medium Rehab	$17,057,064	$5,713,825	$1,395,419
39	2061	None	$0	$0	$0
40	2062	None	$0	$0	$0
41	2063	None	$0	$0	$0
42	2064	None	$0	$0	$0
43	2065	None	$0	$0	$0
44	2066	None	$0	$0	$0
45	2067	None	$0	$0	$0
Pick Last Used DA treatment type to calculate Remaining Service Life ››		Asphalt Medium Rehab	$10,423,761	$2,839,138	$531,053
Enter Year of Last Used DA Improvement ››		2060	Remaining Service Life Cost ^^		

	Net Present Value ($) @ 3%	Net Present Value ($) @ 7%
NET PRESENT VALUE	$64,836,882	$36,727,063
AGENCY COST	$106,956,180	

Design Alternative # 4 - Asphalt Light Rehab

US90 MP 290 - MP 295

Enter Name of Design Alternative

Number of Years	Year	Asphalt Light Rehab Focus	Agency Cost ($)	Net Present Value @ 3%	Net Present Value @ 7%
0	2022	None	$0	$0	$0
1	2023	None	$0	$0	$0
2	2024	None	$0	$0	$0
3	2025	None	$0	$0	$0
4	2026	None	$0	$0	$0
5	2027	Asphalt Light Rehab	$11,371,376	$10,103,320	$8,675,168
6	2028	None	$0	$0	$0
7	2029	None	$0	$0	$0
8	2030	None	$0	$0	$0
9	2031	None	$0	$0	$0
10	2032	None	$0	$0	$0
11	2033	Asphalt Reconstruction	$60,523,061	$45,034,842	$30,766,855
12	2034	None	$0	$0	$0
13	2035	None	$0	$0	$0
14	2036	None	$0	$0	$0
15	2037	None	$0	$0	$0
16	2038	None	$0	$0	$0
17	2039	None	$0	$0	$0
18	2040	None	$0	$0	$0
19	2041	None	$0	$0	$0
20	2042	None	$0	$0	$0
21	2043	None	$0	$0	$0
22	2044	None	$0	$0	$0
23	2045	Asphalt Light Rehab	$11,371,376	$5,934,636	$2,566,669
24	2046	None	$0	$0	$0
25	2047	None	$0	$0	$0
26	2048	None	$0	$0	$0
27	2049	None	$0	$0	$0
28	2050	None	$0	$0	$0
29	2051	Asphalt Medium Rehab	$17,057,064	$7,455,246	$2,565,420
30	2052	None	$0	$0	$0
31	2053	None	$0	$0	$0
32	2054	None	$0	$0	$0
33	2055	None	$0	$0	$0
34	2056	None	$0	$0	$0
35	2057	None	$0	$0	$0
36	2058	None	$0	$0	$0
37	2059	None	$0	$0	$0
38	2060	Asphalt Light Rehab	$11,371,376	$3,809,217	$930,279
39	2061	None	$0	$0	$0
40	2062	None	$0	$0	$0
41	2063	None	$0	$0	$0
42	2064	None	$0	$0	$0
43	2065	None	$0	$0	$0
44	2066	Asphalt Reconstruction	$60,523,061	$16,979,317	$3,299,274
45	2067	None	$0	$0	$0
Pick Last Used DA treatment type to calculate Remaining Service Life ››		Asphalt Reconstruction	$58,001,267	$15,797,909	$2,954,958
Enter Year of Last Used DA Improvement ››		2066	Remaining Service Life Cost ^^		

	Net Present Value ($) @ 3%	Net Present Value ($) @ 7%
NET PRESENT VALUE	$73,518,670	$45,848,709
AGENCY COST	$114,216,048	

Summary of LCCA Results

US90 MP 290 - MP 295

	Concrete Reconstruction	Asphalt Reconstruction	Asphalt Medium Rehab Focus	Asphalt Light Rehab Focus
Net Present Value - 3%	$79,144,138	$82,908,058	$64,836,882	$73,518,670
Net Present Value - 7%	$62,672,394	$58,037,956	$36,727,063	$45,848,709
Agency Cost	$99,551,970	$117,975,437	$106,956,180	$114,216,048

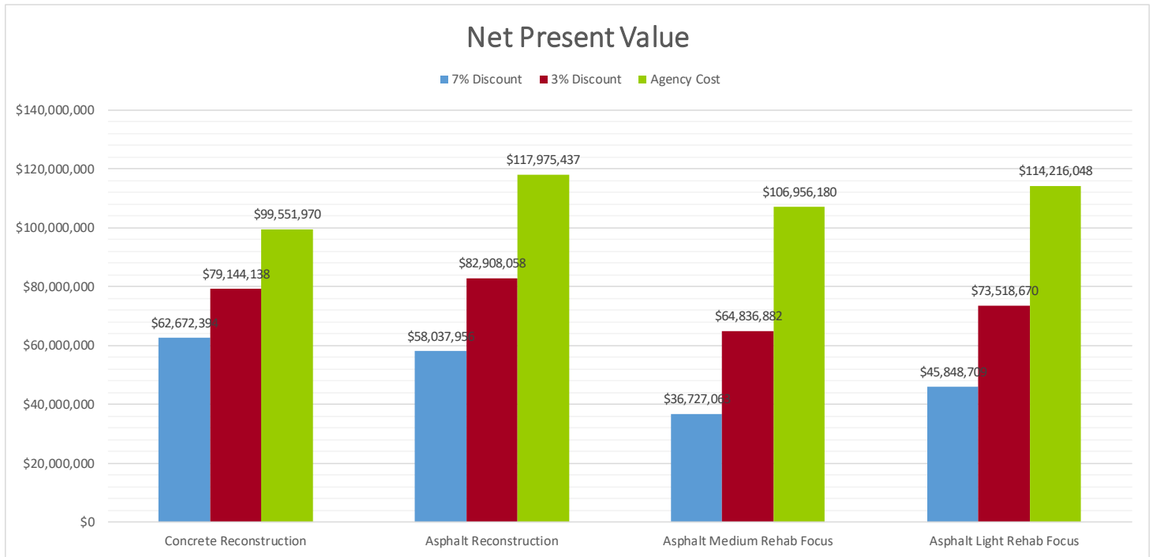
Cost Ratio at 3% Discount Rate

1.22 Ratio of Concrete Reconstruction to Lowest Cost Rehab
1.28 Ratio of Asphalt Reconstruction to Lowest Cost Rehab

Cost Ratio at 7% Discount Rate

1.71 Ratio of Concrete Reconstruction to Lowest Cost Rehab
1.58 Ratio of Asphalt Reconstruction to Lowest Cost Rehab

Note: A cost ratio < 1.15 means the Net Present Value (NPV) of reconstruction is within 15% of the NPV of the lowest cost rehab so reconstruction should likely be the initial improvement solution. A cost ratio > 1.15 means the NPV of reconstruction is more than 15% of the NPV of the lowest cost rehab so rehab should likely be the initial improvement solution.



Appendix F: Crash Modification Factors and Factored Unit Construction Costs

SOLUTION	2016 CONSTRUCTION UNIT COST	INFLATION FACTOR 2016-2022	2022 CONSTRUCTION UNIT COST	UNIT	FACTOR^	2016 FACTORED CONSTRUCTION UNIT COST	2022 FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	2022 CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
REHABILITATION										
Rehabilitate Pavement (AC)	$276,500	1.74	$481,110	Mile	2.20	$610,000	$1,060,000	Mill and replace 1"-3" AC pavement; accounts for 38' width; for one direction of travel on two-lane roadway; includes pavement, striping, delineators, RPMs, rumble strips	0.68	Updated to include 2 additional values (in addition to 3 previous values) from CMF Clearinghouse and revised combination of rehabilitate pavement (0.88), striping, delineators, RPMs (0.77 for combination), and rumble strips (0.89) = 0.68
Rehabilitate Bridge	$65	1.74	$113	SF	2.20	$140	$250	Based on deck area; bridge only - no other costs included	0.95	Assumed - should have a minor effect on crashes at the bridge
GEOMETRIC IMPROVEMENT										
Re-profile Roadway	$974,500	1.74	$1,695,630	Mile	2.20	$2,140,000	$3,730,000	Includes excavation of approximately 3", pavement replacement (AC), striping, delineators, RPMs, rumble strips, for one direction of travel on two-lane roadway (38' width)	0.70	Assumed - this is similar to rehab pavement. This solution is intended to address vertical clearance at bridge, not profile issue; factor the cost as a ratio of needed depth to 3".
Realign Roadway	$2,960,000	1.74	$5,150,400	Mile	2.20	$6,510,000	$11,330,000	All costs per direction except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.50	Based on Caltrans and NCDOT
Improve Skid Resistance	$675,000	1.74	$1,174,500	Mile	2.20	$1,490,000	$2,580,000	Average cost of pavement replacement and variable depth paving to increase super-elevation; for one direction of travel on two-lane roadway; includes pavement, striping, delineators, RPMs, rumble strips	0.65	Updated to include 6 additional values (in addition to 6 previous values) from CMF Clearinghouse (0.71) and calculated composite CMF value using that 0.71 value, the HSM value (0.87) for skid resistance; striping, delineators, RPMs (0.77 for combination), and rumble strips (0.89) = 0.65

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INFRASTRUCTURE IMPROVEMENT										
Reconstruct to Urban Section	$1,000,000	1.74	$1,740,000	Mile	2.20	$2,200,000	$3,828,000	Includes widening by 16' total (AC = 12'+2'+2') to provide median, curb & gutter along both side of roadway, single curb for median, striping (doesn't include widening for additional travel lane).	0.88	From HSM
Construct Auxiliary Lanes (AC)	$914,000	1.74	$1,590,360	Mile	2.20	$2,011,000	$3,499,000	For addition of aux lane (AC) in one direction of travel; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.78	Average of 4 values from clearinghouse
Construct Climbing Lane (High)	$3,000,000	1.74	$5,220,000	Mile	2.20	$6,600,000	$11,484,000	In one direction; all costs except bridges; applicable to areas with large fills and cuts, retaining walls, rock blasting, steep slopes on both sides of road	0.75	From HSM
Construct Climbing Lane (Medium)	$2,250,000	1.74	$3,915,000	Mile	2.20	$4,950,000	$8,613,000	In one direction; all costs except bridges; applicable to areas with medium or large fills and cuts, retaining walls, rock blasting, steep slopes on one side of road	0.75	From HSM

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Construct Climbing Lane (Low)	$1,500,000	1.74	$2,610,000	Mile	2.20	$3,300,000	$5,742,000	In one direction; all costs except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.75	From HSM
Construct Reversible Lane (Low)	$2,400,000	1.74	$4,176,000	Lane-Mile	2.20	$5,280,000	$9,190,000	All costs except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.73 for uphill and 0.88 for downhill	Based on proposed conditions on I-17 with 2 reversible lanes and a concrete barrier
Construct Reversible Lane (High)	$4,800,000	1.74	$8,352,000	Lane-Mile	2.20	$10,560,000	$18,370,000	All costs except bridges; applicable to areas with large fills and cuts, retaining walls, rock blasting, mountainous terrain	0.73 for uphill and 0.88 for downhill	Based on proposed conditions on I-17 with 2 reversible lanes and a concrete barrier
Construct Passing Lane	$1,500,000	1.74	$2,610,000	Mile	2.20	$3,300,000	$5,742,000	In one direction; all costs except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.63	Average of 3 values from clearinghouse
Construct Entry/Exit Ramp	$730,000	1.74	$1,270,200	Each	2.20	$1,610,000	$2,790,000	Cost per ramp; includes pavement, striping, signing, RPMs, lighting, typical earthwork & drainage; does not include any major structures or improvements on crossroad	1.09	Average of 16 values on clearinghouse; for adding a ramp not reconstructing. CMF applied to crashes 0.25 miles upstream/downstream from the gore.

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Relocate Entry/Exit Ramp	$765,000	1.74	$1,331,100	Each	2.20	$1,680,000	$2,930,000	Cost per ramp; includes pavement, striping, signing, RPMs, lighting, typical earthwork, drainage and demolition of existing ramp; does not include any major structures or improvements on crossroad	1.00	Assumed to not add any crashes since the ramp is simply moving and not being added. CMF applied to crashes 0.25 miles upstream/downstream from the gore.
Construct Turn Lanes	$42,500	1.74	$73,950	Each	2.20	$93,500	$163,000	Includes 14' roadway widening (AC) for one additional turn lane (250' long) on one leg of an intersection; includes AC pavement, curb & gutter, sidewalk, ramps, striping, and minor signal modifications	0.81	Average of 7 values from HSM; CMF applied to intersection-related crashes; this solution also applies when installing a deceleration lane
Modify Entry/Exit Ramp	$445,000	1.74	$774,300	Each	2.20	$979,000	$1,703,000	Cost per ramp; includes pavement, striping, signing, RPMs, lighting, minor earthwork, & drainage; For converting existing ramp to parallel-type configuration	0.21	Average of 4 values from clearinghouse (for exit ramps) and equation from HSM (for entrance ramp). CMF applied to crashes within 1/8 mile upstream/downstream from the gore.
Widen & Modify Entry/Exit Ramp	$619,000	1.74	$1,077,060	Each	2.20	$1,361,800	$2,370,000	Cost per ramp; includes pavement, striping, signing, RPMs, lighting, minor earthwork, & drainage; For converting 1-lane ramp to 2-lane ramp and converting to parallel-type ramp	0.21	Will be same as "Modify Ramp"

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Replace Pavement (AC) (with overexcavation)	$1,446,500	1.74	$2,516,910	Mile	2.20	$3,180,000	$5,540,000	Accounts for 38' width; for one direction of travel on two-lane roadway; includes pavement, overexcavation, striping, delineators, RPMs, rumble strips	0.70	Same as rehab
Replace Pavement (PCCP) (with overexcavation)	$1,736,500	1.74	$3,021,510	Mile	2.20	$3,820,000	$6,650,000	Accounts for 38' width; for one direction of travel on two-lane roadway; includes pavement, overexcavation, striping, delineators, RPMs, rumble strips	0.70	Same as rehab
Replace Bridge (Short)	$125	1.74	$218	SF	2.20	$280	$480	Based on deck area; bridge only - no other costs included; cost developed generally applies to bridges crossing small washes	0.95	Assumed - should have a minor effect on crashes at the bridge
Replace Bridge (Medium)	$160	1.74	$278	SF	2.20	$350	$610	Based on deck area; bridge only - no other costs included; cost developed generally applies to bridges crossing over the mainline freeway, crossroads, or large washes	0.95	Assumed - should have a minor effect on crashes at the bridge
Replace Bridge (Long)	$180	1.74	$313	SF	2.20	$400	$690	Based on deck area; bridge only - no other costs included; cost developed generally applies to bridges crossing large rivers or canyons	0.95	Assumed - should have a minor effect on crashes at the bridge

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Widen Bridge	$175	1.74	$305	SF	2.20	$390	$670	Based on deck area; bridge only - no other costs included	0.90	Assumed - should have a minor effect on crashes at the bridge
Install Pedestrian Bridge	$135	1.74	$235	SF	2.20	$300	$520	Includes cost to construct bridge based on linear feet of the bridge. This cost includes and assumes ramps and sidewalks leading to the structure.	0.1 (pedestrian only)	Assumed direct access on both sides of structure
Implement Automated Bridge De-icing	$115	1.74	$200	SF	2.20	$250	$440	Includes cost to replace bridge deck and install system	0.72 (snow/ice)	Average of 3 values on clearinghouse for snow/ice
Install Wildlife Crossing Under Roadway	$650,000	1.74	$1,131,000	Each	2.20	$1,430,000	$2,488,000	Includes cost of structure for wildlife crossing under roadway and 1 mile of fencing in each direction that is centered on the wildlife crossing	0.25 (wildlife)	Assumed; CMF applies to wildlife-related crashes within 0.5 miles both upstream and downstream of the wildlife crossing in both directions
Install Wildlife Crossing Over Roadway	$1,140,000	1.74	$1,983,600	Each	2.20	$2,508,000	$4,364,000	Includes cost of structure for wildlife crossing over roadway and 1 mile of fencing in each direction that is centered on the wildlife crossing	0.25 (wildlife)	Assumed; CMF applies to wildlife-related crashes within 0.5 miles both upstream and downstream of the wildlife crossing in both directions
Construct Drainage Structure - Minor	$280,000	1.74	$487,200	Each	2.20	$616,000	$1,072,000	Includes 3-36" pipes and roadway reconstruction (approx. 1,000 ft) to install pipes	0.70	Same as rehab; CMF applied to crashes 1/8 mile upstream/downstream of the structure
Construct Drainage Structure - Intermediate	$540,000	1.74	$939,600	Each	2.20	$1,188,000	$2,067,000	Includes 5 barrel 8'x6' RCBC and roadway reconstruction (approx. 1,000 ft) to install RCBC	0.70	Same as rehab; CMF applied to crashes 1/8 mile upstream/downstream of the structure

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Construct Drainage Structure - Major	$8,000	1.74	$13,920	LF	2.20	$17,600	$30,600	Includes bridge that is 40' wide and reconstruction of approx. 500' on each approach	0.70	Same as rehab; CMF applied to crashes 1/8 mile upstream/downstream of the structure
Install Acceleration Lane	$127,500	1.74	$221,850	Each	2.20	$280,500	$488,000	For addition of an acceleration lane (AC) on one leg of an intersection that is 1,000' long plus a taper; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.85	Average of 6 values from the FHWA Desktop Reference for Crash Reduction Factors
Install Curb and Gutter	$211,200	1.74	$367,488	Mile	2.20	$465,000	$808,000	In both directions; curb and gutter	0.89	From CMF Clearinghouse
Install Sidewalks, Curb, and Gutter	$475,200	1.74	$826,848	Mile	2.20	$1,045,000	$1,819,000	In both directions; 5' sidewalks, curb, and gutter	0.89 installing sidewalk 0.24 (pedestrian crashes only)	From CMF Clearinghouse Avg of 6 values from FHWA Desktop Reference
Install Sidewalks	$264,000	1.74	$459,360	Mile	2.20	$581,000	$1,011,000	In both directions; 5' sidewalks	0.24 (pedestrian crashes only)	Avg of 6 values from FHWA Desktop Reference
OPERATIONAL IMPROVEMENT										
Implement Variable Speed Limits (Wireless, Overhead)	$718,900	1.25	$898,625	Mile	2.20	$1,580,000	$1,980,000	In one direction; includes 1 sign assembly per mile (foundation and structure), wireless communication, detectors	0.91 (all crashes) 0.69 (weather-related)	Originally only 1 value from CMF Clearinghouse. Updated to include 1 value for all crashes and 2 additional values for weather-related crashes

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Implement Variable Speed Limits (Wireless, Ground-mount)	$169,700	1.25	$212,125	Mile	2.20	$373,300	$467,000	In one direction; includes 2 signs per mile (foundations and posts), wireless communication, detectors	0.91 (all crashes) 0.69 (weather-related)	Originally only 1 value from CMF Clearinghouse. Updated to include 1 value for all crashes and 2 additional values for weather-related crashes
Implement Variable Speed Limits (Wireless, Solar, Overhead)	$502,300	1.25	$627,875	Mile	2.20	$1,110,000	$1,380,000	In one direction; includes 1 sign assembly per mile (foundation and structure), wireless communication, detectors, solar power	0.91 (all crashes) 0.69 (weather-related)	Originally only 1 value from CMF Clearinghouse. Updated to include 1 value for all crashes and 2 additional values for weather-related crashes
Implement Variable Speed Limits (Wireless, Solar, Ground-mount)	$88,400	1.25	$110,500	Mile	2.20	$194,500	$243,000	In one direction; includes 2 signs per mile (foundations and posts), wireless communication, detectors, solar power	0.91 (all crashes) 0.69 (weather-related)	Originally only 1 value from CMF Clearinghouse. Updated to include 1 value for all crashes and 2 additional values for weather-related crashes
Implement Ramp Metering (Low)	$25,000	1.25	$31,250	Each	2.20	$55,000	$68,800	For each entry ramp location; urban area with existing ITS backbone infrastructure; includes signals, poles, timer, pull boxes, etc.	0.64	From 1 value from clearinghouse; CMF applied to crashes 0.25 miles after gore
Implement Ramp Metering (High)	$150,000	1.25	$187,500	Mile	2.20	$330,000	$413,000	Area without existing ITS backbone infrastructure; in addition to ramp meters, also includes conduit, fiber optic lines, and power	0.64	From 1 value from clearinghouse
Implement Signal Coordination	$140,000	1.25	$175,000	Mile	2.20	$308,000	$385,000	Includes conduit, conductors, and controllers for 4 intersections that span a total of approximately 2 miles	0.90	Assumed

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Implement Left-Turn Phasing	$7,500	1.25	$9,375	Each	2.20	$16,500	$20,600	Includes four new signal heads (two in each direction) and associated conductors for one intersection	0.88 (protected) 0.98 (permitted/protected or protected/permitted)	From HSM; CMF = 0.94 for each protected approach and 0.99 for each permitted/protected or protected/permitted approach. CMFs of different approaches should be multiplied together. CMF applied to crashes within intersection
Install Adaptive Signal Control and Signal Coordination	$363,500	1.25	$454,375	mile	2.20	$800,000	$1,000,000	Controller upgrades, advanced detection, software configuration, cameras; includes conduit, conductors, and controllers for 4 intersections that span a total of approximately 2 miles for coordination	0.78 (adaptive control) 0.90 (signal coordination)	Updated to include 15 additional values (in addition to 2 previous values) for adaptive control from CMF Clearinghouse
ROADSIDE DESIGN										
Install Guardrail	$130,000	1.74	$226,200	Mile	2.20	$286,000	$498,000	One side of road	0.62 (ROR)	0.62 is average of 2 values from clearinghouse
Install Cable Barrier	$80,000	1.74	$139,200	Mile	2.20	$176,000	$306,000	In median	0.65	Updated to include 5 additional values (in addition to 5 previous values) from CMF Clearinghouse
Widen Shoulder (AC)	$256,000	1.74	$445,440	Mile	2.20	$563,000	$980,000	Assumes 10' of existing shoulder (combined left and right), includes widening shoulder by a total of 4'; new pavement for 4' width and mill and replace existing 10' width; includes pavement, minor earthwork, striping edge lines, RPMs, high-visibility delineators, safety edge, and rumble strips	0.68 (1-4') 0.64 (>= 4')	0.86 is average of 5 values from clearing house for widening shoulder 1-4'. 0.76 is calculated from HSM for widening shoulder >= 4'. (Cost needs to be updated if dimension of existing and widened shoulder differ from Description.)

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Rehabilitate Shoulder (AC)	$113,000	1.74	$196,620	Mile	2.20	$249,000	$433,000	One direction of travel (14' total shoulder width-4' left and 10' right); includes paving (mill and replace), striping, high-visibility delineators, RPMs, safety edge, and rumble strips for both shoulders	0.72	0.98 is average of 34 values on clearinghouse for shoulder rehab/replace; include striping, delineators, RPMs (0.77 combined CMF), and rumble strips (0.89). (Cost needs to be updated if dimension of existing shoulder differs from Description.)
Replace Shoulder (AC)	$364,000	1.74	$633,360	Mile	2.20	$801,000	$1,393,000	One direction of travel (14' total shoulder width-4' left and 10' right); includes paving (full reconstruction), striping, high-visibility delineators, RPMs, safety edge, and rumble strips for both shoulders	0.72	0.98 is average of 34 values on clearinghouse for shoulder rehab/replace; include striping, delineators, RPMs (0.77 combined CMF), and rumble strips (0.89). (Cost needs to be updated if dimension of existing shoulder differs from Description.)
Install Rumble Strip	$5,500	1.74	$9,570	Mile	2.20	$12,000	$21,000	Both edges - one direction of travel; includes only rumble strip; no shoulder rehab or paving or striping	0.89	Average of 75 values on clearinghouse and consistent with HSM
Install Centerline Rumble Strip	$2,800	1.74	$4,872	Mile	2.20	$6,000	$11,000	Includes rumble strip only; no pavement rehab or striping	0.85	From HSM
Install Wildlife Fencing	$340,000	1.74	$591,600	Mile	2.20	$748,000	$1,302,000	Fencing only plus jump outs for 1 mile (both directions)	0.50 (wildlife)	Assumed
Remove Tree/Vegetation	$200,000	1.74	$348,000	Mile	2.20	$440,000	$766,000	Intended for removing trees that shade the roadway to allow sunlight to help melt snow and ice (see Increase Clear Zone CMF for general tree/vegetation removal in clear zone)	0.72 (snow/ice)	Average of 3 values on clearinghouse for snow/ice

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Increase Clear Zone	$59,000	1.74	$102,660	Mile	2.20	$130,000	$226,000	In one direction; includes widening the clear zone by 10' to a depth of 3'	0.71	Median of 14 values from FHWA Desktop Reference for Crash Reduction Values
Install Access Barrier Fence	$15	1.74	$26	LF	2.20	$33	$60	8' fencing along residential section of roadway	0.10 (pedestrian only)	Equal to pedestrian overpass
Install Rock-Fall Mitigation - Wire Mesh	$1,320,000	1.74	$2,296,800	Mile	2.20	$2,904,000	$5,053,000	Includes wire mesh and rock stabilization (one direction)	0.75 (debris)	Assumed
Install Rock-Fall Mitigation - Containment Fence & Barrier	$2,112,000	1.74	$3,674,880	Mile	2.20	$4,646,000	$8,085,000	Includes containment fencing, concrete barrier, and rock stabilization (one direction)	0.75 (debris)	Assumed
Install Raised Concrete Barrier in Median	$650,000	1.74	$1,131,000	Mile	2.20	$1,430,000	$2,488,000	Includes concrete barrier with associated striping and reflective markings; excludes lighting in barrier (one direction)	0.90 (Cross-median and head on crashes eliminated completely)	All cross median and head-on fatal or incapacitating injury crashes are eliminated completely; all remaining crashes have 0.90 applied
Formalize Pullout (Small)	$7,500	1.74	$13,050	Each	2.20	$17,000	$29,000	Includes paving and signage (signs, posts, and foundations) - approximately 4,200 sf	0.97	Assumed - similar to Install Other General Warning Signs; CMF applied to crashes within 0.25 miles after sign
Formalize Pullout (Medium)	$27,500	1.74	$47,850	Each	2.20	$61,000	$105,000	Includes paving and signage (signs, posts, and foundations) - approximately 22,500 sf	0.97	Assumed - similar to Install Other General Warning Signs; CMF applied to crashes within 0.25 miles after sign
Formalize Pullout (Large)	$80,500	1.74	$140,070	Each	2.20	$177,100	$308,000	Includes paving and signage (signs, posts, and foundations) - approximately 70,000 sf	0.97	Assumed - similar to Install Other General Warning Signs; CMF applied to crashes within 0.25 miles after sign
INTERSECTION IMPROVEMENTS										

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Construct Traffic Signal	$150,000	1.74	$261,000	Each	2.20	$330,000	$574,000	4-legged intersection; includes poles, foundations, conduit, controller, heads, luminaires, mast arms, etc.	0.95	From HSM; CMF applied to crashes within intersection only
Improve Signal Visibility	$35,000	1.74	$60,900	Each	2.20	$77,000	$134,000	4-legged intersection; signal head size upgrade, installation of new back-plates, and installation of additional signal heads on new poles.	0.85	Average of 7 values from clearinghouse; CMF applied to crashes within intersection only
Install Raised Median	$360,000	1.74	$626,400	Mile	2.20	$792,000	$1,378,000	Includes removal of 14' wide pavement and construction of curb & gutter; does not include cost to widen roadway to accommodate the median; if the roadway needs to be widened, include cost from New General Purpose Lane	0.83	Average from HSM
Install Transverse Rumble Strip/Pavement Markings	$3,000	1.74	$5,220	Each	2.20	$7,000	$11,000	Includes pedestrian markings and rumble strips only across a 30' wide travelway; no pavement rehab or other striping	0.95	Average of 17 values from clearinghouse; CMF applied to crashes within 0.5 miles after the rumble strips and markings
Construct Single-Lane Roundabout	$1,500,000	1.74	$2,610,000	Each	2.20	$3,300,000	$5,742,000	Removal of signal at 4-legged intersection; realignment of each leg for approx. 800 feet including paving, curbs, sidewalk, striping, lighting, signing	0.22	From HSM; CMF applied to crashes within intersection only

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Construct Double-Lane Roundabout	$1,800,000	1.74	$3,132,000	Each	2.20	$3,960,000	$6,890,000	Removal of signal at 4-legged intersection; realignment of each leg for approx. 800 feet including paving, curbs, sidewalk, striping, lighting, signing	0.40	From HSM; CMF applied to crashes within intersection only
Install Indirect Left Turn Intersection	$1,140,000	1.74	$1,983,600	Each	2.20	$2,500,000	$4,364,000	Raised concrete median improvements; intersection improvements; turn lanes	0.76	Updated to include 2 additional values (in addition to 1 previous value) from CMF Clearinghouse
Convert Standard Diamond Interchange to Diverging Diamond Interchange	$2,272,700	1.74	$3,954,498	Each	2.20	$5,000,000	$8,700,000	Convert traditional diamond interchange into diverging diamond interchange; assumes re-use of existing bridges	0.56	Updated to include 2 additional values (in addition to 1 previous value) from CMF Clearinghouse
Left-in Only Center Raised Median Improvements	$84,100	1.74	$146,334	Each	2.20	$185,000	$322,000	Left-in only center raised median improvements	0.87	CMF Clearinghouse
ROADWAY DELINEATION										
Install High-Visibility Edge Line Striping	$10,800	1.25	$13,500	Mile	2.20	$23,800	$29,700	2 edge lines and lane line - one direction of travel	0.77	Average of 3 values from clearinghouse. Assumes package of striping, delineators, and RPMs. (If implemented separately, CMF will be higher.)
Install High-Visibility Delineators	$6,500	1.25	$8,125	Mile	2.20	$14,300	$17,900	Both edges - one direction of travel		Average of 3 values from clearinghouse. Assumes package of striping, delineators, and RPMs. (If implemented separately, CMF will be higher.)
Install Raised Pavement Markers	$2,000	1.25	$2,500	Mile	2.20	$4,400	$5,500	Both edges - one direction of travel		Average of 3 values from clearinghouse. Assumes package of striping, delineators, and RPMs. (If implemented separately, CMF will be higher.)

SOLUTION	2016 CONSTRUCTION UNIT COST	INFLATION FACTOR 2016-2022	2022 CONSTRUCTION UNIT COST	UNIT	FACTOR^	2016 FACTORED CONSTRUCTION UNIT COST	2022 FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	2022 CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Install In-Lane Route Markings	$6,000	1.25	$7,500	Each	2.20	$13,200	$16,500	Installation of a series of three in-lane route markings in one lane	0.95	Assumed; CMF applied to crashes within 1.0 mile before the gore
IMPROVED VISIBILITY										
Cut Side Slopes	$80	1.74	$139	LF	2.20	$200	$300	For small grading to correct sight distance issues; not major grading	0.85	Intent of this solution is to improve sight distance. Most CMF's are associated with vehicles traveling on slope. Recommended CMF is based on FDOT and NCDOT but is more conservative.
Install Lighting (connect to existing power)	$270,000	1.74	$469,800	Mile	2.20	$594,000	$1,034,000	One side of road only; offset lighting, not high-mast; does not include power supply; includes poles, luminaire, pull boxes, conduit, conductor	0.75 (night)	Average of 3 values on clearinghouse & consistent with HSM
Install Lighting (solar powered LED)	$10,000	1.74	$17,400	Pole	2.20	$22,000	$38,300	Offset lighting, not high-mast; solar power LED; includes poles, luminaire, solar panel	0.75 (night)	Average of 3 values on clearinghouse & consistent with HSM
DRIVER INFORMATION/WARNING										
Install Dynamic Message Sign (DMS)	$250,000	1.25	$312,500	Each	2.20	$550,000	$688,000	Includes sign, overhead structure, and foundations; wireless communication; does not include power supply	1.00	Not expected to reduce crashes
Install Dynamic Weather Warning Beacons	$40,000	1.25	$50,000	Each	2.20	$88,000	$110,000	Assumes solar operation and wireless communication or connection to existing power and communication; ground mounted; includes posts, foundations, solar panel, and dynamic sign	0.80 (weather-related)	Average of 3 values from FHWA Desktop Reference for Crash Reduction Factors; CMF applies to crashes within 0.25 miles after a sign

SOLUTION	2016 CONSTRUCTION UNIT COST	INFLATION FACTOR 2016-2022	2022 CONSTRUCTION UNIT COST	UNIT	FACTOR^	2016 FACTORED CONSTRUCTION UNIT COST	2022 FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	2022 CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Install Dynamic Speed Feedback Signs	$25,000	1.25	$31,250	Each	2.20	$55,000	$68,800	Assumes solar operation and no communication; ground mounted; includes regulatory sign, posts, foundations, solar panel, and dynamic sign	0.94	Average of 2 clearinghouse values; CMF applies to crashes within 0.50 miles after a sign
Install Chevrons	$18,400	1.25	$23,000	Mile	2.20	$40,500	$50,600	On one side of road - includes signs, posts, and foundations	0.79	Average of 11 clearinghouse values
Install Curve Warning Signs	$2,500	1.25	$3,125	Each	2.20	$5,500	$6,900	Includes 2 signs, posts, and foundations	0.83	Average of 4 clearinghouse values; CMF applies to crashes within 0.25 miles after a sign
Install Traffic Control Device Warning Signs (e.g., stop sign ahead, signal ahead, etc.)	$2,500	1.25	$3,125	Each	2.20	$5,500	$6,900	Includes 2 signs, posts, and foundations	0.85	FHWA Desktop Reference for Crash Reduction Factors; CMF applies to crashes within 0.25 miles after a sign
Install Other General Warning Signs (e.g., intersection ahead, wildlife in area, slow vehicles, etc.)	$2,500	1.25	$3,125	Each	2.20	$5,500	$6,900	Includes 2 signs, posts, and foundations	0.97	Assumed; CMF applies to crashes within 0.25 miles after a sign
Install Wildlife Warning System	$162,000	1.25	$202,500	Each	2.20	$356,400	$446,000	Includes wildlife detection system at a designated wildlife crossing, flashing warning signs (assumes solar power), advance signing, CCTV (solar and wireless), game fencing for approximately 0.25 miles in each direction - centered on the wildlife crossing, and regular fencing for 1.0 mile in each direction - centered on the wildlife crossing.	0.50 (wildlife)	Assumed; CMF applies to wildlife-related crashes within 0.5 miles both upstream and downstream of the wildlife crossing in both directions

SOLUTION	2016 CONSTRUCTION UNIT COST	INFLATION FACTOR 2016-2022	2022 CONSTRUCTION UNIT COST	UNIT	FACTOR^	2016 FACTORED CONSTRUCTION UNIT COST	2022 FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	2022 CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Install Warning Sign with Beacons	$15,000	1.25	$18,750	Each	2.20	$33,000	$41,300	In both directions; includes warning sign, post, and foundation, and flashing beacons (assumes solar power) at one location	0.75	FHWA Desktop Reference for Crash Reduction Factors for Installing Flashing Beacons as Advance Warning; CMF applies to crashes within 0.25 miles after a sign
Install Rectangular Rapid Flashing Beacon (RRFB)	$15,000	1.25	$18,750	Each	2.20	$33,000	$41,300	In both directions; includes warning sign, post, and foundation, and flashing beacons (assumes solar power) at one location	0.53	CMF Clearinghouse
Install Larger Stop Sign with Beacons	$10,000	1.25	$12,500	Each	2.20	$22,000	$27,500	In one direction; includes large stop sign, post, and foundation, and flashing beacons (assumes solar power) at one location	0.85/0.81	Use 0.85 for adding beacons to an existing sign; 0.81 for installing a larger sign with flashing beacons; CMF applies to intersection-related crashes
Install Advanced Warning Signal System	$108,000	1.25	$135,000	each	2.20	$238,000	$297,000	Overhead static sign with flashing beacons, detectors, and radar system. Signs for each mainline approach of the intersection (2)	0.61	FHWA Desktop Reference for CRF
DATA COLLECTION										
Install Roadside Weather Information System (RWIS)	$60,000	1.25	$75,000	Each	2.20	$132,000	$165,000	Assumes wireless communication and solar power, or connection to existing power and communications	1.00	Not expected to reduce crashes
Install Closed Circuit Television (CCTV) Camera	$25,000	1.25	$31,250	Each	2.20	$55,000	$68,800	Assumes connection to existing ITS backbone or wireless communication; does not include fiber-optic backbone infrastructure; includes pole, camera, etc.	1.00	Not expected to reduce crashes

SOLUTION	2016 CONSTRUCTION UNIT COST	INFLATION FACTOR 2016-2022	2022 CONSTRUCTION UNIT COST	UNIT	FACTOR^	2016 FACTORED CONSTRUCTION UNIT COST	2022 FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	2022 CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Install Vehicle Detection Stations	$15,000	1.25	$18,750	Each	2.20	$33,000	$41,300	Assumes wireless communication and solar power, or connection to existing power and communications	1.00	Not expected to reduce crashes
Install Flood Sensors (Activation)	$15,000	1.25	$18,750	Each	2.20	$33,000	$41,300	Sensors with activation cabinet to alert through texting (agency)	1.00	Not expected to reduce crashes
Install Flood Sensors (Gates)	$100,000	1.25	$125,000	Each	2.20	$220,000	$275,000	Sensors with activation cabinet to alert through texting (agency) and beacons (public) plus gates	1.00	Not expected to reduce crashes
WIDEN CORRIDOR										
Construct New General Purpose Lane (PCCP)	$1,740,000	1.74	$3,027,600	Mile	2.20	$3,830,000	$6,660,000	For addition of 1 GP lane (PCCP) in one direction; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.90	North Carolina DOT uses 0.90 and Florida DOT uses 0.87
Construct New General Purpose Lane (AC)	$1,200,000	1.74	$2,088,000	Mile	2.20	$2,640,000	$4,590,000	For addition of 1 GP lane (AC) in one direction; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.90	North Carolina DOT uses 0.90 and Florida DOT uses 0.88
Convert a 2-Lane undivided highway to a 5-Lane highway	$1,576,000	1.74	$2,742,240	Mile	2.20	$3,467,200	$6,030,000	For expanding a 2-lane undivided highway to a 5-lane highway (4 through lanes with TWLTL), includes standard shoulder widths but no curb, gutter, or sidewalks	0.60	Assumed to be slightly lower than converting from a 4-lane to a 5-lane highway

SOLUTION	2016 CONSTRUCTION UNIT COST	INFLATION FACTOR 2016-2022	2022 CONSTRUCTION UNIT COST	UNIT	FACTOR^	2016 FACTORED CONSTRUCTION UNIT COST	2022 FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	2022 CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Install Center Turn Lane	$1,053,000	1.74	$1,832,220	Mile	2.20	$2,316,600	$4,030,000	For adding a center turn lane (i.e., TWLTL); assumes symmetrical widening on both sides of the road; includes standard shoulder widths but no curb, gutter, or sidewalk	0.75	From FHWA Desktop Reference for Crash Reduction Factors, CMF Clearinghouse, and SR 87 CPS comparison
Construct 4-Lane Divided Highway (Using Existing 2-Lane Road for one direction)	$3,000,000	1.74	$5,220,000	Mile	2.20	$6,600,000	$11,484,000	In both directions; one direction uses existing 2-lane road; other direction assumes addition of 2 new lanes (AC) with standard shoulders; includes all costs except bridges	0.67	Assumed
Construct 4-Lane Divided Highway (No Use of Existing Roads)	$6,000,000	1.74	$10,440,000	Mile	2.20	$13,200,000	$22,968,000	In both directions; assumes addition of 2 new lanes (AC) with standard shoulders in each direction; includes all costs except bridges	0.67	Assumed
Construct Bridge over At-Grade Railroad Crossing	$10,000,000	1.74	$17,400,000	Each	2.20	$22,000,000	$38,280,000	Assumes bridge width of 4 lanes (AC) with standard shoulders; includes abutments and bridge approaches; assumes vertical clearance of 23'4" + 6'8" superstructure	0.72 (All train-related crashes eliminated)	Removes all train-related crashes at at-grade crossing; all other crashes CMF = 0.72
Construct Underpass at At-Grade Railroad Crossing	$15,000,000	1.74	$26,100,000	Each	2.20	$33,000,000	$57,420,000	Assumes underpass width of 4 lanes (AC) with standard shoulders; includes railroad bridge with abutments and underpass approaches; assumes vertical clearance of 16'6" + 6'6" superstructure	0.72 (All train-related crashes eliminated)	Removes all train-related crashes at at-grade crossing; all other crashes CMF = 0.72

SOLUTION	2016 CONSTRUCTION UNIT COST	INFLATION FACTOR 2016-2022	2022 CONSTRUCTION UNIT COST	UNIT	FACTOR^	2016 FACTORED CONSTRUCTION UNIT COST	2022 FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	2022 CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Construct High-Occupancy Vehicle (HOV) Lane	$900,000	1.74	$1,566,000	Mile	2.20	$1,980,000	$3,445,000	For addition of 1 HOV lane (AC) in one direction with associated signage and markings; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.95	Similar to general purpose lane
ALTERNATE ROUTE										
Construct Frontage Roads	$2,400,000	1.74	$4,176,000	Mile	2.20	$5,280,000	$9,190,000	For 2-lane AC frontage road; includes all costs except bridges; for generally at-grade facility with minimal walls	0.90	Assumed - similar to new general purpose lane
Construct 2-Lane Undivided Highway	$3,000,000	1.74	$5,220,000	Mile	2.20	$6,600,000	$11,484,000	In both directions; assumes addition of 2 new lanes (AC) with standard shoulders in each direction; includes all costs except bridges	0.90	Assuming new alignment for a bypass

Appendix G: Performance Area Risk Factors

Pavement Performance Area

- Elevation
- Mainline Daily Traffic Volume
- Mainline Daily Truck Volume

Elevation

Variance above 4000' divided by 1000; (Elev-4000)/1000

Score	Condition
0	< 4000’
0-5	4000’- 9000’
5	> 9000’

Mainline Daily Traffic Volume

Exponential equation; score = $5-(5*e^{(ADT*-0.000039)})$

Score	Condition
0	< 6,000
0-5	6,000 – 160,000
5	>160,000

Mainline Daily Truck Volume

Exponential equation; score = $5-(5*e^{(ADT*-0.00025)})$

Score	Condition
0	<900
0-5	900-25,000
5	>25,000

Bridge Performance Area

- Mainline Daily Traffic Volume
- Elevation
- Carries Mainline Traffic
- Detour Length
- Scour Critical Rating
- Vertical Clearance

Mainline Daily Traffic Volume

Exponential equation; score = $5-(5*e^{(ADT*-0.000039)})$

Score	Condition
0	<6,000
0-5	6,000-160,000
5	>160,000

Elevation

Variance above 4000' divided by 1000; (Elev-4000)/1000

Score	Condition
0	< 4000’
0-5	4000’- 9000’
5	> 9000’

Carries Mainline Traffic

Score	Condition
0	Does not carry mainline traffic
5	Carries mainline traffic

Detour Length

Divides detour length by 10 and multiplies by 2.5

Score	Condition
0	0 miles
0-5	0-20 miles
5	> 20 miles

Scour Critical Rating

Variance below 8

Score	Condition
0	Rating > 8
0-5	Rating 8 - 3
5	Rating < 3

Vertical Clearance

Variance below 16’ x 2.5; (16 –Clearance) x 2.5

Score	Condition
0	>16’
0-5	16’-14’
5	<14’

Mobility Performance Area

- Mainline VMT
- Buffer Index (PTI-TTI)
- Detour Length
- Outside Shoulder Width

Mainline VMT

Exponential equation; score = 5-(5*e(ADT*-0.0000139))

Score	Condition
0	<16,000
0-5	16,000-400,000
5	>400,000

Buffer Index

Buffer Index x 10

Score	Condition
0	Buffer Index = 0.00
0-5	Buffer Index 0.00-0.50
5	Buffer Index > 0.50

Detour Length

Score	Condition
0	Detour < 10 miles
5	Detour > 10 miles

Outside Shoulder Width

Variance below 10’, if only 1 lane in each direction

Score	Condition
0	10’ or above or >1 lane in each direction
0-5	10’-5’ and 1 lane in each direction
5	5’ or less and 1 lane in each direction

Safety Performance Area

- Mainline Daily Traffic Volume
- Interrupted Flow
- Elevation
- Outside Shoulder Width
- Vertical Grade

Mainline Daily Traffic Volume

Exponential equation; score = 5-(5*e$^{(ADT*-0.000039)}$)

Score	Condition
0	<6,000
0-5	6,000-160,000
5	>160,000

Interrupted Flow

Score	Condition
0	Not interrupted flow
5	Interrupted Flow

Elevation

Variance above 4000' divided by 1000; (Elev-4000)/1000

Score	Condition
0	< 4000’
0-5	4000’- 9000’
5	> 9000’

Outside Shoulder Width

Variance below 10'

Score	Condition
0	10’ or above
0-5	10’ - 5’
5	5’ or less

Grade

Variance above 3% x 1.5

Score	Condition
0	< 3%
0-5	3% - 6.33%
5	>6.33%

Freight Performance Area

- Mainline Daily Truck Volume
- Detour Length
- Truck Buffer Index (TPTI-TTTI)
- Outside Shoulder Width

Mainline Daily Truck Volume

Exponential equation; score = 5-(5*e$^{(ADT*-0.00025)}$)

Score	Condition
0	<900
0-5	900-25,000
5	>25,000

Detour Length

Score	Condition
0	Detour < 10 miles
5	Detour > 10 miles

Truck Buffer Index

Truck Buffer Index x 10

Score	Condition
0	Buffer Index = 0.00
0-5	Buffer Index 0.00-0.50
5	Buffer Index > 0.50

Outside Shoulder Width

Variance below 10’, if only 1 lane in each direction

Score	Condition
0	10’ or above or >1 lane in each direction
0-5	10’-5’ and 1 lane in each direction
5	5’ or less and 1 lane in each direction

Solution Number	Mainline Traffic Vol (vpd) (2-way)	Solution Length (miles)	Bridge Detour Length (miles) (N19)	Elevation (ft)	Scour Critical Rating (0-9)	Carries Mainline Traffic (Y/N)	Bridge Vert. Clear (ft)	Mainline Truck Vol (vpd) (2-way)	Detour Length > 10 miles (Y/N)	Grade (%)	Interrupted Flow (Y/N)	Outside/ Right Shoulder Width (ft)	1-lane each direction	Segment	Bridge	Pavement	Mobility	Safety	Freight
CS90.1A	8,863	5.0	N/A	4,069	N/A		N/A	975	N	1.93	Y	9.74	N	90.1	N		Y	Y	Y
CS90.1B	8,863	5.0	N/A	4,069	N/A		N/A	975	N/A	1.93	Y	9.74	N	90.1	N		Y	Y	Y
CS90.2	11,679	6.7	N/A	4,500	N/A		N/A	1,285	N	0.7	Y	5.22	N	90.5	N		Y	Y	N
CS80.3	5,157	6.0	N/A	5,200	N/A		N/A	413	Y	5.1	N	4.81	Y	80.7	N		Y	Y	Y
CS80.4A	4,740	0.02	NULL	5,351	8	N	13.95	474	N	3.11	Y	3.16	Y	80.8	N		N	N	Y
CS80.4B	4,740	0.02	NULL	5,351	8	N	13.95	474	N	3.11	Y	3.16	Y	80.8	N		N	N	Y
CS80.5	4,289	2.2	N/A	4,650	N/A		N/A	600	Y	3.3	N	6.31	Y	80.9	N		Y	Y	Y

Solution Number	Bridge	Pavement	Mobility	Safety	Freight	Risk Score (0 to 10)				
						Bridge	Pavement	Mobility	Safety	Freight
CS90.1A	N	0	Y	Y	Y	0.00	0.00	1.53	2.71	0.72
CS90.1B	N	0	Y	Y	Y	0.00	0.00	1.53	2.71	0.72
CS90.2	N	0	Y	Y	N	0.00	0.00	2.21	4.84	0.00
CS80.3	N	0	Y	Y	Y	0.00	0.00	7.83	4.10	7.00
CS80.4A	N	0	N	N	Y	0.00	0.00	0.00	0.00	3.71
CS80.4B	N	0	N	N	Y	0.00	0.00	0.00	0.00	3.71
CS80.5	N	0	Y	Y	Y	0.00	0.00	6.20	2.22	6.26

Appendix H: Candidate Solution Cost Estimates

Candidate Solution #	Location #	Candidate Solution Name	Investment Category (Preservation [P], Modernization [M], Expansion [E])	Scope	BMP	EMP	Unit	Quantity	Factored Construction Unit Cost	Preliminary Engineering Cost	Design Cost	Right-of-Way Cost	Construction Cost	Total Cost	Notes
CS90.1A	L1	North Benson Pavement Preservation	P	Rehabilitate Pavement (AC)	290.0	295.0	mi	5.0	$1,060,000	$159,000	$530,000	$0	$5,300,000	$5,989,000	
									Solution Total	**$159,000**	**$530,000**	**$0**	**$5,300,000**	**$5,989,000**	
CS90.1B			M	Replace Pavement (AC) (with overexcavation)	290.0	295.0	mi	5.0	$5,540,000	$831,000	$2,770,000	$0	$27,700,000	$31,301,000	
									Solution Total	**$831,000**	**$2,770,000**	**$0**	**$27,700,000**	**$31,301,000**	
CS90.2	L9/L10	Sierra Vista Safety and Freight Improvements	M												
				Install speed feedback and signal ahead signs, MP 320 WB and MP 318 EB	318.0	320.0	ea	2.0	$75,700	$5,000	$15,000	$0	$151,400	$171,400	
				Construct raised median	317.0	323.7	mi	6.7	$ 1,378,000.00	$277,000	$923,000	$0	$9,232,600	$10,432,600	
									Solution Total	**$282,000**	**$938,000**	**$0**	**$9,384,000**	**$10,604,000**	
CS80.3	L13	SR-80 West of Bisbee Safety Improvements	M	Construct edge line rumble strips	333.0	339.0	mi	12.0	$21,000	$8,000	$25,000	$0	$252,000	$285,000	Both edges - one direction of travel; includes only rumble strip; no shoulder rehab or paving or striping
				Construct center line rumble strips	333.0	339.0	mi	6.0	$11,000	$2,000	$7,000	$0	$66,000	$75,000	
									Solution Total	**$10,000**	**$32,000**	**$0**	**$318,000**	**$360,000**	
CS80.4A	L18	Bisbee Freight Improvements	P	Reconstruct Lowell RR UP (#269) to increase vertical clearance	343.0	-	SF	14832.8	$ 480.00	$214,000	$712,000	$0	$7,119,740	$8,045,740	
									Solution Total	**$214,000**	**$712,000**	**$0**	**$7,119,740**	**$8,046,000**	
CS80.4B			M	Reprofile mainline to increase vertical clearance	343.0	-	mi	0.049	$3,730,000	$6,000	$18,000	$0	$183,674	$207,674	
									Solution Total	**$6,000**	**$18,000**	**$0**	**$184,000**	**$208,000**	

Candidate Solution #	Location #	Candidate Solution Name	Investment Category (Preservation [P], Modernization [M], Expansion [E])	Scope	BMP	EMP	Unit	Quantity	Factored Construction Unit Cost	Preliminary Engineering Cost	Design Cost	Right-of-Way Cost	Construction Cost	Total Cost	Notes
CS80.5	L22	Mule Gulch Area Freight Improvements	M	Construct passing lane WB	346.9	347.6	mi	0.7	$5,742,000	$121,000	$402,000	$0	$4,019,400	$4,542,400	
				Construct passing lane EB	345.6	346.1	mi	0.5	$5,742,000	$86,000	$287,000	$1	$2,871,000	$3,244,001	
				Construct acceleration lane at entrance to Paul Spur Douglas quarry	357.0		ea	1.0	$ 488,000.00	$15,000	$49,000	$0	$488,000	$552,000	
				Construct deceleration lane at entrance to Paul Spur Douglas quarry	357.0		ea	1.0	$ 488,000.00	$15,000	$49,000	$0	$488,000	$552,000	
									Solution Total	**$121,000**	**$402,000**	**$0**	**$4,019,000**	**$8,890,000**	

Appendix I: Performance Effectiveness Scores

Need Reduction

		Solution #	**90.1A**	**90.1B**	**90.2**	**80.3**	**80.4A**	**80.4B**	**80.5**
		Description	North Benson Pavement Preservation	North Benson Pavement Preservation	Sierra Vista Safety and Freight Improvements	SR-80 West of Bisbee Safety Improvements	Bisbee Freight Improvements	Bisbee Freight Improvements	Mule Gulch Area Freigth Improvements
	LEGEND:	Project Beg MP	290	290	317	333	343.01	343.01	345
		Project End MP	295	295	324	339	343.01	343.01	357
		Project Length (miles)	5	5	6.7	6	0	0	0.6
		Segment Beg MP	290	290	317	333	339	339	345
		Segment End MP	295	295	324	339	345	345	357
		Segment Length (miles)	5	5	7	6	6	6	12
		Segment #	90-1	90-1	90-5	80-7	80-8	80-8	80-9
		Current # of Lanes (both directions)	4	4	4	2	2	2	2
		Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	two-way
		Additional Lanes (one-way)							1
		Pro-Rated # of Lanes	4.00	4.00	4.00	2.00	2.00	2.00	2.10
		Description							
SAFETY	DIRECTIONAL SAFETY	Orig Segment Directional Safety Index (NB)	0.080	0.080	0.930	1.950	1.810	1.810	0.000
		Orig Segment Directional Fatal Crashes (NB)	0	0	1	1	1	1	0
		Orig Segment Directional Suspected Serious Crashes (NB)	1	1	11	1	0	0	0
		Original Fatal Crashes in project limits (NB)	0	0	1	1	0	0	0
		Original Suspected Serious Crashes in project limits (NB)	1	1	11	1	0	0	0
		CMF 1 (NB)(lowest CMF)	0.68	0.7			1	0.7	
		CMF 2 (NB)	1	1			1	1	
		CMF 3 (NB)	1	1	Total CMF Calculated in Separate Workbook	Total CMF Calculated in Separate Workbook	1	1	Total CMF Calculated in Separate Workbook
		CMF 4 (NB)	1	1			1	1	
		CMF 5 (NB)	1	1			1	1	
		Total CMF (NB)	0.680	0.700	1.000	1.000	1.000	0.700	1.000
		Fatal Crash reduction (NB)	0.000	0.000	0.811	0.286	0.000	0.000	0.000
		Suspected Serious Crash reduction (NB)	0.320	0.300	0.340	0.286	0.000	0.000	0.000
		Post-Project Segment Directional Fatal Crashes (NB)	0.000	0.000	0.189	0.714	1.000	1.000	0.000
		Post-Project Segment Directional Suspected Serious Crashes (NB)	0.680	0.700	10.660	0.714	0.000	0.000	0.000
		Post-Project Segment Directional Safety Index (NB)	0.050	0.050	0.780	1.390	1.810	1.810	0.000
		Post-Project Segment Directional Safety Index (NB)	0.050	0.050	0.780	1.390	1.810	1.810	0.000
		Orig Segment Directional Safety Index (SB)	1.450	1.450	2.320	1.920	1.830	1.830	0.000
		Orig Segment Directional Fatal Crashes (SB)	1	1	4	1	1	1	0
		Orig Segment Directional Suspected Serious Crashes (SB)	1	1	2	1	0	0	0
		Original Fatal Crashes in project limits (SB)	1	1	4	1	0	0	0
		Original Suspected Serious Crashes in project limits (SB)	0	0	2	1	0	0	0
		CMF 1 (SB)(lowest CMF)	0.68	0.7			0.95	0.7	
		CMF 2 (SB)	1	1			1	1	
		CMF 3 (SB)	1	1	Total CMF Calculated in Separate Workbook	Total CMF Calculated in Separate Workbook	1	1	Total CMF Calculated in Separate Workbook
		CMF 4 (SB)	1	1			1	1	
		CMF 5 (SB)	1	1			1	1	
		Total CMF (SB)	0.680	0.700	1.000	1.000	0.950	0.700	1.000
		Fatal Crash reduction (SB)	0.320	0.300	0.170	0.177	0.000	0.000	0.000
		Suspected Serious Crash reduction (SB)	0.000	0.000	1.870	0.177	0.000	0.000	0.000
		Post-Project Segment Directional Fatal Crashes (SB)	0.680	0.700	3.830	0.823	1.000	1.000	0.000
		Post-Project Segment Directional Suspected Serious Crashes (SB)	1.000	1.000	0.130	0.823	0.000	0.000	0.000
		Post-Project Segment Directional Safety Index (SB)	1.010	1.040	1.850	1.580	1.830	1.830	0.000
		Post-Project Segment Directional Safety Index (SB)	1.010	1.040	1.850	1.580	1.830	1.830	0.000
	SAFETY INDEX	Current Safety Index	0.765	0.765	1.625	1.935	1.820	1.820	0.000
		Post-Project Safety Index	0.530	0.545	1.315	1.485	1.820	1.820	0.000
	Needs	Original Segment Safety Need	**0.710**	**0.710**	**4.590**	**6.549**	**6.026**	**6.026**	**0.000**
		Post-Project Segment Safety Need	**0.514**	**0.537**	**4.407**	**4.565**	**6.026**	**6.026**	**0.000**

		Solution #	90.1A	90.1B	90.2	80.3	80.4A	80.4B	80.5
		Description	North Benson Pavement Preservation	North Benson Pavement Preservation	Sierra Vista Safety and Freight Improvements	SR-80 West of Bisbee Safety Improvements	Bisbee Freight Improvements	Bisbee Freight Improvements	Mule Gulch Area Freigth Improvements
	LEGEND:	Project Beg MP	290	290	317	333	343.01	343.01	345
		Project End MP	295	295	324	339	343.01	343.01	357
		Project Length (miles)	5	5	6.7	6	0	0	0.6
		Segment Beg MP	290	290	317	333	339	339	345
		Segment End MP	295	295	324	339	345	345	357
		Segment Length (miles)	5	5	7	6	6	6	12
		Segment #	90-1	90-1	90-5	80-7	80-8	80-8	80-9
		Current # of Lanes (both directions)	4	4	4	2	2	2	2
		Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	two-way
		Additional Lanes (one-way)	0	0	0	0	0	0	1
		Pro-Rated # of Lanes	4.00	4.00	4.00	2.00	2.00	2.00	2.10
		Description							
MOBILITY	MOBILITY INDEX	Original Segment Mobility Index	0.320	0.320	0.400	0.410	0.210	0.210	0.090
		Post-Project # of Lanes (both directions)	4.00	4.00	4.00	2.00	2.00	2.00	2.10
		Post-Project Segment Mobility Index	0.32	0.32	0.40	0.41	0.21	0.21	0.09
		Post-Project Segment Mobility Index	0.320	0.320	0.400	0.410	0.210	0.210	0.090
	FUT V/C	Original Segment Future V/C	0.360	0.360	0.440	0.260	0.130	0.130	0.040
		Post-Project Segment Future V/C	0.360	0.360	0.440	0.260	0.130	0.130	0.040
		Post-Project Segment Future V/C	0.360	0.360	0.440	0.260	0.130	0.130	0.040
	PEAK HOUR V/C	Original Segment Peak Hour V/C (NB)	0.210	0.210	0.310	0.420	0.250	0.250	0.150
		Original Segment Peak Hour V/C (SB)	0.200	0.200	0.300	0.430	0.220	0.220	0.170
		Adjusted total # of Lanes for use in directional peak hr	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Post-Project Segement Peak Hr V/C (NB)	0.210	0.210	0.310	0.420	0.25	0.25	0.15
		Post-Project Segement Peak Hr V/C (SB)	0.200	0.200	0.300	0.430	0.22	0.22	0.16
		Post-Project Segment Peak Hr V/C (NB)	0.210	0.210	0.310	0.420	0.250	0.250	0.150
		Post-Project Segment Peak Hr V/C (SB)	0.200	0.200	0.300	0.430	0.220	0.220	0.160
	LOTTR	Safety Reduction Factor	0.693	0.712	0.809	0.767	1.000	1.000	1.000
		Safety Reduction	0.307	0.288	0.191	0.233	0.000	0.000	0.000
		Mobility Reduction Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000
		Mobility Reduction	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		Mobility effect on LOTTR	0.20	0.20	0.20	0.20	0.20	0.20	0.20
		Safety effect on LOTTR	0.30	0.30	0.30	0.30	0.30	0.30	0.30
		Original Directional Segment LOTTR (NB)	2.000	2.000	1.220	1.070	1.170	1.170	1.110
		Original Directional Segment LOTTR (SB)	1.690	1.690	1.380	1.160	1.130	1.130	1.190
		Reduction Factor for Segment LOTTR	0.092	0.086	0.057	0.070	0.000	0.000	0.000
		Post-Project Directional Segment LOTTR (NB)	1.816	1.827	1.150	1.035	1.170	1.170	1.110
		Post-Project Directional Segment LOTTR (SB)	1.534	1.544	1.301	1.079	1.130	1.130	1.190
	CLOSURE EXTENT	Orig Segment Directional Closure Extent (NB)	0.000	0.000	0.140	0.500	0.200	0.200	0.400
		Orig Segment Directional Closure Extent (SB)	0.000	0.000	0.030	0.100	0.540	0.540	0.900
		Segment Closures with fatalities/injuries	0	0	0	1	2	2	4
		Total Segment Closures	0	0	5	10	13	13	13
		% Closures with Fatality/Injury	#DIV/0!	#DIV/0!	0.00	0.10	0.15	0.15	0.31
		Closure Reduction	#DIV/0!	#DIV/0!	0.000	0.023	0.000	0.000	0.000
		Closure Reduction Factor	#DIV/0!	#DIV/0!	1.000	0.977	1.000	1.000	1.000
		Post-Project Segment Directional Closure Extent (NB)	#DIV/0!	#DIV/0!	0.140	0.488	0.200	0.200	0.400
		Post-Project Segment Directional Closure Extent (SB)	#DIV/0!	#DIV/0!	0.030	0.098	0.540	0.540	0.900
	BICYCLE ACCOM	Orig Segment Bicycle Accomodation %	88.0%	88.0%	26.0%	0.0%	43.0%	43.0%	88.0%
		Orig Segment Outside Shoulder width	9.7	9.7	5.2	4.8	3.2	3.2	6.3
		Post-Project Segment Outside Shoulder width	9.7		5.2	8.0	3.2	3.2	6.3
		Post-Project Segment Bicycle Accomodation (%)	88.0%		26.0%	0.0%	43.0%	43.0%	88.0%
		Post-Project Segment Bicycle Accomodation (%)	88.0%	0.0%	26.0%	0.0%	43.0%	43.0%	88.0%
	Needs	Original Segment Mobility Need	**1.105**	**1.105**	**1.176**	**1.394**	**1.002**	**1.002**	**0.643**
		Post-Project Segment Mobility Need	**0.957**	**0.966**	**1.103**	**1.384**	**1.002**	**1.002**	**0.642**

		Solution #	90.1A	90.1B	90.2	80.3	80.4A	80.4B	80.5
		Description	North Benson Pavement Preservation	North Benson Pavement Preservation	Sierra Vista Safety and Freight Improvements	SR-80 West of Bisbee Safety Improvements	Bisbee Freight Improvements	Bisbee Freight Improvements	Mule Gulch Area Freigth Improvements
	LEGEND:	Project Beg MP	290	290	317	333	343.01	343.01	345
		Project End MP	295	295	324	339	343.01	343.01	357
		Project Length (miles)	5	5	7	6	0	0	1.2
		Segment Beg MP	290	290	317	333	339	339	345
		Segment End MP	295	295	324	339	345	345	357
		Segment Length (miles)	5	5	7	6	6	6	12
		Segment #	90-1	90-1	90-5	80-7	80-8	80-8	80-9
		Current # of Lanes (both directions)	4	4	4	2	2	2	2
		Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	two-way
		Additional Lanes (one-way)	0	0	0	0	0	0	1
		Pro-Rated # of Lanes	4.00	4.00	4.00	2.00	2.00	2.00	2.20
		Description							
Freight	**TTTR**	Mobility effect on TTTR	0.10	0.10	0.10	0.10	0.10	0.10	0.10
		Safety effect on TTTR	0.15	0.15	0.15	0.15	0.15	0.15	0.15
		Original Directional Segment TTTR (NB)	2.750	2.750	1.860	1.250	1.480	1.480	1.370
		Original Directional Segment TTTR (SB)	7.370	7.370	2.230	1.650	1.420	1.420	2.480
		Reduction Factor for Segment TTTR (both directions)	0.046	0.043	0.029	0.035	0.000	0.000	0.000
		Post-Project Directional Segment TTTR (NB)	2.623	2.631	1.807	1.206	1.480	1.480	1.370
		Post-Project Directional Segment TTTR (SB)	7.030	7.052	2.166	1.592	1.420	1.420	2.480
	FREIGHT INDEX	Original Segment MAX TTTR (NB)	2.750	2.750	1.860	1.250	1.480	1.480	1.370
		Original Segment MAX TTTR (SB)	7.370	7.370	2.230	1.650	1.420	1.420	2.480
		Original Segment Freight Index	5.0600	5.0600	2.0450	1.4500	1.4500	1.4500	1.9250
		Post-Project Segment MAX TTTR (NB)	2.623	2.631	1.807	1.206	1.480	1.480	1.370
		Post-Project Segment MAX TTTR (SB)	7.030	7.052	2.166	1.592	1.420	1.420	2.480
		Post-Project Segment Freight Index	4.827	4.842	1.986	1.399	1.450	1.450	1.925
	CLOSURE DURATION	Orig Segment Directional Closure Duration (dir 1)	0.000	0.000	12.000	156.070	36.770	36.770	95.000
		Orig Segment Directional Closure Duration (dir 2)	0.000	0.000	6.830	15.570	109.340	109.340	102.200
		Segment Closures with fatalities	0	0	0	1	2	2	4
		Total Segment Closures	0	0	5	10	13	13	13
		% Closures with Fatality	#DIV/0!	#DIV/0!	0.00	0.10	0.15	0.15	0.31
		Closure Reduction	#DIV/0!	#DIV/0!	0.000	0.023	0.000	0.000	0.000
		Closure Reduction Factor	#DIV/0!	#DIV/0!	1.000	0.977	1.000	1.000	1.000
		Post-Project Segment Directional Closure Duration (NB)	#DIV/0!	#DIV/0!	12.000	152.440	36.770	36.770	95.000
		Post-Project Segment Directional Closure Duration (SB)	#DIV/0!	#DIV/0!	6.830	15.208	109.340	109.340	102.200
	VERT CLR	Original Segment Vertical Clearance	No Up	No Up	No Up	No Up	13.95	13.95	No Up
		Original vertical clearance for specific bridge	No Up	No Up	No Up	No Up	13.95	13.95	No Up
		Post-Project vertical clearance for specific bridge	No Change	No Change	No Change	No Change	No Change	No Change	No Change
		Post-Project Segment Vertical Clearance	No Change	No Change	No Change	No Change	16.50	14.20	No Change
		Post-Project Segment Vertical Clearance	No Change	No Change	No Change	No Change	16.50	14.20	No Change
	Needs	Original Segment Freight Need	**16.843**	**16.843**	**3.306**	**3.570**	**1.026**	**1.026**	**7.870**
		Post-Project Segment Freight Need	**15.796**	**15.863**	**3.026**	**3.057**	**0.548**	**1.019**	**7.870**

		Solution #	90.1A	90.1B	90.2	80.3	80.4A	80.4B	80.5
		Description	North Benson Pavement Preservation	North Benson Pavement Preservation	Sierra Vista Safety and Freight Improvements	SR-80 West of Bisbee Safety Improvements	Bisbee Freight Improvements	Bisbee Freight Improvements	Mule Gulch Area Freigth Improvements
	LEGEND:	Project Beg MP	290	290	317	333	343.01	343.01	345
		Project End MP	295	295	324	339	343.01	343.01	357
		Project Length (miles)	5	5	7	6	0	0	12
		Segment Beg MP	290	290	317	333	339	339	345
		Segment End MP	295	295	324	339	345	345	357
		Segment Length (miles)	5	5	7	6	6	6	12
		Segment #	90-1	90-1	90-5	80-7	80-8	80-8	80-9
		Current # of Lanes (both directions)	4	4	4	2	2	2	2
		Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	two-way
		Additional Lanes (one-way)	0	0	0	0	0	0	1
		Pro-Rated # of Lanes	4.00	4.00	4.00	2.00	2.00	2.00	4.00
		Description							
BRIDGE	**BRIDGE INDEX**	Original Segment Bridge Index Original lowest rating for specific bridge Post-Project lowest rating for specific bridge							
		Post-Project lowest rating for specific bridge	0	0	0	0	0	0	0
		Post-Project Segment Bridge Index							
		Post-Project Segment Bridge Index	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SUFF RATING	Original Segment Sufficiency Rating Original Sufficiency Rating for specific bridge Post-Project Sufficiency Rating for specific bridge							
		Post-Project Sufficiency Rating for specific bridge	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post-Project Segment Sufficiency Rating							
		Post-Project Segment Sufficiency Rating	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	BR RTNG	Original Segment Bridge Rating Post-Project Segment Bridge Rating							
		Post-Project Segment Bridge Rating	0	0	0	0	0	0	0
	Needs	Original Segment Bridge Need Post-Project Segment Bridge Need							

			Solution #	90.1A	90.1B	90.2	80.3	80.4A	80.4B	80.5
			Description	North Benson Pavement Preservation	North Benson Pavement Preservation	Sierra Vista Safety and Freight Improvements	SR-80 West of Bisbee Safety Improvements	Bisbee Freight Improvements	Bisbee Freight Improvements	Mule Gulch Area Freigth Improvements
	LEGEND:		Project Beg MP	290	290	317	333	343.01	343.01	345
		- user entered value	Project End MP	295	295	324	339	343.01	343.01	357
		- calculated value for reference only	Project Length (miles)	5	5	7	6	0	0	12
		- calculated value for entry/use in other spreadsheet	Segment Beg MP	290	290	317	333	339	339	345
		- for input into Performance Effectiveness Score spreadsheet	Segment End MP	295	295	324	339	345	345	357
		- assumed values (do not modify)	Segment Length (miles)	5	5	7	6	6	6	12
			Segment #	90-1	90-1	90-5	80-7	80-8	80-8	80-9
			Current # of Lanes (both directions)	4	4	4	2	2	2	2
			Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	two-way
			Additional Lanes (one-way)	0	0	0	0	0	0	1
			Pro-Rated # of Lanes	4.00	4.00	4.00	2.00	2.00	2.00	4.00
		Notes and Directions	**Description**							
PAVEMENT	**PAVEMENT INDEX**	Input current value from performance system	Original Segment Pavement Index							
		Input current value from performance system	Original Segment IRI in project limits							
		Input current value from performance system	Original Segment Cracking in project limits							
		Input current value from performance system	Original Segment Rutting in project limits							
		Input post-project value (For rehab, increase to 45; for replace increase to 30)	Post-Project IRI in project limits							
		Enter in Pavement Index spreadsheet to calculate new Pavement Index	Post-Project IRI in project limits	0	0	0	0	0	0	0
		Input post-project value (Lower to 0 for rehab or replace)	Post-Project Cracking in project limits							
		Enter in Pavement Index spreadsheet to calculate new Pavement Index	Post-Project Cracking in project limits	0	0	0	0	0	0	0
		Input post-project value (Lower to 0 for rehab or replace)	Post-Project Rutting in project limits							
		Enter in Pavement Index spreadsheet to calculate new Pavement Index	Post-Project Rutting in project limits	0	0	0	0	0	0	0
		Input updated segment value from updated Pavement Index spreadsheet	Post-Project Segment Pavement Index							
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Pavement Index	0	0	0	0	0	0	0
	DIRECTION PSR	Input current value from performance system (direction 1) Input current value from performance system (direction 2)	Original Segment Directional PSR (NB) Original Segment Directional PSR (SB)							
		Value from above	Original Segment IRI in project limits	0	0	0	0	0	0	0
		Value from above	Post-Project directional IRI in project limits	0	0	0	0	0	0	0
		Input updated segment value from updated Pavement Index spreadsheet (direction 1) Input updated segment value from updated Pavement Index spreadsheet (direction 2)	Post-Project Segment Directional PSR (NB) Post-Project Segment Directional PSR (SB)							
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Directional PSR (NB) Post-Project Segment Directional PSR (SB)	0 0	0 0	0 0	0 0	0 0	0 0	0 0
	% FAIL	Input current value from performance system Input value from updated Pavement Index spreadsheet	Original Segment % Failure Post-Project Segment % Failure							
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment % Failure	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Needs	User entered value from Pavement Needs spreadsheet and for use in Performance Effectiveness spreadsheet User entered value from Pavement Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Pavement Need Post-Project Segment Pavement Need							

CMF Application

SR 80_90|US XX Corridor Profile Study
CMF Application

=user input

CS90.2 (MP317-324)

BMP	EMP	CMF1	CMF2	CMF3	CMF4	Dir	Effective CMF	Crashes in Segment Limits Fatal	Crashes in Segment Limits Incap	Crashes in Solution Limits Fatal	Crashes in Solution Limits Incap	Post-Solution Crashes Fatal	Post-Solution Crashes Incap	Total Crash Reduction Fatal	Total Crash Reduction Incap	
318	318	0.94	0.85	1	1	EB	0.870			1	0	0.870	0.000	0.131	0.000	Centerline speed feedback sign
320	320	0.94	0.85	1	1	WB	0.870			0	0	0.000	0.000	0.000	0.000	Centerline Rumble Strip. High-Visibilty Striping
317	324	0.83	1.00	1	1	EB	0.830			4	2	3.320	1.660	0.680	0.340	Centerline raised median
317	324	0.83	1.00	1	1	WB	0.830			1	11	0.830	9.130	0.170	1.870	Centerline Rumble Strip. High-Visibilty Striping
						EB		4	2			**3.190**	**1.660**	0.811	0.340	
						WB		1	11			**0.830**	**9.130**	0.170	1.870	

CS80.3 (MP 333-339)

BMP	EMP	CMF1	CMF2	CMF3	CMF4	Dir	Effective CMF	Crashes in Segment Limits Fatal	Crashes in Segment Limits Incap	Crashes in Solution Limits Fatal	Crashes in Solution Limits Incap	Post-Solution Crashes Fatal	Post-Solution Crashes Incap	Total Crash Reduction Fatal	Total Crash Reduction Incap	
333	339	0.85	0.68	1.00	1.00	WB	0.714			1	1	0.714	0.714	0.286	0.286	Climbing l shoulder rumble strips, centerline rumble strips
333	339	0.89	0.85	1.00	1.00	EB	0.823			1	1	0.823	0.823	0.177	0.177	
							0.500					0.000	0.000	0.000	0.000	
							0.500					0.000	0.000	0.000	0.000	
							0.500					0.000	0.000	0.000	0.000	
							0.500					0.000	0.000	0.000	0.000	
						WB		1	1			**0.714**	**0.714**	0.286	0.286	
						EB		1	1			**0.823**	**0.823**	0.177	0.177	

CS80.5 (MP 345-357)

BMP	EMP	CMF1	CMF2	CMF3	CMF4	Dir	Effective CMF	Crashes in Segment Limits Fatal	Crashes in Segment Limits Incap	Crashes in Solution Limits Fatal	Crashes in Solution Limits Incap	Post-Solution Crashes Fatal	Post-Solution Crashes Incap	Total Crash Reduction Fatal	Total Crash Reduction Incap	
346.9	347.6	0.63	1.00	1.00	1	WB	0.63			0	0	0.000	0.000	0.000	0.000	Climbing l passing lane
345.6	346.1	0.63	1.00	1.00	1	EB	0.63			0	0	0.000	0.000	0.000	0.000	passing lane
356.5	356.5	0.81	0.85	1.00	1	WB	0.74925			0	0	0.000	0.000	0.000	0.000	Construct turn lane, acceleration lane
356.5	356.5	0.81	0.85	1.00	1	EB	0.74925			0	0	0.000	0.000	0.000	0.000	
						WB		0	0			**0.000**	**0.000**	0.000	0.000	
						EB		0	0			**0.000**	**0.000**	0.000	0.000	

Performance Area Scoring

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost ($ millions)	Pavement					Bridge				
				Existing Segment Need	Post-Solution Segment Need	Raw Score	Risk Factor	Factored Score	Existing Segment Need	Post-Solution Segment Need	Raw Score	Risk Factor	Factored Score
CS90.2	Sierra Vista Safety and Freight Improvements	317-324	$ 10.60	3.519	3.519	0.000	3.519	0.000	0.000	0.000	0.000	0.000	0.000
CS80.3	SR-80 West of Bisbee Safety Improvements	333-339	$ 3.540	0.000	0.000	0.000	0.000	0.000	0.966	0.966	0.000	0.966	0.000
CS80.4A	Bisbee Freight Improvements (Lowell RR UP)	343.01	$ 8.05	3.967	3.967	0.000	3.967	0.000	0.844	0.844	0.000	0.844	0.000
CS80.4B	Bisbee Freight Improvements (Lowell RR UP)	343.01	$ 0.208	3.967	3.967	0.000	3.967	0.000	0.844	0.844	0.000	0.844	0.000
CS80.5	Mule Gulch Area Freight Improvements	345-357	$ 8.89	1.000	1.000	0.000	1.000	0.000	0.605	0.605	0.000	0.605	0.000

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost ($ millions)	Safety					Mobility					Freight					Total Risk Factored Performance Area Benefit
				Existing Segment Need	Post-Solution Segment	Raw Score	Risk Factor	Factored Score	Existing Segment Need	Post-Solution Segment	Raw Score	Risk Factor	Factored Score	Existing Segme	Post-Solution Segment	Raw Score	Risk Factor	Factored Score	
CS90.2	Sierra Vista Safety and Freight Improvements	317-324	$ 10.60	4.590	3.279	1.311	4.84	6.345	1.176	1.103	0.073	2.21	0.161	3.306	3.026	0.280	0.00	0.000	6.506
CS80.3	SR-80 West of Bisbee Safety Improvements	333-339	$ 3.540	6.549	4.565	1.984	4.10	8.137	1.394	1.384	0.010	7.83	0.076	3.570	3.057	0.513	7.00	3.589	11.802
CS80.4A	Bisbee Freight Improvements (Lowell RR UP)	343.01	$ 8.05	6.026	6.026	0.000	0.00	0.000	1.002	1.002	0.000	0.00	0.000	1.026	0.548	0.478	3.71	1.773	1.773
CS80.4B	Bisbee Freight Improvements (Lowell RR UP)	343.01	$ 0.208	6.026	6.026	0.000	0.00	0.000	1.002	1.002	0.000	0.00	0.000	1.026	1.019	0.007	3.71	0.028	0.028
CS80.5	Mule Gulch Area Freight Improvements	345-357	$ 8.89	0.000	0.000	0.000	2.22	0.000	0.643	0.642	0.001	6.20	0.006	7.870	7.870	0.000	6.26	0.000	0.006

Emphasis Area Scoring

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost ($ millions)	Pavement Emphasis Area						Bridge Emphasis Area					
				Existing Corridor Need	Post-Solution Corridor Need	Raw Score	Risk Factor	Emphasis Factor	Factored Score	Existing Corridor Need	Post-Solution Corridor Need	Raw Score	Risk Factor	Emphasis Factor	Factored Score
CS90.2	Sierra Vista Safety and Freight Improvements	317-324	10.604	1.060		1.060	3.52		0.000	0.966		0.966	0.00		0.000
CS80.3	SR-80 West of Bisbee Safety Improvements	333-339	3.54	1.060		1.060	0.00		0.000	0.966		0.966	0.97		0.000
CS80.4A	Bisbee Freight Improvements (Lowell RR UP)	343.01	8.046	1.060		1.060	3.97		0.000	0.966		0.966	0.84		0.000
CS80.4B	Bisbee Freight Improvements (Lowell RR UP)	343.01	0.208	1.060		1.060	3.97		0.000	0.966		0.966	0.84		0.000
CS80.5	Mule Gulch Area Freight Improvements	345-357	8.89	1.060		1.060	1.00		0.000	0.966		0.966	0.61		0.000

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost ($ millions)	Safety Emphasis Area						Mobility Emphasis Area						Freight Emphasis Area					
				Existing Corridor Need	Post-Solution Corridor Need	Raw Score	Risk Factor	Emphasis Factor	Factored Score	Existing Corridor Need	Post-Solution Corridor Need	Raw Score	Risk Factor	Emphasis Factor	Factored Score	Existing Corridor Need	Post-Solution Corridor Need	Raw Score	Risk Factor	Emphasis Factor	Factored Score
CS90.2	Sierra Vista Safety and Freight Improvements	317-324	10.604	0.330	0.312	0.018	4.84	1.50	0.131	0.235		0.235	2.21		0.000	5.065	5.041	0.024	0.00	1.50	0.000
CS80.3	SR-80 West of Bisbee Safety Improvements	333-339	3.54	0.330	0.311	0.019	4.10	1.50	0.118	0.235		0.235	7.83		0.000	5.065	5.050	0.015	7.00	1.50	0.162
CS80.4A	Bisbee Freight Improvements (Lowell RR UP)	343.01	8.046	0.330	0.330	0.000	0.00	1.50	0.000	0.235		0.235	0.00		0.000	5.065	5.064	0.001	3.71	1.50	0.004
CS80.4B	Bisbee Freight Improvements (Lowell RR UP)	343.01	0.208	0.330	0.330	0.000	0.00	1.50	0.000	0.235		0.235	0.00		0.000	5.065	5.064	0.001	3.71	1.50	0.004
CS80.5	Mule Gulch Area Freight Improvements	345-357	8.89	0.330	0.330	0.000	2.22	1.50	0.000	0.235		0.235	6.20		0.000	5.065	5.065	0.000	6.26	1.50	0.000

Performance Effectiveness Scoring

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost ($ millions)	Total Factored Benefit	VMT Factor	NPV Factor	Performance Effectiveness Score		miles	2020 ADT	1-way or 2-way	VMT
CS90.2	Sierra Vista Safety and Freight Improvements	317-324	10.604	6.637	3.31	15.3	31.7		6.70	11679	2	78246.40554
CS80.3	SR-80 West of Bisbee Safety Improvements	333-339	3.54	12.082	1.75	15.3	91.3		6.00	5157	2	30942
CS80.4A	Bisbee Freight Improvements (Lowell RR UP)	343.01	8.046	1.777	1.63	20.2	7.3		6.00	4740	2	28441.01361
CS80.4B	Bisbee Freight Improvements (Lowell RR UP)	343.01	0.208	0.032	1.63	20.2	5.1		6.00	4740	2	28441.01361
CS80.5	Mule Gulch Area Freight Improvements	345-357	8.89	0.007	2.56	20.2	0.0		12.00	4289	2	51472.74028

Appendix J: Solution Prioritization Scores

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost ($ millions)	Pavement		Bridge		Safety		Mobility		Freight		Total Factored Score	Risk Factors					Weighted Risk Factor	Segment Need	Prioritization Score
				Score	%	Score	%	Score	%	Score	%	Score	%		Pavement	Bridge	Safety	Mobility	Freight			
CS90.2	Sierra Vista Safety and Freight Improvements	317-324	10.604	0.000	0.0%	0.000	0.0%	6.476	97.6%	0.161	2.4%	0.000	0.0%	6.637	1.14	1.51	1.78	1.36	1.36	1.770	2.23	**125.3**
CS80.3	SR-80 West of Bisbee Safety Improvements	333-339	3.54	0.000	0.0%	0.000	0.0%	8.255	68.3%	0.076	0.6%	3.751	31.0%	12.082	1.14	1.51	1.78	1.36	1.36	1.647	1.69	**254.0**
CS80.4A	Bisbee Freight Improvements (Lowell RR UP)	343.01	8.046	0.000	0.0%	0.000	0.0%	0.000	0.0%	0.000	0.0%	1.777	100.0%	1.777	1.14	1.51	1.78	1.36	1.36	1.360	1.92	**19.0**
CS80.4B	Bisbee Freight Improvements (Lowell RR UP)	343.01	0.208	0.000	0.0%	0.000	0.0%	0.000	0.0%	0.000	0.0%	0.032	100.0%	0.032	1.14	1.51	1.78	1.36	1.36	1.360	1.92	**13.3**
CS80.5	Mule Gulch Area Freight Improvements	345-357	8.89	0.000	0.0%	0.000	0.0%	0.000	5.5%	0.006	94.5%	0.000	0.0%	0.007	1.14	1.51	1.78	1.36	1.36	1.383	1.08	**0.1**

Appendix K: Preliminary Scoping Reports for Prioritized Solutions

ADOT

PRELIMINARY SCOPING REPORT

GENERAL PROJECT INFORMATION	
Date: 01-24-18	**ADOT Project Manager:**
Project Name: Huachuca City Area Safety Improvements – Options A and B (CS90.1)	
City/Town: Huachuca City	**County:** Cochise
COG/MPO: SEAGO and SVMPO	**ADOT District:** Southcentral
Primary Route/Street: SR 90	
Beginning Limit: MP 313	
End Limit: MP 317	
Project Length: 4 miles	
Right-of-Way Ownership(s) (where proposed project construction would occur): *(Check all that apply)* ☐ City/Town; ☐ County; ☒ ADOT; ☐ Private; ☐ Federal; ☐ Tribal; ☐ Other:	
Adjacent Land Ownership(s): *(Check all that apply)* ☐ City/Town; ☐ County; ☐ ADOT; ☒ Private; ☒ Federal; ☐ Tribal; ☐ Other: *http://gis.azland.gov/webapps/parcel/*	

LOCAL PUBLIC AGENCY (LPA) or TRIBAL GOVERNMENT INFORMATION *(If applicable)*		
LPA/Tribal Name:		
LPA/Tribal Contact:		
Email Address:	**Phone Number:**	
Administration: ☐ ADOT Administered	☐ Self-Administered	☐ Certification Acceptance

PROJECT NEED
Safety Need: Crash hot spots at MP 313-315 and MP 316-317

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☐	Modernization ☒	Expansion ☐
Address identified Safety Need by installing a raised median barrier (MP 313-314) and by either installing centerline rumble strips or widening the roadway and installing a raised median (MP 314-317)			

ADOT

PRELIMINARY SCOPING REPORT

PROJECT RISKS	
Check any risks identified that may impact the project's scope, schedule, or budget:	
☒ Access / Traffic Control / Detour Issues	☐ Right-of-Way
☐ Constructability / Construction Window Issues	☐ Environmental
☐ Stakeholder Issues	☐ Utilities
☐ Structures & Geotech	☐ Other:
Risk Description: Will need to coordinate with adjacent properties regarding access management	

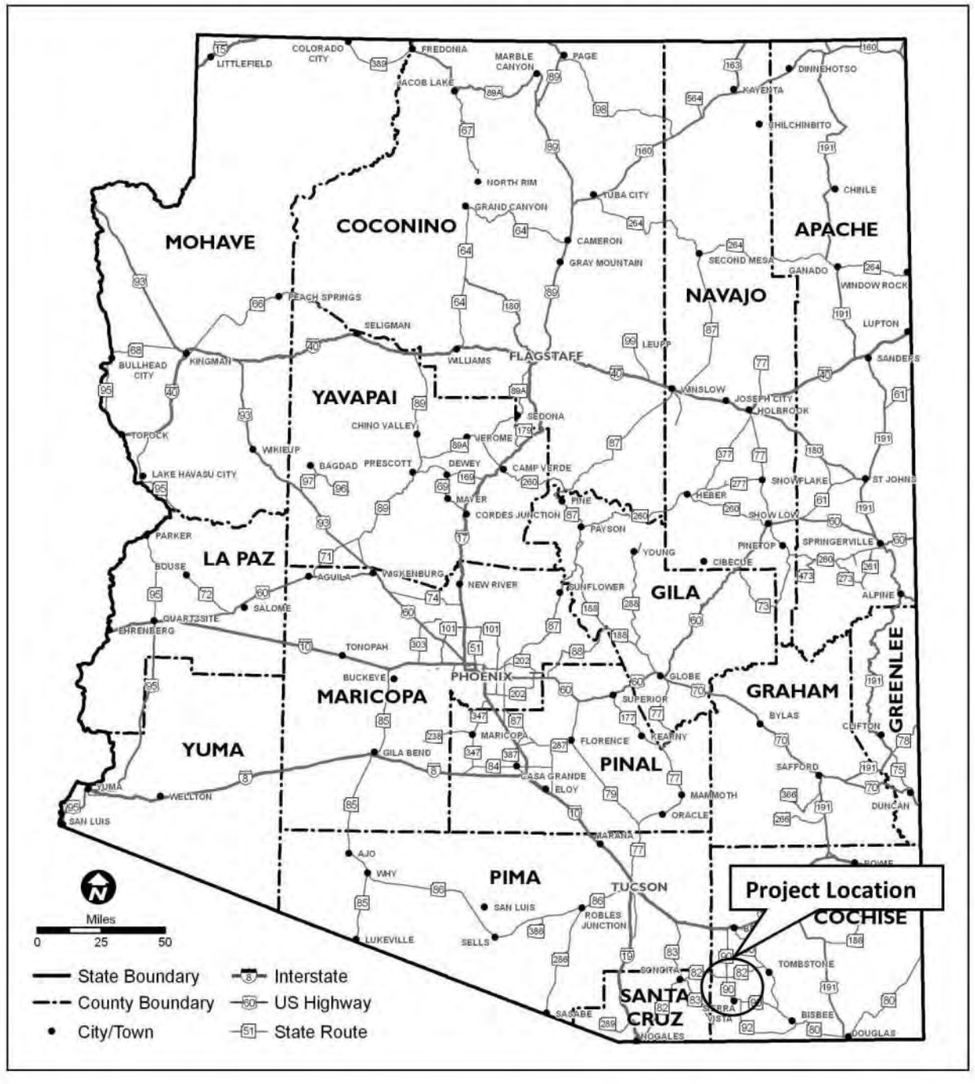
POTENTIAL FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STBG	☐ TAP	☐ HSIP	☐ State
	☐ Local	☐ Private	☐ Tribal	☐ Other:

COST ESTIMATE				
Preliminary Engineering	Design	Right-of-Way	Construction	Total
$ 25,000 (Option A) $215,000 (Option B)	$ 81,000 (Option A) $717,000 (Option B)	$0 (Option A) $0 (Option B)	$ 810,000 (Option A) $7,173,000 (Option B)	$ 916,000 (Option A) $8,105,000 (Option B)

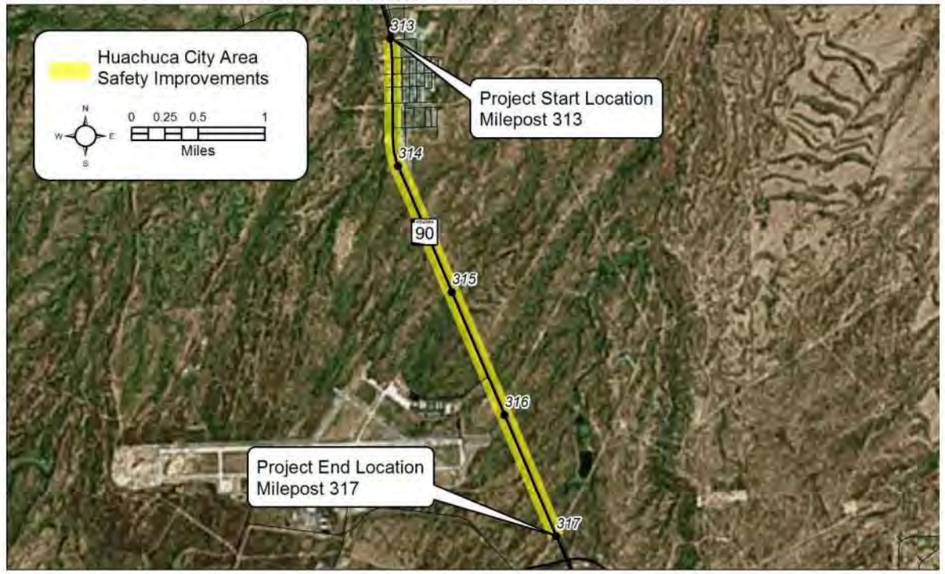
RECOMMENDED PROJECT DELIVERY
Delivery: ☐ Design-Bid-Build ☐ Design-Build ☐ Other:
Design Program Year: FY
Construction Program Year: FY

ATTACHMENTS
1) **State Location Map** 2) **Project Vicinity Map** 3) **Project Scope of Work**

ATTACHMENT 1 – STATE LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP



ATTACHMENT 3 – SCOPE OF WORK

SCOPE OF WORK
Option A: • Install raised median, MP 313-314 • Install centerline rumble strips, MP 314-317 Option B: • Install raised median, MP 313-314 • Widen roadway to install raised median, MP 314-317

SCOPE ITEMS CONSIDERED, BUT NOT INCLUDED

Pursuant to 23 USC 409: Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or rail-way-highway crossings, pursuant to sections 130, 144, and 148 [152] of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

ADOT

PRELIMINARY SCOPING REPORT

GENERAL PROJECT INFORMATION	
Date: 01-24-18	**ADOT Project Manager:**
Project Name: Sierra Vista Area Safety and Freight Improvements (CS90.2)	
City/Town: Sierra Vista	**County: Cochise**
COG/MPO: SVMPO	**ADOT District: Southcentral**
Primary Route/Street: SR 90	
Beginning Limit: MP 317	
End Limit: MP 324	
Project Length: 7 miles	
Right-of-Way Ownership(s) (where proposed project construction would occur): *(Check all that apply)* ☐ City/Town; ☐ County; ☒ ADOT; ☐ Private; ☐ Federal; ☐ Tribal; ☐ Other:	
Adjacent Land Ownership(s): *(Check all that apply)* ☐ City/Town; ☐ County; ☐ ADOT; ☒ Private; ☒ Federal; ☐ Tribal; ☒ Other: State Trust *http://gis.azland.gov/webapps/parcel/*	

LOCAL PUBLIC AGENCY (LPA) or TRIBAL GOVERNMENT INFORMATION *(If applicable)*			
LPA/Tribal Name:			
LPA/Tribal Contact:			
Email Address:	**Phone Number:**		
Administration: ☐ ADOT Administered	☐ Self-Administered	☐ Certification Acceptance	

PROJECT NEED
Safety Need: Crash hot spot at MP 319-323 Freight Need: High level of need based on the overall Freight Index and SB/EB Directional TPTI ratings

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☐	Modernization ☒	Expansion ☐
Address identified Safety and Freight Needs by implementing signal coordination for 9 signals, installing speed feedback and signal ahead signs, installing centerline rumble strips, and constructing a raised median			

ADOT

PRELIMINARY SCOPING REPORT

PROJECT RISKS	
Check any risks identified that may impact the project's scope, schedule, or budget:	
☒ Access / Traffic Control / Detour Issues	☐ Right-of-Way
☐ Constructability / Construction Window Issues	☐ Environmental
☐ Stakeholder Issues	☐ Utilities
☐ Structures & Geotech	☐ Other:
Risk Description: Will need to coordinate with adjacent properties regarding access management	

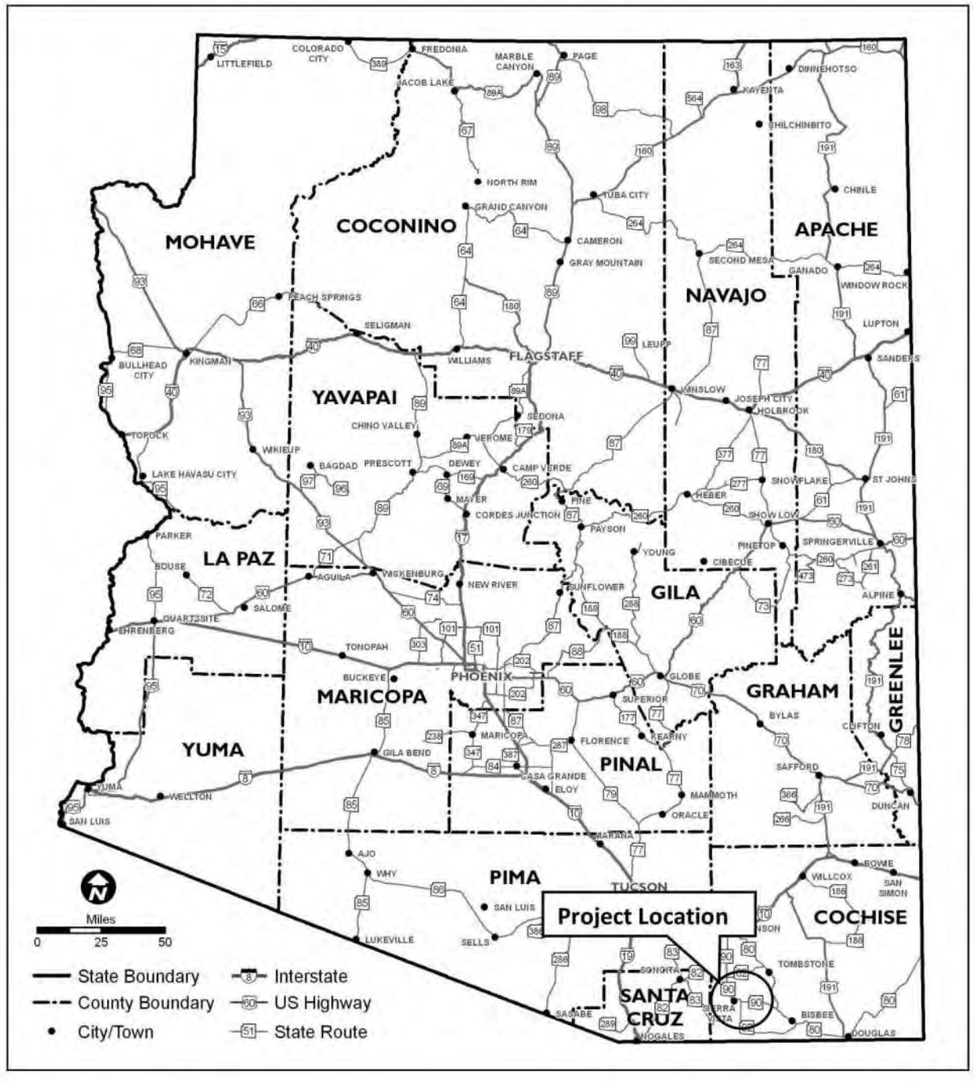
POTENTIAL FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STBG	☐ TAP	☐ HSIP	☐ State
	☐ Local	☐ Private	☐ Tribal	☐ Other:

COST ESTIMATE				
Preliminary Engineering	Design	Right-of-Way	Construction	Total
$78,000	$260,000	$0	$2,581,000	$2,919,000

RECOMMENDED PROJECT DELIVERY
Delivery: ☐ Design-Bid-Build ☐ Design-Build ☐ Other:
Design Program Year: FY
Construction Program Year: FY

ATTACHMENTS
1) State Location Map **2) Project Vicinity Map** **3) Project Scope of Work**

ATTACHMENT 1 – STATE LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP

ATTACHMENT 3 – SCOPE OF WORK

SCOPE OF WORK
• Implement signal coordination for 3 signals from Hatfield St/Buffalo Soldier Trail intersection (MP 317.2) to Coronado Dr (MP 319.6), and for 6 signals from Campus Dr (MP 321.0) to Colonia De Salud (MP 323.0) • Install speed feedback and signal ahead signs, MP 318 EB and MP 320 WB • Install centerline rumble strips, MP 317.2-320.8 • Construct raised median, MP 321.5-323.7

SCOPE ITEMS CONSIDERED, BUT NOT INCLUDED

Pursuant to 23 USC 409: Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or rail-way-highway crossings, pursuant to sections 130, 144, and 148 [152] of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

ADOT

PRELIMINARY SCOPING REPORT

GENERAL PROJECT INFORMATION	
Date: 01-24-18	**ADOT Project Manager:**
Project Name: San Pedro River Area Safety Improvement (CS90.3)	
City/Town: -	**County: Cochise**
COG/MPO: SVMPO and SEAGO	**ADOT District: Southcentral**
Primary Route/Street: SR 90	
Beginning Limit: MP 324	
End Limit: MP 336	
Project Length: 12 miles	
Right-of-Way Ownership(s) (where proposed project construction would occur): *(Check all that apply)* ☐ City/Town; ☐ County; ☒ ADOT; ☐ Private; ☐ Federal; ☐ Tribal; ☐ Other:	
Adjacent Land Ownership(s): *(Check all that apply)* ☐ City/Town; ☐ County; ☐ ADOT; ☒ Private; ☒ Federal; ☐ Tribal; ☒ Other: State Trust *http://gis.azland.gov/webapps/parcel/*	

LOCAL PUBLIC AGENCY (LPA) or TRIBAL GOVERNMENT INFORMATION *(If applicable)*	
LPA/Tribal Name:	
LPA/Tribal Contact:	
Email Address:	**Phone Number:**
Administration: ☐ ADOT Administered ☐ Self-Administered ☐ Certification Acceptance	

PROJECT NEED
Safety Need: Safety Index and NB/WB Directional Safety Index above the statewide average, MP 324-336

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☐	Modernization ☒	Expansion ☐
Address identified Safety Need by widening shoulders to 8 feet in both directions and installing centerline rumble strips			

ADOT

PRELIMINARY SCOPING REPORT

PROJECT RISKS	
Check any risks identified that may impact the project's scope, schedule, or budget:	
☐ Access / Traffic Control / Detour Issues	☐ Right-of-Way
☐ Constructability / Construction Window Issues	☐ Environmental
☐ Stakeholder Issues	☐ Utilities
☐ Structures & Geotech	☐ Other:
Risk Description:	

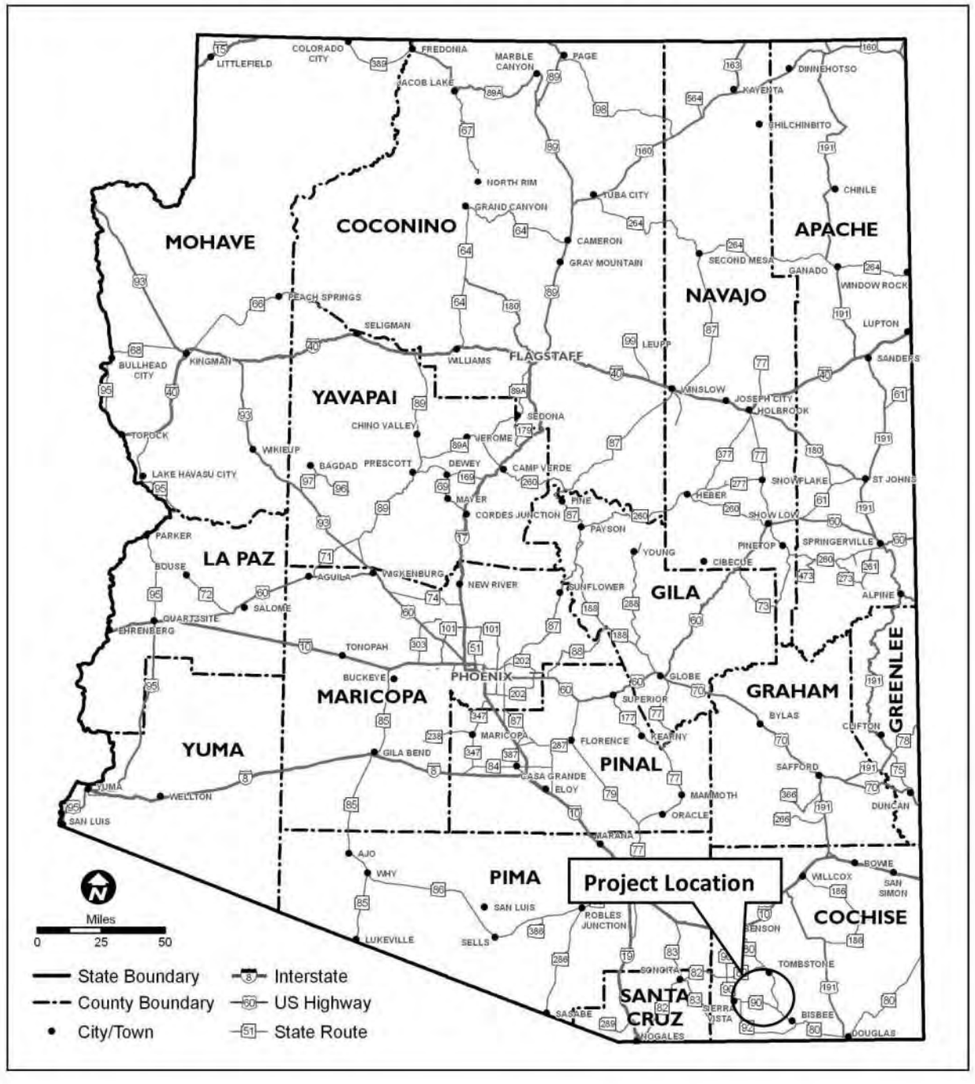
POTENTIAL FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STBG	☐ TAP	☐ HSIP	☐ State
	☐ Local	☐ Private	☐ Tribal	☐ Other:

COST ESTIMATE				
Preliminary Engineering	Design	Right-of-Way	Construction	Total
$260,000	$867,000	$0	$8,675,000	$9,802,000

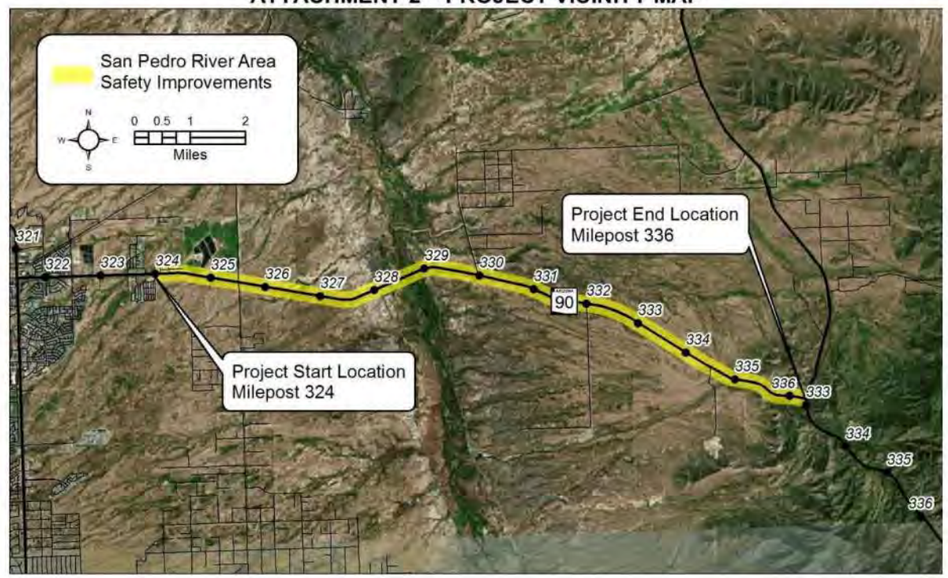
RECOMMENDED PROJECT DELIVERY
Delivery: ☐ Design-Bid-Build ☐ Design-Build ☐ Other:
Design Program Year: FY
Construction Program Year: FY

ATTACHMENTS
1) State Location Map **2) Project Vicinity Map** **3) Project Scope of Work**

ATTACHMENT 1 – STATE LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP



ATTACHMENT 3 – SCOPE OF WORK

SCOPE OF WORK
• Widen shoulders to 8 feet in both directions (striping, delineators, RPMs, safety edge, and rumble strips for both shoulders), MP 324-336 • Install centerline rumble strips, MP 324-336

SCOPE ITEMS CONSIDERED, BUT NOT INCLUDED

Pursuant to 23 USC 409: Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or rail-way-highway crossings, pursuant to sections 130, 144, and 148 [152] of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

ADOT

PRELIMINARY SCOPING REPORT

GENERAL PROJECT INFORMATION	
Date: 01-24-18	**ADOT Project Manager:**
Project Name: Banning Creek Area Climbing Lane (CS80.4)	
City/Town: -	**County: Cochise**
COG/MPO: SEAGO	**ADOT District: Southeast**
Primary Route/Street: SR 80	
Beginning Limit: MP 336	
End Limit: MP 338	
Project Length: 2 miles	
Right-of-Way Ownership(s) (where proposed project construction would occur)**:** *(Check all that apply)* ☐ City/Town; ☐ County; ☒ ADOT; ☐ Private; ☐ Federal; ☐ Tribal; ☐ Other:	
Adjacent Land Ownership(s): *(Check all that apply)* ☐ City/Town; ☐ County; ☐ ADOT; ☒ Private; ☒ Federal; ☐ Tribal; ☒ Other: State Trust *http://gis.azland.gov/webapps/parcel/*	

LOCAL PUBLIC AGENCY (LPA) or TRIBAL GOVERNMENT INFORMATION *(If applicable)*	
LPA/Tribal Name:	
LPA/Tribal Contact:	
Email Address:	**Phone Number:**
Administration: ☐ ADOT Administered ☐ Self-Administered ☐ Certification Acceptance	

PROJECT NEED
Freight Need: High level of need based on the overall Freight Index and SB/EB Directional TPTI ratings

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☐	Modernization ☒	Expansion ☐
Address identified Freight Need by constructing a climbing lane			

ADOT

PRELIMINARY SCOPING REPORT

PROJECT RISKS	
Check any risks identified that may impact the project's scope, schedule, or budget:	
☐ Access / Traffic Control / Detour Issues	☐ Right-of-Way
☐ Constructability / Construction Window Issues	☐ Environmental
☐ Stakeholder Issues	☐ Utilities
☐ Structures & Geotech	☒ Other: Potential rock cuts
Risk Description: Could potentially require rock cuts	

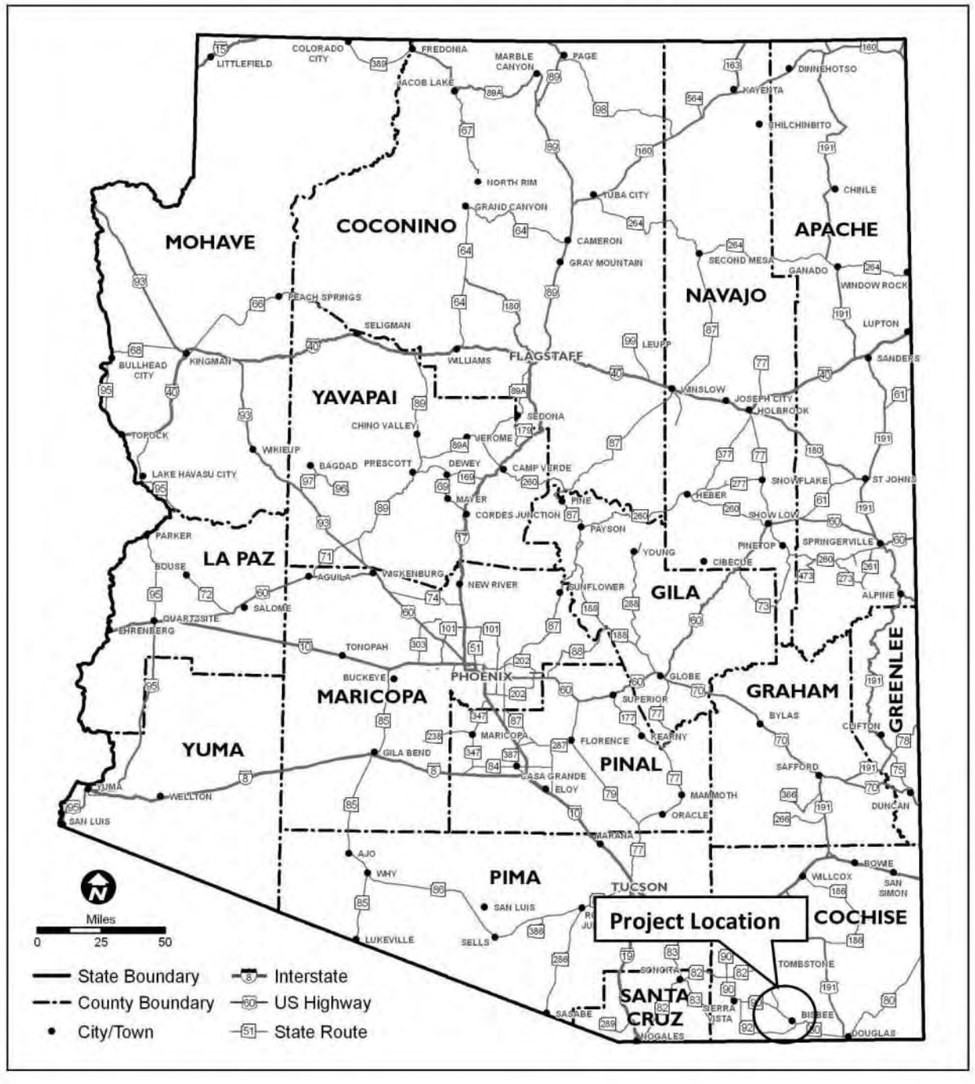
POTENTIAL FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STBG	☐ TAP	☐ HSIP	☐ State
	☐ Local	☐ Private	☐ Tribal	☐ Other:

COST ESTIMATE				
Preliminary Engineering	Design	Right-of-Way	Construction	Total
$193,000	$644,000	$0	$6,435,000	$7,272,000

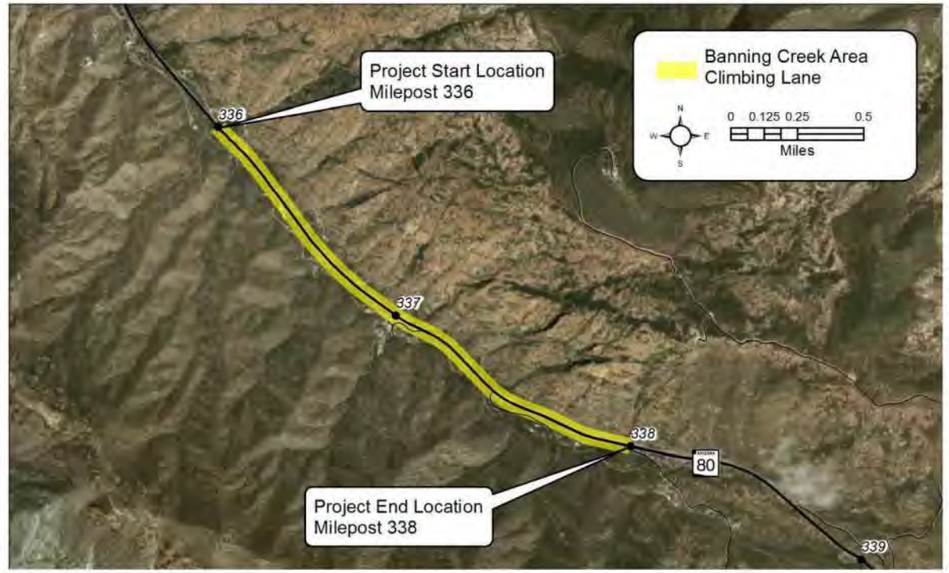
RECOMMENDED PROJECT DELIVERY
Delivery: ☐ Design-Bid-Build ☐ Design-Build ☐ Other:
Design Program Year: FY
Construction Program Year: FY

ATTACHMENTS
1) State Location Map **2) Project Vicinity Map** **3) Project Scope of Work**

ATTACHMENT 1 – STATE LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP



ATTACHMENT 3 – SCOPE OF WORK

SCOPE OF WORK
• Construct climbing lane EB, MP 336.0-337.3

SCOPE ITEMS CONSIDERED, BUT NOT INCLUDED

Pursuant to 23 USC 409: Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or rail-way-highway crossings, pursuant to sections 130, 144, and 148 [152] of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

ADOT

PRELIMINARY SCOPING REPORT

GENERAL PROJECT INFORMATION	
Date: 01-24-18	**ADOT Project Manager:**
Project Name: Banning Creek Area Freight Improvements (CS80.5)	
City/Town: -	**County:** Cochise
COG/MPO: SEAGO	**ADOT District:** Southeast
Primary Route/Street: SR 80	
Beginning Limit: MP 333	
End Limit: MP 339	
Project Length: 6 miles	
Right-of-Way Ownership(s) (where proposed project construction would occur): *(Check all that apply)* ☐ City/Town; ☐ County; ☒ ADOT; ☐ Private; ☐ Federal; ☐ Tribal; ☐ Other:	
Adjacent Land Ownership(s): *(Check all that apply)* ☐ City/Town; ☐ County; ☐ ADOT; ☒ Private; ☒ Federal; ☐ Tribal; ☒ Other: State Trust *http://gis.azland.gov/webapps/parcel/*	

LOCAL PUBLIC AGENCY (LPA) or TRIBAL GOVERNMENT INFORMATION *(If applicable)*		
LPA/Tribal Name:		
LPA/Tribal Contact:		
Email Address:	**Phone Number:**	
Administration: ☐ ADOT Administered	☐ Self-Administered	☐ Certification Acceptance

PROJECT NEED
Freight Need: High level of need based on the overall Freight Index and SB/EB Directional TPTI ratings

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☐	Modernization ☒	Expansion ☐
Address identified Freight Need by widening shoulders to 8 feet in both directions			

ADOT

PRELIMINARY SCOPING REPORT

PROJECT RISKS	
Check any risks identified that may impact the project's scope, schedule, or budget:	
☐ Access / Traffic Control / Detour Issues	☐ Right-of-Way
☐ Constructability / Construction Window Issues	☐ Environmental
☐ Stakeholder Issues	☐ Utilities
☐ Structures & Geotech	☒ Other: Potential rock cuts
Risk Description: Could potentially require rock cuts	

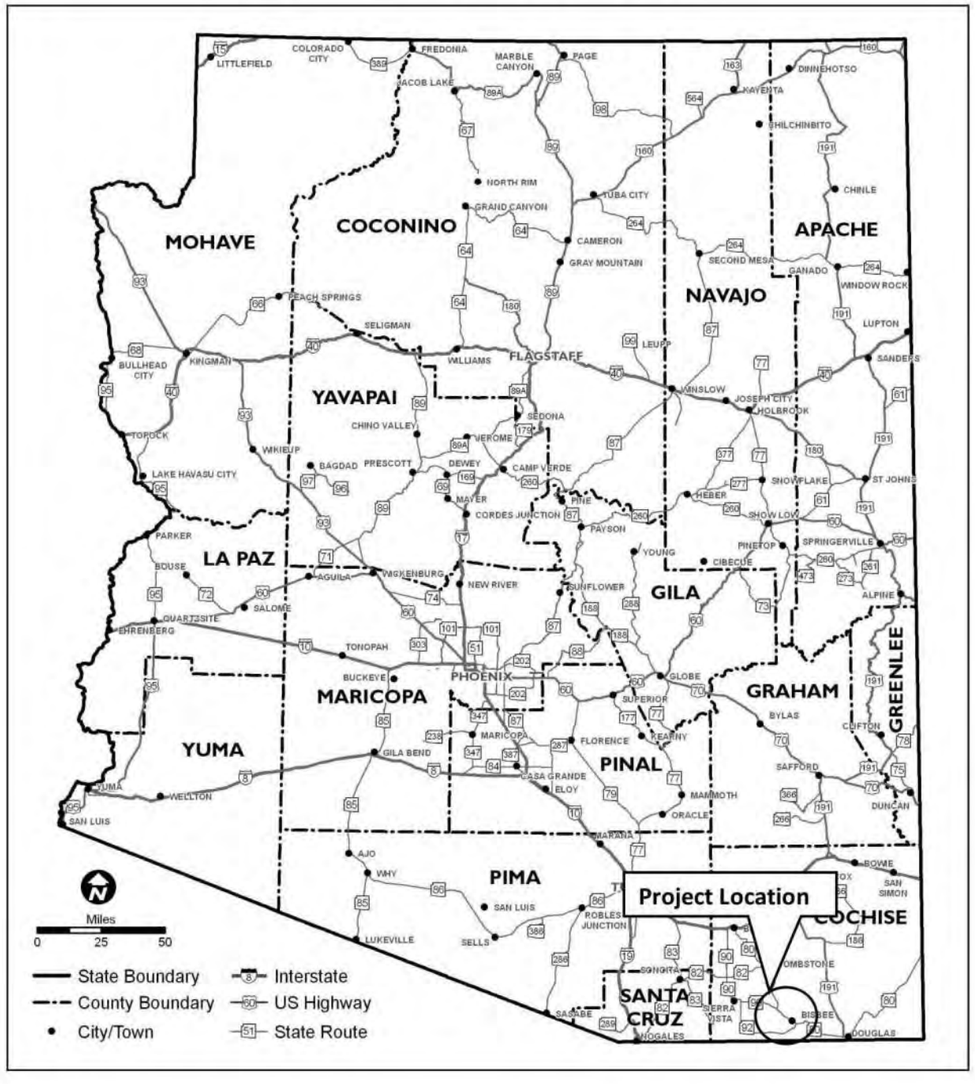
POTENTIAL FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STBG	☐ TAP	☐ HSIP	☐ State
	☐ Local	☐ Private	☐ Tribal	☐ Other:

COST ESTIMATE				
Preliminary Engineering	Design	Right-of-Way	Construction	Total
$106,000	$355,000	$0	$3,548,000	$4,009,000

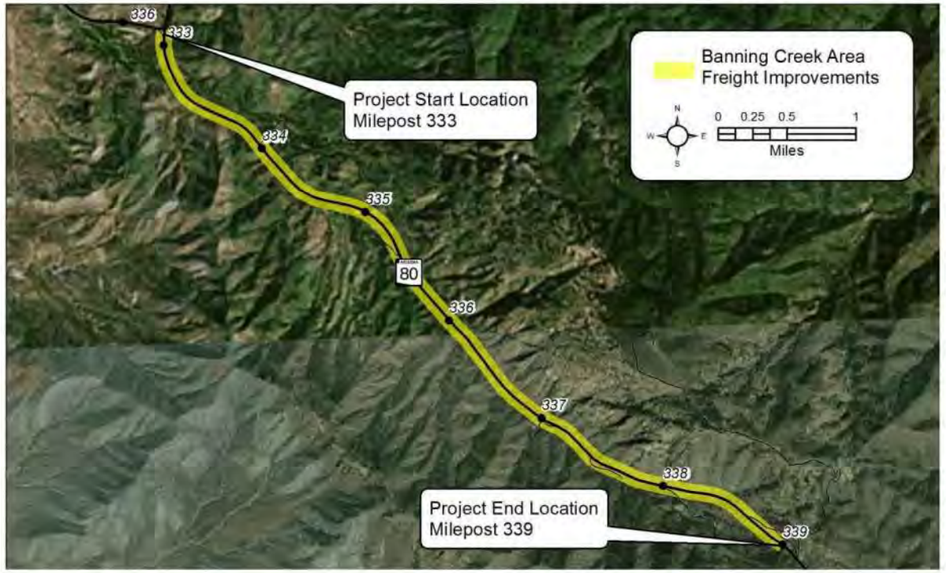
RECOMMENDED PROJECT DELIVERY
Delivery: ☐ Design-Bid-Build ☐ Design-Build ☐ Other:
Design Program Year: FY
Construction Program Year: FY

ATTACHMENTS
1) **State Location Map**
2) **Project Vicinity Map**
3) **Project Scope of Work**

ATTACHMENT 1 – STATE LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP



ATTACHMENT 3 – SCOPE OF WORK

SCOPE OF WORK
• Widen shoulders to 8 feet in both directions (striping, delineators, RPMs, safety edge, and rumble strips for both shoulders), MP 333-339

SCOPE ITEMS CONSIDERED, BUT NOT INCLUDED

Pursuant to 23 USC 409: Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or rail-way-highway crossings, pursuant to sections 130, 144, and 148 [152] of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

ADOT

PRELIMINARY SCOPING REPORT

GENERAL PROJECT INFORMATION	
Date: 01-24-18	**ADOT Project Manager:**
Project Name: Mule Gulch Area Freight Improvements (CS80.6)	
City/Town: -	**County: Cochise**
COG/MPO: SEAGO	**ADOT District: Southeast**
Primary Route/Street: SR 80	
Beginning Limit: MP 345	
End Limit: MP 348	
Project Length: 3 miles	
Right-of-Way Ownership(s) (where proposed project construction would occur): *(Check all that apply)* ☐ City/Town; ☐ County; ☒ ADOT; ☐ Private; ☐ Federal; ☐ Tribal; ☐ Other:	
Adjacent Land Ownership(s): *(Check all that apply)* ☐ City/Town; ☐ County; ☐ ADOT; ☒ Private; ☒ Federal; ☐ Tribal; ☐ Other: *http://gis.azland.gov/webapps/parcel/*	

LOCAL PUBLIC AGENCY (LPA) or TRIBAL GOVERNMENT INFORMATION *(If applicable)*	
LPA/Tribal Name:	
LPA/Tribal Contact:	
Email Address:	**Phone Number:**
Administration: ☐ ADOT Administered ☐ Self-Administered ☐ Certification Acceptance	

PROJECT NEED
Freight Need: High level of need based on the overall Freight Index and NB/WB Directional TPTI ratings

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☐	Modernization ☒	Expansion ☐
Address Freight Need by constructing passing lanes			

ADOT

PRELIMINARY SCOPING REPORT

PROJECT RISKS	
Check any risks identified that may impact the project's scope, schedule, or budget:	
☐ Access / Traffic Control / Detour Issues	☐ Right-of-Way
☐ Constructability / Construction Window Issues	☐ Environmental
☐ Stakeholder Issues	☐ Utilities
☐ Structures & Geotech	☐ Other:
Risk Description:	

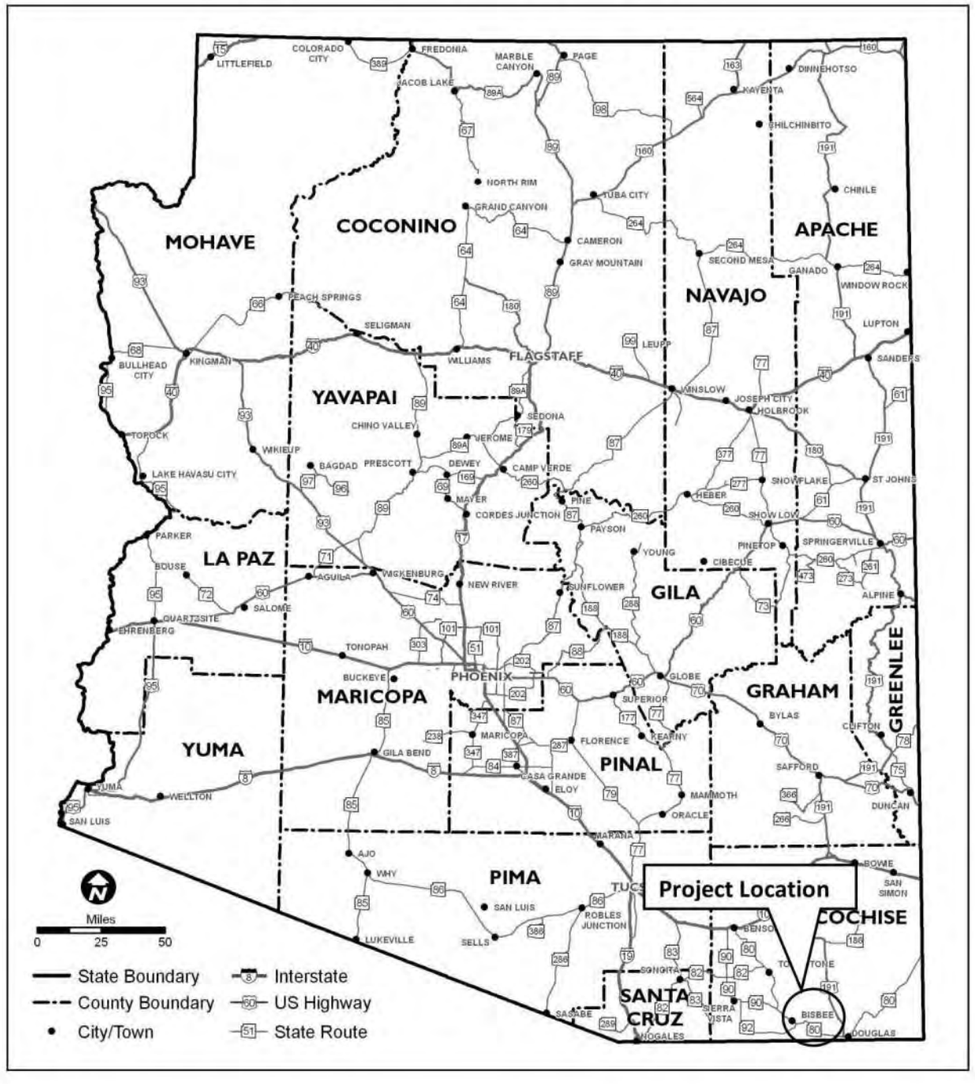
POTENTIAL FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STBG	☐ TAP	☐ HSIP	☐ State
	☐ Local	☐ Private	☐ Tribal	☐ Other:

COST ESTIMATE				
Preliminary Engineering	Design	Right-of-Way	Construction	Total
$119,000	$396,000	$0	$3,960,000	$4,475,000

RECOMMENDED PROJECT DELIVERY
Delivery: ☐ Design-Bid-Build ☐ Design-Build ☐ Other:
Design Program Year: FY
Construction Program Year: FY

ATTACHMENTS
1) State Location Map **2) Project Vicinity Map** **3) Project Scope of Work**

ATTACHMENT 1 – STATE LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP

ATTACHMENT 3 – SCOPE OF WORK

SCOPE OF WORK
• Construct passing lane WB, MP 346.9-347.6 • Construct passing lane EB, MP 345.6-346.1

SCOPE ITEMS CONSIDERED, BUT NOT INCLUDED

Pursuant to 23 USC 409: Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or rail-way-highway crossings, pursuant to sections 130, 144, and 148 [152] of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.