FINAL REPORT

I-19 Corridor Profile Study

Nogales to Junction I-10

PREPARED FOR ADOT MARCH 2017

ADOT WORK TASK NO.
MPD 072A-14

ADOT CONTRACT NO.
11-013177

Prepared by

I-19 CORRIDOR PROFILE STUDY

NOGALES TO JUNCTION I-10

ADOT WORK TASK NO. MPD 072A-14
ADOT CONTRACT NO. 11-013177

FINAL REPORT

MARCH 2017

PREPARED FOR:

ARIZONA DEPARTMENT OF TRANSPORTATION

PREPARED BY:

AECOM

This report was funded in part through grants from the Federal Highway Administration, U.S. Department of Transportation. The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data, and for the use or adaptation of previously published material, presented herein. The contents do not necessarily reflect the official views or policies of the Arizona Department of Transportation or the Federal Highway Administration, U.S. Department of Transportation. This report does not constitute a standard, specification, or regulation. Trade or manufacturers' names that may appear herein are cited only because they are considered essential to the objectives of the report. The U.S. government and the State of Arizona do not endorse products or manufacturers.

Table of Contents

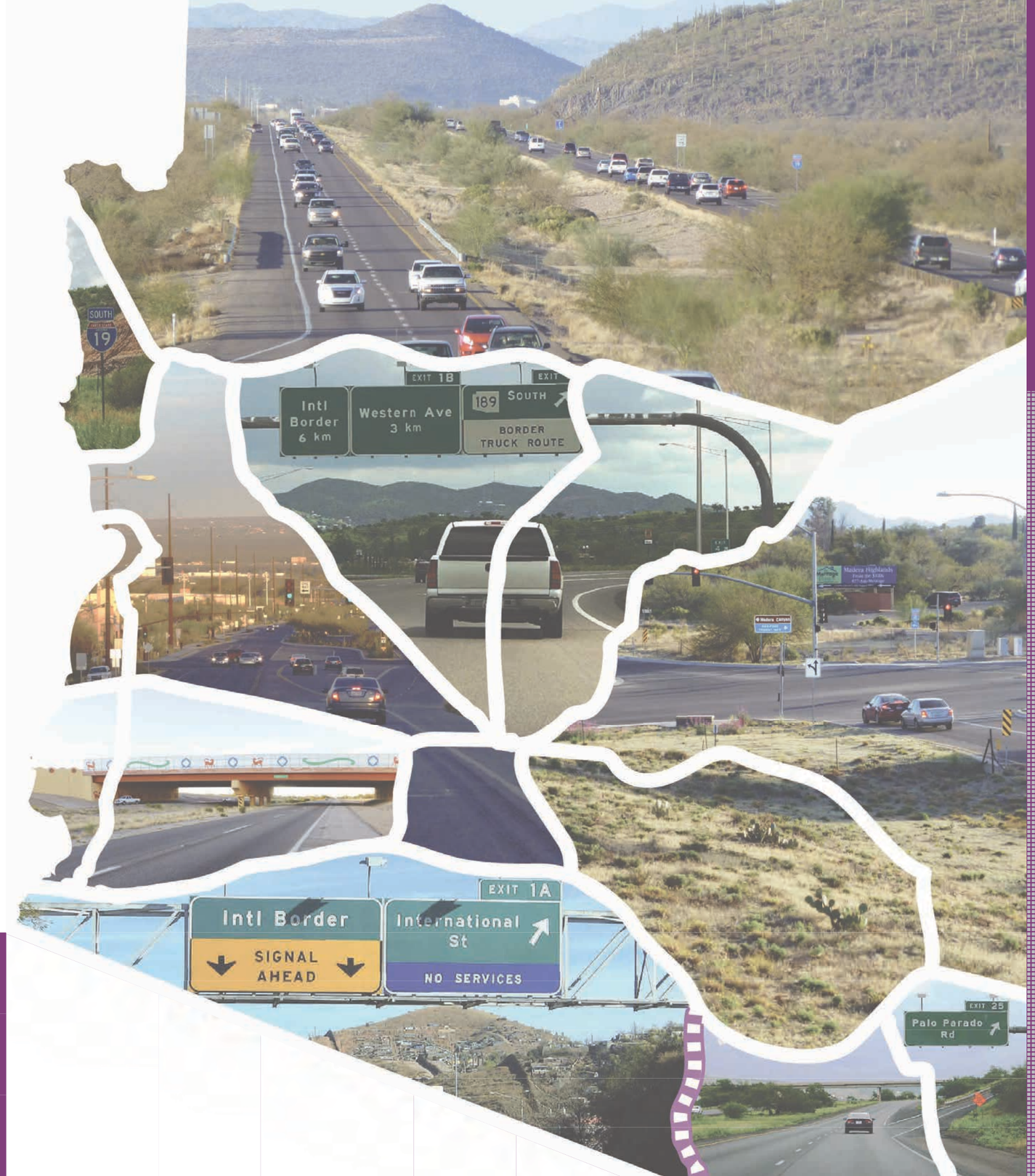
List of Figures

List of Tables

Appendices

ACRONYMS & ABBREVIATIONS

AADT	Average Annual Daily Traffic
ABISS	Arizona Bridge Information System
ADOT	Arizona Department of Transportation
AGFD	Arizona Game and Fish Department
AZTDM	Arizona Travel Demand Model
BCA	Benefit Cost Analysis
bqAZ	Building a Quality Arizona
CANAMEX	Nationally designated high priority freight route linking western states, Mexico, Canada
CCTV	Closed Circuit Television
DCR	Design Concept Report
DMS	Digital Message Signs
FY	Fiscal Year
HCRS	Highway Condition Reporting System
HERE	Real time traffic conditions database produced by American Digital Cartography Inc.
HPMS	Highway Performance Monitoring System
I-19	Interstate 19
IRI	International Roughness Index
LCCA	Life Cycle Cost Analysis
LOS	Level of Service
MAP 21	Moving Ahead for Progress in the 21st Century
MP	Milepost
NB	Northbound
OP	Overpass
PAG	Pima Association of Governments
PARA	Planning Assistance for Rural Areas Studies
PES	Performance Effectiveness Score
P2P	Planning to Programming
PDI	Pavement Distress Index
PS	Prioritization Score
PSR	Pavement Serviceability Rating
PTI	Planning Time Index
RTP	Regional Transportation Plan
SEAGO	Southeast Arizona Council of Governments
SB	Southbound
SERI	Species of Economic and Recreational Importance
SGCN	Species of Greatest Conservation Need
SHCG	Species and Habitat Conservation Guide
SHSP	Strategic Highway Safety Plan
SPUI	Single Point Urban Interchange
SR	State Route
SWAP	State Wildlife Action Plan
TI	Traffic Interchange
TIP	Transportation Improvement Plan
TPTI	Truck Planning Time Index
TTI	Travel Time Index
TTTI	Truck Travel Time Index
USDOT	United States Department of Transportation
UP	Underpass
V/C	Volume to Capacity Ratio
VMT	Vehicle-Miles Traveled



Executive Summary

EXECUTIVE SUMMARY

INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study (CPS) of Interstate 19 (I-19) between the International Border and Interstate 10 (I-10). This study examines key performance measures relative to the I-19 corridor, and the results of this performance evaluation will be used to identify potential strategic improvements. The intent of the corridor profile program, and of the 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 is conducting eleven CPS within three separate groupings. The I-19 corridor, depicted in **Figure ES-1**, is one of the strategic statewide corridors identified and the subject of this CPS.

Corridor Study Purpose, Goals and Objectives

The purpose of the Corridor Profile Study 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:

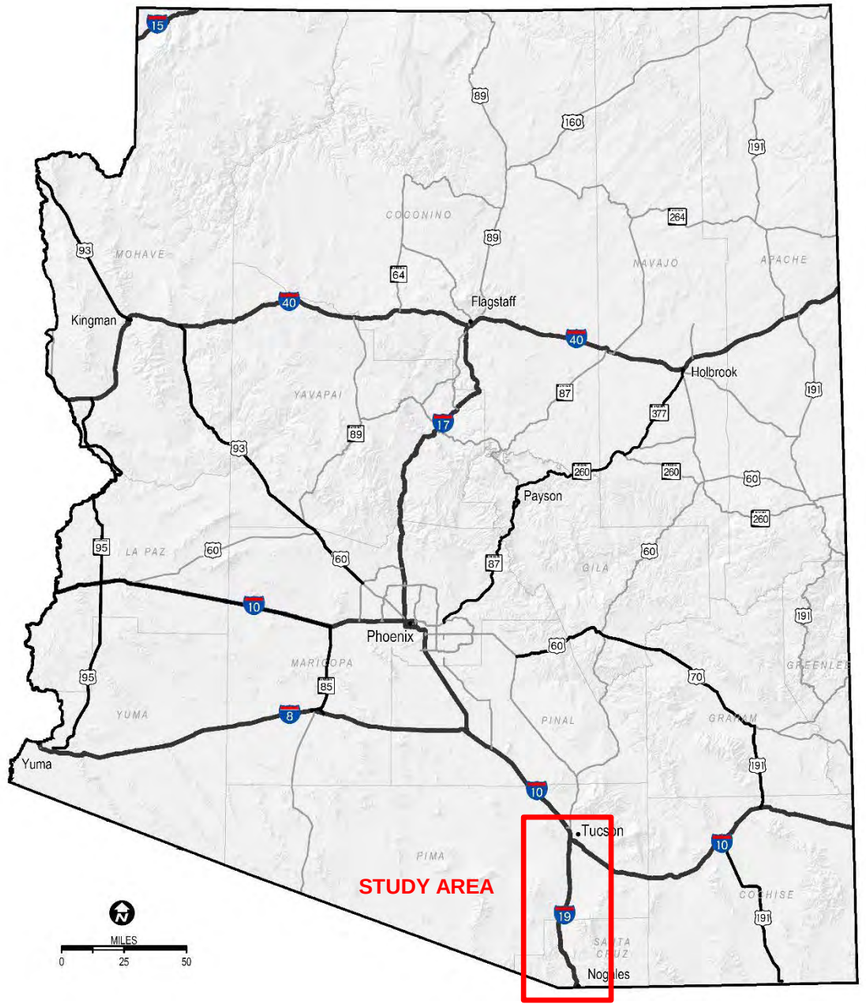
- Inventory past improvement recommendations
- Define corridor goals and objectives
- Assess existing performance based on quantifiable performance measures
- Propose various solutions to improve corridor performance
- Identify specific solutions that can provide quantifiable benefits relative to the 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 I-19 Corridor Profile Study will define solutions and improvements for the corridor that can be evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance.

The following goals have been 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.

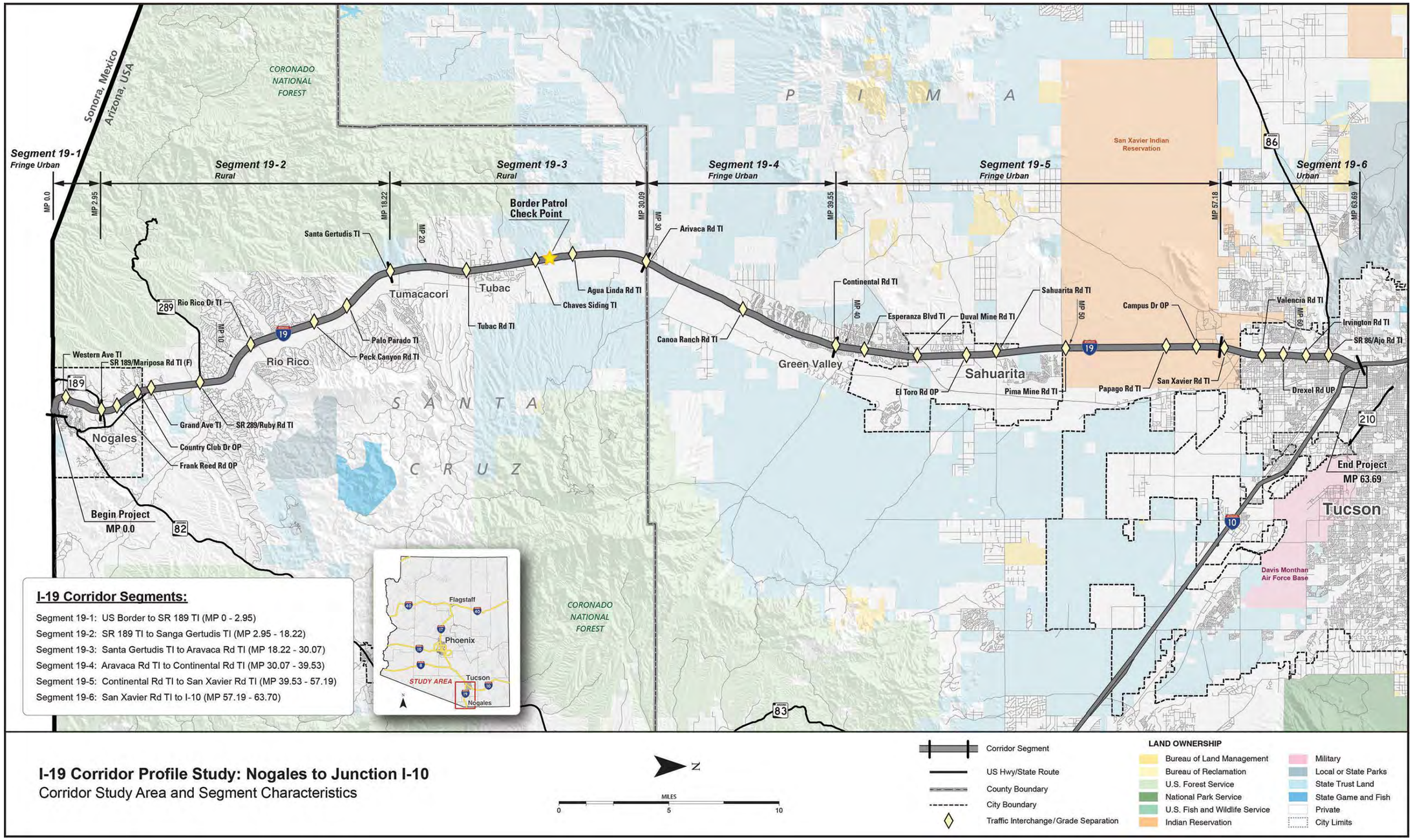
Figure ES-1: Corridor Study Area



Study Location and Corridor Segments

The I-19 Corridor is divided into 6 planning segments for analysis and evaluation. The corridor is segmented at logical breaks where the context changes 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



CORRIDOR PERFORMANCE

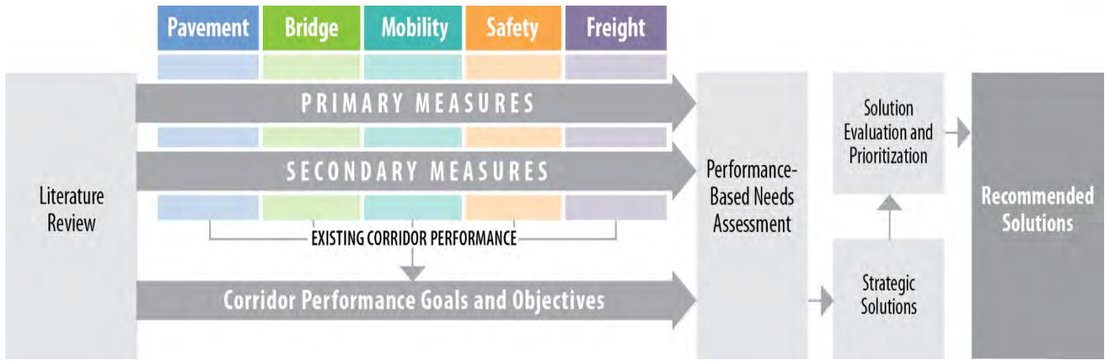
A series of performance measure were used to assess the I-19 corridor. The results of the performance evaluation were used to define overall corridor need relative to the long term goals and objectives for the corridor.

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 consultant teams for the Corridor Profile Studies.

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 were identified 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 and Cracking	• Directional Pavement Serviceability • Pavement Failure • Pavement Hot Spots
Bridge	**Bridge Index** Based on lowest of deck, substructure, superstructure and structural evaluation rating	• Bridge Sufficiency • Functionally Obsolete Bridges • 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 Highway Safety Plan Emphasis Areas • Crash Unit Types • Safety Hot Spots
Freight	**Freight Index** Based on bi-directional truck planning time index	• Recurring Delay • Non-Recurring Delay • Closure Duration • Bridge Vertical Clearance • Bridge Vertical Clearance Hot Spots

Each of the primary and secondary performance measures identified 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 identified desirable/average range

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

Poor/Below Average Performance – Rating is below 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 I-19 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 most significant results for the I-19 corridor report Poor Safety performance on all segments except segment 19-4, including NB and SB lanes.
- Pavement performance is generally Good/Above Average throughout the corridor.
- Bridge performance is generally Good/Above Average throughout the corridor. Exceptions include a series of Functionally Obsolete bridges in segment 19-1 and an average bridge rating of 4 (Below Average) on segment 19-5.
- Mobility performance is generally Good/Above Average throughout the corridor. Exceptions include segment 19-6 in the Tucson urban area, where project traffic increases push the Mobility Index into the poor range.
- Freight performance is generally Good/Above Average throughout the corridor. Exceptions include a low clearance bridge on segment 19-5 and a corridor average PTI (NB) that is largely the result of:
    - Conditions on segment 19-1 which delay trucks from reaching signed speed limits, and
    - The US Customs Border Patrol Checkpoint on segment 19-3, where delays contribute to lower average speeds for the segment.

Table ES-2 shows a summary of all primary and secondary performance measures for the I-19 corridor. A weighted average rating (based on the length of the segment) was calculated for each primary and secondary measure as shown in **Table ES-2**.

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

Segment	Length (miles)	Pavement Performance Area				Bridge Performance Area				Mobility Performance Area											
		Pavement Index	Directional PSR		Pavement Failure	Bridge Index	Bridge Sufficiency	Bridge Rating	% Deck Area of Functionally Obsolete Bridges	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent (instances/milepost / year/mile)		Directional TTI (all vehicles)		Directional PTI (all vehicles)		% Bicycle Acc.	% Non-Single Occupancy Vehicle (SOV) Opportunities
			NB	SB								NB	SB	NB	SB	NB	SB	NB	SB		
19-1[1a*]	3	4.03	3.72	3.96	16.7%	5.98	90.03	5	100.0%	0.16	0.19	0.12	0.11	0.27	0.20	1.40	1.01	2.28	1.30	90%	14%
19-2[2a^]	15	4.39	4.28	4.26	3.3%	5.79	92.24	5	27.3%	0.32	0.39	0.19	0.20	0.22	0.17	1.16	1.13	1.25	1.22	100%	17%
19-3[2b*]	12	3.57	3.74	3.90	0.0%	6.18	93.08	6	19.7%	0.26	0.32	0.17	0.17	0.30	0.17	1.58	1.10	2.50	1.17	100%	15%
19-4[1a^]	10	3.54	3.76	3.90	0.0%	6.60	95.35	6	15.7%	0.34	0.41	0.23	0.23	0.20	0.02	1.06	1.06	1.08	1.12	100%	16%
19-5[1a^]	17	4.08	3.97	4.02	0.0%	5.30	90.92	4	21.3%	0.56	0.66	0.35	0.36	0.25	0.15	1.06	1.07	1.11	1.12	100%	13%
19-6[1a^]	7	3.61	3.54	3.57	18.8%	6.06	77.36	5	19.4%	1.01	1.21	0.78	0.76	0.38	0.06	1.00	1.04	1.03	1.12	95%	15%
Weighted Corridor Average		3.92	3.91	3.98	3.6%	5.90	90.80	5.08	25.0%	0.44	0.53	0.30	0.30	0.26	0.13	1.19	1.08	1.44	1.16	99%	15%
Scale		Interstate								Urban or Rural						Uninterrupted or Interrupted					
Good/Above Average		> 3.75			< 5%	> 6.5	> 80	> 6	< 12%	< 0.71[1] < 0.56[2]				< 0.22		< 1.15^ < 1.30*		< 1.30^ < 3.00*		> 90%	> 17%
Fair/Average		3.2 - 3.75			5% - 20%	5.0 - 6.5	50 - 80	5 – 6	12% - 40%	0.71 - 0.89[1] 0.56 - 0.76[2]				0.22 – 0.62		1.15-1.33^ 1.30-2.00*		1.30-1.50^ 3.00-6.00*		60% - 90%	11% - 17%
Poor/Below Average		< 3.2			> 20%	< 5.0	< 50	< 5	> 40 %	> 0.89[1] >0.76[2]				> 0.62		> 1.33^ > 2.00*		> 1.50^ > 6.00*		< 60%	< 11%

Segment	Length (miles)	Safety Performance Area					Freight Performance Area							
		Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks	Freight Index	Directional Truck TTI		Directional Truck PTI		Closure Duration (minutes/milepost closed/year/mile)		Vertical Bridge Clearance
			NB	SB				NB	SB	NB	SB	NB	SB	
19-1[1a*]	3	1.94	1.99	1.90	*Insufficient Data*	*Insufficient Data*	0.46	1.54	1.08	2.37	1.96	30.03	46.78	No UP
19-2[2a^]	15	1.33	1.34	1.32	59%	*Insufficient Data*	0.93	1.04	1.04	1.09	1.08	45.09	33.78	16.15
19-3[2b*]	12	1.36	1.59	1.12	33%	*Insufficient Data*	0.34	1.43	1.03	4.91	1.06	87.90	53.94	16.13
19-4[1a^]	10	0.52	0.59	0.44	44%	*Insufficient Data*	0.95	1.02	1.03	1.05	1.06	22.82	7.36	No UP
19-5[1a^]	17	1.48	2.11	0.86	39%	*Insufficient Data*	0.94	1.03	1.03	1.05	1.06	39.82	23.75	16.78
19-6[1a^]	7	1.42	0.80	2.04	53%	*Insufficient Data*	0.88	1.02	1.08	1.06	1.20	66.47	22.61	15.98
Weighted Corridor Average		1.29	1.45	1.13	45%	*Insufficient Data*	0.80	1.13	1.04	1.85	1.12	49.87	30.16	16.33
Scale		Urban 4 Lane Freeway or Rural 4 Lane < 25,000 vpd					Uninterrupted or Interrupted							
Good/ Above Average		< 0.79[a] < 0.73[b]			< 49.1%[a] < 42.8% [b]	N/A	> 0.77^ > 0.33*	< 1.15 ^ < 1.30*		< 1.30^ < 3.00*		< 44.18		> 16.5
Fair/ Average		0.79-1.21[a] 0.73-1.27[b]			49.1%-59.4%[a] 42.8%-52.9%[b]	N/A	0.67 - 0.77^ 0.17 - 0.33*	1.15 -1.33^ 1.30 -2.00*		1.30-1.50^ 3.00-6.00*		44.18 -124.86		16.0-16.5
Poor/ Below Average		> 1.21[a] > 1.27[b]			> 59.4%[a] > 52.9%[b]	N/A	< 0.67^ < 0.17*	> 1.33^ > 2.00*		>1.50^ > 6.00*		> 124.86		< 16.0

^Uninterrupted Flow Facility [a]Urban 4 Lane Freeway [1]Urban Operating Environment
*Interrupted Flow Facility [b]Rural 4 Lane < 25,000 [2]Rural Operating Environment

Note: "Insufficient Data" indicates there was not enough data available to generate reliable performance ratings

NEEDS ASSESSMENT

Corridor Description

The I-19 Corridor functions as a significant international and regional route, connecting the border city of Nogales to Tucson in southern Arizona. The corridor serves as a major truck route due to the border crossing, bringing manufactured goods and produce north from Mexico. ADOT has designated it as a critical link in Arizona's Primary Freight Network and the CANAMEX Trade Corridor. The connection to I-10 gives those products access to distribution points throughout the country.

Corridor Objectives

Statewide goals and performance measures were established by the ADOT Long-Range Transportation Plan (LRTP), 2010-2035. Statewide performance goals that are relevant to the I-19 performance framework areas were identified and corridor goals were then formulated for each of the five performance framework areas that aligned with the overall statewide goals established by the LRTP. Based on stakeholder input, corridor goals, corridor objectives, and performance three "Emphasis Areas" were identified for the I-19 corridor: Mobility, 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 objectives will help ensure that investments are targeted toward improvements that support the safe and efficient movement of travelers on the corridor. Corridor performance will be measured against corridor and segment objectives to determine needs – the gap between observed performance and the target.

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 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 in **Figure ES-5.**

Figure ES-4: Needs Assessment Process

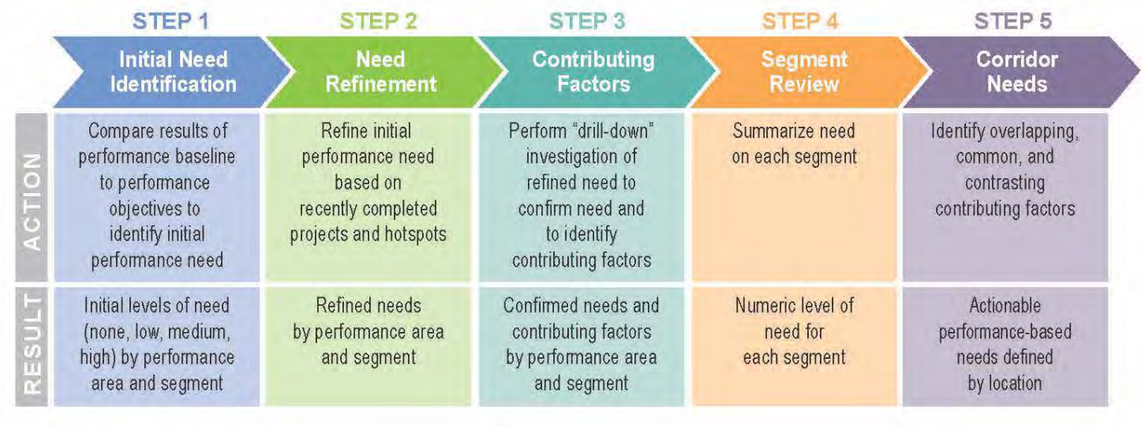


Figure ES-5: Initial Need Ratings in Relation to Baseline Performance (Bridge Example)

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		

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.

Summary of Needs

Table ES-3 provides a summary of needs for each segment across all performance areas, and the average needs for each segment. A weighting factor of 1.5 is applied to the average need scores of the performance areas identified as emphasis areas (mobility, safety, and freight for the I-19 corridor). There are no segments with a High average need, five segments with a Medium average need, and only one segment with a Low average need. More information on the identified final needs in each performance area is provided below.

Pavement Needs

- Overall final pavement needs are Low or None throughout the corridor. No changes to the level of need resulting from hot spot analysis occur on the corridor.
- The pavement hot spot on segment 19-2 at MP 17-18 was addressed in a 2015 improvement project.
- Other pavement hot spots were identified on approximately six miles of the corridor on three segments, but are generally expected to be mitigated through upcoming programmed projects.

Bridge Needs

- Bridge needs occur due to poor performing bridges or hot spots on four of six segments, with High needs identified in segment 19-5 and Medium needs identified in segment 19-1.
- Bridge needs were identified at 17 of the total 74 bridges (23%).
- Four bridges have potential historical issues and are candidates for life-cycle cost analysis to evaluate alternative solutions.
- Bridge hot spots along I-19 are not sufficient to change the Initial Need from its original calculated value.

Mobility Needs

- The Mobility Performance Area is an Emphasis Area for the I-19 corridor, giving it a heavier weight in the analysis.
- High Mobility Needs were identified only on segment 19-6 in the Tucson area related to high traffic volumes and poor level of service values.
- While commuting traffic from residential areas south of Tucson is partly responsible for heavier traffic volumes, traffic volumes are high seven days per week. This results from Tucson's position as the regional center for shopping, entertainment, and other services in addition to being an employment center.
- Directional TTI and PTI issues on segment 19-1 are attributed to slowdowns in truck traffic at grade level intersections in Nogales. Truck traffic is expected to be dramatically reduced with improvements to SR 189 connecting to the Mariposa International Border Crossing, reducing the level of need on the segment.

Safety Needs

- The Safety Performance Area is an Emphasis Area for the I-19 corridor, giving it a heavier weight in the analysis.
- High Safety Needs were identified in all segments except 19-4, resulting in Poor performance for the corridor as a whole.
- Multiple crash hot spots are identified, especially in the northern part of the corridor, segments 19-4 through 19-6.
- The high rate of serious injury and fatal crashes throughout the corridor may be attributed to outdated designs on some entrance ramps, lack of lighting, equipment failure, alcohol related crashes, low levels of seat belt use, and other driver behaviors.
- While a high rate of serious injury and fatal crashes is reported on segment 19-1, the low number of such crashes (2), especially within the Strategic Highway Safety Plan (SHSP) Top 5, reported during the analysis period points to caution in this result.
- Crashes involving trucks, motorcycles, and non-motorized during the analysis period were too few to provide significant results at any point on the corridor. Other crash types predominate.

Freight Needs

- The Freight Performance Area is an Emphasis Area for the I-19 corridor, giving it a heavier weight in the analysis.
- Final Freight Needs are Low or None throughout the corridor. In general, limits on truck travel and planning times are not significant factors.
- The most significant need shows a Low performance in the Bridge Clearance secondary measure. However, all of the low clearance bridges can be avoided by using ramps at the grade separated traffic interchanges and do not represent a hot spot under the criteria used for the analysis.
- Truck traffic is also affected by slowdowns in segment 19-3 related to the Border Patrol checkpoint north of Tubac, but is not sufficient to raise the level of need.

Overlapping Needs

This section identifies overlapping performance needs on the I-19 Corridor, which provides guidance to develop strategic solutions that address more than one performance are with elevated levels of need. 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:

- 19-1 – Bridge (Medium) and Safety (High) Needs are elevated in this segment within Nogales. This relatively short section (three miles) has lower traffic volumes than the rest of the corridor and transitions to interrupted flow characteristics. Improvements on SR 189 from the Mariposa Interchange south to the Mariposa Border Crossing will remove some pressure from the segment. The Bridge Needs relating to several functionally obsolete bridges and

Safety Needs related to high fatality rates were further evaluated in subsequent phases of the project.

- 19-5 - Bridge (High) and Safety (High) Needs are elevated in this segment in the Sahuarita area. Low performing bridges, including the El Toro Road Overpass, the Pima Mine Traffic Interchange, and the Santa Cruz River Bridge are noted. Crash hot spots and higher rates of serious injury crashes contribute to the elevated Safety Need.
- 19-6 - Mobility (High) and Safety (High) Needs are elevated in this segment within Tucson. Mobility issues are related to near-term growth in traffic volumes, putting the segment over capacity within 10 years. Safety Needs result from crashes associated with congestion and inadequate traffic interchange ramps.

Table ES-3: Summary of Needs by Segment

Performance Area	Segment	19-1	19-2	19-3	19-4	19-5	19-6
	Milepost	MP 0 - 3	MP 3 -18	MP 18 - 30	MP 30 - 40	MP 40 - 57	MP 57 - 64
Pavement		Low	Low	None*	Low	None*	Low
Bridge		Medium	Low	None*	None*	High	Low
Mobility		None*	None*	Low	None*	None*	High
Safety		High	High	High	Low	High	High
Freight		Low	Low	Low	None*	None*	Low
Average Need (0-3)		**1.38**	**1.23**	**1.15**	**0.38**	**1.15**	**1.92**

**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.*

Scale	
None	< 0.10
Low	0.10 - 1.00
Medium	1.00 - 2.00
High	> 2.00

STRATEGIC SOLUTIONS

The principal objective of the corridor profile study 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 was 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.

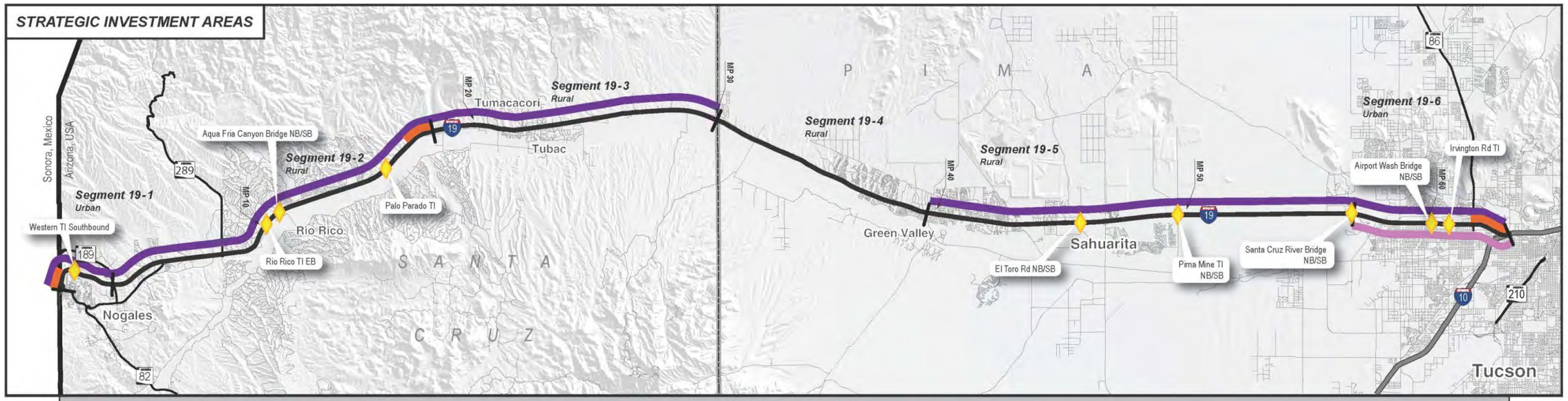
The I-19 strategic investments areas (resulting from the elevated needs) are shown in **Figure ES-6**.

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 has is programmed to address this need.
- The need is a result of a Pavement or Bridge hot spot that does not show historical investment 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.

Figure ES-6: Strategic Investment Areas



	SEGMENT						
Segments	19-1	19-2	19-3	19-4	19-5	19-6	Segments
Pavement	Hotspot	Hotspot	–	–	–	Hotspot	Pavement
Bridge	Med	Hotspot	–	–	High	Hotspot	Bridge
Mobility	–	–	–	–	–	High	Mobility
Safety	High	High	High	–	High	High	Safety
Freight	–	–	–	–	–	–	Freight

I-19 Corridor Profile Study: Nogales to Junction I-10
Strategic Investment Areas

N

MILES
0 5 10

Corridor Segment
US Hwy/State Route
County Boundary
City Boundary

MAP SYMBOLOGY
SAFETY NEEDS
PAVEMENT NEEDS
FREIGHT NEEDS
MOBILITY NEEDS

LEVEL OF NEED
Low
Medium
High

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 I-19 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 measureable benefit (benefit/cost ratio, risk, LCCA, performance system, etc.).

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.

SOLUTION EVALUATION AND PRIORITIZATION

Candidate Solutions were evaluated in multiple ways including a LCCA or BCA (where applicable), Risk Analysis, and a Performance Effectiveness Analysis. 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 multiple options, rehabilitate the area of need, or fully reconstruct the issue area or structure. These options are evaluated through a LCCA to determine the best approach for each location where a pavement or bridge solution is recommended. The LCCA could eliminate options from further consideration and will identify which options should be carried forward for further evaluation.

All Mobility, Safety, and Freight strategic investment areas that result in multiple independent candidate solutions are advanced directly to the Performance Effectiveness Evaluation.

LCCA was performed on four bridge solutions for the I-19 corridor. Of the four bridges subjected to LCCA, rehabilitation was determined to be the most effective solution in each location.

Performance Effectiveness Evaluation

After the LCCA process are complete, 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 Evaluation to help differentiate between similar solutions based on factors that are not directly addressed in the performance system.

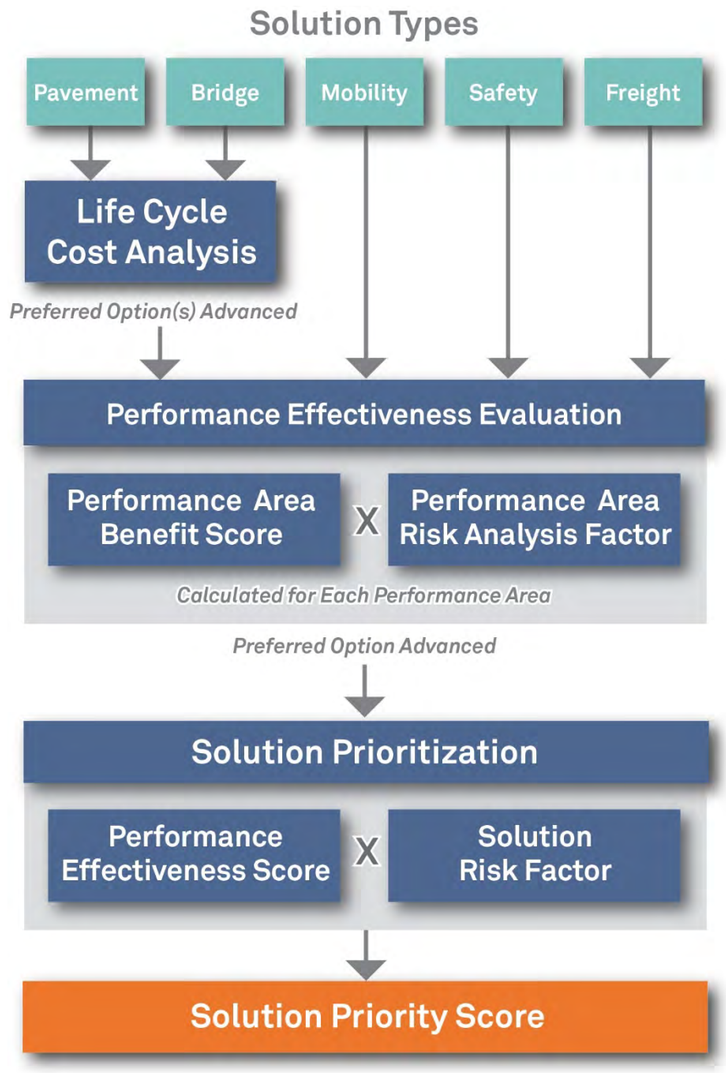
Risk Analysis

All candidate solutions advanced through the Performance Effectiveness Evaluation are also evaluated through a Risk Analysis process. The risk analysis is conducted to develop a 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 and risk factor 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 I-19 Corridor. The recommended solutions are shown in. These solutions will increase the performance of the I-19 corridor across a majority of the performance areas. Solutions that address multiple performance areas tend to score higher in this process. The highest ranking projects tended to have overlapping benefits in Safety, Mobility, and Freight.

- Two of the top three projects include shoulder and roadside improvements through much of the corridor that will reduce the incidence of run off the road type vehicle crashes that often result in fatal and serious injuries.
- Additional benefits to Mobility and Freight will occur due to the reduction in the number of incidents that cause delays along I-19.
- The I-19 Tucson Widening project will increase capacity on this congested segment, reduce delays, and improve safety.
- The Ajo Way/I-19 Pavement Rehabilitation project scored well due to extending the improvements of a previously programmed project to address pavement issues.
- The Drexel/Irvington Pedestrian Overpass and Barrier Fencing project will help reduce the high number of fatal vehicle-pedestrian crashes resulting from pedestrians attempting to cross I-19.
- The remaining traffic interchange ramp and lighting improvements will increase safety at those locations as well as improve traffic throughput by reducing delay and the potential for conflicting movements in the merge areas.

Other Corridor Recommendations

As part of the investigation of strategic investment areas and candidate solutions, other corridor recommendations were also identified. These recommendations could include modifications to the existing Statewide Construction Program, areas for further study, or other corridor specific recommendations that are not construction or policy related. The list below identified other corridor recommendations for the I-19 corridor:

- The analysis shows a high ratio of fatal to incapacitating injury crashes that are not clearly patterned to specific locations. This report recommends that a Roadway Safety Analysis should be conducted on the corridor in order to better understand the high occurrence of fatal crashes.
- Consider a corridor strategy to upgrade all bridges to current standards in anticipation of increased truck/freight traffic over the medium to long term.
- Consider corridor wide ITS solutions to assist truck/freight traffic over the medium to long term.
- Advance Irvington Rd TI Underpass to construction programming. Irvington Rd TI has design funds only programmed in the Pima Association of Governments (PAG) five year transportation facilities construction program for fiscal year 2019.
- Extend the limits of the Ajo Way TI Phase 2 scope to reach the pavement hot spot at milepost 63 in fiscal year 2018.
- When recommending future projects along I-19, review historical ratings and levels of investment. According to data used for this study, the following pavement and bridge locations have exhibited high historical investment (pavement) or rating fluctuation (bridge) issues:
    - Pavement MP 6-9
    - Western Ave TI OP NB (MP 1.17)
    - Pajarito Rd OP NB/SB (MP 3.67)
    - Ruby Road TI UP (MP 7.7)
    - Agua Fria Canyon Bridge NB/SB (MP 11.97)
    - Peck Canyon TI UP (MP 13.96)
    - Peck Canyon Wash SB (MP 14.37)
    - Palo Parado Rd (MP 15.65)
    - Agua Linda UP (MP 26.54)
    - El Toro Rd OP NB/SB (MP 45.80)
    - Pima Mine TI OP NB/SB (MP 49.62)
    - Papago Rest Area TI OP NB/SB (MP 54.40)
    - Santa Cruz River Bridge NB/SB (MP 56.80)
    - Airport Wash Bridge NB/SB (MP 60.32)

Policy and Initiatives 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 I-19, 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 Round 1, Round 2, and Round 3 CPS:

- 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

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 I-19 Corridor will be considered along with other candidate projects in the ADOT statewide programming process.

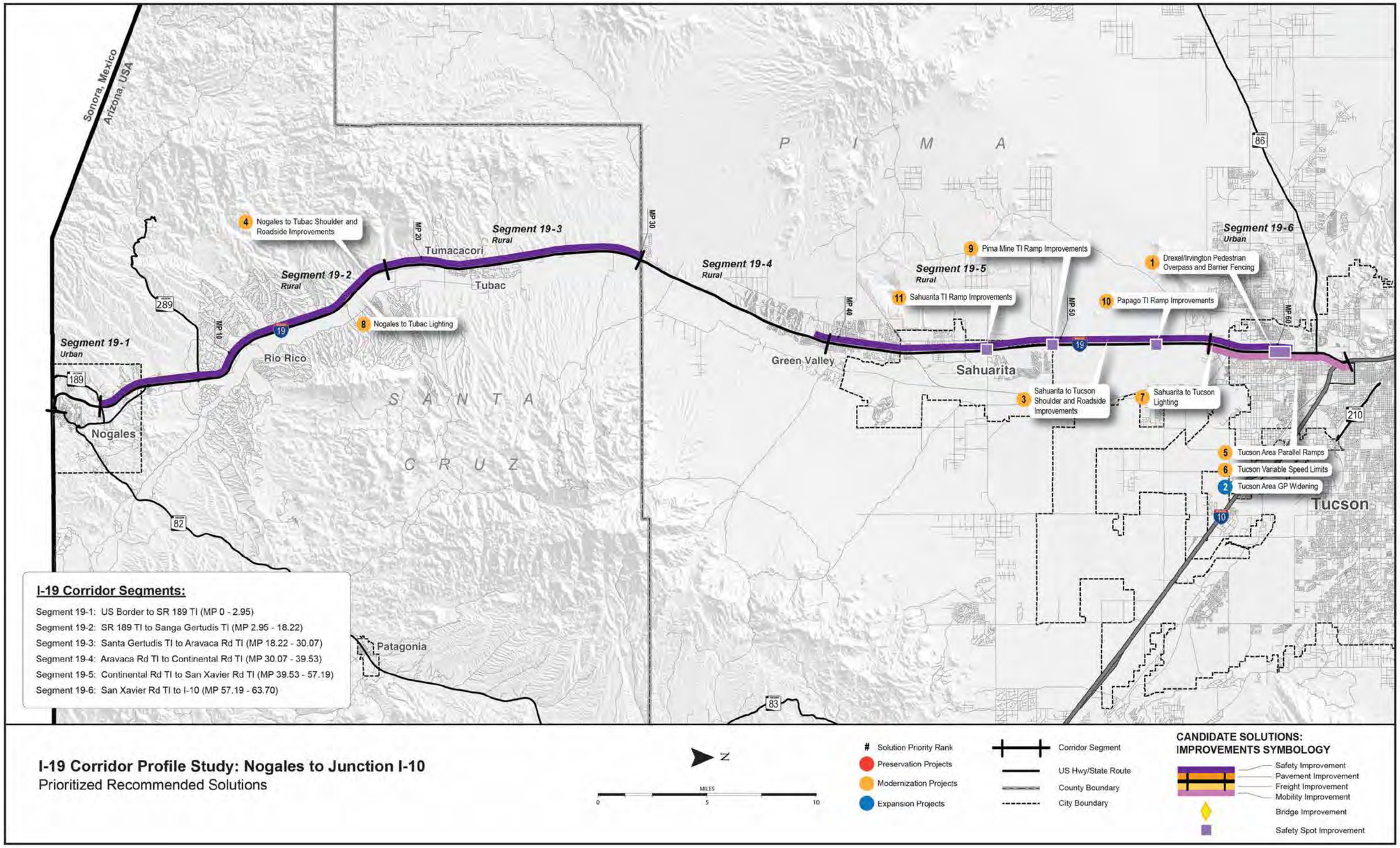
It is important to note that the candidate solutions are intended to represent strategic solutions to address existing performance needs related to the Pavement, Bridge, Mobility, Safety, and Freight performance areas. Therefore, the strategic solutions are not intended to preclude recommendations related 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.

Upon completion of all three CPS rounds, the 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.

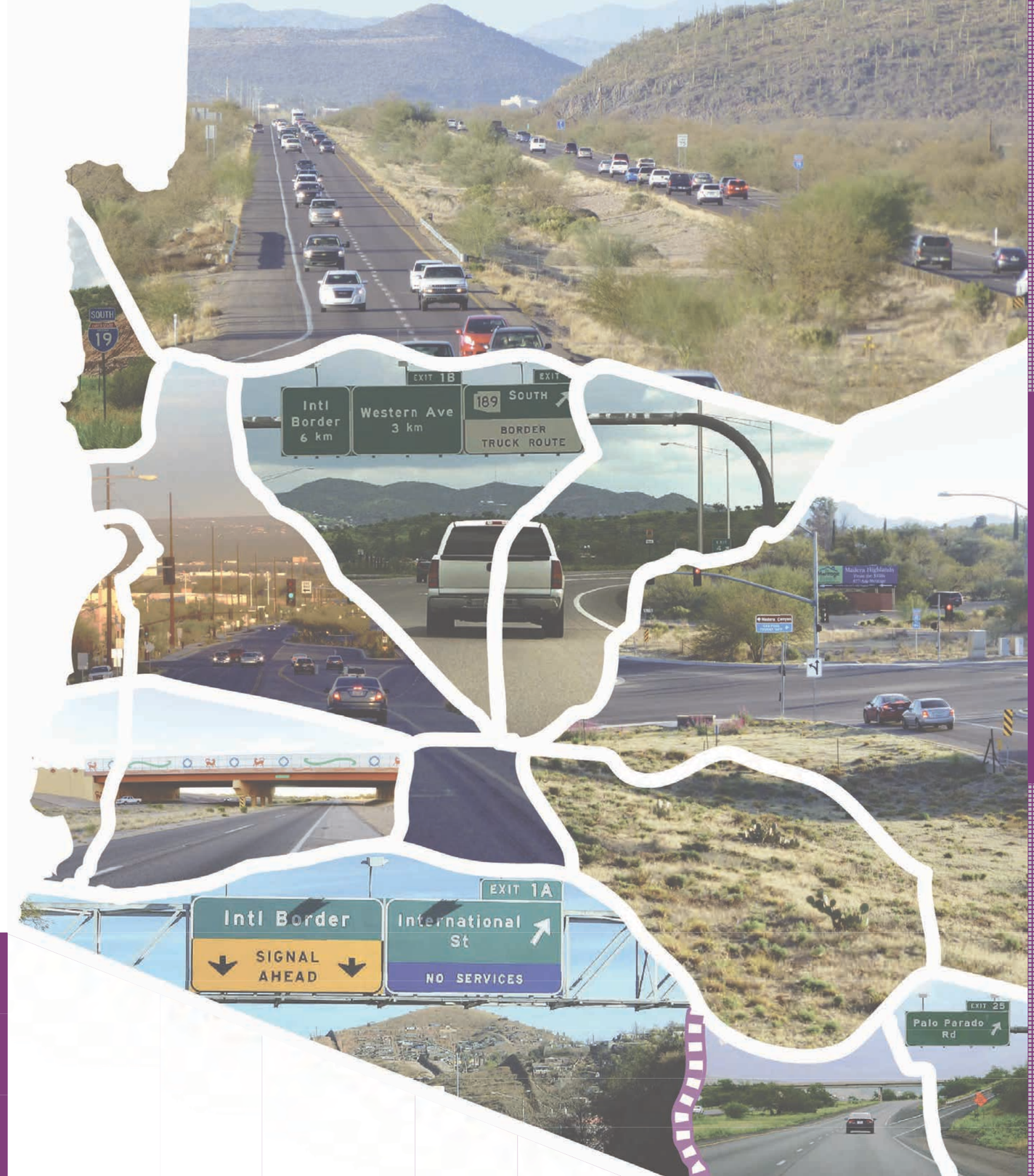
Table ES-4: Prioritized Recommended Solutions

Rank	Candidate Solution #	Solution Name and Location	Description/Scope	Estimated Cost ($ million)	Investment Category (Preservation [P], Modernization [M], Expansion [E])	Prioritization Score
1	CS19.15	Drexel/Irvington Pedestrian Overpass (I-19 MP 59.5-62)	Construct pedestrian overpass between Drexel and Irvington; construct 8' barrier fencing Valencia to Ajo Way (east side) and between Drexel and Irvington Rd (west side)	$2.25	M	**188**
2	CS19.14	Tucson Area GP Widening (I-19 MP 57-61.9)	Construct new general purpose lane (inside) in NB/SB direction between Irvington Rd and San Xavier Rd	$33.43	E	**106**
3	CS19.6	Sahuarita to Tucson Shoulder & Roadside Improvements (I-19 MP 39.5-61.9)	Rehabilitate shoulders in both directions from Sahuarita Rd to Irvington Rd.	$13.79	M	**89**
4	CS19.1	Nogales to Tubac Shoulder & Roadside Improvements (I-19 MP 3-30)	Rehabilitate shoulders in both directions from the SR189 TI to Aravaca Rd TI	$15.19	M	**74**
5	CS19.12	Tucson Area Parallel Ramps (I-19 MP 57-61.9)	Modify entry/exit ramps to parallel configuration Implement ramp metering at Irvington Rd SB, Valencia Rd NB/SB, and San Xavier Rd NB	$13.94	M	**47**
6	CS19.13	Tucson Variable Speed Limits (I-19 MP 57-64)	Implement Variable Speed Limits (both directions)	$24.99	M	**31**
7	CS19.5	Sahuarita to Tucson Lighting (I-19 MP 39.5-60)	Install lighting (both directions)	$27.52	M	**16**
8	CS19.3	Nogales to Tubac Lighting (I-19 MP 3-30)	Install lighting (both directions)	$36.25	M	**16**
9	CS19.10	Pima Mine TI Ramp Improvements (I-19 MP 49.6)	Modify entry/exit ramps to parallel configuration	$5.60	M	**13**
10	CS19.11	Papago TI Ramp Improvements (I-19 MP 54.4)	Modify entry/exit ramps to parallel configuration	$4.43	M	**6**
11	CS19.9	Sahuarita TI Ramp Improvements (I-19 MP 46.8)	Modify entry/exit ramps to parallel configuration	$4.43	M	**1**

Figure ES-8: 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 Interstate 19 (I-19)/ between the Mexico Line and Interstate 10 (I-10). The study examines key performance measures relative to the I-19 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 is conducting eleven CPS within three separate groupings.

The eleven corridors are being evaluated within three separate groups.

The first three studies (**Round 1**) began in Spring 2014, and encompass:

- I-17: SR 101L to I-40
- I-19: Nogales to I-10
- I-40: California State Line to I-17

The second round (**Round 2**) of studies, initiated in Spring 2015, includes:

- I-8: California State Line to I-10
- I-40: I-17 to the New Mexico State Line
- SR 95: I-8 to I-40

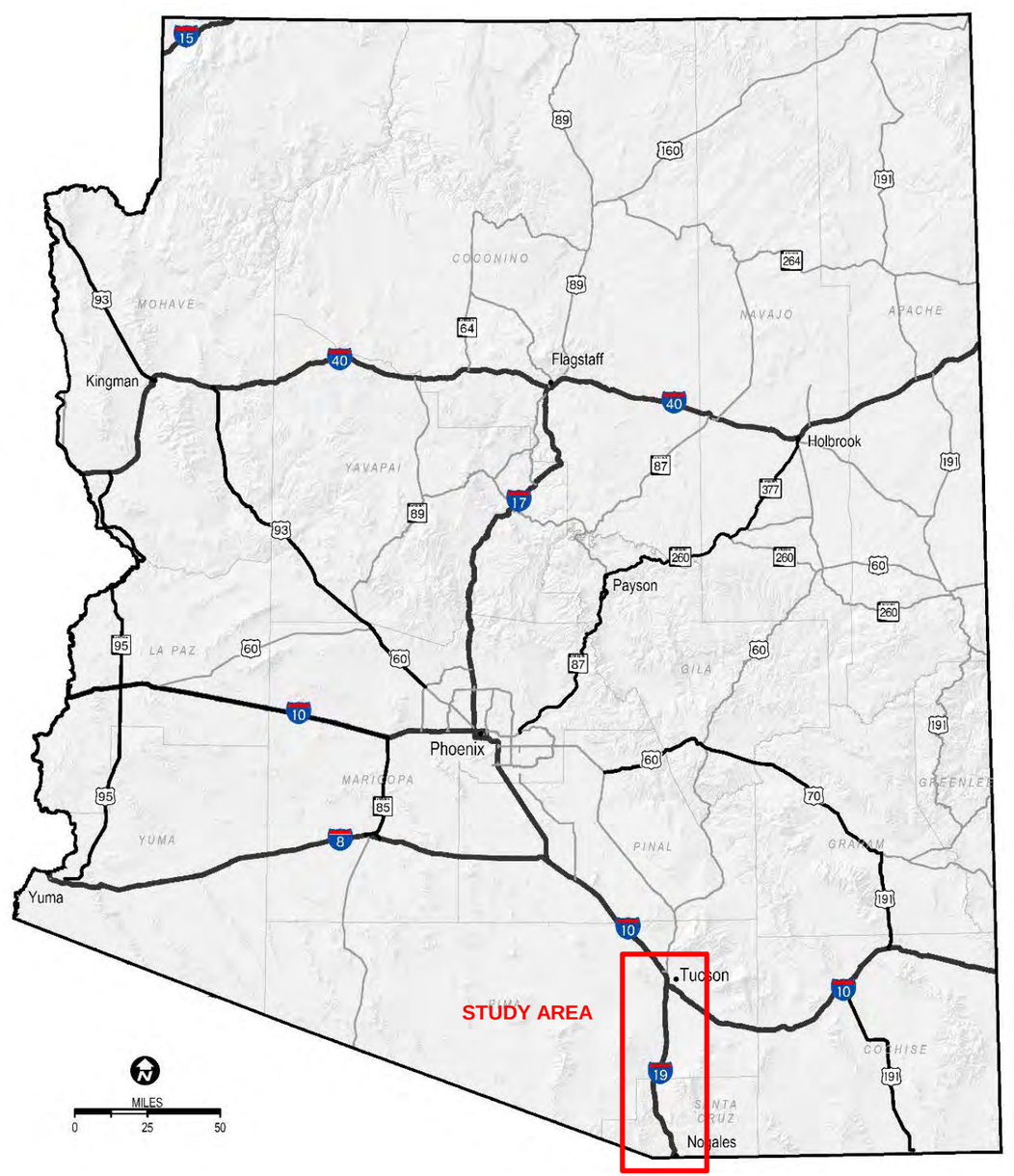
The third round (**Round 3**) of studies, initiated in Fall 2015, includes:

- I-10: California State Line to SR 85 and SR 85: I-10 to I-8
- I-10: SR 202L to New Mexico State Line
- SR 87/SR 260/SR 377: SR 202L to I-40
- US 60/US 70: SR 79 to US 191 and US 191: US 70 to SR 80
- US 93/US 60: Nevada State Line to SR 303L

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 I-19 Corridor, depicted in **Figure 1,** is one of the strategic statewide corridors identified and the subject of this Round 1 CPS.

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 I-19 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 I-19 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

Interstate 19 (I-19) is a major corridor for intrastate and international commerce between Mexico and the United States. It is one of nine ADOT defined corridors that play a key role in the understanding the overall health of the statewide transportation system. I-19 is considered a strategic highway corridor by ADOT as well as a key commerce corridor as part of the National Primary Freight Network. Safe and reliable movement of people, vehicles, and goods, and the maintenance of corridor infrastructure are priorities for I-19. Within Tucson, I-19 serves as a route for daily commuters and intrastate and international travel to and from Mexico. As both Tucson and the use of international trade ports of Mexico continue to grow in the future, highway capacity, safety, and freight logistics will become higher priorities along I-19.

1.4 Corridor Segments

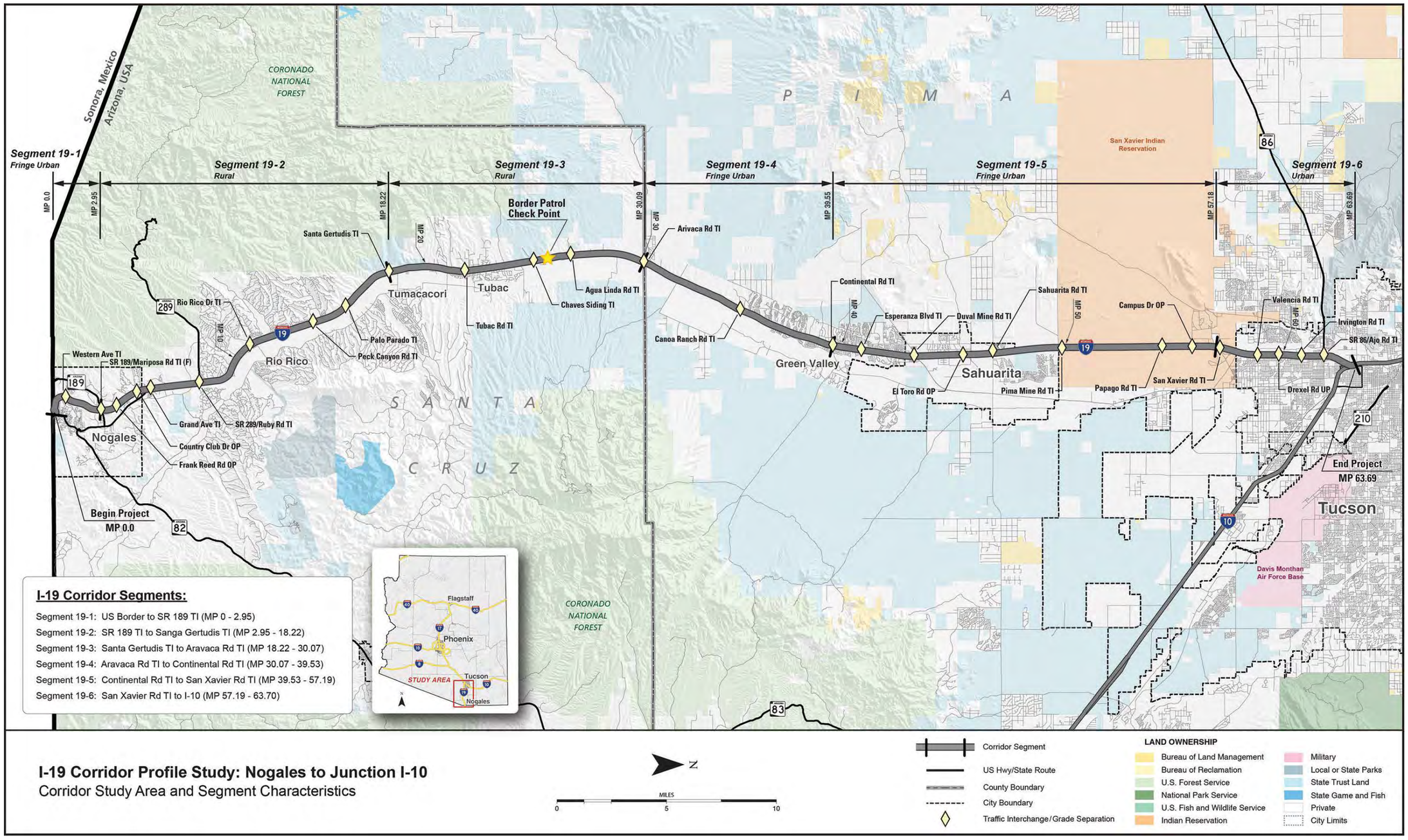
The I-19 Corridor is a multi-modal corridor located in southern Arizona that serves international, regional, and local traffic and commerce demand between the United States and Mexico. I-19 spans approximately 63 miles from the international border near Nogales, Arizona at milepost 0.00 north to the junction with Interstate 10 (I-10) at milepost 63.69 in Tucson, Arizona as illustrated in **Figure 2.**

The I-19 Corridor is divided into 6 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 section. Corridor segments are described in **Table 1** and shown in **Figure 2**.

Table 1: I-19 Corridor Segments

Segment	Begin	End	Approx. Begin Milepost	Approx. End Milepost	Approx. Length (miles)	Typical Through Lanes (NB/EB, SB/WB)	2014/2035 Average Annual Daily Traffic Volume (vpd)	Character Description
19-1	International Border	Nogales	0.00	2.95	3	4	10,015 / 15,591	Fringe urban, rolling terrain, transition from 4-lane surface street to 4-lane divided, 0 interchanges, Santa Cruz County, City of Nogales
19-2	Nogales	Santa Gertudis TI (Rock Corral Rd)	2.95	18.22	15	4	20,595 / 31,603	Rural, level terrain, 4-lane divided, 6 interchanges, Santa Cruz County
19-3	Santa Gertudis TI	Aravaca Rd TI	18.22	30.07	12	4	16,071 / 25,329	Rural, level terrain, 4-lane divided, 3 interchanges, Santa Cruz County,
19-4	Aravaca Rd TI	Continental Rd TI	30.07	39.53	10	4	21,491 / 32,910	Fringe urban, level terrain, 4-lane divided, 4 interchanges, Pima County
19-5	Continental Rd TI	San Xavier Rd. TI	39.53	57.19	17	4	36,855 / 51,970	Fringe urban, level terrain, 4-lane divided, 7 interchanges, Pima County, Tohono O'odham Nation San Xavier District
19-6	San Xavier Rd. TI	Tucson	57.19	63.70	7	4-6	67,438 / 101,375	Urban, level terrain, 4-lane divided, 7 interchanges, Pima County, City of Tucson, Tohono O'odham Nation San Xavier District

Figure 2: Corridor Location and Segments



1.5 Corridor Characteristics

I-19 is a major corridor for intrastate and international commerce between Mexico and the United States. It is one of nine ADOT defined corridors that play a key role in the understanding the overall health of the statewide transportation system.

National Context

The I-19 Corridor functions as a significant international and regional route, connecting the border city of Nogales to Tucson in southern Arizona. It is primarily a four-lane access controlled Interstate facility with a divided median. The terrain is generally flat with some rolling, or hilly, sections on the south end. Volumes are generally moderate to the south ranging from 11,000 – 22,000, increasing in the Tucson area up to 82,000 vehicles per day.

Regional Connectivity

There are approximately 60 miles of frontage roads, mostly on the southern two-thirds of the corridor. Frontage roads, cross roads, and freeway ramps are not included in this analysis. I-19 will eventually connect to the proposed I-11 corridor transporting freight and other traffic throughout Arizona.

Commercial Truck Traffic

The corridors serves as a major truck route due to the border crossing, bringing manufactured goods and produce north from Mexico and has been designated by ADOT as a critical link in Arizona's Primary Freight Network and the CANAMEX Trade Corridor, envisioned to connect Mexico, the United States and Canada. The connection to I-10 gives those products access to distribution points throughout the country. Total truck volumes are about 8-14% of the total vehicle flow, with over 5,000 trucks per day on I-19 in the Tucson area.

Commuter Traffic

I-19 serves as a commuter route from communities south of Tucson to employment centers in the metropolitan area. With over 369,000 jobs in Tucson (US Census 2010), the City itself is a major traffic generator and receiver of local and regional trips. Resulting traffic volumes on the northern segments of the corridor, already pushing capacity limits with about 82,000 vehicles per day is projected to grow to over 100,000 vehicles per day by 2035. Efficient travel for commuting traffic must be maintained in order to fulfill the corridor's role in support of the State's economic vitality.

Recreation and Tourism

The corridor serves as a tourism and travel route between Arizona and Mexico. Recreational opportunities along the corridor include:

- Coronado National Forest – 1,783,639 acres of multiple use opportunities throughout southeastern Arizona
- Tubac - Home to the Art Colony of Tubac
- Presidio State Historic Park – Presidio established 1752 at Tubac
- Santa Cruz River - a top spot for Arizona birding
- Saguaro National Park - near Tucson, over 700,000 annual visitors

Multi-Modal Uses

Freight Rail

The CANAMEX Corridor is a nationally designated high priority freight route linking western states to Mexico and Canada. The CANAMEX Corridor generally follows I-19 from Nogales to Tucson, then north to Phoenix. Approximately six trains per day carry six million tons annually on the UPRR Nogales Subdivision. Growing international trade is expected to increase the need to develop the corridor in the near future.

Passenger Rail

No passenger rail services are currently available on the corridor. However, the Arizona State Rail Plan supports the possibility of intercity passenger rail from Tucson to Nogales and across the border to Mexico as a recommended action.

Bicycles/Pedestrians

Bicycles are permitted on the outside shoulders of I-19 from MP 0 – 43. They are prohibited on the portion of the corridor between MP 43 – 64 (Jct I-10). Pedestrians are prohibited along the entire length of I-19 mainline.

Bus/Transit

The Pima Association of Governments (PAG) manages federal transportation dollars apportioned to the Tucson region, including funding for regional transit improvements. Regional transit is also supported by a Regional Transportation Authority's funded through a ½ cent transaction privilege tax (Short Range Transit Plan, PAG, 2013).

PAG operates a variety of services, designed as an integrated and seamless transit concept, including:

- Sun Tran
- Sun Express
- Sun Van
- Sun Shuttle
- Sun Shuttle Dial-a-Ride

Riders use an integrated fare payment system to access different services without the need to purchase additional full fare passes. The services provide an important link connecting the Tucson Metropolitan area to surrounding rural and suburban communities.

The current Sun Tran system provides over 20 million passenger trips annually utilizing a fleet of 253 buses on 27 local routes and 17 express routes serving the majority of the City of Tucson as well as South Tucson, Marana, unincorporated Pima County, and Oro Valley. Sun Tran's 253 bus fleet runs 365 days a year to meet the transportation needs of customers.

Dial-a-Ride services extend to Oro Valley and Green Valley/Sahuarita. The Town of Oro Valley funds, manages and operates Sun Shuttle Dial-a-Ride senior services as well as general public services in Oro Valley.

Although there is interest in transit services from Nogales along the I-19 corridor to Rio Rico and Tubac, with connections to Tucson, no public agency has been identified to operate a transit system in the area (Unified Nogales South Santa Cruz County Transportation Plan 2010). No private service is available on the corridor.

Aviation

The region is served by Tucson International Airport. It is the second largest airport in Arizona, with approximately 1.5 million annual enplanements. The airport is not a hub or focus city for any airline. Public transportation to the airport is available through Sun Tran.

Tribes

The Tohono O'odham Nation, San Xavier District abuts the I-19 corridor south of Tucson. Approximately 1,250 people live within the District. It operates two Desert Diamond Casino locations near Valencia Road/Nogales Highway and at I-19/Pima Mine Road in Sahuarita.

The Pascua Yaqui Indian Reservation is located in Pima County, in the southwestern part of the Tucson metropolitan area near Drexel Heights and Valencia West, with a resident population over 3,300. The Tribe operates two gaming facilities, the Casino of the Sun and the Casino del Sol. While not directly adjacent to the I-19 corridor, it is nearby. It is adjacent to eastern section of the Tohono O'odham Nation, San Xavier District.

Land Ownership, Land Uses, and Jurisdictions

The I-19 corridor serves a variety of land uses and jurisdictions. The corridor begins in the City of Nogales on the south end at the border with Mexico. Segments 19-1 and 19-2 are characterized as fringe urban in nature, dominated by commercial, industrial, and transportation industry uses.

The north end is anchored by the City of Tucson, and transitions from fringe urban in segment 19-5 to urban uses and heavier traffic in segment 19-6. The outlying areas include residential subdivisions with a variety of lot sizes, dispersed residences, and light commercial development.

Population Centers

The corridor between the two cities is predominantly rural in nature, with several retirement and bedroom communities. The small towns of Rio Rico, Tumacacori, Tubac, and Amado are in Santa Cruz County. The communities of Green Valley and Sahuarita in Pima County orient more toward Tucson, with many people commuting to employment in the City.

Pima County will grow from just over one million residents in 2015 to 1.3 million by 2035, with over half the County's residents in Tucson. Overall, the County will see moderate growth during the period, with faster growth in some outlying areas such as Sahuarita. The urbanized zone will grow toward the south, with accompanying urban-style traffic. Santa Cruz County is also projected to receive moderate population growth during the period. **Table 2** summarizes the current and project population for the jurisdictions within Santa Cruz County and Pima County.

Table 2: Current and Future Population

Community	2015 Population	2035 Population	Annual Growth Rate	Total Growth
Santa Cruz County	**50,903**	**67,923**	**1.45%**	**33.4%**
Nogales	22,348	29,821	1.45%	33.4%
Patagonia	978	1,305	1.45%	33.4%
Rio Rico CDP	20,370	27,181	1.45%	33.4%
Sonoita CDP	879	1,173	1.45%	33.4%
Tubac CDP	1,279	1,707	1.45%	33.4%
Balance of County	27,576	36,797	1.45%	33.4%
Pima County	**1,022,079**	**1,312,101**	**1.26%**	**28.4%**
Marana	41,019	68,859	2.62%	67.9%
Oro Valley	42,259	52,072	1.05%	23.2%
Sahuarita	28,483	48,527	2.70%	70.4%
South Tucson	5,670	5,544	-0.11%	-2.2%
Tucson	537,129	683,038	1.21%	27.2%
Balance of County	367,519	454,061	1.06%	23.5%

source: https://population.az.gov/population-projections

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 suggestive actions that can be taken to alleviate those stressors. The Habimap Tool™ (http://www.habimap.org/) provides an interactive database of information included in the SWAP. These databases and other environmental resources should be conducted early on during all project related activities to ensure appropriate environmental compliance. Managers of potentially impacted areas should be included in outreach and coordination programs. The following wildlife and habitat considerations affecting rights-of-way along the I-19 corridor were identified should not be considered a comprehensive listing of affected resources:

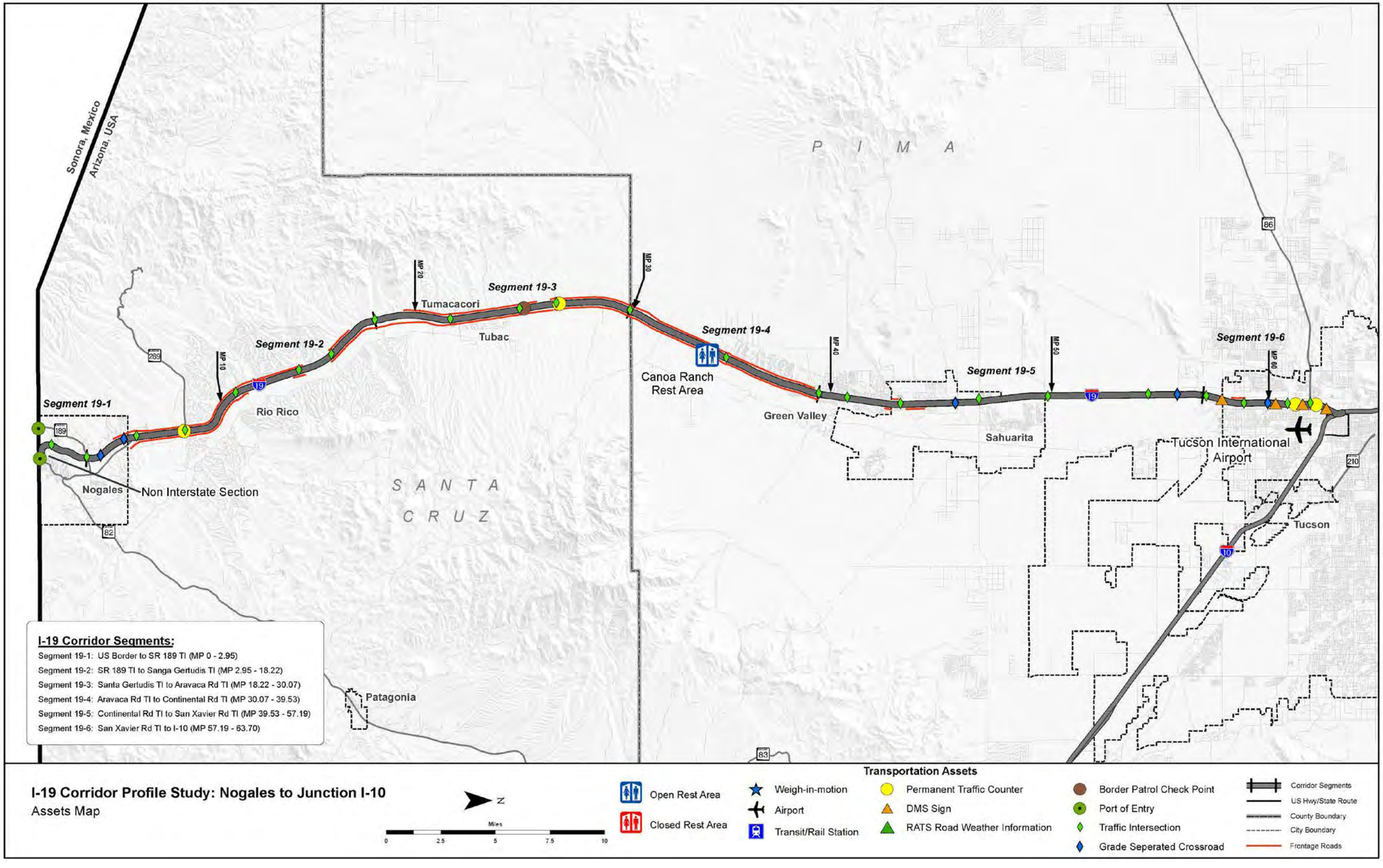
- Wildlife waters – None
- Important Bird Areas – None
- Allotments/Pastures (grazing) including State Land Department, Bureau of Land Management, US Forest Service – Tumacacori area, north of Tubac
- Arizona Game and Fish Department Parcels – None
- State Land Trust lands are present, immediately adjacent to the corridor near Tumacacori and Sahuarita
- Arizona Wildlife Linkages – Missing or Potential Linkages noted: Tumacacori Santa Ritas Linkage at Polero Creek north of Nogales, in the Tumacacori area, north of Tubac, and near W. Arivaca Rd
- Species and Habitat Conservation Guide (SHCG) indicates several high value areas of sensitive habitats throughout the southern part of the corridor
- Species of Economic and Recreational Importance (SERI) model indicates areas of high importance throughout the southern end of the corridor
- Species of Greatest Conservation Need (SGCN) identifies several areas of high value sensitive habitats throughout the southern part of the corridor

Corridor Assets

Corridor transportation assets of note are summarized in **Figure 3**.

- Grade separated traffic interchanges: 23
- Signalized intersections in Nogales: 3
- Un-signalized intersections in Nogales: 2
- Grade separated cross roads: 5
- Frontage roads: NB 32 miles; SB 29 miles
- Port of Entry: 2
    - Nogales - Private vehicles and pedestrians only at MP 0.0
    - Mariposa Land Port of Entry - Commercial vehicles at US 189 MP 0.0
- Border Patrol check point: MP 25.0 NB
- Rest Area: Canoa Ranch Rest Area MP 34.0 near Green Valley
- Permanent traffic counters: MP 7.7, MP 26.6, MP 61.1, MP 62.1
- Digital Message Signs (DMS): MP 57.9 NB, MP 60.1 SB, MP 61.4 NB, MP 62.8 SB
- Tucson International Airport

Figure 3: Corridor Assets



1.6 Corridor Stakeholders and Input Process

A Technical Advisory Committee (TAC) was created that was comprised of representatives from the stakeholders. TAC meetings were held at key milestones to present results and obtain feedback. In addition, several meetings were conducted with key stakeholders between June 2014 and October 2016 to present the results and obtain feedback.

Key stakeholders identified for this study include:

- ADOT South Central District
- City of Nogales
- City of Tucson
- Fresh Produce Association of the Americas
- Greater Nogales Santa Cruz County Port Authority
- Pascua Yaqui Tribe
- PAG
- Pima County
- Regional Transportation Authority/Mainstreet Program
- Santa Cruz County
- SEAGO
- Tohono O'odham Nation
- Town of Sahuarita
- Tucson Hispanic Chamber

Several Working Papers were developed during the course of the Corridor Profile Study. The Working Papers 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 I-19 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 Studies

- 2015-2019 Five-Year Transportation Facilities Construction Program
- What Moves You Arizona, Arizona Long-Range Transportation Plan 2010-2035
- Arizona Statewide Travel Demand Model (AZTDM)

Regional Planning Studies

- PAG 2040 Regional Transportation Plan (RTP)
- PAG 2015-2019 5-Year Regional Transportation Improvement Program
- PAG Regional Significant Corridor Study
- PAG State Transportation System Mobility and Regional Circulation Needs Feasibility Study
- PAG Southeast Area Arterial Study
- Regional Transportation Authority Our Mobility Plan
- PAG Short-Range Transit Program Implementation Plan – FY2014-FY2018
- PAG High Capacity Transit System Plan
- I-11 Southern Arizona Future Connectivity Corridor Feasibility Assessment Report
- Arizona-Sonora Border Master Plan
- Mariposa Port of Entry Bottleneck Study
- Mariposa/I-19 Connector Route Study Final Report
- Southeast Arizona Regional Transportation Profile Study – Nogales Railroad Assessment Study
- Santa Cruz County Comprehensive Plan
- Unified Nogales Santa Cruz County Transportation Plan
- City of Nogales General Plan

Planning Assistance for Rural Areas (PARA) Studies

- Sahuarita/El Toro Corridor Study Final Report
- Rio Rico Walking and Biking Study
- Town of Sahuarita Area Transportation Study
- San Xavier District Pedestrian Access and Safety Study

Design Concept Studies and Final Design

- I-19 Pavement Preservation, MP 31.8 to MP 42.5
- SR 189: International Border to Grand Avenue Stage I Alternative Corridor Screening
- I-19 East Frontage Rd Project Assessment, Ruby Road to Rio Rico Dr.
- I-19, Southbound Valencia Road Exit Ramp Final Design
- I-19, Ajo Way TI Final Design
- I-19, San Xavier to I-10 DCR and EA
- I-19 Frontage Roads Study
- I-19 Corridor Study, I-10 to Pima/Santa Cruz County Line

Summary of Prior Recommendations

The recommendations of each study were carefully considered during the corridor profile study. Many of the studies recommend duplicate actions, representing significant capacity and operational improvements to the corridor. Many of these recommendations have already been implemented or programmed for completion. The aggregate recommendations are summarized in **Table 3** and illustrated on **Figure 4**.

A summary of major prior recommendations includes:

Major Widening/Capacity Improvements

- Widen to 6 lanes from SR 189/Mariposa TI to Tubac Road TI
- Widen to 6 lanes from Continental Road TI to Sahuarita Road TI
- Widen to 8 lanes from Sahuarita Road TI to I-10

Interchanges

- SR 189/Mariposa Road pending completion of Environmental Assessment
- Minor improvements have been recommended at all traffic interchanges from Nogales to Continental Road TI
- Reconstruction or other major improvements have been recommended at all traffic interchanges from Continental Road TI north to I-10
- New traffic interchange at Los Reales Road
- New traffic interchange at Drexel Road

Table 3: Corridor Recommendations from Previous Studies

Map Key Ref. No.	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)?	
1	0	3	3	International Border - Mariposa/SR 189 Mill and Replace	√			FY 2015	H839401C	N	2015-2019 Five-Year Transportation Facilities Construction Program
2	0	1.17	1.17	I-19, I-19B Terminus to West Street - Roadway Improvements for Future Capacity			√	N/A	N/A	N	Unified Nogales Santa Cruz County Transportation Plan 2010, Site 75
3	0.71	4.95	1.25	Conduct Feasibility Study for the extension of the I-19 Frontage Road System between Country Club Road, Frank Reed Road and Mariposa Road			√ √ √	N/A N/A N/A	N/A N/A N/A	N	I-19 Frontage Road Study 2008 Unified Nogales Santa Cruz County Transportation Plan 2010, Site 26 City of Nogales General Plan Santa Cruz County Complete Plan 2013
4	2.95	18.19	15.24	I-19, SR 189/Mariposa Road TI to Tumacocori TI – Roadway Improvements for Future Capacity			√	N/A	N/A	N	Unified Nogales Santa Cruz County Transportation Plan 2010, Site 76
5	2.95	-	N/A	I-19 and Mariposa TI reconfiguration			√	N/A	N/A	N	Unified Nogales Santa Cruz County Transportation Plan 2010, Site 13 City of Nogales General Plan
6	2.95	-	N/A	Add dual southbound left turn lanes at I-19 and Mariposa Southbound off-ramp at the Mariposa Road (SR 189) intersection		√ √		N/A N/A	H8045 01L N/A	Y	SR 189, International Border to Grand Avenue, Stage I Alternative Screening Memo – April 2014
7	2.95	-	N/A	Add dual eastbound left turn lanes on SR 189 (Mariposa) at the I-19 and Mariposa TI northbound on-ramp (COMPLETED)		√ √		N/A N/A	H8045 01L N/A	Y	SR 189, International Border to Grand Avenue, Stage I Alternative Screening Memo – April 2014 Bottleneck Study – Mariposa Port of Entry – October 2008
8	2.95	-	N/A	Widen the throat of the I-19 and Mariposa TI northbound on-ramp (COMPLETED)		√ √		N/A N/A	H8045 01L N/A	Y	SR 189, International Border to Grand Avenue, Stage I Alternative Screening Memo – April 2014 Bottleneck Study – Mariposa Port of Entry – October 2008
9	5	6	1	West Frontage Rd At Country Club - Intersection Improvements		√		FY 2015	H868501C	N	2015-2019 Five-Year Transportation Facilities Contraction Program
10	5.3	-	N/A	I-19/Grand Avenue Partial Interchange – Interchange Improvement		√		N/A	N/A	N	Unified Nogales Santa Cruz County Transportation Plan 2010, Site 35 City of Nogales General Plan
11	5.30	10.96	5.66	I-19 East and West Frontage Roads, Grand Ave TI to Rio Rico Drive TI – Roadway Improvements for Future Capacity			√	N/A	N/A	N	Unified Nogales Santa Cruz County Transportation Plan 2010, Site 77
12	7.70	14.37	6.67	Complete Shared Use Path along I-19 West Frontage Road (Ruby Road to Peck Canyon Wash)		√		N/A	N/A	N	Rio Rico Walking and Biking Study - 2013
13	7.71	10.88	3.17	Evaluate and recommend operational improvements at the intersection of the I-19 East Frontage Road and Ruby Road		√ √		N/A N/A	H840101L N/A	Y	Final Project Assessment – East Frontage Road, Ruby Road – Rio Rico Drive (MP 7.71 – MP 10.88) – June 2014 Unified Nogales Santa Cruz County Transportation Plan 2010, Site 30 Rio Rico Walking and Biking Study – 2013 Arizona-Sonoran Border Master Plan
14	8.4	9.4	1.0	I-19 "The Curve", Safety Corridor Improvements		√		N/A	N/A	N	Unified Nogales Santa Cruz County Transportation Plan 2010, Site 34
15	10.06	10.89	0.82	Design and construct New I-19 West Frontage Road from Yavapai Drive (Rio Rico Drive) to Calle Calabasas			√ √ √	N/A N/A N/A	N/A N/A N/A	N	I-19 Frontage Road Study 2008 Unified Nogales Santa Cruz County Transportation Plan 2010, Site16 Santa Cruz County Complete Plan 2013

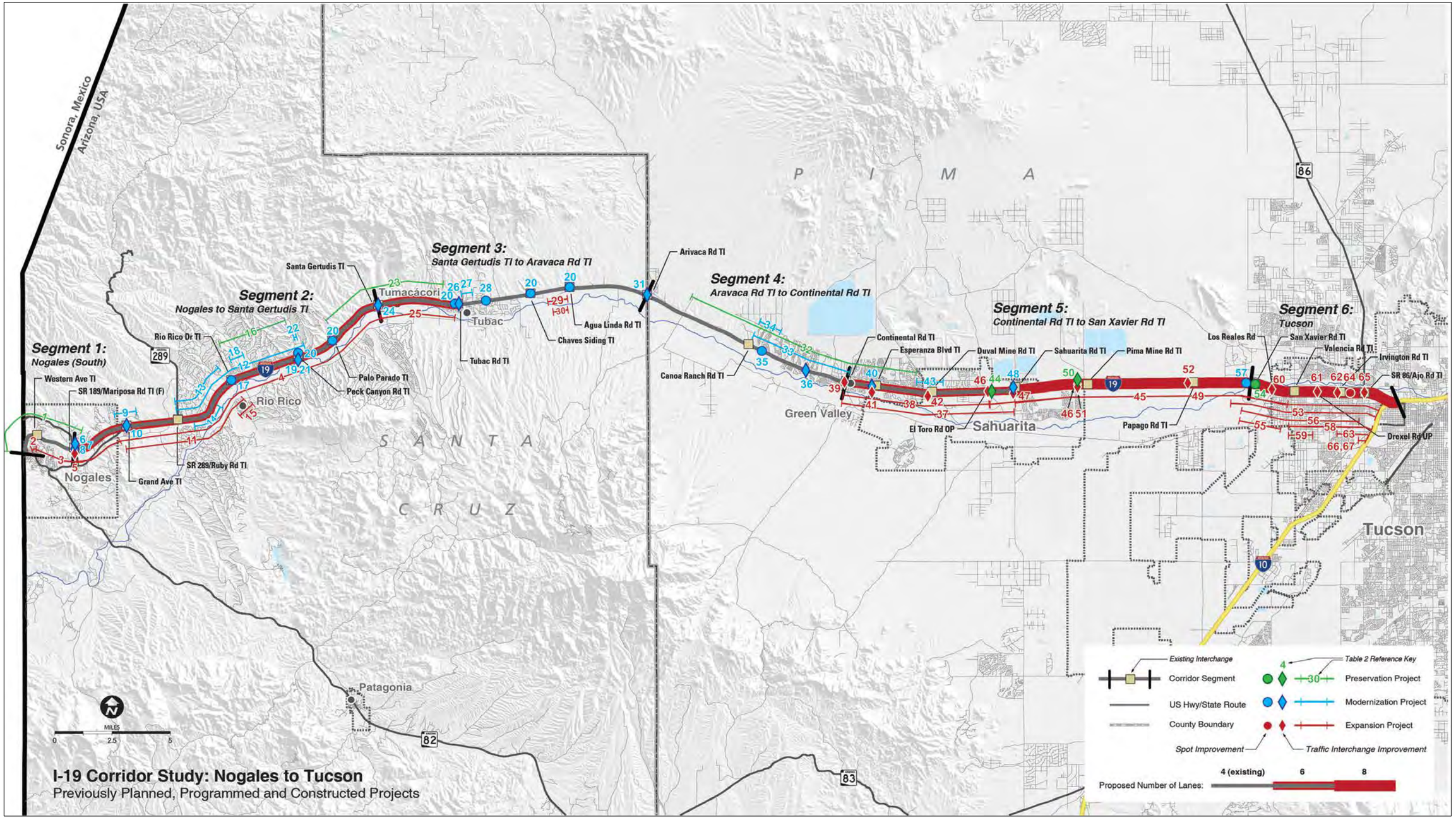
Map Key Ref. No.	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization[M], Expansion [E])			Status of Recommendation			Name of Study
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)?	
16	10.89	13.95	3.11	Improve pavement condition along I-19 West Frontage Road	√ √ √			N/A N/A N/A	N/A N/A N/A	N	I-19 Frontage Road Study 2008 Unified Nogales Santa Cruz County Transportation Plan 2010, Site 17 Santa Cruz County Complete Plan 2013
17	10.96	-	N/A	Improvements recommended include a formal modification of the existing striped shoulder area to a striped and signed bike lane for one way travel together with a sidewalk in both directions at the Rio Rico Drive and I-19 OP (Approximately 700 feet including approaches and I-19 On Ramps)		√		N/A	N/A	N	Rio Rico Walking and Biking Study - 2013
18	11.13	11.77	0.69	Design and construct continuous left-turn lane from the I-19 West Frontage Road and Circlo Mercado intersection to 0.25 miles south of Circulo Mercado intersection		√ √ √		N/A N/A N/A	N/A N/A N/A	N	I-19 Frontage Road Study 2008
19	13.82	-	N/A	Design and construct a northbound left-turn lane and a southbound right-turn lane at the I-19 West Frontage Road and Camino Lito Galindo Intersection		√ √ √		N/A N/A N/A	N/A N/A N/A	N	I-19 Frontage Road Study 2008 Unified Nogales Santa Cruz County Transportation Plan 2010, Site 19 Santa Cruz County Complete Plan 2013
20	13.96	30.00	N/A	I-19, Exit 22 (Peck Canyon Rd) to Exit 48 (Arivaca Road) – Interchange Improvements		√		N/A	N/A	N	Unified Nogales Santa Cruz County Transportation Plan 2010, Site 53
21	13.96	-	N/A	I-19, Exit 22 (Peck Canyon Rd) widen overpass and approach roads		√		N/A	N/A	N	Unified Nogales Santa Cruz County Transportation Plan 2010, Site 18
22	14.03	14.17	0.13	Design and construct a continuous left-turn lane between the access to the San Cayetano Elementary School and the access to the school district bus barn along the I-19 West Frontage Road.		√ √ √		N/A N/A N/A	N/A N/A N/A	N	I-19 Frontage Road Study 2008 Unified Nogales Santa Cruz County Transportation Plan 2010, Site 19 Santa Cruz County Complete Plan 2013
23	16	21	5	I-19 - MP 16 to MP 21.1 - RR (4" TL, 3" PL) + FR	√			FY 2015	H815601C	N	2015-2019 Five-Year Transportation Facilities Contraction Program
24	18.23	-	N/A	Design and construct a northbound left-turn lane at the I-19 East Frontage Road and Tumacacori Road Intersection		√ √ √		N/A N/A N/A	N/A N/A N/A	N	I-19 Frontage Road Study 2008 Unified Nogales Santa Cruz County Transportation Plan 2010, Site 22 Santa Cruz County Complete Plan 2013
25	18.19	21.64	N/A	I-19, Tumacocori to Tubac Wildlife Preservation Crossings			√	N/A	N/A	N	Unified Nogales Santa Cruz County Transportation Plan 2010, Site 29
26	21.71	-	N/A	Design and construct northbound and southbound left-turn lanes at the I-19 East Frontage Road and Barrio De Tubac Road intersection.		√ √ √		N/A N/A N/A	N/A N/A N/A	N	I-19 Frontage Road Study 2008 Unified Nogales Santa Cruz County Transportation Plan 2010, Site 23 Santa Cruz County Complete Plan 2013
27	21.90	22.41	0.7	Design and construct a continuous left-turn lane at the I-19 East Frontage Road and Avenida Goya intersection to Bridge Road.		√ √ √		N/A N/A N/A	N/A N/A N/A	N	I-19 Frontage Road Study 2008 Unified Nogales Santa Cruz County Transportation Plan 2010 Site 24 Santa Cruz County Complete Plan 2013
28	22.92	-	N/A	Design and construct a northbound right-turn lanes at the I-19 East Frontage Road and Avenida de Otero intersection		√ √ √		N/A N/A N/A	N/A N/A N/A	N	I-19 Frontage Road Study 2008 Unified Nogales Santa Cruz County Transportation Plan 2010 Site 25 Santa Cruz County Complete Plan 2013
29	25.56	26.46	1.0	Design and construct a new one-way I-19 East Frontage Road from Chavez Siding to Agua Linda Road.			√ √ √	N/A N/A N/A	N/A N/A N/A	N	I-19 Frontage Road Study 2008 Unified Nogales Santa Cruz County Transportation Plan 2010, Site 21 Santa Cruz County Complete Plan 2013
30	25.74	26.41	0.67	Design and construct a new one-way I-19 West Frontage Road from Chavez Siding to Agua Linda Road.			√ √ √	N/A N/A N/A	N/A N/A N/A	N	I-19 Frontage Road Study 2008 Unified Nogales Santa Cruz County Transportation Plan 2010 Site 20 Santa Cruz County Complete Plan 2013

Map Key Ref. No.	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)?	
31	29.96	-	N/A	Design and construct northbound left-turn lanes at the I-19 West Frontage Road and Arivaca Road intersection Design and construct a southbound left-turn lane at the I-19 West Frontage Road and County Line Road intersection.		√ √ √		N/A N/A N/A	N/A N/A N/A	N	I-19 Frontage Road Study 2008
32	31.8	42.5	10.7	I-19 - MP 31.8 to MP 42.5 – Mill & Replace	√			Not Programmed	H871601D	Y	Final Design - 2014
33	34.96	39.54	4.55	Design and construct wider shoulders along I-19 West Frontage Road from Continental Road to Canoa Ranch Road. Design and construct intersection lighting at the I-19 West Frontage Road and Camino Encanto. Design and construct intersection lighting at the I-19 West Frontage Road and Via Del Petirrojo.)		√ √ √ √		N/A N/A N/A N/A	N/A N/A N/A N/A	N	I-19 Frontage Road Study 2008
34	35	36	1	Canoa Shoulders - Construct Shoulder Widening		√		FY 2015	H868801C	N	2015-2019 Five-Year Transportation Facilities Contraction Program
35	35.50	-	N/A	Design and construct a northbound left-turn lane and intersection Lighting at the I-19 West Frontage Road and Calle Tres Intersection.		√ √ √		N/A N/A N/A	N/A N/A N/A	N	I-19 Frontage Road Study 2008
36	37.68	-	N/A	Construct a New Freeway Crossing on the Camino Encanto Roadway Alignment		√		N/A	H594901L	N	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003
37	39.44	46.81	7.37	I-19, Continental Road to Sahuarita Road (Helmet Peak) TI – Widen to 6 – lanes plus auxiliary lane			√	N/A	H594901L	N	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003
38	39.45	45.80	6.35	I-19, Continental Road to El Toro Road – Widen to 6 - lanes			√ √ √	N/A N/A N/A	H594901L N/A N/A	N	PAG 2040 Regional Transportation Plan
39	39.44	-	N/A	I-19 and Continental Road TI – TI reconstruction to incorporate wider mainline			√	N/A	H594901L	N	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003
40	40.65	-	N/A	I-19 and Esperanza Blvd TI - Construct Pedestrian Enhancements		√		FY 2016	H828601C	N	2015-2019 Five-Year Transportation Facilities Contraction Program
41	40.65	-	N/A	I-19 and Esperanza Blvd TI – TI reconstruction to incorporate wider mainline			√	N/A	H594901L	N	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003
42	43.10	-	N/A	I-19 and Duval Mine Road TI – TI reconstruction to incorporate wider mainline			√	N/A	H594901L	N	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003
43	43.10	-	0.50	I-19 East Frontage Road – Realign and Reconstruct Roadway from S ¼ corner of Sec 26,T17S,R13E to Nogales Highway		√ √		N/A N/A	N/A N/A	N	Town of Sahuarita Area Transportation Study – 2010 PAG 2040 Regional Transportation Plan
44	45.80	-	1.0	El Toro Road OP, SB #1573 & NB #1572 - Design Bridge Deck Rehabilitation	√			FY 2016	None Assigned	N	2015-2019 Five-Year Transportation Facilities Contraction Program
45	45.70	58.90	13.20	I-19, El Toro Road to Valencia Road – Widen to 6 - lanes			√ √ √	N/A N/A N/A	H594901L N/A N/A	N	PAG 2040 Regional Transportation Plan
46	45.70 / 49.62	-	N/A	Alternate truck route to avoid the future I-10/I-19 interchange congestion for eastbound freight. Project would require a new interchange at El Toro and I-19 or an upgrade to Pima Mine Road and I-19.			√ √	N/A N/A	N/A N/A	N	Town of Sahuarita Area Transportation Study – 2010 PAG Southeast Area Study Sahuarita/El Toro Corridor Study – March 2013

Map Key Ref. No.	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)?	
47	46.81	-	N/A	I-19 and Sahuarita Road (Helmet Peak Rd) TI – Reconstruct traffic interchange			√ √	N/A N/A	N/A N/A	N	Town of Sahuarita Area Transportation Study – 2010 PAG Southeast Area Study PAG 2040 Regional Transportation Plan
48	46.81	-	N/A	I-19 and Sahuarita Road – Park & Ride Lots		√ √		N/A N/A	N/A N/A	N	Town of Sahuarita Area Transportation Study – 2010 PAG 2040 Regional Transportation Plan (Reserve)
49	46.81	63	16.19	Reconstruct I-19 to four lanes in each direction and provide auxiliary lanes for Northbound and Southbound I-19 from the I-19 and Sahuarita TI to I-10			√	N/A	H594901L	N	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003
50	49.62	-	N/A	Pima Mine TI OP BR SB# 1304/ NB #1303 - Bridge Deck Rehabilitation	√			FY 2016	H817801C	N	2015-2019 Five-Year Transportation Facilities Contraction Program
51	49.62	-	N/A	I-19 and Pima Mine Road Interchange (Phase 1) – Reconstruct interchange and widen Pima Mine Road to 4-lanes east of north ramp to Casino Entrance (or Nogales Highway)			√ √ √	N/A N/A N/A	H594901L N/A N/A	N	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003 Sahuarita/El Toro Corridor Study – March 2013 Town of Sahuarita Area Transportation Study – 2010 PAG Southeast Area Study PAG 2040 Regional Transportation Plan
52	54.40	-	N/A	I-19 and Papago TI – Reconstruct traffic interchange			√	N/A	H594901L	N	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003
53	56.3	63	6.7	Reconstruct I-19 to four lanes in each direction between San Xavier Road and I-10			√ √ √	N/A N/A N/A	H594901L H846701L N/A	Y	Final Design Concept Report, I-19 San Xavier Road TO I-10, August 23, 2012
54	56.80	57.80	1	Santa Cruz River BR SB# 1244 / NB #1243 Bridge Deck Rehabilitation	√			FY 2016	H858201C	N	2015-2019 Five-Year Transportation Facilities Construction Program
55	56.90	58.85	1.95	Construct modified split diamond interchange between San Xavier Road and Los Reales Road connected by Collector-Distributor (CD) roads.			√ √ √	N/A N/A N/A	H594901L H846701L N/A	N	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003 Final Design Concept Report, I-19 San Xavier Road TO I-10, August 23, 2012 PAG 2040 Regional Transportation Plan
56	56.90	61.90	5.00	I-19, San Xavier Rd to Ajo Way – Widen to 6 - lanes			√ √	N/A N/A	N/A H846701L	N	PAG 2040 Regional Transportation Plan
57	56.95	-	N/A	Shared Use Path near San Xavier Road and I-19 TI On and Off Ramps		√		N/A	N/A	N	San Xavier District Pedestrian Access and Safety Study – 2009
58	58.82	63	4.15	Provide auxiliary lanes for Northbound I-19 between Los Reales Road and Valencia Road, Valencia Road and Drexel Road, Drexel Road and Irvington Road, Irvington Road and Ajo Way, and Ajo Way and I-10			√ √	N/A N/A	H594901L H846701L	Y	Final Design Concept Report, I-19 San Xavier Road TO I-10, August 23, 2012
59	58.82	59.90	1.08	Reconstruct the existing Southbound I-19 off-ramp at Valencia Road to accommodate the new braided ramps between Valencia Road and Drexel Road			√ √	N/A N/A	H594901L H846701L	Y	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003 Final Design Concept Report, I-19 San Xavier Road TO I-10, August 23, 2012
60	58.82	-	N/A	Los Reales Road & I-19 – Connect Los Reales from I-19 to Old Nogales Highway. Construct New TI at Los Reales Road and I-19			√ √	N/A N/A	H594901L H846701L	Y	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003 PAG Southeast Area Study Final Design Concept Report, I-19 San Xavier Road TO I-10, August 23, 2012
61	59.90	-	N/A	Drexel Road and I-19 – Construct New SPUI			√ √	N/A N/A	H594901L H846701L	Y	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003 Final Design Concept Report, I-19 San Xavier Road TO I-10, August 23, 2012 PAG 2040 Regional Transportation Plan

Map Key Ref. No.	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)?	
62	60.95	-	N/A	Irvington Road and I-19 – Design and reconstruct new TI (SPUI)			√ √ √ √	N/A FY 2019 N/A N/A	H594901L None Assigned H846701L N/A	Y	2015-2019 PAG Five-Year Transportation Facilities Construction Program Final Design Concept Report, I-19 San Xavier Road TO I-10, August 23, 2012 PAG 2040 Regional Transportation Plan
63	60.95	63	2.05	Reconstruct the existing ramps in the southbound direction between I-10 and Ajo Way (SR 86), and between Ajo Way and Irvington Road as braided ramps (Phase 1)			√ √ √ √	N/A FY 2015 N/A N/A	H594901L H84601D H846701L N/A	Y	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003 2015-2019 Five-Year Transportation Facilities Construction Program Final Design Concept Report, I-19 San Xavier Road TO I-10, August 23, 2012 PAG 2040 Regional Transportation Plan
64	61.40	-	N/A	Construct new pedestrian bridge over I-19 near Michigan Street			√		H846701L	Y	Final Design Concept Report, I-19 San Xavier Road TO I-10, August 23, 2012
65	61.90	-	N/A	Reconstruct the existing partial clover leaf TI at Ajo Way (SR 86) to a SPUI (Phase 2)			√ √ √ √	N/A FY 2018 N/A N/A	N/A H84601D N/A N/A	Y	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003 2015-2019 Five-Year Transportation Facilities Construction Program Final Design Concept Report, I-19 San Xavier Road TO I-10, August 23, 2012 PAG 2040 Regional Transportation Plan
66	61.90	63	1.1	Provide CD roads between Ajo Way and I-10			√	N/A	H846701L	Y	Final Design Concept Report, I-19 San Xavier Road TO I-10, August 23, 2012
67	61.90	63	1.1	Reconstruct the existing ramps in the northbound direction between Ajo Way and I-10 as braided ramps			√	N/A	H846701L	Y	Final Design Concept Report, I-19 San Xavier Road TO I-10, August 23, 2012
68	-	-	N/A	High Occupancy Vehicle (HOV) Lanes Expansion – I-10 & I-19			√	N/A	N/A	N	PAG 2040 Regional Transportation Plan (Reserve)
69	-	-	N/A	Freeway Management System Expansion – I-10 & I-19		√ √		N/A N/A	H846701L N/A	N	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003 PAG 2040 Regional Transportation Plan (Reserve)
70	-	-	N/A	Reevaluation of I-19/I-10 System Interchange to accommodate 2030 traffic demands in the vicinity of the system interchange			√	N/A	H594901L	N	I-19 Corridor Study – I-10 to Pima/Santa Cruz Line – Oct 2003

Figure 4: Corridor Recommendations from Previous Studies



2.0 CORRIDOR PERFORMANCE

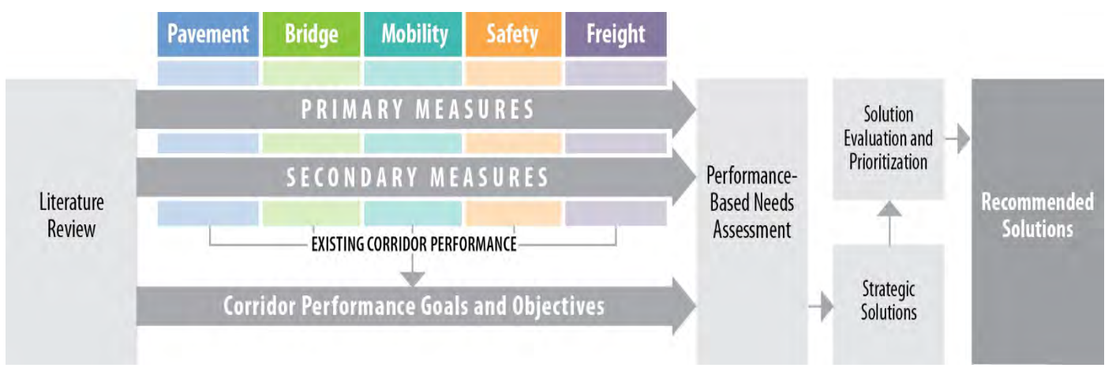
This chapter describes the evaluation of the existing performance of the I-19 corridor. A series of performance measures is used to assess the corridor. The results of the performance evaluations are used to define corridor needs relative to the long term goals and objectives for the corridor.

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.

The MAP-21 performance goals 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.

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

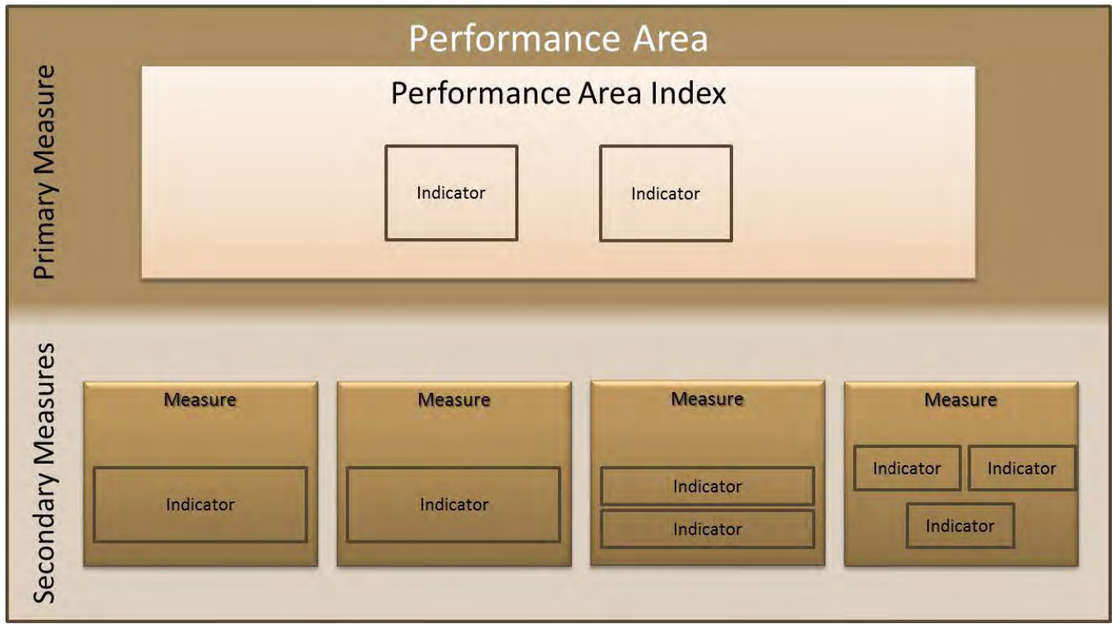
Performance Area	Primary Measure	Secondary Measures
Pavement	**Pavement Index** Based on a combination of International Roughness Index and cracking	• Directional Pavement Serviceability • Pavement Failure • Pavement Hot Spots
Bridge	**Bridge Index** Based on lowest of deck, substructure, superstructure and structural evaluation rating	• Bridge Sufficiency • Functionally Obsolete Bridges • 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 Highway Safety Plan Emphasis Areas • Crash Unit Types • Safety Hot Spots
Freight	**Freight Index** Based on bi-directional truck planning time index	• Recurring Delay • Non-Recurring Delay • Closure Duration • 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

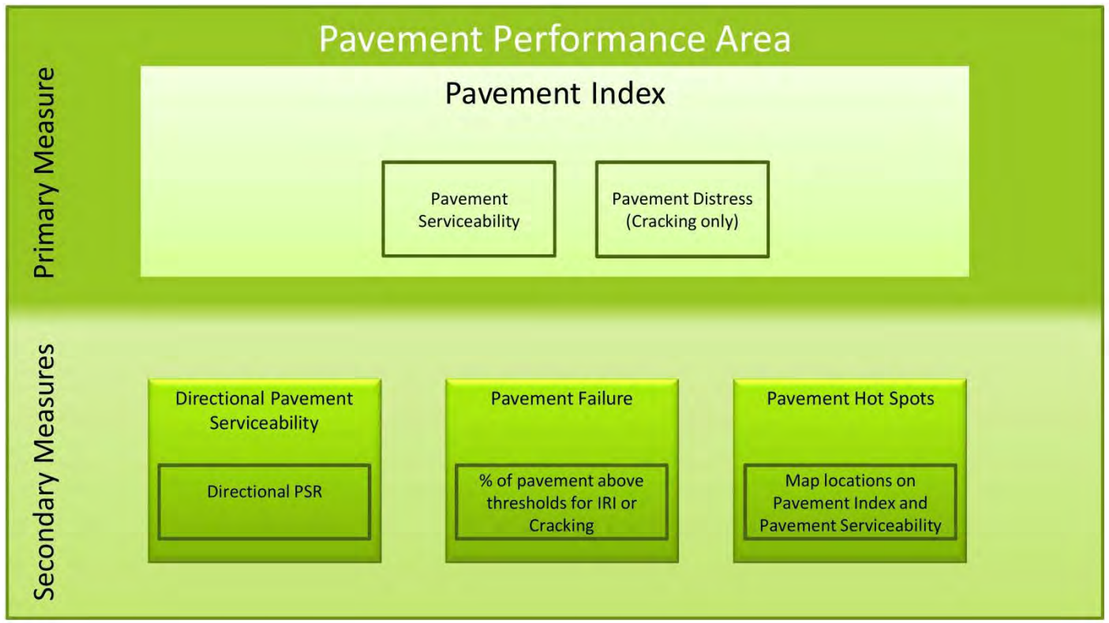
Figure 6: Performance Area Template



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 I-10/SR 85 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 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), 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 I-19 Corridor, the following operating environment was identified:

- 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) which measures the PSR of the pavement in each direction of travel.

Pavement Failure

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

Pavement Hot spots

- A pavement “hot spot” exists where a given 1-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, 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:

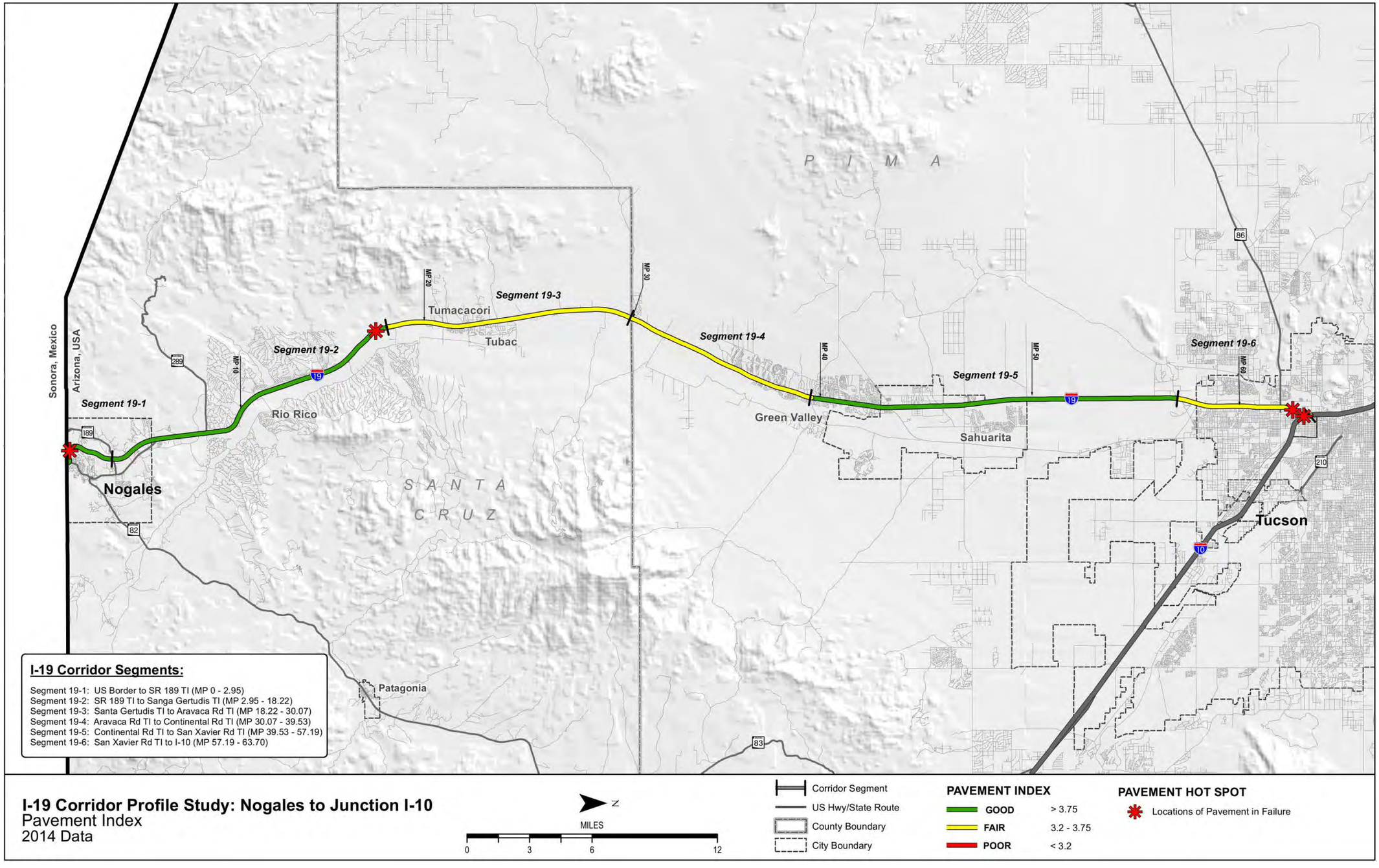
- No Poor/Below Average pavement conditions are reported on the corridor.
- Northbound lanes show somewhat lesser Pavement Serviceability Rating than southbound lanes.
- Segment 19-6 in the Tucson area shows generally lower level of pavement performance than the rest of the corridor.
- Segments 19-1 and 19-6 show Pavement Failure ratings in the Fair/Average range.
- Pavement Hot spots include:
    - Segment 19-1 NB MP 0-1
    - Segment 19-2 NB 17-18
    - Segment 19-6 NB MP 62-63; SB MP 63-64

Table 5 summarizes the pavement performance for the I-19 corridor. **Figure 8** illustrates the primary Pavement Index performance and locations of Pavement hot spots along the I-19 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	SB	
19-1	3	4.03	3.72	3.96	16.7%
19-2	15	4.39	4.28	4.26	3.3%
19-3	12	3.57	3.74	3.90	0.0%
19-4	10	3.54	3.76	3.90	0.0%
19-5	17	4.08	3.97	4.02	0.0%
19-6	7	3.61	3.54	3.57	18.8%
Weighted Corridor Averages		3.92	3.91	3.98	3.6%
SCALES					
Interstate					
Good		> 3.75			< 5%
Fair		3.2 - 3.75			5% - 20%
Poor		< 3.2			> 20%

Figure 8: Pavement Performance

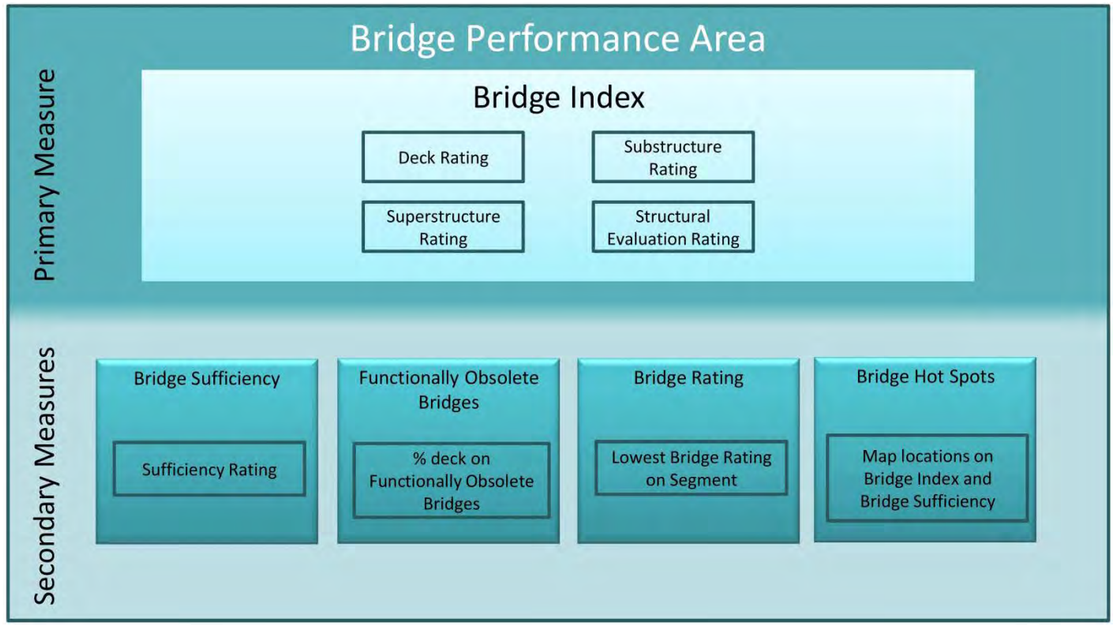


2.3 Bridge Performance Area

The Bridge Performance Area consists of a primary measure (Bridge Index) and four secondary measures, as shown in **Figure 9**. These measures assess the condition of the existing bridges along the I-19 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.**

Figure 9: Bridge Performance Measures



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 include the Deck Rating, Substructure Rating, Superstructure Rating, and Structural Evaluation Rating. These ratings are based on inspection reports and are used to establish the structural adequacy of each bridge. The condition 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 ADOT Bridge Group to assess the need for bridge rehabilitation. The Bridge Index is calculated as weighted average for each segment based on deck area.

Secondary Bridge Measures

Four 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

Functionally Obsolete Bridges

- Percentage of total deck area in a segment that is on functionally obsolete bridges
- Identifies bridges that no longer meet standards for current traffic volumes, lane width, shoulder width, or bridge rails
- A bridge that is functionally obsolete may still be structurally sound

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:

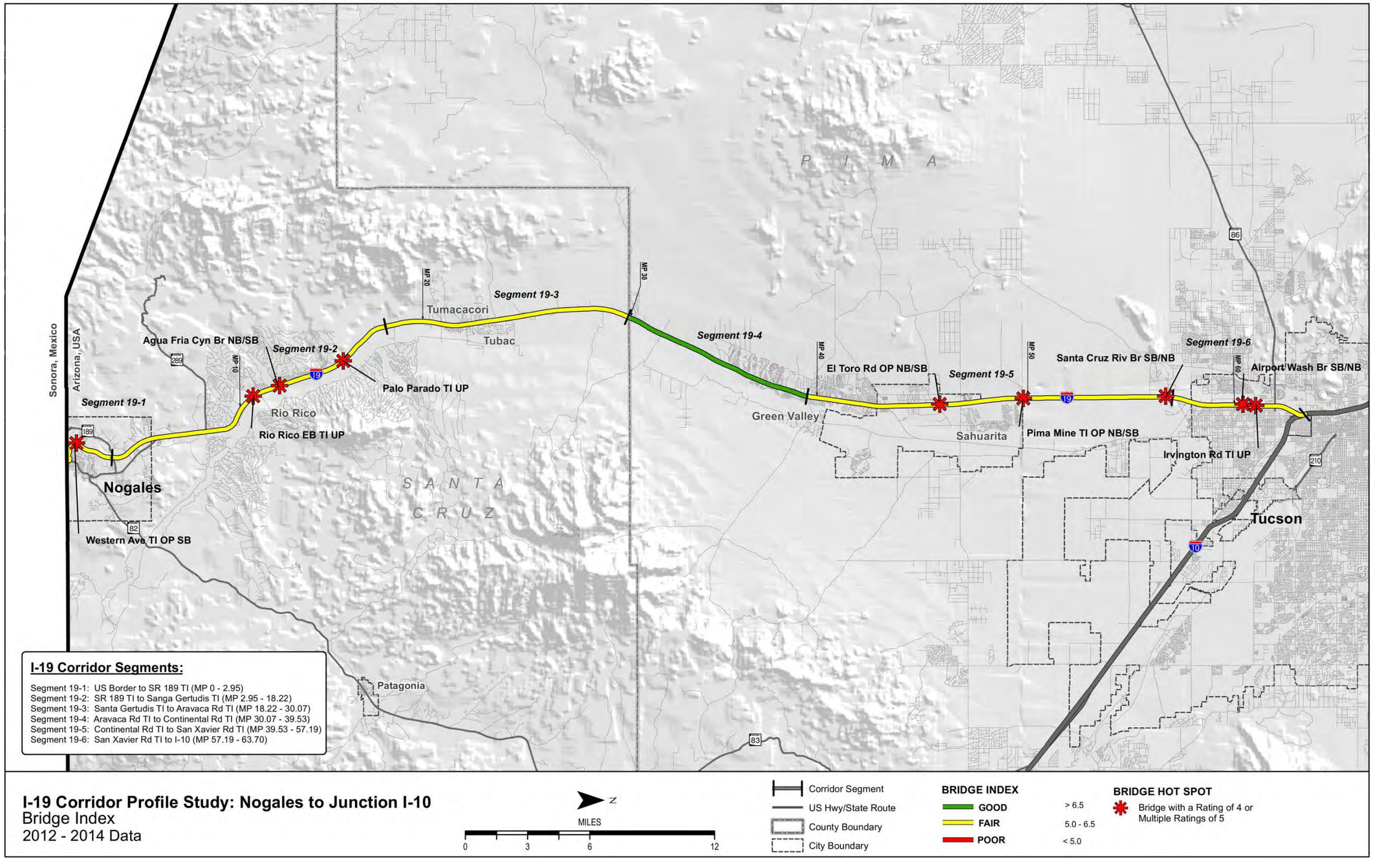
- The Bridge Index is predominantly in the Fair/Average range, with the exception of segment 19-4 where the Index shows Good/Above Average.
- Bridge Rating averages in the Fair/Average range (5 or 6) throughout the corridor with the exception of segment 19-5 where the rating is 4, indicating structural or recurring maintenance issues.
- Bridge Sufficiency - Every segment along I-19 rates in the Good range with the exception of Segment 6 near Tucson which rates Fair. The sufficiency rating for the bridges at the Valencia Road Traffic Interchange and the Irvington Road Traffic Interchange both rate below 70.0, which lowers the segment average score into the Fair range.
- Functionally Obsolete Bridges - Every segment along I-19 rates Fair in terms of the percentage of functionally obsolete bridges, with the exception of Segment 19-1 near Nogales. All bridges within Segment 19-1 are considered functionally obsolete by current ADOT design standards, primarily due to insufficient width for current traffic volumes.
- Bridge Hot spots along I-19 include:
  - Western Ave TI OP SB
  - Rio Rico EB TI UP
  - Agua Fria Canyon Br NB/SB
  - Palo Parado TI UP
  - El Toro Rd OP NB/SB
  - Pima Mine TI OP NB/SB
  - Santa Cruz River Br NB/SB
  - Airport Wash Br NB/SB
  - Pedestrian UP (MP 61.4)

Table 6 summarizes the Bridge performance results for the I-19 Corridor. **Figure 10** illustrates the primary Bridge Index performance and locations of bridge hot spots along the I-19 Corridor. Maps for each secondary measure can be found in **Appendix A.**

Table 6: Bridge Performance

Segment	Length (miles)	# of Bridges	Bridge Index	Bridge Sufficiency	Bridge Rating	% Deck Area of Functionally Obsolete Bridges
19-1	3	4	5.98	90.03	5	100.0%
19-2	15	18	5.79	92.24	5	27.3%
19-3	12	9	6.18	93.08	6	19.7%
19-4	10	10	6.60	95.35	6	15.7%
19-5	17	22	5.30	90.92	4	21.3%
19-6	7	11	6.06	77.36	5	19.4%
Weighted Corridor Averages			5.90	90.80	5.08	25.0%
SCALES						
Good			> 6.5	> 80	> 6	< 12%
Fair			5.0 - 6.5	50 - 80	5 – 6	12% - 40%
Poor			< 5.0	< 50	< 5	> 40 %

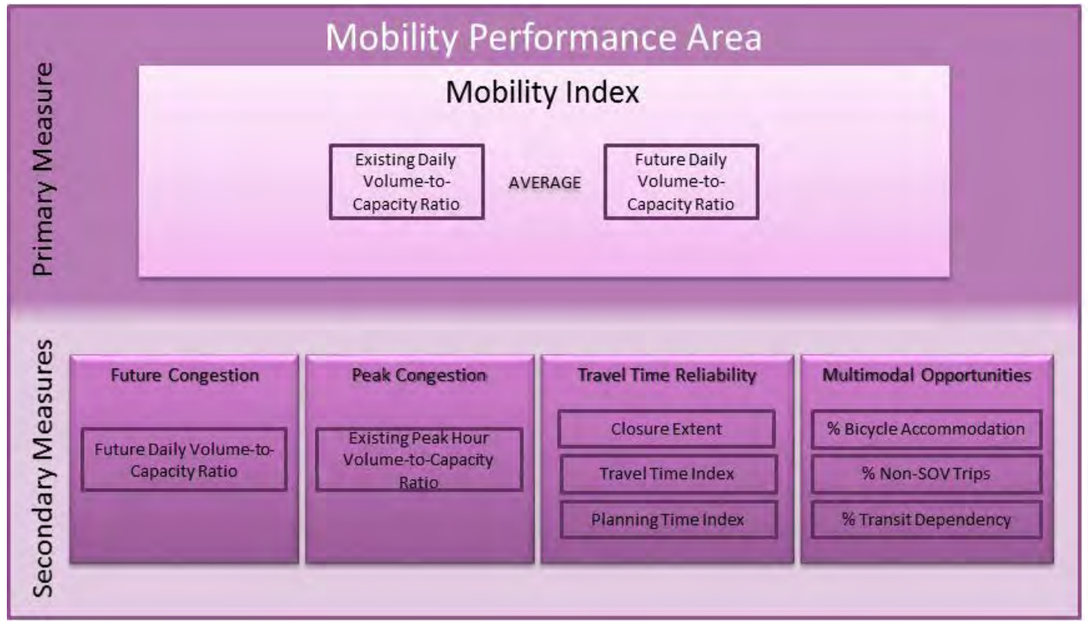
Figure 10: Bridge Performance



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 theI-19 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 (2014) daily volume-to-capacity (V/C) ratio and the future (2035 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 (2025) 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 I-19 Corridor, the following operating environments were identified:

- Urban Interrupted Flow: Segment 19-1
- Urban Uninterrupted Flow: Segments 19-4 through 19-6
- Rural Interrupted Flow: Segment 19-3
- Rural Uninterrupted Flow: Segment 19-4

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 (2035 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– Three 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

- Directional Travel Time Index (TTI):
  - The ratio of the average peak period travel time to the free-flow travel time (based on the posted speed limit) in a given direction
  - The TTI recognizes the delay potential from recurring congestion during peak periods; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics
- Directional Planning Time Index (PTI):
  - The ratio of the 95th percentile travel time to the free-flow travel time (based on the posted speed limit) in a given direction
  - The PTI recognizes the delay potential from non-recurring delays such as traffic crashes, weather, or other incidents; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics
  - The PTI indicates the amount of time in addition to the typical travel time that should be allocated to make an on-time trip 95% of the time in a given direction

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.

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

- The Mobility Index is 'Good' throughout the corridor, with the exception of Segment 19-6 in the Tucson urban area where it is 'Poor' possibly as a result of current and future traffic volumes that exceed capacity of the roadway.
- The Future V/C is 'Good' throughout, also with the exception of Segment 19-6 in the Tucson urban area where it is 'Poor'.
- The Existing Peak Hour traffic operations are 'Good' throughout, with the exception of segment 19-6 in the Tucson urban area where it is 'Fair.'
- The Closure extent is rated Good for the length of all southbound lanes. However, closures were more frequent or longer in duration on the northbound lanes in four segments:
  - 19-1 – Non-freeway conditions.
  - 19-3 – US Customs Border Patrol Checkpoint.
  - 19-5 – Vehicle crashes and other non-recurring closures.
  - 19-6 – Vehicle crashes and other non-recurring closures.
- The TTI and PTI measures are mostly 'Good' throughout the corridor, with the exception of segments 19-1, 19-2, and 19-3 TTI measures which are 'Fair.' These slightly lower results coming north from the US – Mexico Border are possibly due to lower speed limits and lower sustained speeds, especially for commercial trucks.
- Non-SOV Travel is rated 'Fair' throughout the corridor.
- All segments show 'Good' performance for Bicycle Accommodation since bicycles are allowed to travel on the paved shoulders throughout the length of the corridor.
- Segments 19-1 and 19-3 are considered Interrupted Flow segments. 19-1 is located within parts of arterial streets in Nogales. There is a Border Patrol checkpoint in segment 19-3 that requires all traffic to stop. These characteristics will result in increased PTI and TTI scores.

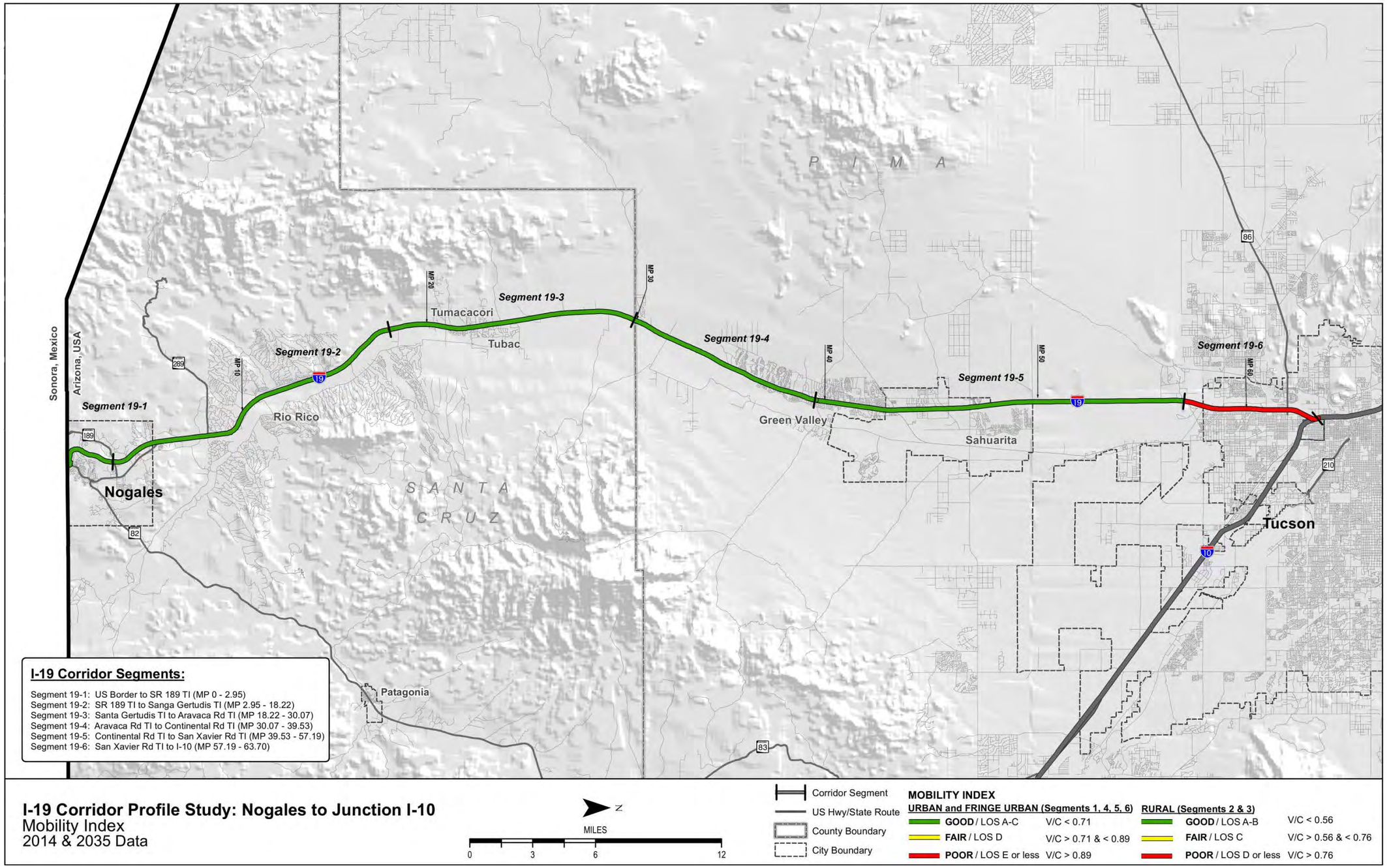
Table 7 summarizes the mobility performance results for the I-19 Corridor. **Figure 12** illustrates the primary Mobility Index performance along I-19. Maps for each secondary measure can be found in **Appendix A**.

Table 7: Mobility Performance

Segment	Length (miles)	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent (occurrences)		Directional TTI (all vehicles)		Directional PTI (all vehicles)		% Bicycle Accommodation	% Non-Single Occupancy Vehicle (SOV) Trips
				NB	SB	NB	SB	NB	SB	NB	SB		
19-1[1]*	3	0.16	0.19	0.12	0.11	0.27	0.20	1.40	1.01	2.28	1.30	90%	14%
19-2[2]^	15	0.32	0.39	0.19	0.20	0.22	0.17	1.16	1.13	1.25	1.22	100%	17%
19-3[2]*	12	0.26	0.32	0.17	0.17	0.30	0.17	1.58	1.10	2.50	1.17	100%	15%
19-4[1]^	10	0.34	0.41	0.23	0.23	0.20	0.02	1.06	1.06	1.08	1.12	100%	16%
19-5[1]^	17	0.56	0.66	0.35	0.36	0.25	0.15	1.06	1.07	1.11	1.12	100%	13%
19-6[1]^	7	1.01	1.21	0.78	0.76	0.38	0.06	1.00	1.04	1.03	1.12	95%	15%
Weighted Corridor Averages		0.44	0.53	0.30	0.30	0.26	0.13	1.19	1.08	1.44	1.16	99%	15%
SCALES													
Performance Level		**Urban (Rural)**				**All**		**Uninterrupted (Interrupted)**				**All**	
Good		< 0.71 (< 0.56)				< 0.22		< 1.15 < 1.30		< 1.30 (< 3.00)		> 90%	> 17%
Fair		0.71 - 0.89 (0.56 - 0.76)				0.22 – 0.62		1.15 - 1.33 (1.30 - 2.00)		1.30 - 1.50 (3.00 - 6.00)		60% - 90%	11% - 17%
Poor		> 0.89 (> 0.76)				> 0.62		> 1.33 (> 2.00)		> 1.50 (> 6.00)		< 60%	< 11%

[1]Urban Operating Environment
[2]Rural Operating Environment
^Uninterrupted Flow Facility
*Interrupted Flow Facility

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 incapacitating injuries, as these types of crashes are the emphasis of the ADOT Strategic Highway Safety Plan (SHSP), 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 incapacitating injury crashes, the relative cost of those types of crashes, and crash occurrences on similar roadways in Arizona. According to ADOT's 2010 Highway Safety Improvement Program Manual, fatal crashes have an estimated cost that is 14.5 times the estimated cost of incapacitating injury crashes ($5.8 million compared to $400,000).

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 I-19 Corridor, the following operating environments were identified:

- Segment 19-1: Urban 4 Lane Freeway
- Segment 19-2: Urban 4 Lane Freeway
- Segment 19-3: Rural 4 Lane Freeway < 25,000 vehicles per day
- Segment 19-4: Urban 4 Lane Freeway
- Segment 19-5: Urban 4 Lane Freeway
- Segment 19-6: Urban 4 Lane Freeway

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 incapacitating injury crashes

SHSP Emphasis Areas

ADOT's 2014 SHSP identified several emphasis areas for reducing fatal and incapacitating injury crashes. This measure compared rates of crashes in the top five SHSP emphasis areas to other corridors with a similar operating environment. The top five SHSP emphasis areas related to the following driver behaviors:

- Speeding and aggressive driving
- Impaired driving
- Lack of restraint usage
- Lack of motorcycle helmet usage
- Distracted driving

Crash Unit Types

- The percentage of total fatal and incapacitating injury crashes that involves crash unit types of motorcycles, trucks, or non-motorized travelers 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 incapacitating 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 Safety Index the corridor rates 'Below Average' for all segments, with the exception of segment 19-4 with an 'Above Average' rating.
- There is some directional variation within the Safety Index on the northbound and southbound lanes, providing insight to the conditions and factors contributing to the crash history.
- Due to the short length of segment 19-1 and limited number of recorded crashes during the analysis period, the analysis does not include Fatal/Incapacitating SHSP Top 5 crash types on this segment.
- Segments 19-2 and 19-6 report Fatal/Incapacitating SHSP Top 5 crash types in the 'Average' range, with remaining segments rating 'Above Average'.
- There was insufficient data to report SHSP Crash Unit Types on the corridor.
- Safety Hot spots include:
    - Segment 19-2 SB MP 9.0
    - Segment 19-4 NB 31.0, 33.0, 39.0
    - Segment 19-5
        - NB MP 43.0, 45.0, 53.0, 56.0
        - SB MP 47.0, 54.0
    - Segment 19-6
        - NB MP 58.0, 59.0, 61.0
        - SB MP 61.0

Table 8 summarizes the Safety performance results for the I-19 corridor. **Figure 14** illustrates the primary Safety Index performance and locations of safety hot spots along the I-19 Corridor. Maps for each secondary measure can be found in **Appendix A**.

Table 8: Safety Performance

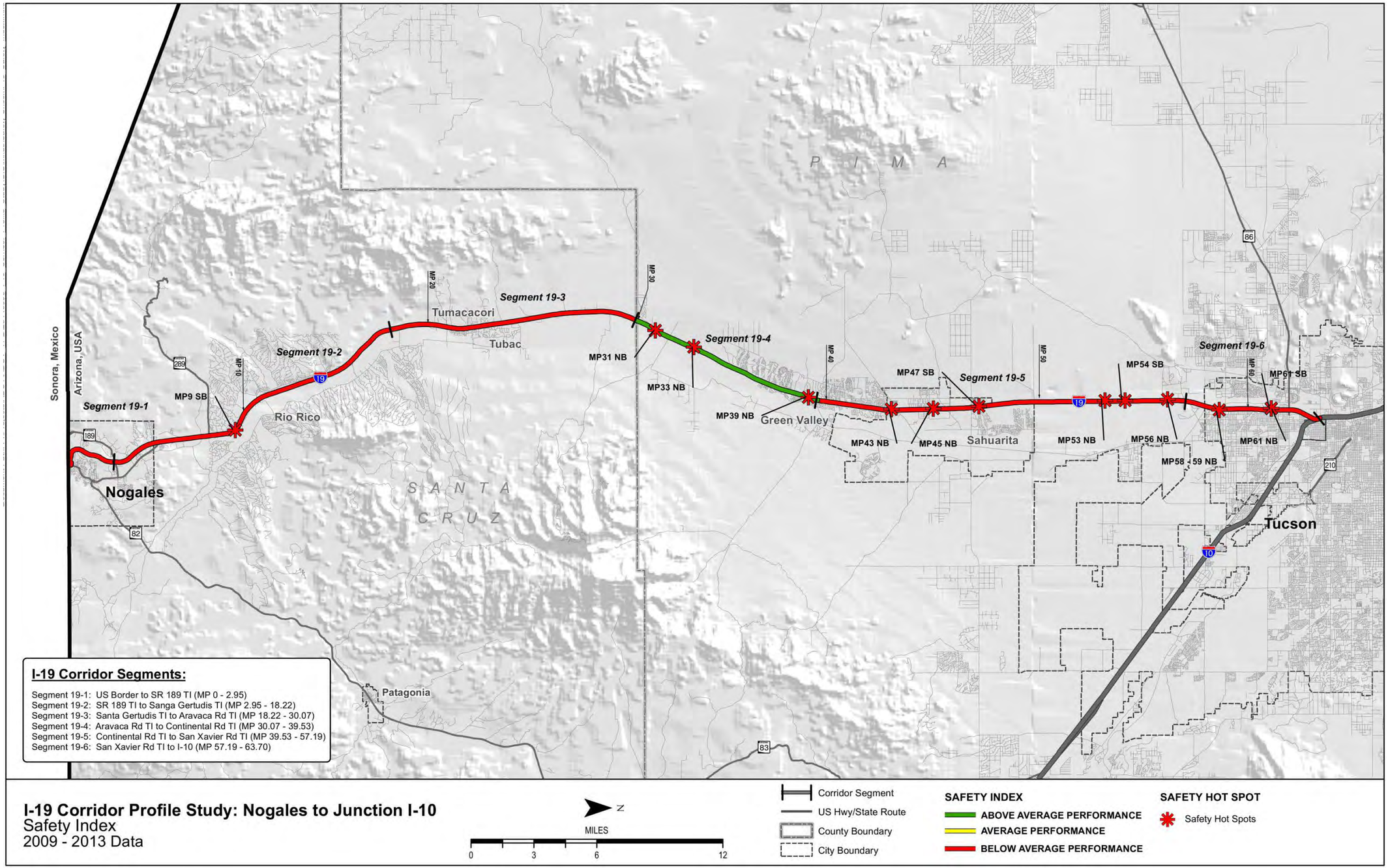
Segment	Length (miles)	Total Fatal & Incapacitating Injury Crashes (F/I)	Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks
				NB	SB		
19-1[a]	3	2 / 1	1.94	1.99	1.90	*Insufficient Data*	*Insufficient Data*
19-2[a]	15	10 / 12	1.33	1.34	1.32	59%	*Insufficient Data*
19-3[b]	12	5 / 7	1.36	1.59	1.12	33%	*Insufficient Data*
19-4[a]	10	2 / 7	0.52	0.59	0.44	44%	*Insufficient Data*
19-5[a]	17	18 / 13	1.48	2.11	0.86	39%	*Insufficient Data*
19-6[a]	7	8 / 11	1.42	0.80	2.04	53%	*Insufficient Data*
Weighted Corridor Averages			1.29	1.45	1.13	45%	*Insufficient Data*

SCALES			
	Urban 4 Lane Freeway (Rural 4 Lane < 25,000)		
Above Average	< 0.79 (< 0.73)	< 49.1% (< 42.8%)	N/A
Average	0.79-1.21 (0.73-1.27)	49.1%-59.4% (42.8%-52.9%)	N/A
Below Average	> 1.21 (> 1.27)	> 59.4% (> 52.9%)	N/A

[a]Urban 4 Lane Freeway Operating Environment
[b]Rural 4 Lane Freeway with Daily Volume < 25,000

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 Freight Index and five secondary measures as illustrated in **Figure 15**. All measures relate to the reliability of truck travel as measured by observed truck travel time speed and delays to truck travel from freeway closures or physical restrictions to truck travel. The detailed calculations and equations developed for each measure can be referenced 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 PTI for truck travel. The Truck Planning Time Index (TPTI) is the ratio of the 95th percentile truck travel time to the free-flow truck travel time. The TPTI reflects the extra buffer time needed for on-time delivery while accounting for non-recurring delay. Non-recurring delay refers to unexpected or abnormal delay due to closures or restrictions resulting from circumstances such as 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).

Secondary Freight Measures

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

Recurring Delay (Directional Truck Travel Time Index [TTTI])

- The ratio of the average peak period truck travel time to the free-flow truck travel time (based on the posted speed limit up to a maximum of 65 miles per hour) in a given direction
- The TTTI recognizes the delay potential from recurring congestion during peak periods; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics

Non-Recurring Delay (Directional TPTI)

- The ratio of the 95th percentile truck travel time to the free-flow truck travel time (based on the posted speed limit up to a maximum of 65 miles per hour) in a given direction
- The TPTI recognizes the delay potential from non-recurring delays such as traffic crashes, weather, or other incidents; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics
- The TPTI indicates the amount of time in addition to the typical travel time that should be allocated to make an on-time trip 95% of the time in a given direction

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 top-level assessment of the freight mobility for the corridor and for each segment. The four secondary measures provide more detailed information to assess freight performance for each segment.

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

Each Segment along I-19 was classified with the following flow type:

Segment 19-1: Interrupted Flow Facility

Segment 19-2: Uninterrupted Flow Facility

Segment 19-3: Interrupted Flow Facility

Segment 19-4: Uninterrupted Flow Facility

Segment 19-5: Uninterrupted Flow Facility

Segment 19-6: Uninterrupted Flow Facility

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

- Recurring delay is also reported as Poor for the Truck Travel Time Index and the Truck Planning Time Index on the urban segment 19-1 in Nogales.
- Recurring delay is also reported as Poor for the Truck Planning Time Index on segment 19-3 in the northbound lanes, a result of the Border Patrol checkpoint.
- Fair performance is reported for Closure Duration on segments 19-1 (SB), 19-2 (NB), 19-3 (NB & SB), and 19-6 (NB).
- Vertical Bridge Clearance is reported Fair on segments 19-2 and 19-3 with low points just under the design standard of 16.' The Ajo Way underpass measures just under the design standard, resulting in the Poor performance rating on segment 19-6. These low clearance structures can be avoided by using the off-on ramps at the interchange.
- No Vertical Bridge Clearance Hot spots are present on the corridor where the clearance is less than the design standard and cannot be avoided by using interchange ramps.

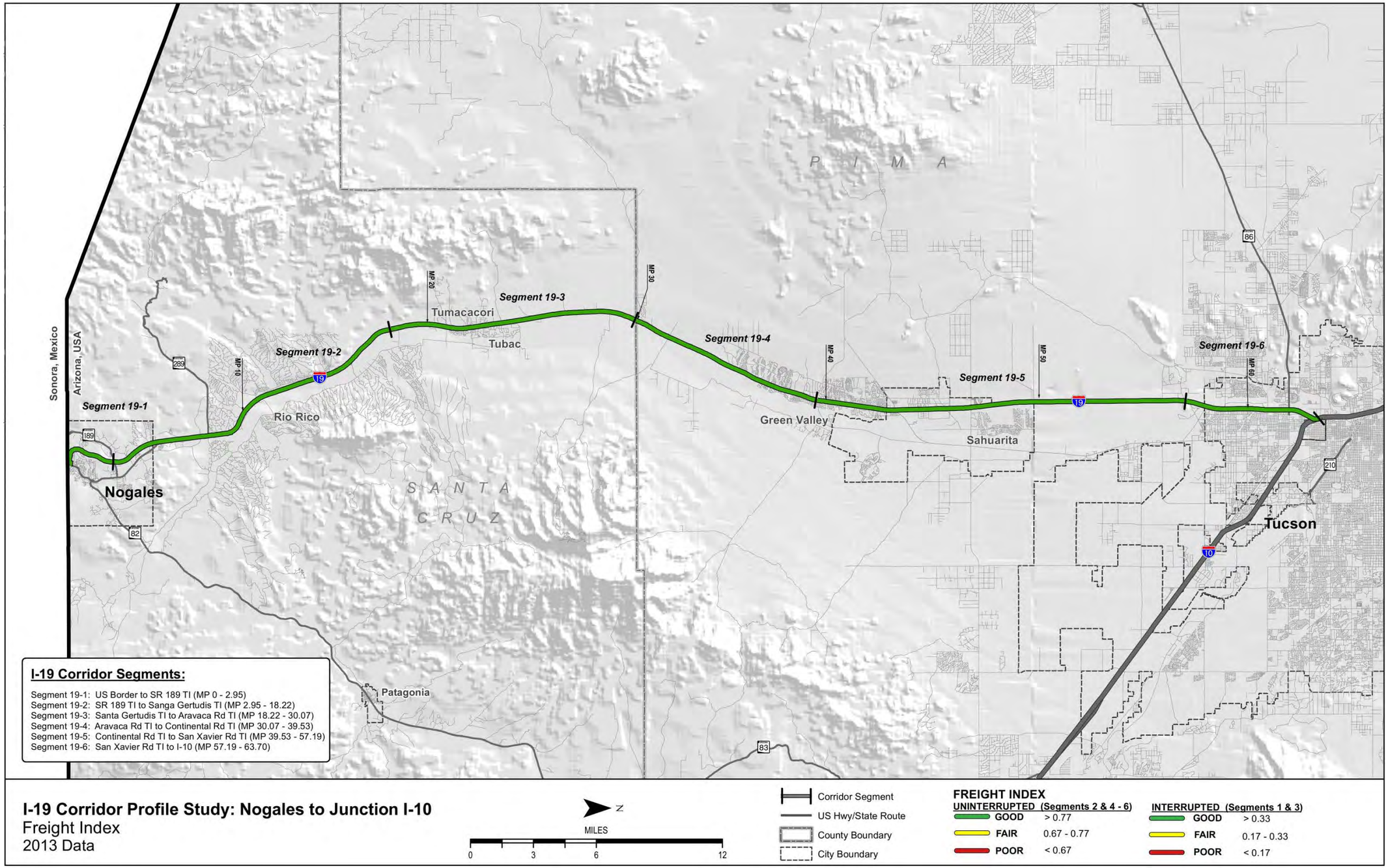
Table 9 summarizes the freight performance for the I-19 corridor. **Figure 16** illustrates the primary Freight Index performance and locations of freight hot spots along I-19. Maps for each secondary measure can be found in **Appendix A.**

Table 9: Freight Performance

Segment	Length (miles)	Freight Index	Directional Truck TTI		Directional Truck PTI		Closure Duration (minutes/milepost closed/year/mile)		Vertical Bridge Clearance (feet)
			NB	SB	NB	SB	NB	SB	
19-1*	3	0.46	1.54	1.08	2.37	1.96	30.03	46.78	No UP
19-2^	15	0.93	1.04	1.04	1.09	1.08	45.09	33.78	16.15
19-3*	12	0.34	1.43	1.03	4.91	1.06	87.90	53.94	16.13
19-4^	10	0.95	1.02	1.03	1.05	1.06	22.82	7.36	No UP
19-5^	17	0.94	1.03	1.03	1.05	1.06	39.82	23.75	16.78
19-6^	7	0.88	1.02	1.08	1.06	1.20	66.47	22.61	15.98
Weighted Corridor Averages		0.80	1.13	1.04	1.85	1.12	49.87	30.16	16.34
SCALES									
Performance Level		Uninterrupted (Interrupted Flow)					ALL		
Good		> 0.77 (> 0.33)	< 1.15 (< 1.30)		< 1.30 (< 3.00)		< 44.18		> 16.5
Fair		0.67 - 0.77 (0.17 - 0.33)	1.15 -1.33 (1.30 - 2.00)		1.30 - 1.50 (3.00-6.00)		44.18 -124.86		16.0 - 16.5
Poor		< 0.67 (< 0.17)	> 1.33 (> 2.00)		> 1.50 (> 6.00)		> 124.86		< 16.0

^Uninterrupted Flow Facility
*Interrupted Flow Facility

Figure 16: Freight Performance



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 I-19 Corridor:

- The most significant results for the I-19 Corridor report Poor Safety performance on all segments except segment 19-4, including NB and SB lanes.
- Pavement performance is generally Good/Above Average throughout the corridor.
- Bridge performance is generally Good/Above Average throughout the corridor. Exceptions include a series of Functionally Obsolete bridges in segment 19-1 and an average bridge rating of 4 (Poor/Below Average) on segment 19-5.
- Mobility performance is generally Good/Above Average throughout the corridor. Exceptions include segment 19-6 in the Tucson urban area, where project traffic increases push the Mobility Index into the Poor/Below Average range.
- Freight performance is generally Good/Above Average throughout the corridor. Exceptions include a low clearance bridge on segment 19-5 and a corridor average PTI (NB) that is largely the result of:
    - Conditions on segment 19-1 which delay trucks from reaching signed speed limits, and
    - The US Customs Border Patrol Checkpoint on segment 19-3, where delays contribute to lower average speeds for the segment.

Figure 17 shows the percentage of the I-19 corridor that rates either "good/above average performance", "fair/average performance", or "poor/below average" performance for each primary measure. All segments on the corridor are performing in the Fair/Average or Good/Above Average range in all performance areas with the exception of the Safety Index. A total of 54 miles or 84% of the corridor is performing in the Poor/Below Average range for the Safety Index.

Table 10 shows a summary of corridor performance for all primary measures and secondary measure indicators for the I-19 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

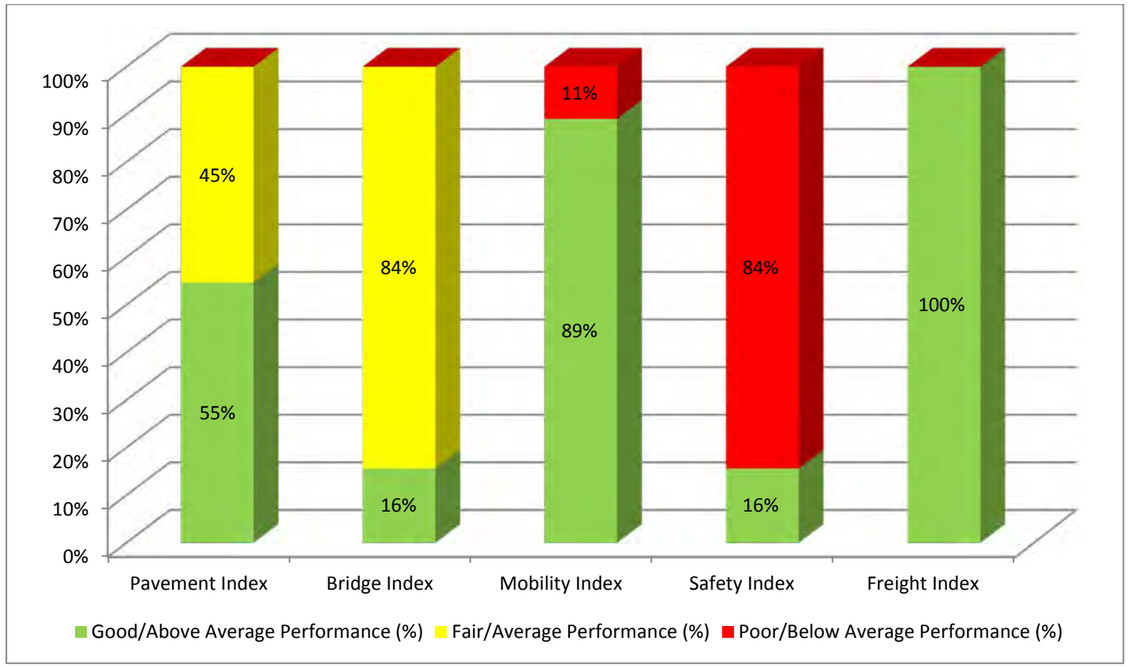


Figure 18: Corridor Performance Summary by Performance Measure

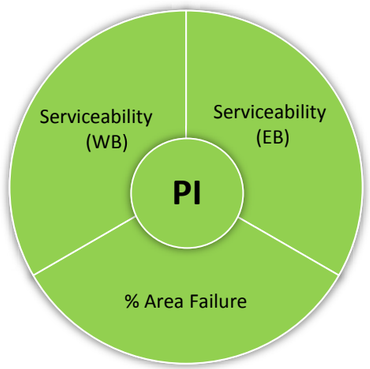
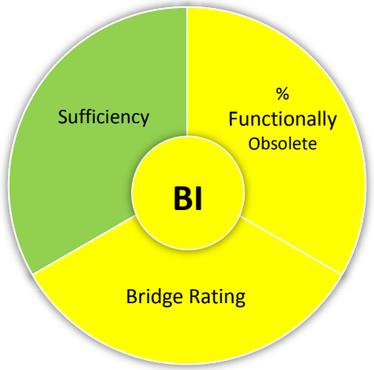
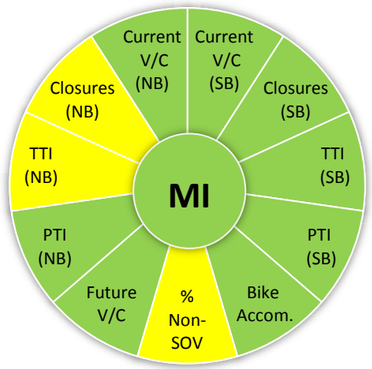
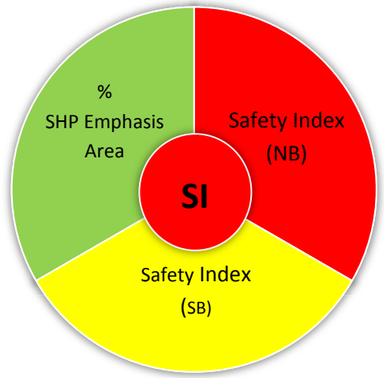
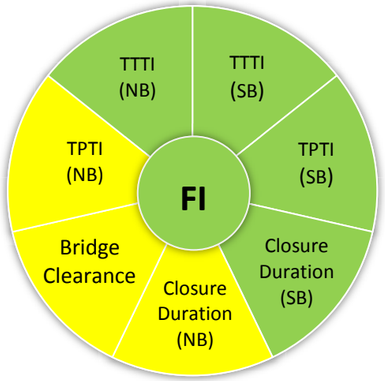
Pavement	Bridge	Mobility	Safety	Freight
				
Pavement Index (PI): based on two pavement condition ratings from the ADOT Pavement Database; the two ratings are the International Roughness Index (IRI) and the Cracking Rating.	**Bridge Index (BI):** based on four bridge condition ratings from the ADOT Bridge 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 2035 daily V/C ratio	**Safety Index (SI):** combines the bi-directional frequency and rate of fatal and incapacitating injury crashes, compared to crash occurrences on similar roadways in Arizona	**Freight Index (FI):** a reliability performance measure based on the bi-directional planning time index 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 ➢ **% of Deck Area on Functionally Obsolete Bridges**– the percentage of deck area in a segment that is on functionally obsolete bridges; identifies bridges that no longer meet standards for current traffic volumes, lane width, shoulder width, or bridge rails; a bridge that is functionally obsolete may still be structurally sound ➢ **Lowest Bridge Rating** –the lowest rating of the four bridge condition ratings on each segment	➢ **Future Daily V/C** – the future 2035 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 Travel Time Index (TTI)** – the ratio of the average peak period travel time to the free-flow travel time; the TTI represents recurring delay along the corridor ➢ **Directional Planning Time Index (PTI)** – the ratio of the 95th percentile travel time to the free-flow travel time; the PTI represents non-recurring delay along the corridor ➢ **% 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 incapacitating injury crashes, compared to crash occurrences on similar roadways in Arizona ➢ **% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors** – the percentage of fatal and incapacitating crashes that involve at least one of the five Strategic Highway Safety Plan (SHSP) emphasis areas on a given segment compared to the statewide average percentage on roads with similar operating environments ➢ **% of Fatal + Incapacitating Crashes Involving SHSP Crash Unit Types** – the percentage of total fatal and incapacitating injury crashes that involves a given crash unit type (motorcycle, truck, non-motorized traveler) compared to the statewide average percentage on roads with similar operating environments	➢ **Directional Truck Travel Time Index (TTTI)** – the ratio of the average peak period truck travel time to the free-flow truck travel time; the TTTI represents recurring delay along the corridor ➢ **Directional Truck Planning Time Index (TPTI)** – the ratio the 95th percentile truck travel time to the free-flow truck travel time; the TPTI represents non-recurring delay along the corridor ➢ **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 10: Corridor Performance Summary by Segment and Performance Measure

Segment	Length (miles)	Pavement Performance Area				Bridge Performance Area				Mobility Performance Area											
		Pavement Index	Directional PSR		Pavement Failure	Bridge Index	Bridge Sufficiency	Bridge Rating	Obsolete Bridges	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent (instances/milepost / year/mile)		Directional TTI (all vehicles)		Directional PTI (all vehicles)		% Bicycle Acc.	% Non-Single Occupancy Vehicle (SOV) Opportunities
			NB	SB								NB	SB	NB	SB	NB	SB	NB	SB		
19-1[1a*]	3	4.03	3.72	3.96	16.7%	5.98	90.03	5	100.0%	0.16	0.19	0.12	0.11	0.27	0.20	1.40	1.01	2.28	1.30	90%	14%
19-2[2a^]	15	4.39	4.28	4.26	3.3%	5.79	92.24	5	27.3%	0.32	0.39	0.19	0.20	0.22	0.17	1.16	1.13	1.25	1.22	100%	17%
19-3[2b*]	12	3.57	3.74	3.90	0.0%	6.18	93.08	6	19.7%	0.26	0.32	0.17	0.17	0.30	0.17	1.58	1.10	2.50	1.17	100%	15%
19-4[1a^]	10	3.54	3.76	3.90	0.0%	6.60	95.35	6	15.7%	0.34	0.41	0.23	0.23	0.20	0.02	1.06	1.06	1.08	1.12	100%	16%
19-5[1a^]	17	4.08	3.97	4.02	0.0%	5.30	90.92	4	21.3%	0.56	0.66	0.35	0.36	0.25	0.15	1.06	1.07	1.11	1.12	100%	13%
19-6[1a^]	7	3.61	3.54	3.57	18.8%	6.06	77.36	5	19.4%	1.01	1.21	0.78	0.76	0.38	0.06	1.00	1.04	1.03	1.12	95%	15%
Weighted Corridor Averages		3.92	3.91	3.98	3.6%	5.90	90.80	5.08	25.04%	0.44	0.53	0.30	0.30	0.26	0.13	1.19	1.08	1.44	1.16	99%	15%
Scale		Interstate								Urban or Rural						Uninterrupted or Interrupted					
Good/Above Average		> 3.75			< 5%	> 6.5	> 80	> 6	< 12%	< 0.71[1] < 0.56[2]				< 0.22		< 1.15^ < 1.30*		< 1.30^ < 3.00*		> 90%	> 17%
Fair/Average		3.2 - 3.7			5% - 20%	5.0 - 6.5	50 - 80	5 – 6	12% - 40%	0.71 - 0.89[1] 0.56 - 0.76[2]				0.22 – 0.62		1.15-1.33^ 1.30-2.00*		1.30-1.50^ 3.00-6.00*		60% - 90%	11% - 17%
Poor/Below Average		< 3.2			> 20%	< 5.0	< 50	< 5	> 40 %	> 0.89[1] >0.76[2]				> 0.62		> 1.33^ > 2.00*		> 1.50^ > 6.00*		< 60%	< 11%

Segment	Length (miles)	Safety Performance Area					Freight Performance Area							
		Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks	Freight Index	Directional Truck TTI		Directional Truck PTI		Closure Duration (minutes/milepost closed/year/mile)		Vertical Bridge Clearance
			NB	SB				NB	SB	NB	SB	NB	SB	
19-1[1a*]	3	1.94	1.99	1.90	Insufficient Data	Insufficient Data	0.46	1.54	1.08	2.37	1.96	30.03	46.78	No UP
19-2[2a^]	15	1.33	1.34	1.32	59%	Insufficient Data	0.93	1.04	1.04	1.09	1.08	45.09	33.78	16.15
19-3[2b*]	12	1.36	1.59	1.12	33%	Insufficient Data	0.34	1.43	1.03	4.91	1.06	87.90	53.94	16.13
19-4[1a^]	10	0.52	0.59	0.44	44%	Insufficient Data	0.95	1.02	1.03	1.05	1.06	22.82	7.36	No UP
19-5[1a^]	17	1.48	2.11	0.86	39%	Insufficient Data	0.94	1.03	1.03	1.05	1.06	39.82	23.75	16.78
19-6[1a^]	7	1.42	0.80	2.04	53%	Insufficient Data	0.88	1.02	1.08	1.06	1.20	66.47	22.61	15.98
Weighted Corridor Averages		1.29	1.45	1.13	45%	Insufficient Data	0.80	1.13	1.04	1.85	1.12	49.87	30.16	16.34
Scale		Urban 4 Lane Freeway or Rural 4 Lane < 25,000 vpd					Uninterrupted or Interrupted							
Good/ Above Average		< 0.79[a] < 0.73[b]			< 49.1%[a] < 42.8% [b]	N/A	> 0.77^ > 0.33*	< 1.15 ^ < 1.30*		< 1.30^ < 3.00*		< 44.18		> 16.5
Fair/ Average		0.79-1.21[a] 0.73-1.27[b]			49.1%-59.4%[a] 42.8%-52.9%[b]	N/A	0.67 - 0.77^ 0.17 - 0.33*	1.15 -1.33^ 1.30 -2.00*		1.30-1.50^ 3.00-6.00*		44.18 -124.86		16.0-16.5
Poor/ Below Average		> 1.21[a] > 1.27[b]			> 59.4%[a] > 52.9%[b]	N/A	< 0.67^ < 0.17*	> 1.33^ > 2.00*		>1.50^ > 6.00*		> 124.86		< 16.0

^Uninterrupted Flow Facility [a]Urban 4 Lane Freeway [1]Urban Operating Environment
*Interrupted Flow Facility [b]Rural 4 Lane < 25,000 [2]Rural Operating Environment

Note: "Insufficient Data" indicates there was not enough data available to generate reliable performance ratings

3.0 NEEDS ASSESSMENT

3.1 Corridor Objectives

Statewide goals and performance measures were established by the ADOT Long-Range Transportation Plan (LRTP), 2010-2035. Statewide performance goals that are relevant to I-19 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 I-19 Corridor: Mobility, 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 11** shows the I-19 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 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 11: Corridor Performance Goals and Objectives

ADOT Statewide LRTP Goals	I-19 Corridor Goals	I-19 Corridor Objectives	Performance Area	Performance Measure	Performance Objective	
				Secondary Measure Indicators	Corridor Average	Segment
Preserve & Maintain the State Transportation System	Maintain and preserve highway infrastructure	Improve pavement ride quality for all corridor users Reduce long-term pavement maintenance costs	Pavement	Pavement Index	Fair or better	Fair or better
				Pavement Serviceability (Directional)		
				Percent Pavement Area Failure		
		Maintain structural integrity of bridges	Bridge	Bridge Index	Fair or better	Fair or better
				Bridge Rating		
				Bridge Sufficiency		
				Obsolete Bridges		
Improve Mobility & Accessibility **Support Economic Growth**	Improve mobility through additional capacity and improved roadway geometry Provide a safe and reliable route for recreational and tourist travel to/from Mexico, and Southern Arizona destinations Provide safe, reliable and efficient connection to all communities along the corridor to permit efficient regional travel	Reduce current congestion and plan to facilitate future congestion that accounts for anticipated growth and land use changes Reduce delays from recurring and non-recurring events to improve reliability Improve bicycle and pedestrian accommodations	Mobility *(Emphasis Area)*	Mobility Index	Good	Fair or better
				Future V/C		
				Existing Peak Hour V/C (Directional)		
				Closure Extent (Directional)		
				Travel Time Index (Directional)		
				Planning Time Index (Directional)		
				Percent Non-SOV Trips		
				Bicycle Accommodation		
Enhance Safety & Security	Provide a safe, reliable, and efficient connection for the communities along the corridor Promote safety by implementing appropriate countermeasures	Reduce fatal and incapacitating injury crashes for all roadway users	Safety *(Emphasis Area)*	Safety Index	Above Average	Average or better
				Safety Index (Directional)		
				Percent Fatal/Incapacitating Crashes in SHSP Emphasis Areas		
				Percent Fatal/Incapacitating Truck Crashes		
				Percent Fatal/Incapacitating Motorcycle Crashes		
				Percent Fatal/Incapacitating Non-motorized Crashes		
Improve Mobility & Accessibility **Support Economic Growth**	Provide a safe, reliable and efficient freight route between Arizona and Mexico	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
				Travel Time Index (Directional)		
				Planning Time Index (Directional)		
				Closure Duration		
				Bridge Vertical Clearance		

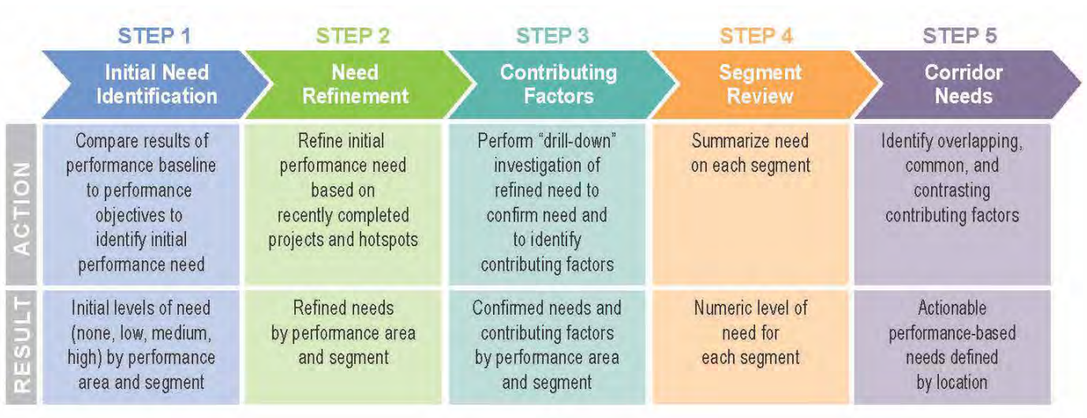
3.2 Needs Assessment Process

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 Need 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 levels of need for each primary and secondary performance measure are combined to produce a weighted 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 principle 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
- AZ Travel Demand Model (AZTDM)
- Real time traffic conditions database produced by American Digital Cartography Inc. (HERE) Database
- Highway Conditions Reporting System (HCRS) Database

Safety Performance Area

- Crash Database

Freight Performance Area

- HERE Database
- HCRS Database

In addition, other sources were considered to help identify the contributing factors such as:

- Maintenance history (from ADOT PeCoS for pavement), the level of past investments, or trends in historical data were used to help provide context for pavement and bridge history.
- Field observations from ADOT district personnel could 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.

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 1 and refined in Step 2 are quantified for each segment to numerically estimate the level of need for each segment. Values of 0 to 3 were 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 was 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 will result 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 the analysis are shown in **Table 12** through **Table 16**.

Pavement Needs

- Overall final pavement needs are generally Low or None throughout the corridor. The only change in the level of need resulting from hot spot analysis occurs on segment 19-2, resulting in raising the level of need from None to Low.
- The hot spot on segment 19-2 at MP 17-18 has a particularly high level of historical investment, meaning that some previous projects have proven to provide only temporary improvements and require frequent attention.
- Other pavement hot spots were identified on approximately six miles of the corridor on three segments, but are generally expected to be mitigated through upcoming projects.
- See other Contributing Factors in Appendix D, including descriptions of currently programmed projects that have not yet been constructed.
- See **Appendix D** for detailed information on contributing factors.

Table 12: Final Pavement Needs

Segment	Performance Score and Level of Need				Initial Segment Need	Hot spots	Recently Completed or Programmed Projects	Final Segment Need
	Pavement Index	Directional PSR		% Area Failure				
		NB	SB					
19-1	4.03	3.72	3.96	17%	0.4	NB (MP 0-1)	Pavement Preservation project programmed FY15 from MP 0 - MP3	Low
19-2	4.39	4.28	4.26	3%	0.0	NB (MP 17-18)	Pavement Preservation (RR[4" TL, 3" PL] + FR) from MP 16 - MP 21 programmed FY 15	Low
19-3	3.57	3.74	3.90	0%	0.0	None	Pavement Preservation MP 16-21 is programmed in FY 15 and from MP 21-32 in FY 19	None
19-4	3.54	3.76	3.90	0%	1.0	None	Pavement Preservation MP 21-32 and MP 32-44 is programmed in FY 19	Low
19-5	4.08	3.97	4.02	0%	0.0	None	None	None
19-6	3.61	3.54	3.57	19%	0.5	NB and SB (MP 62-63)	None	Low

Level of Need (Score)	Performance Score Need Scale		Segment Level Need Scale
None* (0)	> 3.30	< 10%	0
Low (1)	3.10 – 3.30	10%-15%	< 1.5
Medium (2)	2.70 – 3.10	15%-25%	1.5-2.5
High (3)	< 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

- Bridge needs occur due to poor performing bridges or hot spots on four of six segments, with High Needs identified in segment 19-5.
- Bridge needs were identified at 17 of the total 74 bridges (23%).
- Four bridges have potential historical issues and are candidates for life-cycle cost analysis to evaluate alternative solutions.
- Bridge hot spots along I-19 are not sufficient to change the Initial Need from original calculated values.
- See other Contributing Factors in Appendix C, including descriptions of currently programmed projects that have not yet been constructed.
- See **Appendix D** for detailed information on contributing factors.

Table 13: Final Bridge Needs

Segment	Performance Scores and Level of Need				Initial Segment Need	Hot Spots	Recently Completed or Programmed Projects	Final Segment Need
	Bridge Index	Bridge Sufficiency	Bridge Rating	Functionally Obsolete Bridges				
19-1	5.98	90.0	5	100.0%	1.5	Yes	None	Medium
19-2	5.79	92.2	5	27.3%	1.3	Yes	None	Low
19-3	6.18	93.1	6	19.7%	0.0	No	None	None
19-4	6.60	95.4	6	15.7%	0.0	No	None	None
19-5	5.30	90.9	4	21.3%	2.5	Yes	El Toro Rd OP SB & NB Bridge Deck Rehabilitation programmed FY 16; Pima Mine TI SB & NB programmed FY 16; Santa Cruz River Bridge SB & NB Bridge Deck Rehabilitation FY 16.	High
19-6	6.06	77.4	5	19.4%	0.2	Yes	Ajo Way TI reconstruction programmed FY 18.	Low

Level of Need (Score)	Performance Score Needs Scale				Segment Level Need Scale
None* (0)	> 6.0	> 70	> 5.0	< 21.0%	0
Low (1)	5.5-6.0	60-70	5.0	21.0%-31.0%	< 1.5
Medium (2)	4.5-5.5	40-60	4.0	31.0%-49.0%	1.5-2.5
High (3)	< 4.5	< 40	< 4.0	> 49.0%	> 2.5

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicated 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

- The Mobility Performance Area is an Emphasis Area for the I-19 corridor. High Mobility Needs identified only one segment, Segment 19-6 in the Tucson area, related to high traffic volumes and poor level of service values.
- While commuting traffic from residential areas south of Tucson is partly responsible for heavier traffic volumes, traffic volumes are high seven days per week. This results from Tucson's position as the regional center for shopping, entertainment, and other services in addition to being an employment center.
- Directional TTI and PTI issues on segment 19-1 are attributed to slowdowns in truck traffic at grade level intersections in Nogales. Truck traffic is expected to be dramatically reduced with improvements to SR 189 connecting to the Mariposa International Border Crossing, reducing the level of need on the segment.
- See other Contributing Factors in **Appendix D**, including descriptions of currently programmed projects that have not yet been constructed.

Table 14: Final Mobility Needs

Segment	Performance Scores and Level of Need											Initial Segment Need	Recently Completed Projects	Final Segment Need
	Mobility Index	Future V/C	Existing Peak Hour V/C		Closure Extent		Directional TTI		Directional PTI		Bicycle Accommodation			
			NB	SB	NB	SB	NB	SB	NB	SB				
19-1[1]*	0.16	0.19	0.12	0.11	0.27	0.20	1.40	1.01	2.28	1.30	90%	0.0	None	None
19-2[2]^	0.32	0.39	0.19	0.20	0.22	0.17	1.16	1.13	1.25	1.22	100%	0.0	None	None
19-3[2]*	0.26	0.32	0.17	0.17	0.30	0.17	1.58	1.10	2.50	1.17	100%	0.1	Canoa Shoulders FY 2015	Low
19-4[1]^	0.34	0.41	0.23	0.23	0.20	0.02	1.06	1.06	1.08	1.12	100%	0.0	None	None
19-5[1]^	0.56	0.66	0.35	0.36	0.25	0.15	1.06	1.07	1.11	1.12	100%	0.0	None	None
19-6[1]^	1.01	1.21	0.78	0.76	0.38	0.06	1.00	1.04	1.03	1.12	95%	3.8	Ajo Way TI - Reconstruct TI and Mainline 2015,/2018 Irvington Road and I-19 – Design and reconstruct new TI	High

Level of Need (Score)	Performance Score Needs Scale					Segment Level Need Scale
None* (0)	< 0.77[1] < 0.63[2]	< 0.35	< 1.21^ < 1.53*	< 1.37^ < 2.67*	> 80%	0
Low (1)	0.77-0.83[1] 0.63-0.69[2]	0.35-0.49	1.21-1.27^ 1.53-1.77*	1.37-1.43^ 2.67-3.33*	70%-80%	< 1.5
Medium (2)	0.83-0.95[1] 0.69-0.83[2]	0.49-0.75	1.27-1.39^ 1.77-2.23*	1.43-1.57^ 3.33-4.67*	50%-70%	1.5-2.5
High (3)	> 0.95[1] > 0.83[2]	> 0.75	> 1.39^ > 2.23*	> 1.57^ > 4.67*	< 50%	> 2.5

[1]Urban Operating Environment
[2]Rural Operating Environment
^Uninterrupted Flow
*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

- The Safety Performance Area is an Emphasis Area for the I-19 corridor. High Safety Needs were identified in all segments except 19-4, resulting in 'Below Average' performance for the corridor as a whole.
- Multiple crash hot spots are identified, especially in the northern part of the corridor, segments 19-4 through 19-6.
- The high rate of serious injury and fatal crashes throughout the corridor may be attributed to outdated designs on some entrance ramps, lack of lighting, equipment failure, alcohol related crashes, low levels of seat belt use, and other driver behaviors.
- While a high rate of serious injury and fatal crashes is reported on segment 19-1, the low number of such crashes (2), especially within the SHSP Top 5, reported during the analysis period points to caution in this result.
- Crashes involving trucks, motorcycles, and non-motorized during the analysis period were too few to provide significant results at any point on the corridor. Other crash types predominate.
- See other Contributing Factors in **Appendix D**, including descriptions of currently programmed projects that have not yet been constructed.

Table 15: Final Safety Needs

Segment	Performance Scores and Level of Need							Initial Segment Need	Hot spots	Recently Completed Projects	Final Segment Need
	Safety Index	Safety Index Directional		Fatal/Incapacitating SHSP Top 5	SHSP Crash Unit Type						
		NB	SB		Truck	Motorcycle	Non-motorized				
19-1[a]	1.94	1.99	1.90	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	3.6	None	None	High
19-2[a]	1.33	1.34	1.32	59%	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	2.8	SB MP 9	None	High
19-3[b]	1.36	1.59	1.12	33%	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	2.5	None	Canoa Shoulders FY 2015	High
19-4[a]	0.52	0.59	0.44	44%	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	0.0	NB MP 31, 33, 39	None	Low
19-5[a]	1.48	2.11	0.86	39%	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	3.3	NB MP 43, 45, 53, 56 SB MP 47, 54	None	High
19-6[a]	1.42	0.80	2.04	53%	*Insufficient Data*	*Insufficient Data*	*Insufficient Data*	3.5	NB MP 58, 59, 61 SB MP 61	Ajo Way TI - Reconstruct TI and Mainline 2015,/2018; Irvington Road and I-19 – Design and reconstruct new TI	High
Level of Need (Score)	**Performance Score Needs Scale**							**Segment Level Need Scale**			
None* (0)	< 0.93[a] < 0.91[b]			< 52%[a] < 46%[b]	N/A	N/A	N/A	0			
Low (1)	0.93-1.07[a] 0.91-1.09[b]			52%-55%[a] 46%-49%[b]	N/A	N/A	N/A	< 1.5			
Medium (2)	1.07-1.35[a] 1.09-1.45[b]			55%-62%[a] 49%-56%[b]	N/A	N/A	N/A	1.5-2.5			
High (3)	> 1.35[a] > 1.45[b]			> 62%[a] > 56%[b]	N/A	N/A	N/A	> 2.5			

[a]Urban 4 Lane Operating Environment
[b]Rural 4 Lane Freeway with Daily Volume < 25,000
**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

- The Freight Performance Area is an Emphasis Area for the I-19 corridor, giving it a heavier weight in the analysis.
- Final Freight Needs are Low or None throughout the corridor. In general, limits on truck travel and planning times are not significant factors.
- The most significant need evident on Table 16 shows a Low performance in the Bridge Clearance secondary measure. However, all of the low clearance bridges can be avoided by using ramps at the grade separated traffic interchanges and do not represent a Hot spot under the criteria used for the analysis.
- Truck traffic is also affected by slowdowns in segment 19-3 related to the Border Patrol checkpoint north of Tubac, but is not sufficient to raise the level of need.
- See other Contributing Factors in Appendix C, including descriptions of currently programmed projects that have not yet been constructed.
- See **Appendix D** for detailed information on contributing factors.

Table 16: Final Freight Needs

Segment	Performance Scores and Level of Need								Initial Segment Need	Hot Spots	Recently Completed Projects	Final Segment Need
	Freight Index	Directional TTTI		Directional TPTI		Closure Duration (min)		Vertical Bridge Clearance				
		NB	SB	NB	SB	NB	SB					
19-1*	0.46	1.54	1.08	2.37	1.96	30.03	46.78	No Underpass in segment	0.1	None	Mariposa Land Port of Entry in Nogales on SR 189 MP 0.12 DMS	Low
19-2^	0.93	1.04	1.04	1.09	1.08	45.09	33.78	16.15	0.4	None		Low
19-3*	0.34	1.43	1.03	4.91	1.06	87.90	53.94	16.13	0.6	None	Canoa Shoulders FY 2015	Low
19-4^	0.95	1.02	1.03	1.05	1.06	22.82	7.36	No Underpass in segment	0.0	None		None
19-5^	0.94	1.03	1.03	1.05	1.06	39.82	23.75	16.78	0.0	None		None
19-6^	0.88	1.02	1.08	1.06	1.20	66.47	22.61	15.98	0.4	None	Ajo Way TI - Reconstruct TI and Mainline 2015,/2018 Irvington Road and I-19 – Design and reconstruct new TI	Low

Level of Need (Score)	Performance Score Needs Scale					Segment Level Need Scale
None* (0)	> 0.74^ > 0.28*	< 1.21^ < 1.53*	< 1.37^ < 4.0*	< 71.07	> 16.33	0
Low (1)	0.70-0.74^ 0.22-0.28*	1.21-1.27^ 1.53-1.77*	1.37-1.43^ 4.0-5.0*	71.07-97.97	16.17-16.33	< 1.5
Medium (2)	0.64-0.70^ 0.12-0.22*	1.27-1.39^ 1.77-2.23*	1.43-1.57^ 5.0-7.0*	97.97-151.75	15.83-16.17	1.5-2.5
High (3)	< 0.64^ < 0.12*	> 1.39^ > 2.23*	> 1.57^ > 7.0*	> 151.75	< 15.83	> 2.5

^Uninterrupted Flow Facility
*Interrupted Flow Facility

**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 17** 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 (Mobility, Safety, and Freight for the I-19 Corridor). There are five segments with a Medium overall average need, and one segment with a Low overall average need.

Table 17: Summary of Needs by Segment

Performance Area	Segment	19-1	19-2	19-3	19-4	19-5	19-6
	Milepost	MP 0 - 3	MP 3 -18	MP 18 - 30	MP 30 - 40	MP 40 - 57	MP 57 - 64
Pavement		Low	Low	None*	Low	None*	Low
Bridge		Medium	Low	None*	None*	High	Low
Mobility+		None*	None*	Low	None*	None*	High
Safety+		High	High	High	Low	High	High
Freight+		Low	Low	Low	None*	None*	Low
Average Need (0-3)		**1.38**	**1.23**	**1.15**	**0.38**	**1.15**	**1.92**

**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.*

+ Identified as an emphasis area for the I-19 Corridor.

Scale	
None	< 0.10
Low	0.1 - 1.0
Medium	1.0 - 2.0
High	> 2.0

Summary Corridor Needs

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

Pavement Performance Area

- Overall final pavement needs are Low or None throughout the corridor. No changes to the level of need resulting from hot spot analysis occur on the corridor.
- The pavement hot spot on segment 19-2 at MP 17-18 was addressed in a 2015 improvement project.
- Other pavement hot spots were identified on approximately six miles of the corridor on three segments, but are generally expected to be mitigated through upcoming programmed projects.

Bridge Performance Area

- Bridge needs occur due to poor performing bridges or hot spots on four of six segments, with High needs identified in segment 19-5 and Medium needs identified in segment 19-1.
- Bridge needs were identified at 17 of the total 74 bridges (23%).
- Four bridges have potential historical issues and are candidates for life-cycle cost analysis to evaluate alternative solutions.
- Bridge hot spots along I-19 are not sufficient to change the Initial Need from its original calculated value.

Mobility Performance Area

- The Mobility Performance Area is an Emphasis Area for the I-19 corridor, giving it a heavier weight in the analysis.
- High Mobility Needs were identified only on segment 19-6 in the Tucson area related to high traffic volumes and poor level of service values.
- While commuting traffic from residential areas south of Tucson is partly responsible for heavier traffic volumes, traffic volumes are high seven days per week. This results from Tucson's position as the regional center for shopping, entertainment, and other services in addition to being an employment center.
- Directional TTI and PTI issues on segment 19-1 are attributed to slowdowns in truck traffic at grade level intersections in Nogales. Truck traffic is expected to be dramatically reduced with improvements to SR 189 connecting to the Mariposa International Border Crossing, reducing the level of need on the segment.

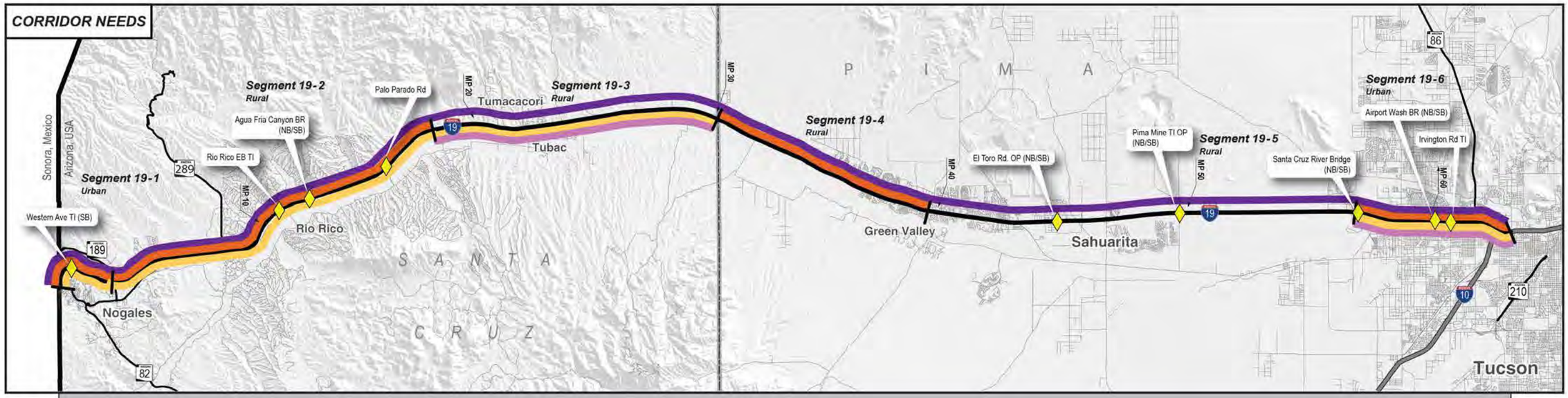
Safety Performance Area

- The Safety Performance Area is an Emphasis Area for the I-19 corridor, giving it a heavier weight in the analysis.
- High Safety Needs were identified in all segments except 19-4, resulting in Poor performance for the corridor as a whole.
- Multiple crash hot spots are identified, especially in the northern part of the corridor, segments 19-4 through 19-6.
- The high rate of serious injury and fatal crashes throughout the corridor may be attributed to outdated designs on some entrance ramps, lack of lighting, equipment failure, alcohol related crashes, low levels of seat belt use, and other driver behaviors.
- While a high rate of serious injury and fatal crashes is reported on segment 19-1, the low number of such crashes (2), especially within the SHSP Top 5, reported during the analysis period points to caution in this result.
- Crashes involving trucks, motorcycles, and non-motorized during the analysis period were too few to provide significant results at any point on the corridor. Other crash types predominate.

Freight Performance Area

- The Freight Performance Area is an Emphasis Area for the I-19 corridor, giving it a heavier weight in the analysis.
- Final Freight Needs are Low or None throughout the corridor. In general, limits on truck travel and planning times are not significant factors.
- The most significant need evident on Table 16 shows a Low performance in the Bridge Clearance secondary measure. However, all of the low clearance bridges can be avoided by using ramps at the grade separated traffic interchanges and do not represent a hot spot under the criteria used for the analysis.
- Truck traffic is also affected by slowdowns in segment 19-3 related to the Border Patrol checkpoint north of Tubac, but is not sufficient to raise the level of need.

Figure 21: Corridor Needs Summary



	SEGMENT						
Segments	19-1	19-2	19-3	19-4	19-5	19-6	Segments
Pavement	Low	Low	None*	Low	None*	Low	Pavement
Bridge	Med	Low	None*	None*	High	Low	Bridge
Mobility	None*	None*	Low	None*	None*	High	Mobility*
Safety	High	High	High	Low	High	High	Safety*
Freight	Low	Low	Low	None*	None*	Low	Freight*

I-19 Corridor Profile Study: Nogales to Junction I-10
Summary of Corridor Needs

N

MILES
0 5 10

Corridor Segment
US Hwy/State Route
County Boundary
City Boundary

NEEDS SYMBOLOGY
SAFETY NEEDS
PAVEMENT NEEDS
FREIGHT NEEDS
MOBILITY NEEDS
BRIDGE NEEDS

LEVEL OF NEED
Low
Medium
High

*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.

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 would 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 I-19 strategic investment areas (resulting from the elevated needs) are shown in **Figure 22**.

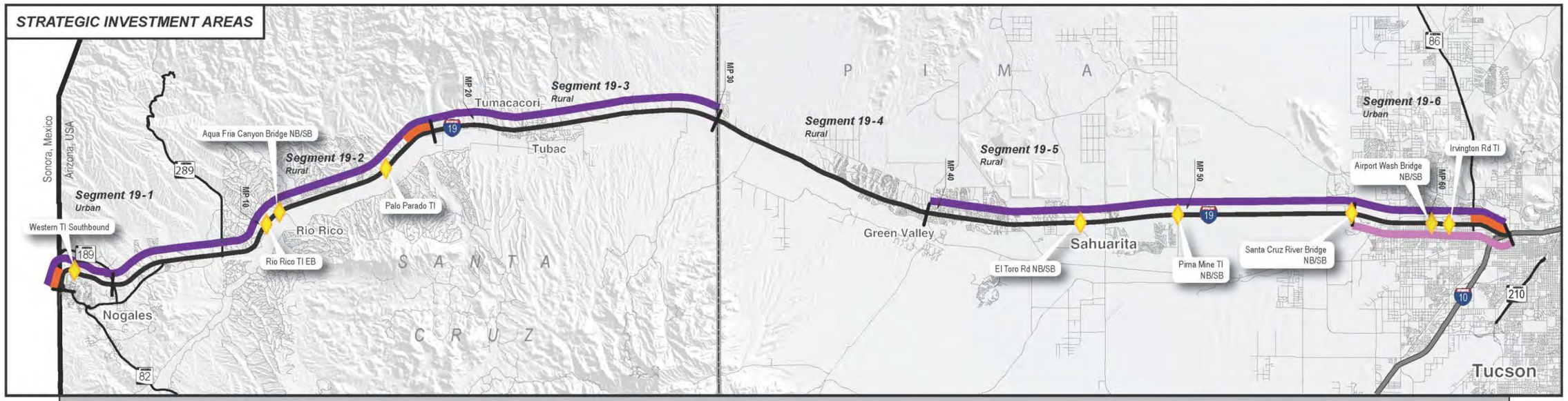
4.1 Screening Process

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 18 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



	SEGMENT						
Segments	19-1	19-2	19-3	19-4	19-5	19-6	Segments
Pavement	Hotspot	Hotspot	–	–	–	Hotspot	Pavement
Bridge	Med	Hotspot	–	–	High	Hotspot	Bridge
Mobility	–	–	–	–	–	High	Mobility
Safety	High	High	High	–	High	High	Safety
Freight	–	–	–	–	–	–	Freight

I-19 Corridor Profile Study: Nogales to Junction I-10
Strategic Investment Areas

N

MILES
0 5 10

Corridor Segment
US Hwy/State Route
County Boundary
City Boundary

MAP SYMBOLOGY
SAFETY NEEDS
PAVEMENT NEEDS
FREIGHT NEEDS
MOBILITY NEEDS

LEVEL OF NEED
Low
Medium
High

Table 18: Strategic Investment Area Screening

Segment	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
19-1	Hot spot	Medium	-	High	-	L1	Pavement	Hot spot in northbound lanes MP 0-1	N	Pavement preservation project programmed MP 0-3 FY 2015 will address need
						L2	Bridge	Medium level of need, including a hot spot at the Western TI Overpass (SB) (#1546) with deck rating 5, superstructure rating 5	N	Structure does not meet criteria for historical review, therefore not considered for strategic investment
						L3	Safety	High level of need resulting from two fatal crashes in 2012	N	Not enough data to determine a trend and define a solution, therefore not considered strategic
19-2	Hot spot	Hot spot	-	High	-	L4	Pavement	Hot spot on NB side from MP 17-18.5, which includes an area of high historical investment	N	Pavement preservation project programmed MP 15-21 FY 2016 will address need
						L5	Bridge	Hot spot at Rio Rico TI (EB) (#933) with deck rating 5, superstructure rating 5	N	Structure does not meet criteria for historical review, therefore not considered for strategic investment
						L6	Bridge	Hot spot at Agua Fria Canyon Bridge (NB) (#353) with deck rating 5, superstructure rating 5	N	Structure does not meet criteria for historical review, therefore not considered for strategic investment
						L7	Bridge	Hot spot at Agua Fria Canyon Bridge (SB) (#906) with deck rating 5, superstructure rating 5, substructure rating 5	Y	Meets criteria for strategic investment
						L8	Bridge	Hot spot at Palo Parado TI (#937) with deck rating 5, superstructure 5	Y	Meets criteria for strategic investment
						L9	Safety	High number of crashes resulting from run off the road and merging in unlighted areas.	Y	Meets criteria for strategic investment
19-3	-	-	-	High	Medium	L10	Safety	High number of crashes resulting from run off the road and merging in unlighted areas.	Y	Meets criteria for strategic investment
						L11	Freight	Medium level of need due to elevated Truck Travel Time and Truck Planning Time Index	N	Elevated need due to NB border patrol checkpoint in Tubac, therefore not considered for strategic investment
19-4	-	-	-	-	-	NA	NA	None	N	NA
19-5	-	High	-	High	-	L12	Bridge	Hot spot at El Toro Road Overpass (NB) (#1572) with deck rating 4	Y	Bridge deck rehabilitation project programmed FY 2016 (design only); advance for construction consideration
						L13	Bridge	Hot spot at El Toro Road Overpass (SB) (#1573) with deck rating 4	Y	Bridge deck rehabilitation project programmed FY 2016 (design only); advance for construction consideration
						L14	Bridge	Hot spot at Pima Mine OP (NB) (#1303) with deck rating 4	N	Bridge deck rehabilitation project programmed for construction FY 2016 will address need
						L15	Bridge	Hot spot at Pima Mine OP (SB) (#1304) with deck rating 4	N	Bridge deck rehab project programmed for construction FY 2016 will address need
						L16	Bridge	Hot spot at Santa Cruz River Bridge (NB) (#1243) with deck rating 4	N	Bridge deck rehab project programmed for construction FY 2016 will address need
						L17	Bridge	Hot spot at Santa Cruz River Bridge (SB) (#1244) with deck rating 4	N	Bridge deck rehab project programmed for construction FY 2016 will address need
						L18	Safety	Medium level of need with hot spots northbound lanes at MP 53-56	Y	Meets criteria for strategic investment
						L19	Safety	Medium level of need with hot spots southbound lanes at MP 47-49	Y	Meets criteria for strategic investment
19-6	Hot spot	Hot spot	High	High	-	L20	Pavement	Hot spot NB/SB at MP 62-63.7	N	I-19 reconstruction project programmed FY 2015 and FY 2018 MP 58-62; recommend modifying existing programmed project to address hot spots
						L21	Bridge	Hot spot at Airport Wash Bridge (NB) (#1121) with deck rating 5, superstructure rating 5	Y	Meets criteria for strategic investment
						L22	Bridge	Hot spot at Airport Wash Bridge (SB) (#1122) with deck rating 5, superstructure rating 5	Y	Meets criteria for strategic investment
						L23	Bridge	Hot spot at Irvington Road TI (#1123) with deck rating 5, superstructure rating 5	N	TI design programmed FY 2019; advance for construction consideration
						L24	Mobility	High level of need resulting from poor current and future volume to capacity ratios	Y	Meets criteria for strategic investment. Ajo Way TI reconstruction project programmed 2018 will address some of need
						L25	Safety	High number of pedestrian/bicycle fatalities	Y	Meets criteria for strategic investment

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 I-19 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 17 candidate solutions are proposed to address the identified needs on the I-19 Corridor.

Table 19 identifies each strategic location that has been assigned a candidate solution with a number (e.g., CS19.1, CS19.2, 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.

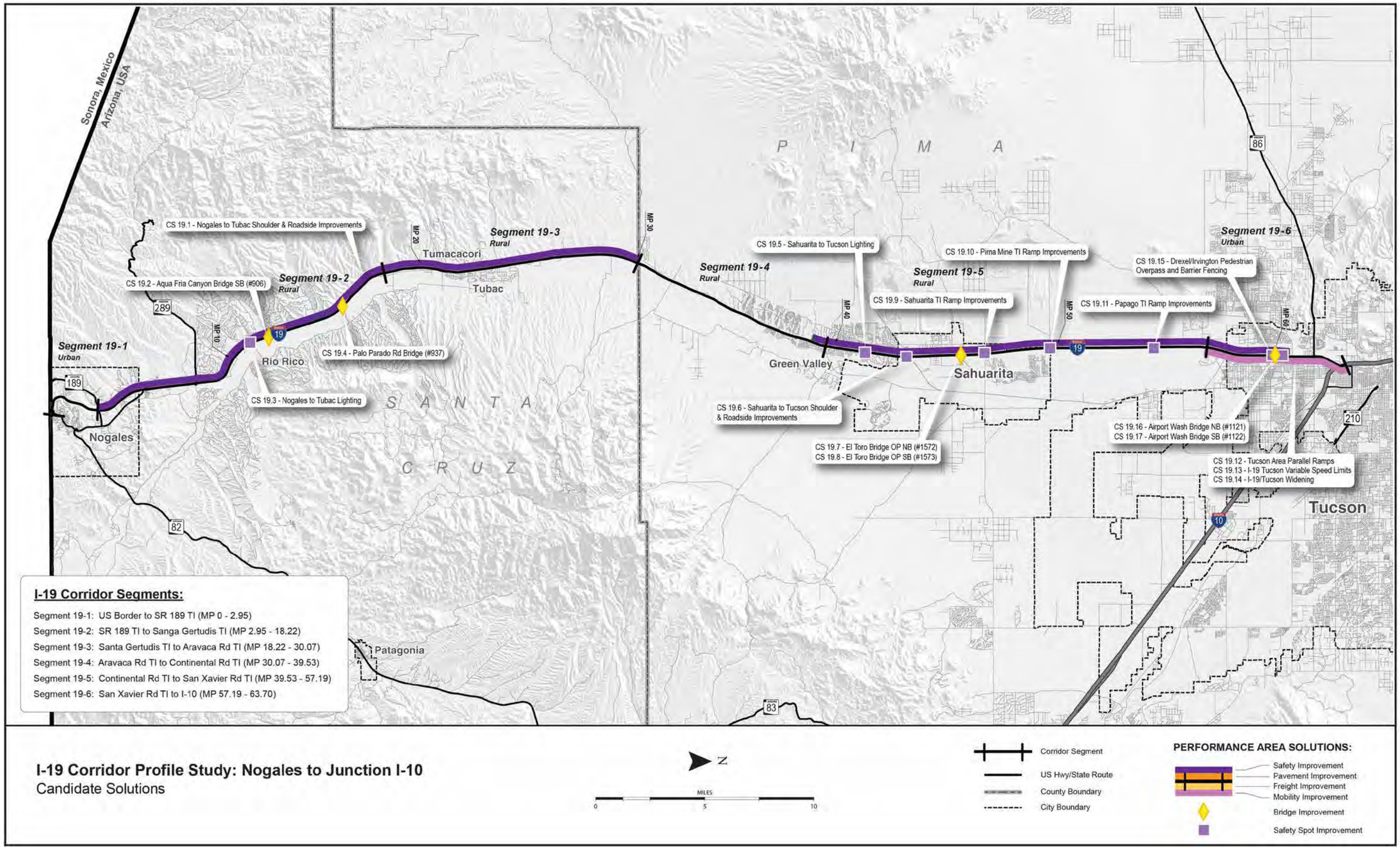
Candidate solutions that are recommended to expand or modify the scope of an already programmed project are noted and are not advanced to solution evaluation and prioritization. These solutions are directly recommended for programming.

Table 19: Candidate Solutions

Candidate Solution	Segment	Location	Beg Milepost	End Milepost	Candidate Solution Name	Option*	Scope	Investment Category (Preservation [P], Modernization [M], Expansion [E])
CS19.1	19-2 19-3	L9 L10	3	30	Nogales to Tubac Shoulder & Roadside Improvements	-	Rehabilitate shoulders in both directions from the SR189 TI to Aravaca Rd TI	M
CS19.2	19-2	L7	12.0	12.0	Agua Fria Canyon Bridge SB (#906)	A	Rehabilitate bridge	P
						B	Replace bridge	M
CS19.3	19-2 19-3	L8	3	30	Nogales to Tubac Lighting	-	Install lighting (both directions)	M
CS19.4	19-2	L8	15.7	15.7	Palo Parado Rd Bridge (#937)	A	Rehabilitate bridge	P
						B	Replace bridge	M
CS 19.5	19-5 19-6	L10	39.5	60	Sahuarita to Tucson Lighting	-	Install lighting (both directions)	M
CS19.6	19-5 19-6	L18 L19	39.5	62	Sahuarita to Tucson Shoulder & Roadside Improvements	-	Rehabilitate shoulders in both directions from Sahuarita Rd to Irvington Rd.	M
CS19.7	19-5	L12	45.8	45.8	El Toro Bridge OP NB (#1572)	-	Rehabilitate bridge following programmed design FY 2016	P
CS19.8	19-5	L13	45.8	45.8	El Toro Bridge OP SB (#1573)	-	Rehabilitate bridge following programmed design FY 2016	P
CS 19.9	19-5	L18 L19	46.8	46.8	Sahuarita TI Ramp Improvements	-	Modify entry/exit ramps to parallel configuration	M
CS19.10	19-5	L18 L19	49.6	49.6	Pima Mine TI Ramp Improvements	-	Modify entry/exit ramps to parallel configuration	M
CS19.11	19-5	L18 L19	54.4	54.4	Papago TI Ramp Improvements	-	Modify entry/exit ramps to parallel configuration	M
CS19.12	19-5 19-6	L24	57	62	Tucson Area Parallel Ramps	-	Modify entry/exit ramps to parallel configuration Implement ramp metering at Irvington Rd SB, Valencia Rd NB/SB, and San Xavier Rd NB	M
CS19.13	19-5 19-6	L24	57	64	I-19 Tucson Variable Speed Limits	-	Implement Variable Speed Limits (both directions)	M
CS19.14	19-5 19-6	L24	57	62	I-19/Tucson Widening	-	Construct new general purpose lane (inside) in NB/SB direction between Irvington Rd and San Xavier Rd	E
CS19.15	19-5 19-6	L25	59.5	61.5	Drexel-Irvington Pedestrian Overpass and Barrier Fencing	-	Construct pedestrian overpass between Drexel and Irvington; construct 8' barrier fencing Valencia to Ajo Way (east side)	M
CS19.16	19-6	L21	60.3	60.3	Airport Wash Bridge NB (#1121)	A	Rehabilitate bridge	P
						B	Replace bridge	M
CS19.17	19-6	L22	60.3	60.3	Airport Wash Bridge SB (#1122)	A	Rehabilitate bridge	P
						B	Replace bridge	M

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

Figure 23: 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.

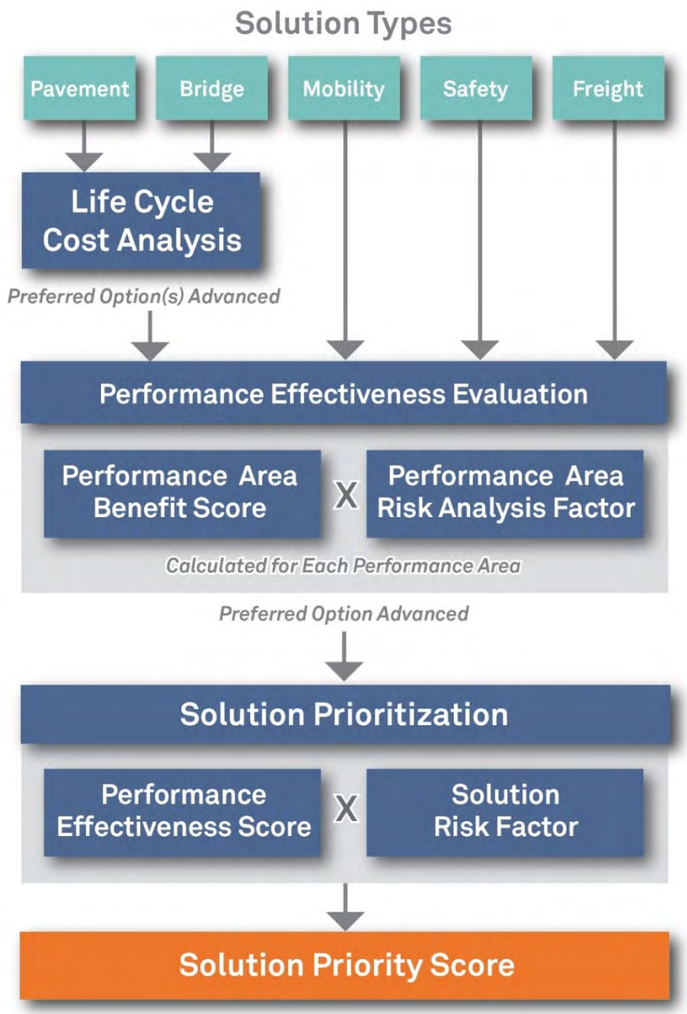
Solution Risk Analysis

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 2015 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 19**, LCCA was conducted on four bridges on the I-19 Corridor. A summary of this analysis is shown in **Table 20.** 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 2015 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 19**, the following conclusions were determined based on the LCCA:

- Rehabilitation or repair was determined to be the most effective approach for all the candidate solutions evaluated.
- The following bridges do not require replacement according to the results of the LCCA, therefore, it is assumed that these will be addressed by normal programming processes and were dropped from further consideration:
  - Agua Fria Canyon Bridge SB (CS19.2)
  - Palo Parado Road Bridge (CS 19.4)
- While Airport Wash Bridge NB (CS 19.16) and Airport Wash Bridge SB (CS 19.17) do not qualify for a standalone bridge replacement according to LCCA results, improvements to these structures were recommended through other Candidate Solutions.
- LCCA was not conducted on the following bridges because design funds are currently programmed in the ADOT 5 Year STIP. This I-19 Corridor Profile Study recommends advancing those projects to construction, including:
  - El Toro Rd. Bridge NB (CS 19.7)
  - El Toro Rd. Bridge SB (CS.19.8)

There are no Candidate Solutions that require a pavement LCCA for the I-19 Corridor.

Table 20: 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		
Airport Wash Bridge NB (CS19.16)	$1,044,000	$927,000	$756,000	1.38	1.23	1.00	Yes	Not strategic as a stand-alone project; carry forward for further evaluation with other Needs
Airport Wash Bridge SB (CS19.17)	$1,044,000	$951,000	$764,000	1.36	1.24	1.00	Yes	Not strategic as a stand-alone project; carry forward for further evaluation with other Needs
Agua Fria Canyon Bridge SB (CS19.2)	$566,000	$588,000	$412,000	1.37	1.43	1.00	No	Not strategic as a stand-alone project and no other Needs – no further evaluation
Palo Parado Road Bridge (CS 19.4)	$1,263,000	$1,074,000	$912,000	1.38	1.18	1.00	No	Not strategic as a stand-alone project and no other Needs – no further evaluation

Table 21: 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
	Replace	Rehab	Repair	Replace	Rehab	Repair		
No LCCA conducted for any pavement solutions on the I-19 Corridor.								

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 a Performance Effectiveness Score (PES). 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 TTI secondary measure
  - Changes in the Mobility Index (due to increased capacity) and Safety Index (due to crash reductions) would have a direct effect on the PTI 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 TPTI secondary measure
  - Changes in the Mobility Index (due to increased capacity) would have a direct effect on the TTTI 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 (2014) 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 22**. 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 others (more than twice the PES value and a difference in magnitude of at least 20 points) the lower scoring 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 I-19 Corridor, there were no candidate solutions with options to address Mobility, Safety, or Freight needs.

Following the LCCA, the following Candidate Solutions were eliminated from further consideration as standalone projects or have been directly recommended for construction programming. These Candidate Solutions have not been evaluated for prioritization:

- *Agua Fria Canyon Bridge SB (CS19.2) – Eliminated*
- *Palo Parado Road Bridge (CS19.4) - Eliminated*
- **El Toro Road Bridge NB (CS19.7) – Advance to Programming**
- **El Toro Road Bridge SB (CS19.8) – Advance to Programming**
- *Airport Wash Bridge NB (CS19.16) – Eliminated*
- *Airport Wash Bridge SB (CS19.17) – Eliminated*

Table 22: Performance Effectiveness Scores

Candidate Solution	Segment	Option	Candidate Solution Name	Milepost Location	Estimated Cost ($ million)	Risk Factored Benefit Score					Risk Factored Emphasis Area Scores			Total Factored Benefit Score	F_{VMT}	F_{NPV}	Performance Effectiveness Score
						Pavement	Bridge	Safety	Mobility	Freight	Safety	Mobility	Freight				
CS19.1	19-2 19-3	-	Nogales to Tubac Shoulder & Roadside Improvements	3-30	$15.19	0.00	0.00	5.498	0.07	0.05	1.35	0.00	0.00	6.962	5.00	15.3	35.0
CS19.3	19-2 19-3	-	Nogales to Tubac Lighting	3-30	$36.25	0.00	0.00	2.77	0.03	0.01	0.70	0.00	0.00	3.505	5.00	15.3	7.4
CS19.5	19-5 19-6	-	Sahuarita to Tucson Lighting	39.5-60	$27.52	0.00	0.00	1.93	0.15	0.02	0.45	0.00	0.00	2.546	5.00	15.3	7.1
CS19.6	19-5 19-6	-	Sahuarita to Tucson Shoulder & Roadside Improvements	39.5-62	$13.79	0.00	0.00	5.45	0.359	0.064	0.76	0.015	0.00	6.652	5.00	15.3	36.9
CS19.9	19-5	-	Sahuarita TI Ramp Improvements	46.8	$4.43	0.00	0.00	0.025	0.040	0.004	0.012	0.015	0.00	0.095	1.13	20.2	0.5
CS19.10	19-5	-	Pima Mine TI Ramp Improvements	49.6	$5.60	0.00	0.59	0.72	0.044	0.013	0.249	0.015	0.00	1.622	1.13	20.2	6.6
CS19.11	19-5	-	Papago TI Ramp Improvements	54.4	$4.43	0.00	0.00	0.357	0.042	0.009	0.15	0.015	0.00	0.569	1.13	20.2	2.9
CS19.12	19-6	-	Tucson Area Parallel Ramps	57 – 62	$13.94	0.00	0.345	1.237	1.798	0.016	0.175	0.025	0.00	3.596	3.04	20.2	15.9
CS19.13	19-6	-	Tucson Variable Speed Limits	57 – 64	$24.99	0.00	0.00	0.748	2.743	0.012	0.106	0.038	0.00	3.646	4.99	15.3	11.1
CS19.14	19-6	-	Tucson Area GP Widening	57 – 62	$33.43	4.05	0.35	0.65	8.72	0.016	0.09	0.104	0.00	13.976	4.95	20.2	41.8
CS19.15	19-6	-	Drexel/Irvington Pedestrian Overpass	59.5-61.5	$2.25	0.00	0.00	5.11	0.097	0.05	0.65	0.00	0.00	5.912	1.04	20.2	55.4

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 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	1.05	1.10	1.21	1.32	1.43	1.54
	Seldom	1.10	1.20	1.32	1.44	1.56	1.68
	Common	1.15	1.30	1.43	1.56	1.69	1.82
	Frequent	1.20	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 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 22***

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 level need score as shown in **Table 17***

Table 23 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. The prioritized list of candidate solutions is provided in the subsequent section. See **Appendix J** for additional information on the prioritization process.

Table 23: 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
CS19.1	19-2 and 19-3	-	Nogales to Tubac Shoulder & Roadside Improvements	3 - 30	$15.19	35.0	1.773	1.19	**74**	0.00%	0.00%	2.29%	43.56%	2.85%
CS19.3	19-2 and 19-3	-	Nogales to Tubac Lighting	3-30	$36.25	7.4	1.766	1.19	**16**	0.00%	0.00%	1.01%	19.71%	0.42%
CS19.5	19-5 and 19-6	-	Sahuarita to Tucson Lighting	39.5-60	$27.52	7.1	1.752	1.26	**16**	0.00%	0.00%	1.09%	14.44%	1.18%
CS19.6	19-5 and 19-6	-	Sahuarita to Tucson Shoulder & Roadside Improvements	39.5-62	$13.79	36.9	1.752	1.37	**89**	0.00%	0.00%	1.53%	38.13%	3.29%
CS19.9	19-5	-	Sahuarita TI Ramp Improvements	46.8	$4.43	0.5	1.520	1.15	**1**	0.00%	0.00%	6.79%	0.40%	0.97%
CS19.10	19-5	-	Pima Mine TI Ramp Improvements	49.6	$5.60	6.6	1.664	1.15	**13**	0.00%	9.74%	7.48%	11.67%	2.90%
CS19.11	19-5	-	Papago TI Ramp Improvements	54.4	$4.43	2.9	1.731	1.15	**6**	0.00%	0.00%	7.20%	5.82%	1.93%
CS19.12	19-6	-	Tucson Area Parallel Ramps	57 – 62	$13.94	15.9	1.539	1.92	**47**	0.00%	15.20%	22.89%	17.42%	1.24%
CS19.13	19-6	-	Tucson Variable Speed Limits	57 – 64	$24.99	11.1	1.458	1.92	**31**	0.00%	0.00%	22.73%	10.53%	0.93%
CS19.14	19-6	-	Tucson Area GP Widening	57 – 62	$33.43	41.8	1.322	1.92	**106**	87.60%	15.20%	72.68%	9.10%	1.24%
CS19.15	19-6	-	Drexel/Irvington Pedestrian Overpass	59.5 – 61.5	$2.25	55.4	1.770	1.92	**188**	0.00%	0.00%	0.93%	71.97%	3.88%

6.0 SUMMARY OF CORRIDOR RECOMMENDATIONS

6.1 Prioritized Candidate Solution Recommendations

Table 24 and **Figure 27** show the ranked prioritized candidate solutions recommended for the I-10/SR 85 corridor. Implementation of these solutions is anticipated to improve performance of the I-10/SR 85 corridor. The following observations were noted about the prioritized solutions:

- Two of the top three projects include shoulder and roadside improvements through much of the corridor that will reduce the incidence of run off the road type vehicle crashes that often result in fatal and serious injuries.
- Additional benefits to Mobility and Freight will occur due to the reduction in the number of incidents that cause delays along I-19.
- The I-19 Tucson Area GP Widening project will increase capacity on this congested segment, reduce delays, and improve safety.
- The Drexel/Irvington Pedestrian Overpass and Barrier Fencing project will help reduce the high number of fatal vehicle-pedestrian crashes resulting from pedestrians attempting to cross I-19.
- The remaining traffic interchange ramp and lighting improvements will increase safety at those locations as well as improve traffic throughput by reducing delay and the potential for conflicting movements in the merge areas.

6.2 Other Corridor Recommendations

As part of the investigation of strategic investment areas and candidate solutions, other corridor recommendations were also identified. These recommendations could include modifications to the existing Statewide Construction Program, areas for further study, or other corridor specific recommendations that are not construction or policy related. The list below identified other corridor recommendations for the I-19 corridor:

- The analysis shows a high ratio of fatal to incapacitating injury crashes that are not clearly patterned to specific locations. This report recommends that a Roadway Safety Analysis should be conducted on the corridor in order to better understand the high occurrence of fatal crashes.
- Consider a corridor strategy to upgrade all bridges to current standards in anticipation of increased truck/freight traffic over the medium to long term.
- Consider corridor wide ITS solutions to assist truck/freight traffic over the medium to long term.
- Advance Irvington Rd TI Underpass to construction programming. Irvington Rd TI has design funds only programmed in the Pima Association of Governments (PAG) five year transportation facilities construction program for fiscal year 2019.
- Extend the limits of the Ajo Way TI Phase 2 scope to reach the pavement hot spot at milepost 63 in fiscal year 2018.
- When recommending future projects along I-19, review historical ratings and levels of investment. According to data used for this study, the following pavement and bridge locations have exhibited high historical investment (pavement) or rating fluctuation (bridge) issues:
  - Pavement MP 6-9
  - Western Ave TI OP NB (MP 1.17)
  - Pajarito Rd OP NB/SB (MP 3.67)
  - Ruby Road TI UP (MP 7.7)
  - Agua Fria Canyon Bridge NB/SB (MP 11.97)
  - Peck Canyon TI UP (MP 13.96)
  - Peck Canyon Wash SB (MP 14.37)
  - Palo Parado Rd (MP 15.65)
  - Agua Linda UP (MP 26.54)
  - El Toro Rd OP NB/SB (MP 45.80)
  - Pima Mine TI OP NB/SB (MP 49.62)
  - Papago Rest Area TI OP NB/SB (MP 54.40)
  - Santa Cruz River Bridge NB/SB (MP 56.80)
  - Airport Wash Bridge NB/SB (MP 60.32)

6.3 Policy and Initiatives Recommendations

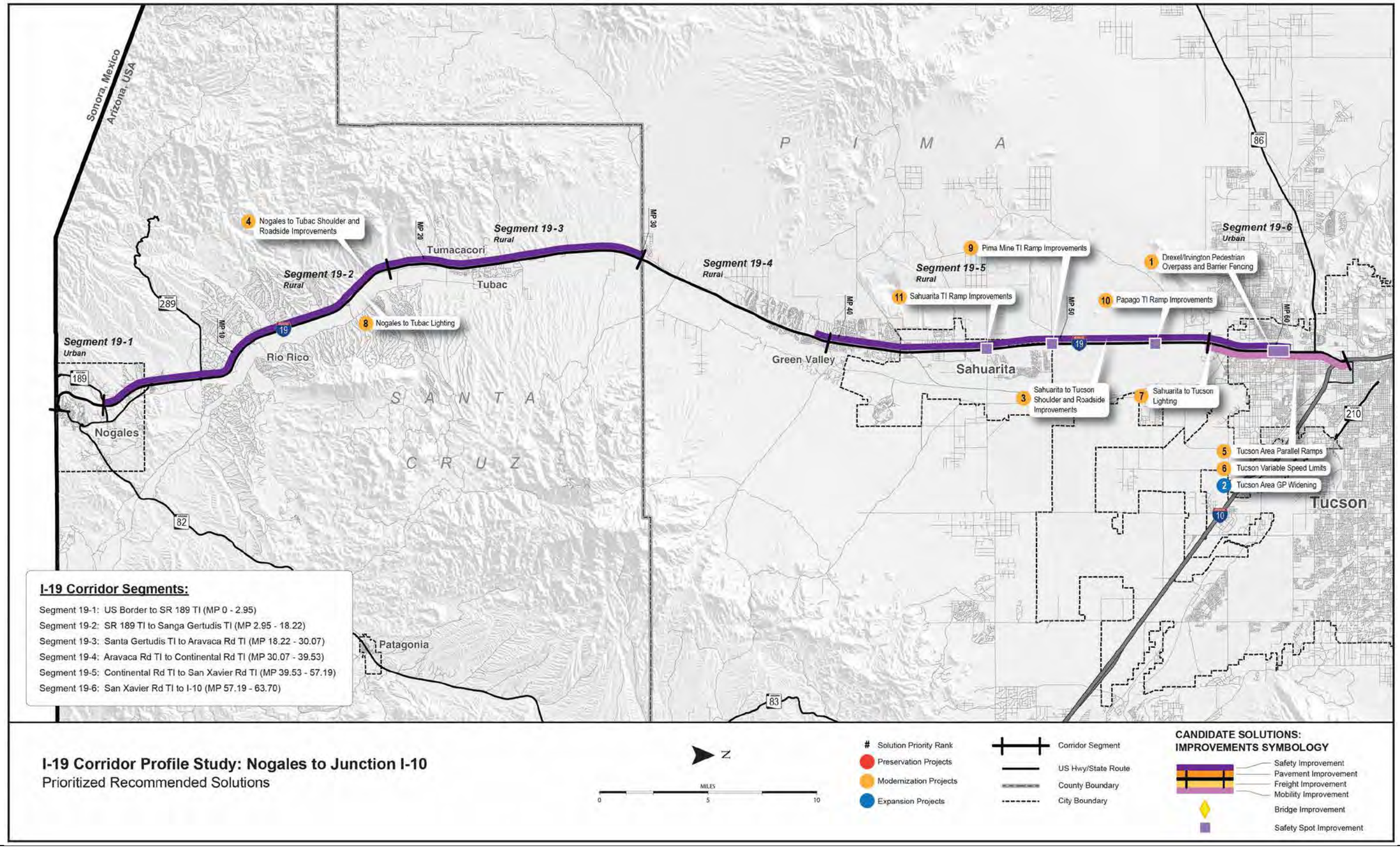
In addition to location-specific needs, general corridor and system-wide needs have also been identified through the CPS process. While these needs are more overarching and cannot be individually evaluated through this process, it is important to document them. A list of recommended policies and initiatives was developed for consideration when programming future projects not only on I-19, 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 Round 1, Round 2, and Round 3 CPS:

- 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
- Collision data on tribal lands may be incomplete or inconsistent; additional coordination for data on tribal lands is required 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

Table 24: Prioritized Recommended Solutions

Rank	Candidate Solution	Solution Name and Location	Description/Scope	Estimated Cost ($ million)	Investment Category (Preservation [P], Modernization [M], Expansion [E])	Prioritization Score
1	CS19.15	Drexel/Irvington Pedestrian Overpass (I-19 MP 59.5-62)	Construct pedestrian overpass between Drexel and Irvington; construct 8' barrier fencing Valencia to Ajo Way (east side) and from Drexel to Irvington Rd (west side)	$2.25	M	**188**
2	CS19.14	Tucson Area GP Widening (I-19 MP 57-61.9)	Construct new general purpose lane (inside) in NB/SB direction between Irvington Rd and San Xavier Rd	$33.43	E	**106**
3	CS19.6	Sahuarita to Tucson Shoulder & Roadside Improvements (I-19 MP 39.5-61.9)	Rehabilitate shoulders in both directions from Sahuarita Rd to Irvington Rd.	$13.79	M	**89**
4	CS19.1	Nogales to Tubac Shoulder & Roadside Improvements (I-19 MP 3-30)	Rehabilitate shoulders in both directions from the SR189 TI to Aravaca Rd TI	$15.19	M	**74**
5	CS19.12	Tucson Area Parallel Ramps (I-19 MP 57-61.9)	Modify entry/exit ramps to parallel configuration Implement ramp metering at Irvington Rd SB, Valencia Rd NB/SB, and San Xavier Rd NB	$13.94	M	**47**
6	CS19.13	Tucson Variable Speed Limits (I-19 MP 57-64)	Implement Variable Speed Limits (both directions)	$24.99	M	**31**
7	CS19.5	Sahuarita to Tucson Lighting (I-19 MP 39.5-60)	Install lighting (both directions)	$27.52	M	**16**
8	CS19.3	Nogales to Tubac Lighting (I-19 MP 3-30)	Install lighting (both directions)	$36.25	M	**16**
9	CS19.10	Pima Mine TI Ramp Improvements (I-19 MP 49.6)	Modify entry/exit ramps to parallel configuration	$5.60	M	**13**
10	CS19.11	Papago TI Ramp Improvements (I-19 MP 54.4)	Modify entry/exit ramps to parallel configuration	$4.43	M	**6**
11	CS19.9	Sahuarita TI Ramp Improvements (I-19 MP 46.8)	Modify entry/exit ramps to parallel configuration	$4.43	M	**1**

Figure 27: Recommended Solutions



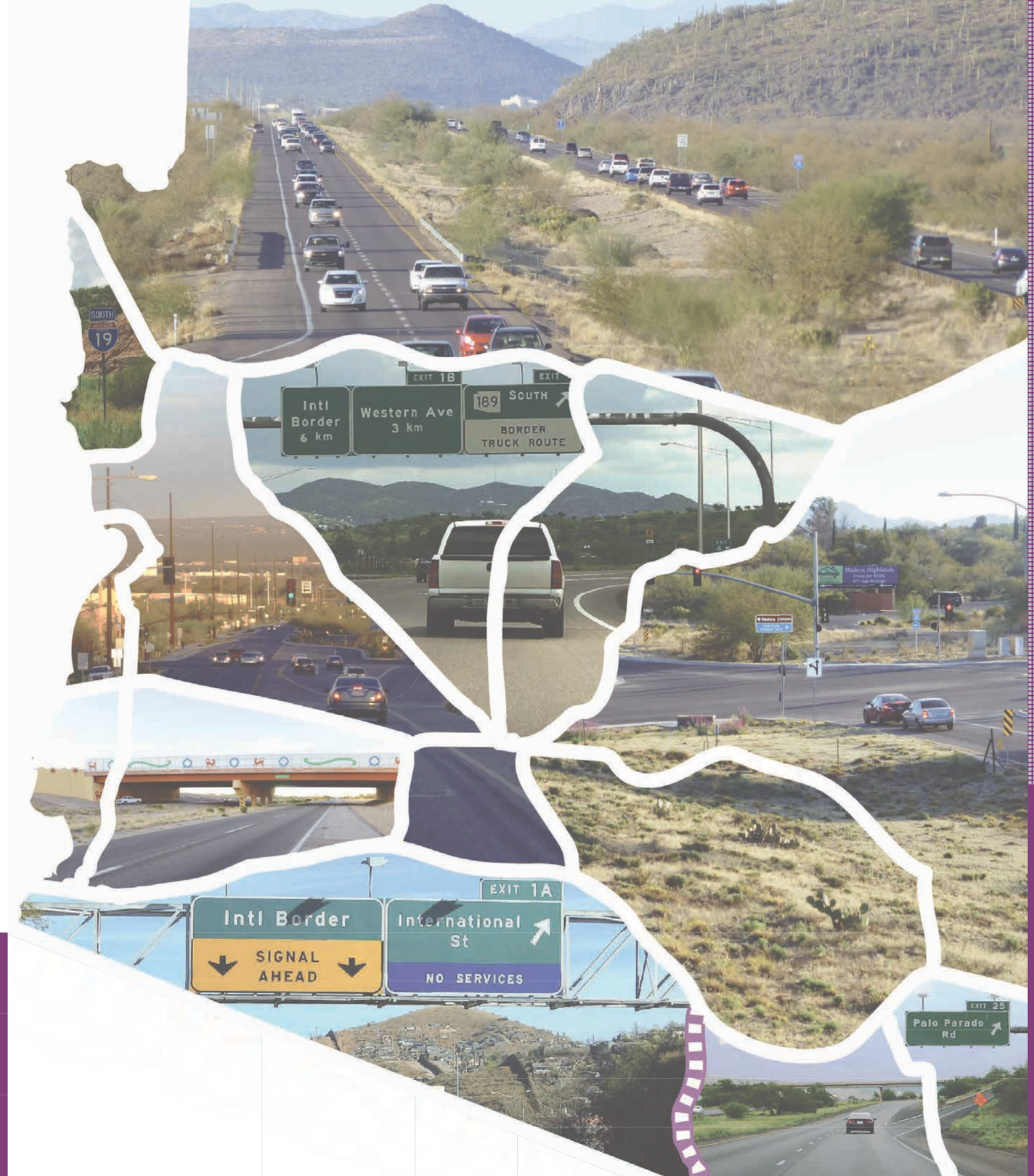
6.4 Next Steps

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 I-19 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.

Upon completion of all three CPS rounds, the 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


SOUTH
19
EXIT 1B
Intl Border
6 km
Western Ave
3 km
EXIT
189 SOUTH
BORDER
TRUCK ROUTE
Intl Border
SIGNAL
AHEAD
EXIT 1A
International
St
NO SERVICES
EXIT 25
Palo Parado
Rd

Appendix A: Corridor Performance Maps

This appendix contains maps of each primary and secondary measure associated with the five performance areas for the I-19 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
- Percent of Deck Area on Functionally Obsolete Bridges
- Lowest Bridge Rating

Mobility Performance Area:

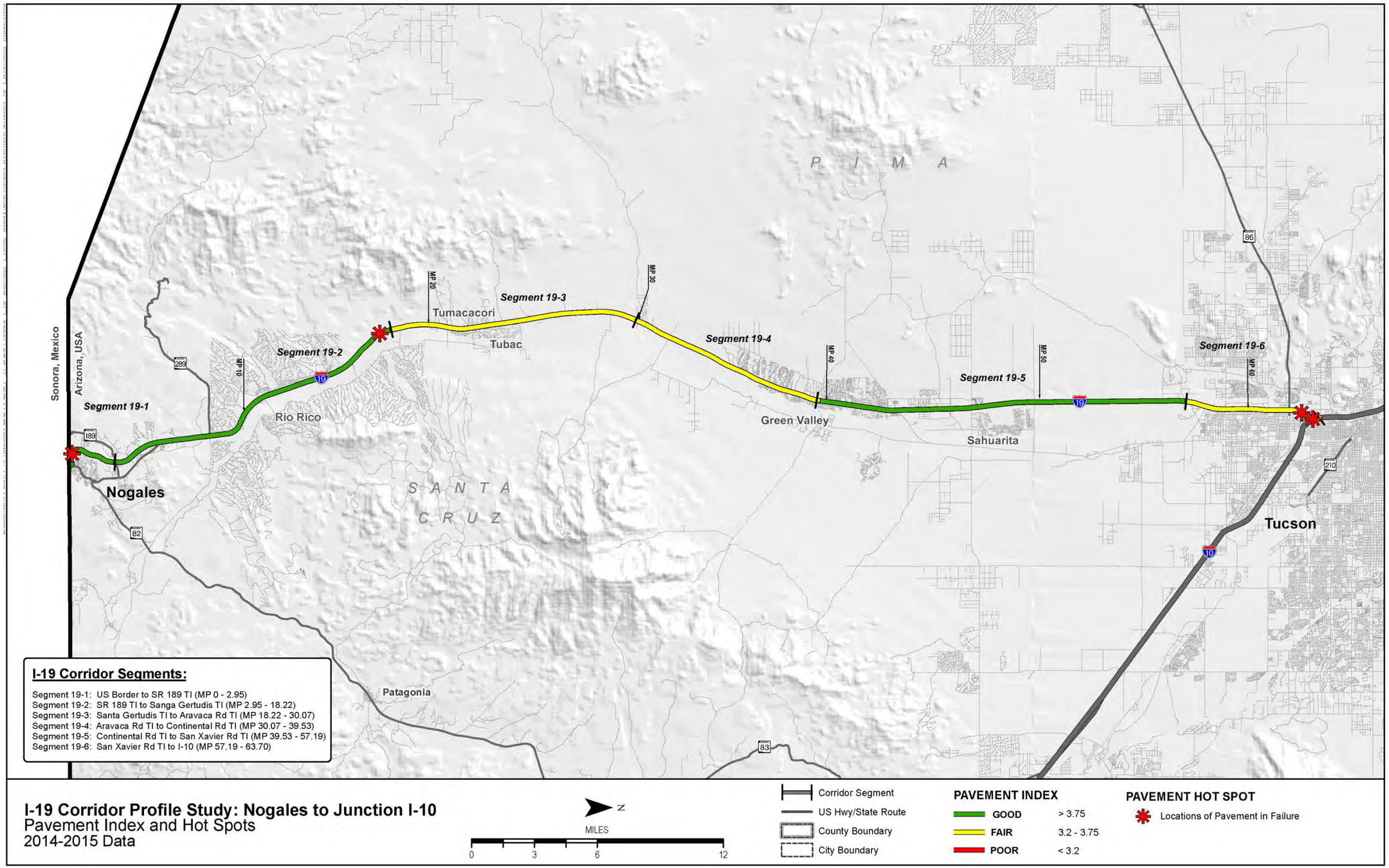
- Mobility Index
- Future Daily V/C
- Existing Peak V/C (directional)
- Average Instances Per Year a Given Milepost is Closed Per Segment Mile
- All Vehicles Travel Time Index
- All Vehicles Planning Time Index
- Multimodal Opportunities
- Percentage of Bicycle Accommodation

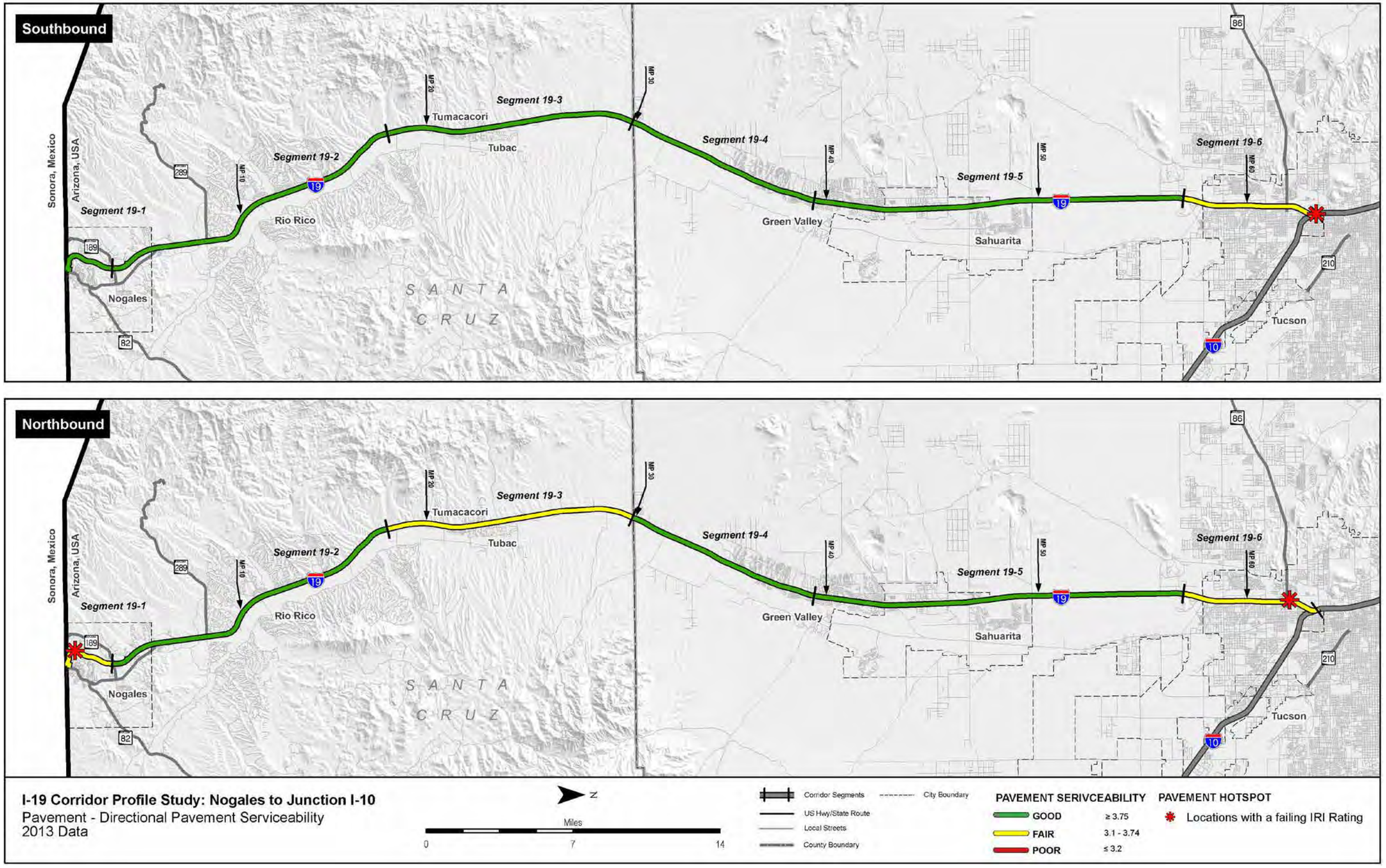
Safety Performance Area:

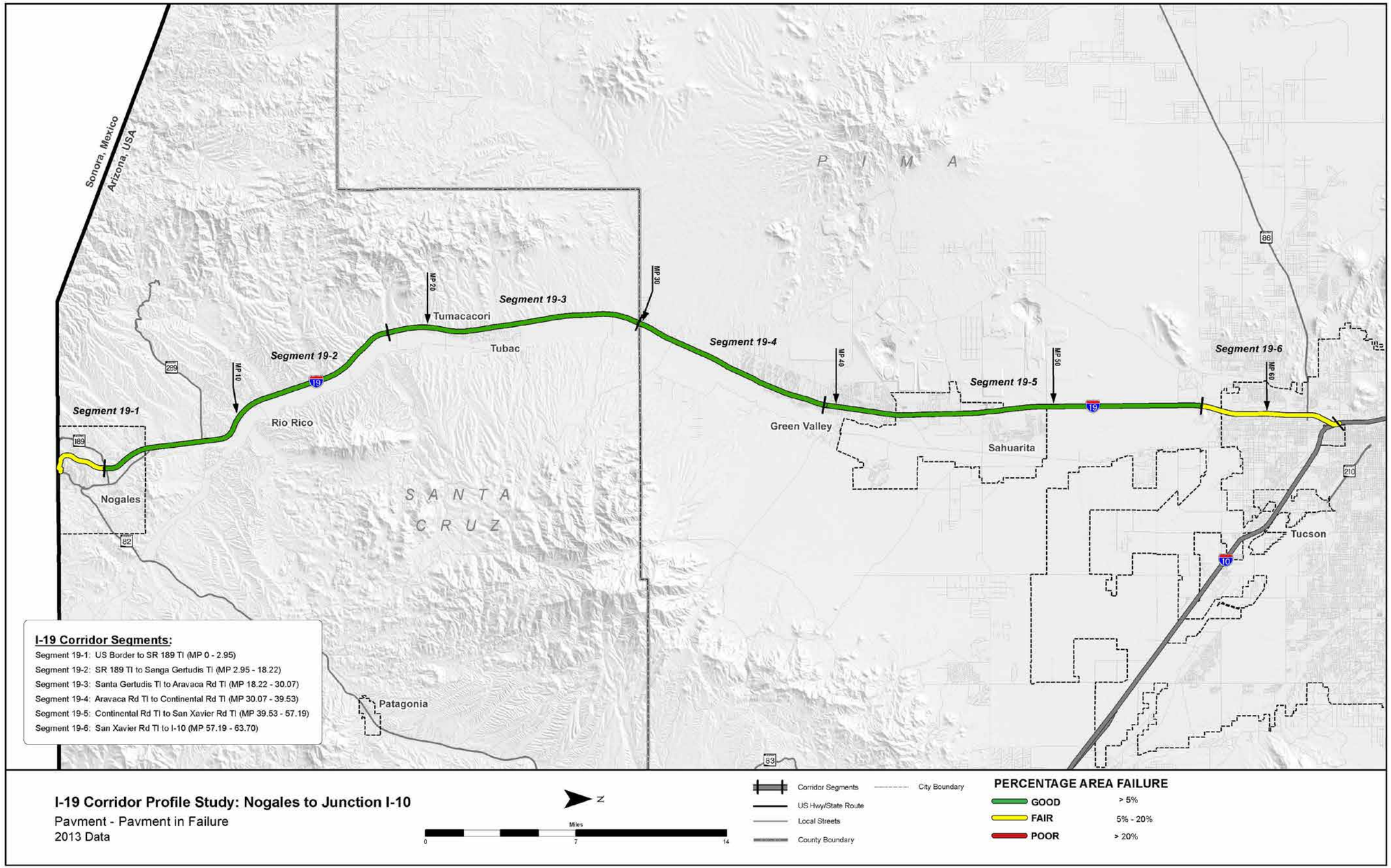
- Safety Index and Hot Spots
- Safety Index and Hot Spots (directional)
- Relative Frequency of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors Compared to the Statewide Average for Similar Segments

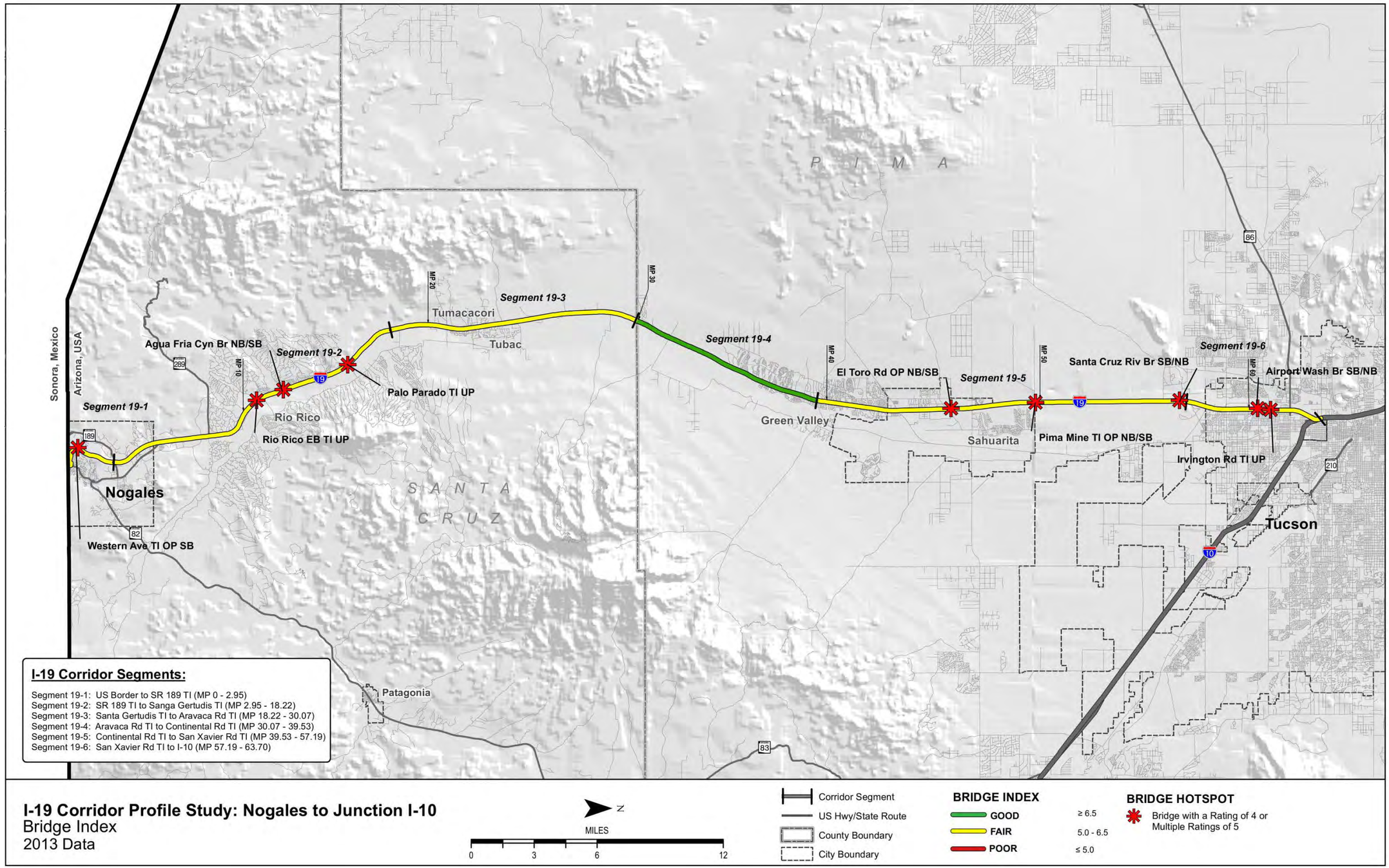
Freight Performance Area:

- Freight Index and Hot Spots
- Truck Travel Time Index
- Truck Planning Time Index
- Average Minutes Per Year Given Milepost is Closed Per Segment Mile
- Bridge Vertical Clearance


Sonora, Mexico
Arizona, USA
P I M A
S A N T A
C R U Z
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Nogales
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Tucson
Patagonia
189
289
19
82
83
86
210
10
I-19 Corridor Segments:
Segment 19-1: US Border to SR 189 TI (MP 0 - 2.95)
Segment 19-2: SR 189 TI to Sanga Gertudis TI (MP 2.95 - 18.22)
Segment 19-3: Santa Gertudis TI to Aravaca Rd TI (MP 18.22 - 30.07)
Segment 19-4: Aravaca Rd TI to Continental Rd TI (MP 30.07 - 39.53)
Segment 19-5: Continental Rd TI to San Xavier Rd TI (MP 39.53 - 57.19)
Segment 19-6: San Xavier Rd TI to I-10 (MP 57.19 - 63.70)
I-19 Corridor Profile Study: Nogales to Junction I-10
Pavement Index and Hot Spots
2014-2015 Data
N
MILES
0
3
6
12
Corridor Segment
US Hwy/State Route
County Boundary
City Boundary
PAVEMENT INDEX
GOOD > 3.75
FAIR 3.2 - 3.75
POOR < 3.2
PAVEMENT HOT SPOT
Locations of Pavement in Failure


Southbound
Northbound
Sonora, Mexico
Arizona, USA
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Nogales
Tucson
SANTA CRUZ
189
289
82
19
86
210
10
I-19 Corridor Profile Study: Nogales to Junction I-10
Pavement - Directional Pavement Serviceability
2013 Data
N
Miles
0
7
14
Corridor Segments
US Hwy/State Route
Local Streets
County Boundary
City Boundary
PAVEMENT SERIVCEABILITY
GOOD ≥ 3.75
FAIR 3.1 - 3.74
POOR ≤ 3.2
PAVEMENT HOTSPOT
Locations with a failing IRI Rating


Sonora, Mexico
Arizona, USA
P I M A
S A N T A
C R U Z
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Nogales
Green Valley
Sahuarita
Tucson
Patagonia
189
289
82
19
86
210
10
83
I-19 Corridor Segments:
Segment 19-1: US Border to SR 189 TI (MP 0 - 2.95)
Segment 19-2: SR 189 TI to Sanga Gertudis TI (MP 2.95 - 18.22)
Segment 19-3: Santa Gertudis TI to Aravaca Rd TI (MP 18.22 - 30.07)
Segment 19-4: Aravaca Rd TI to Continental Rd TI (MP 30.07 - 39.53)
Segment 19-5: Continental Rd TI to San Xavier Rd TI (MP 39.53 - 57.19)
Segment 19-6: San Xavier Rd TI to I-10 (MP 57.19 - 63.70)
I-19 Corridor Profile Study: Nogales to Junction I-10
Pavment - Pavment in Failure
2013 Data
N
Miles
0
7
14
Corridor Segments
US Hwy/State Route
Local Streets
County Boundary
City Boundary
PERCENTAGE AREA FAILURE
GOOD > 5%
FAIR 5% - 20%
POOR > 20%



I-19 Corridor Segments:

Segment 19-1: US Border to SR 189 TI (MP 0 - 2.95)
Segment 19-2: SR 189 TI to Sanga Gertudis TI (MP 2.95 - 18.22)
Segment 19-3: Santa Gertudis TI to Aravaca Rd TI (MP 18.22 - 30.07)
Segment 19-4: Aravaca Rd TI to Continental Rd TI (MP 30.07 - 39.53)
Segment 19-5: Continental Rd TI to San Xavier Rd TI (MP 39.53 - 57.19)
Segment 19-6: San Xavier Rd TI to I-10 (MP 57.19 - 63.70)

I-19 Corridor Profile Study: Nogales to Junction I-10
Bridge Index
2013 Data

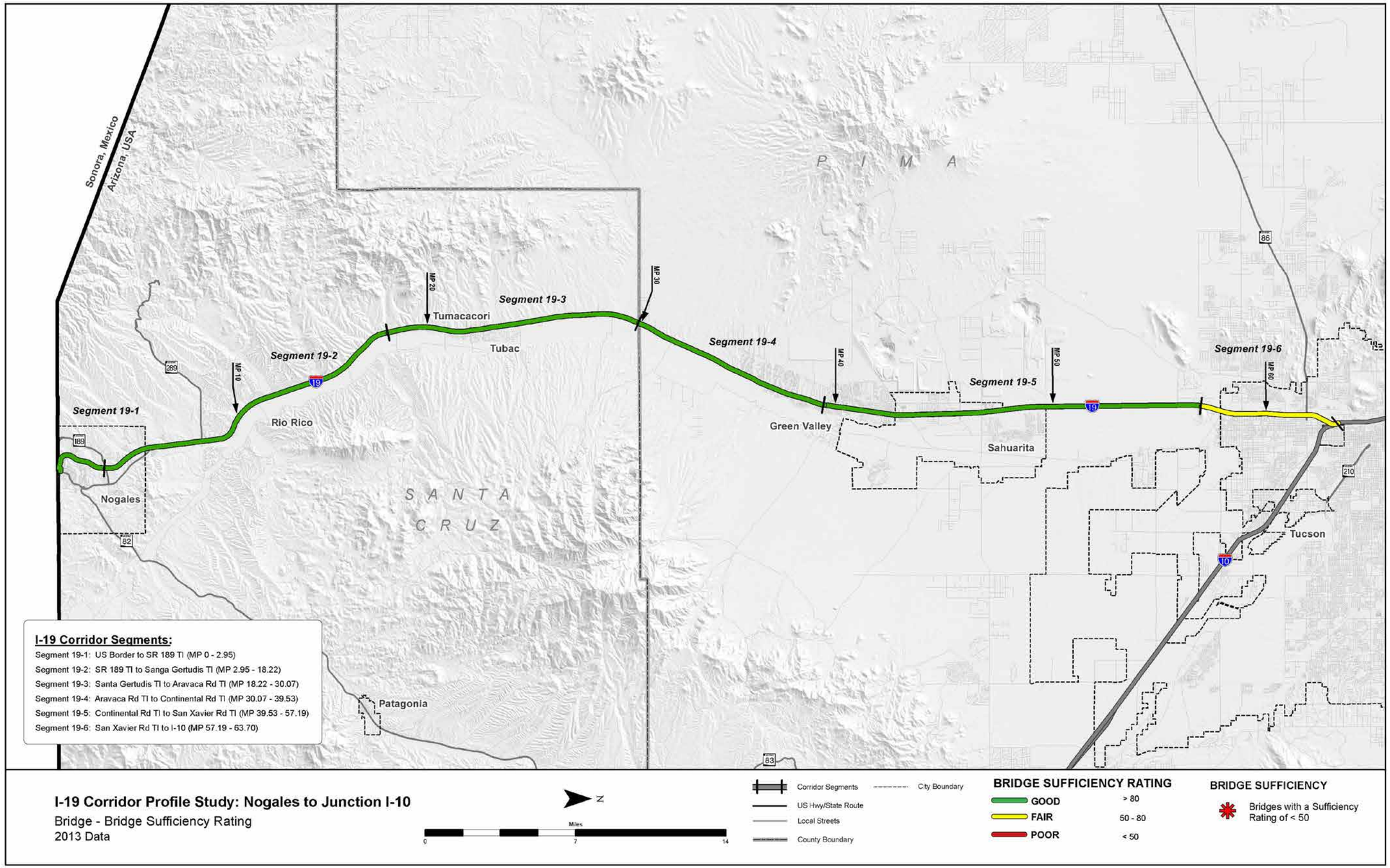
N
MILES
0 3 6 12

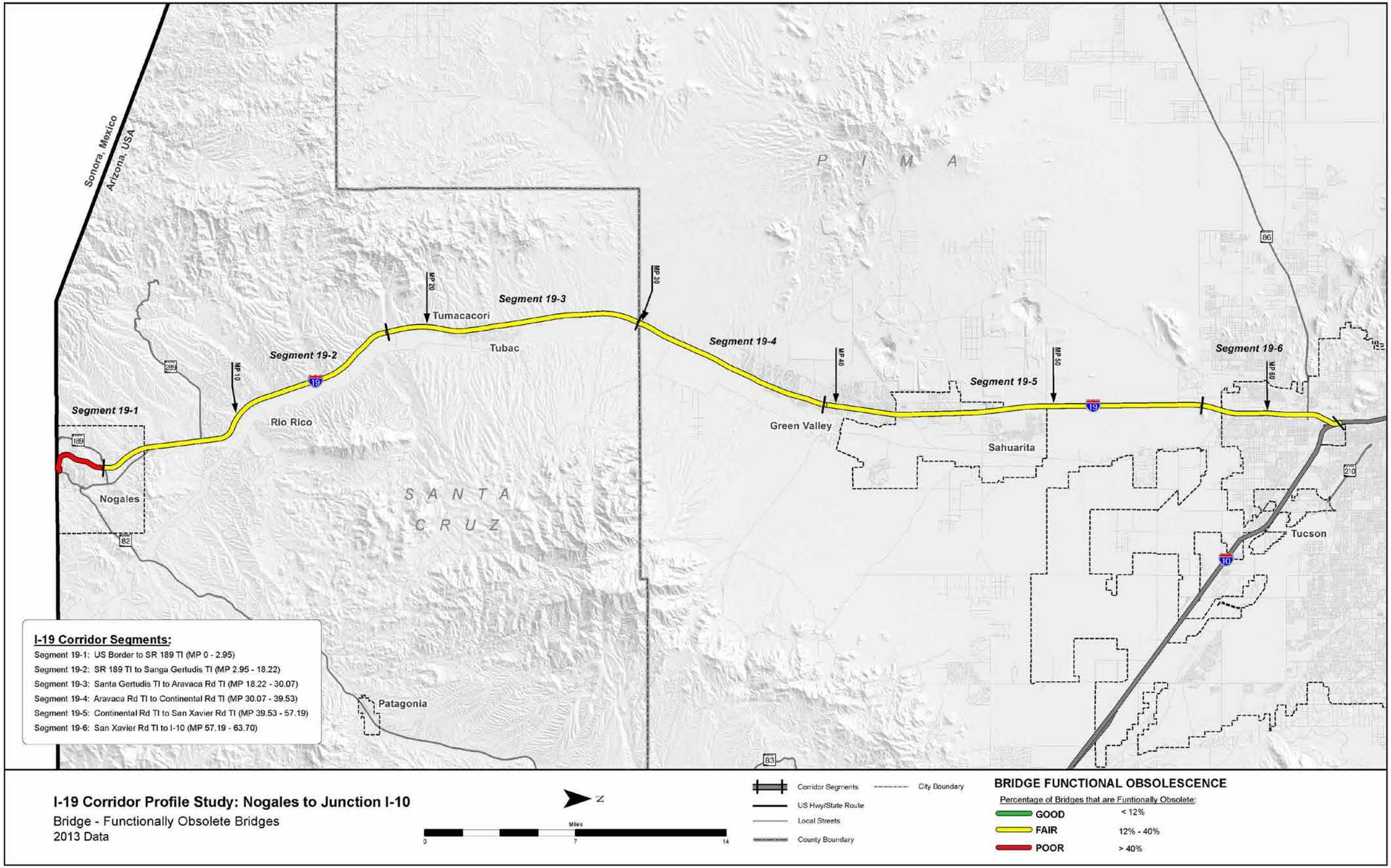
Corridor Segment
US Hwy/State Route
County Boundary
City Boundary

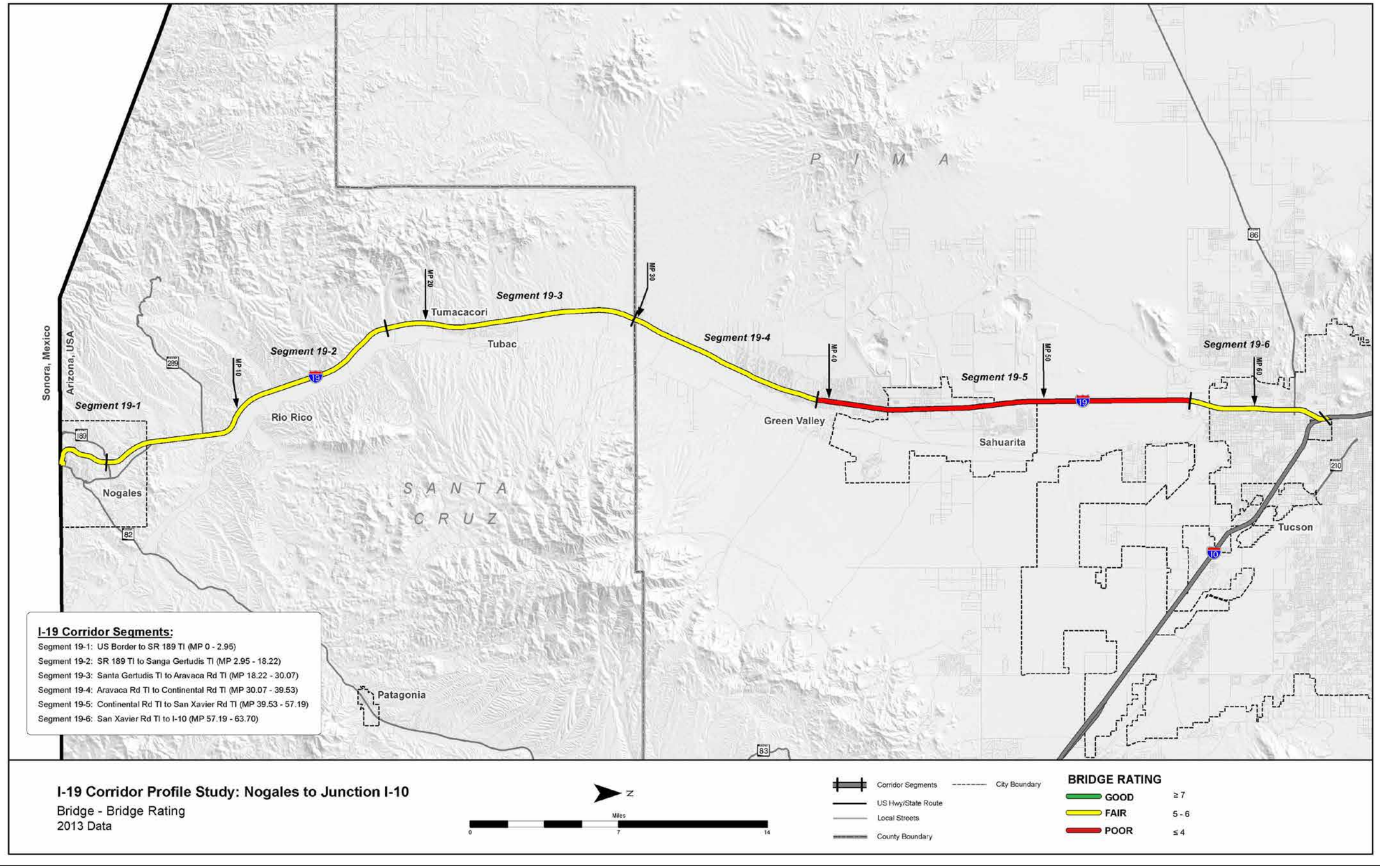
BRIDGE INDEX

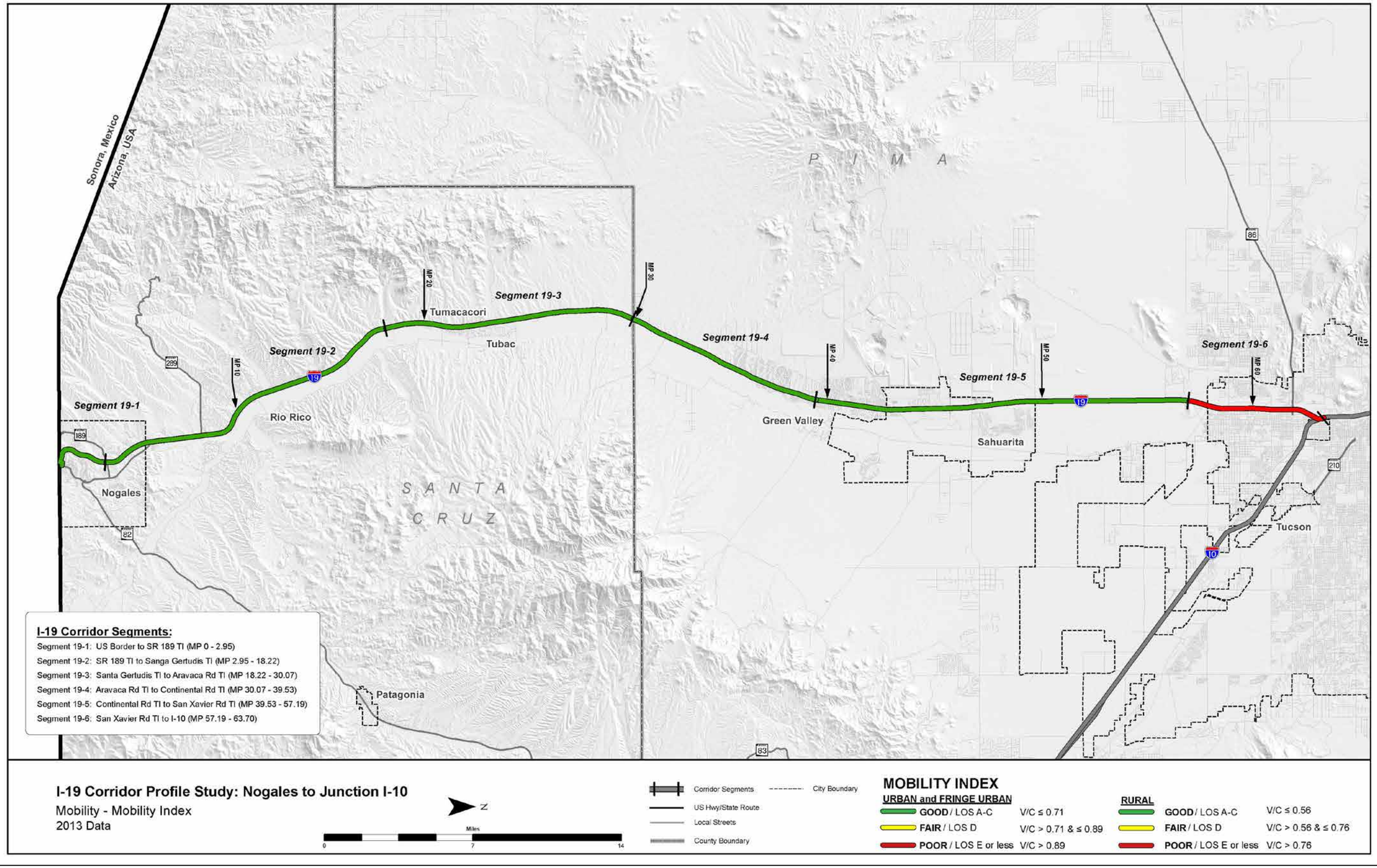
GOOD	≥ 6.5
FAIR	5.0 - 6.5
POOR	≤ 5.0

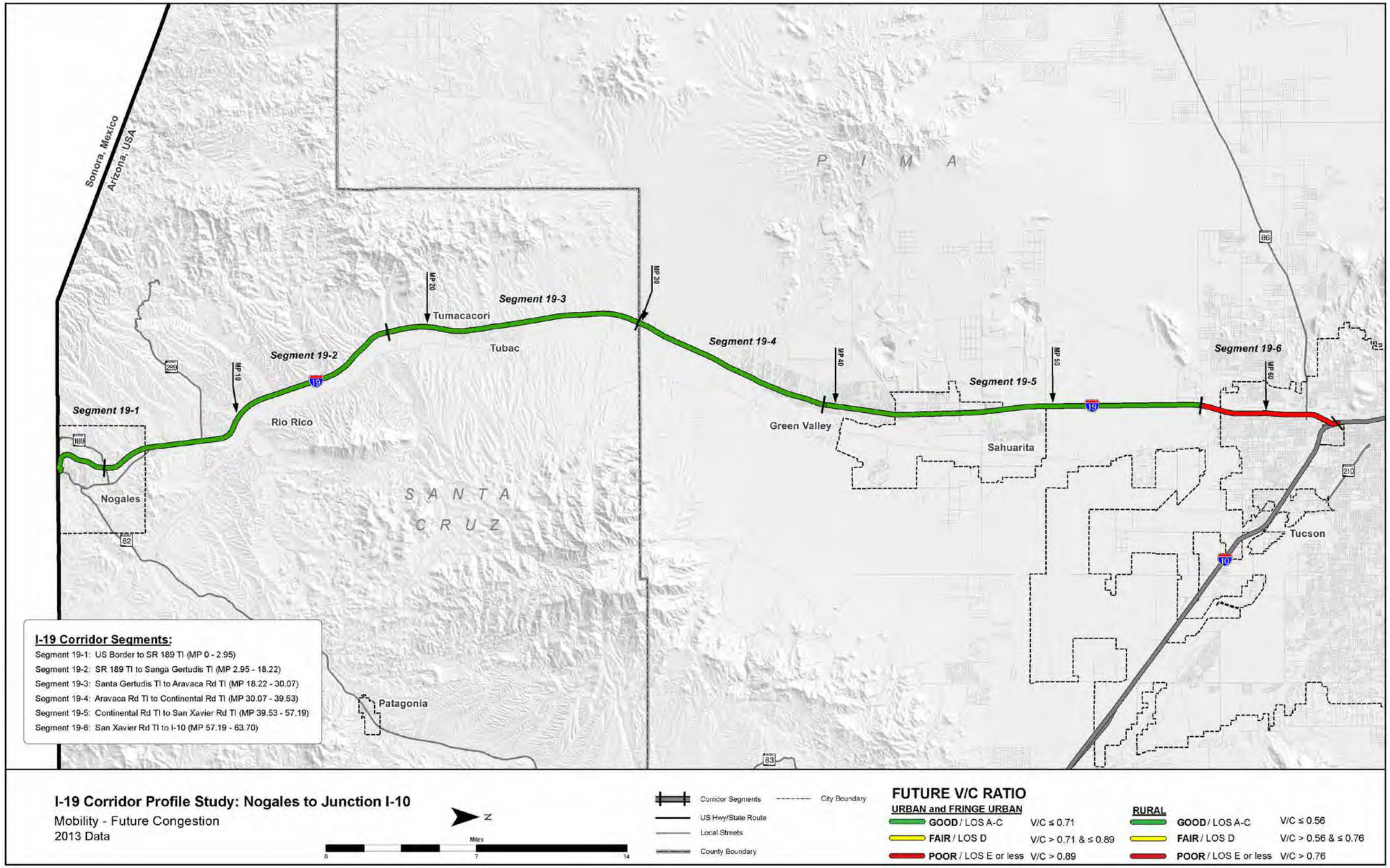
BRIDGE HOTSPOT
Bridge with a Rating of 4 or Multiple Ratings of 5

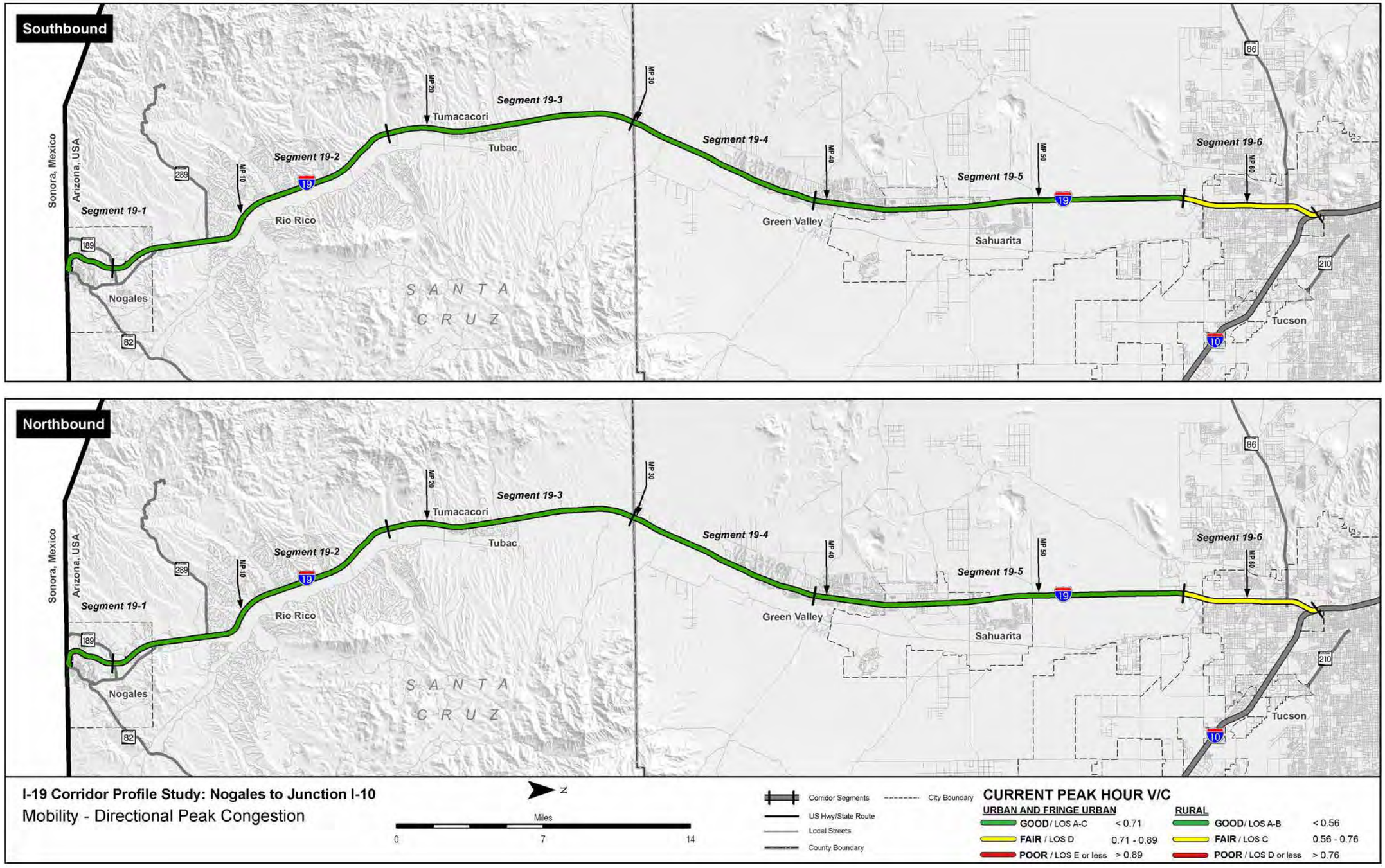

Sonora, Mexico
Arizona, USA
P I M A
S A N T A
C R U Z
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Nogales
Patagonia
Tucson
189
289
19
82
83
86
10
210
I-19 Corridor Segments:
Segment 19-1: US Border to SR 189 TI (MP 0 - 2.95)
Segment 19-2: SR 189 TI to Sanga Gertudis TI (MP 2.95 - 18.22)
Segment 19-3: Santa Gertudis TI to Aravaca Rd TI (MP 18.22 - 30.07)
Segment 19-4: Aravaca Rd TI to Continental Rd TI (MP 30.07 - 39.53)
Segment 19-5: Continental Rd TI to San Xavier Rd TI (MP 39.53 - 57.19)
Segment 19-6: San Xavier Rd TI to I-10 (MP 57.19 - 63.70)
I-19 Corridor Profile Study: Nogales to Junction I-10
Bridge - Bridge Sufficiency Rating
2013 Data
N
Miles
0
7
14
Corridor Segments
US Hwy/State Route
Local Streets
County Boundary
City Boundary
BRIDGE SUFFICIENCY RATING
GOOD > 80
FAIR 50 - 80
POOR < 50
BRIDGE SUFFICIENCY
Bridges with a Sufficiency Rating of < 50

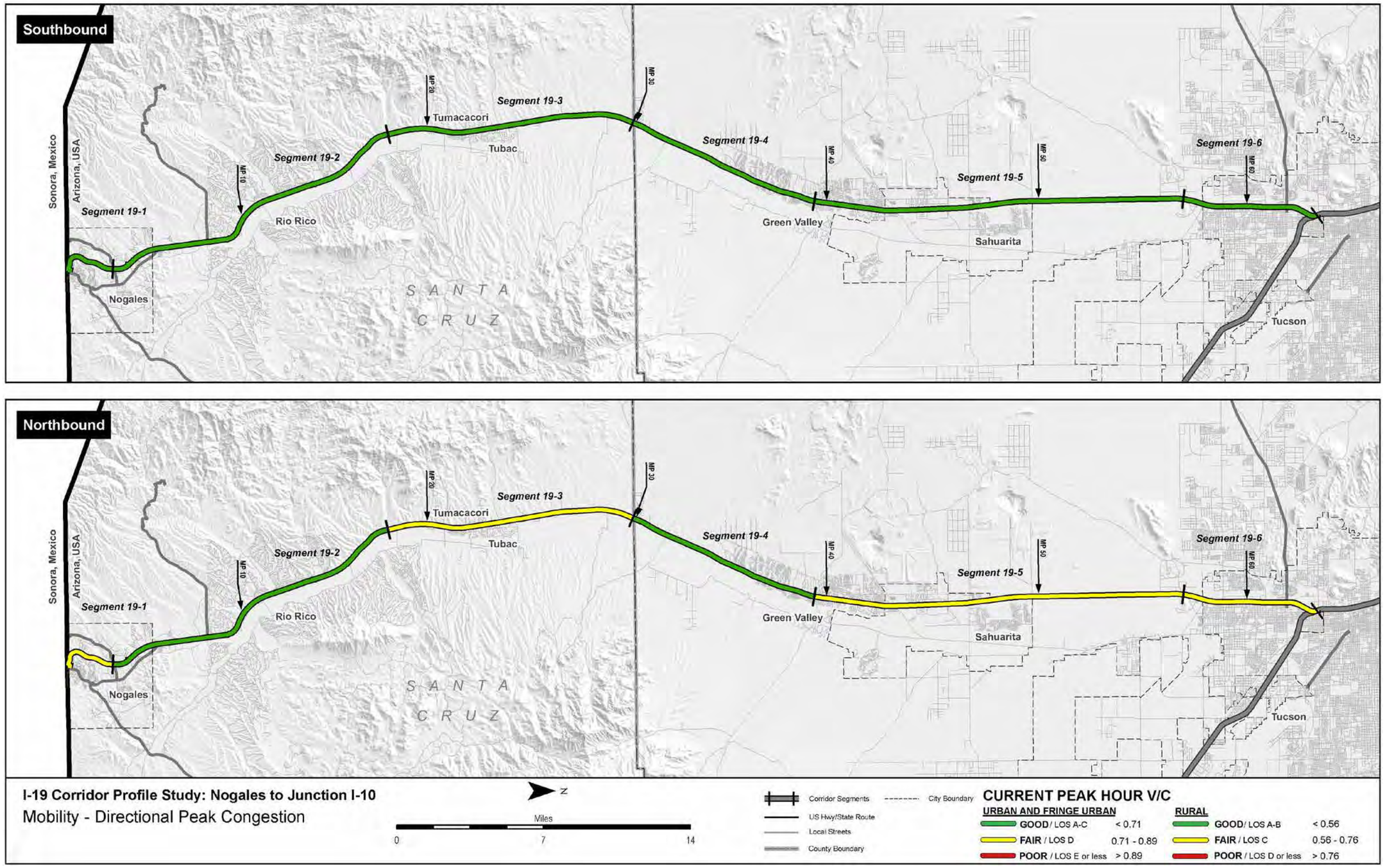

Sonora, Mexico
Arizona, USA
P I M A
S A N T A
C R U Z
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Nogales
Patagonia
Green Valley
Sahuarita
Tucson
I-19 Corridor Segments:
Segment 19-1: US Border to SR 189 TI (MP 0 - 2.95)
Segment 19-2: SR 189 TI to Sanga Gertudis TI (MP 2.95 - 18.22)
Segment 19-3: Santa Gertudis TI to Aravaca Rd TI (MP 18.22 - 30.07)
Segment 19-4: Aravaca Rd TI to Continental Rd TI (MP 30.07 - 39.53)
Segment 19-5: Continental Rd TI to San Xavier Rd TI (MP 39.53 - 57.19)
Segment 19-6: San Xavier Rd TI to I-10 (MP 57.19 - 63.70)
I-19 Corridor Profile Study: Nogales to Junction I-10
Bridge - Functionally Obsolete Bridges
2013 Data
N
Miles
0
7
14
Corridor Segments
US Hwy/State Route
Local Streets
County Boundary
City Boundary
BRIDGE FUNCTIONAL OBSOLESCENCE
Percentage of Bridges that are Funtionally Obsolete:
GOOD < 12%
FAIR 12% - 40%
POOR > 40%

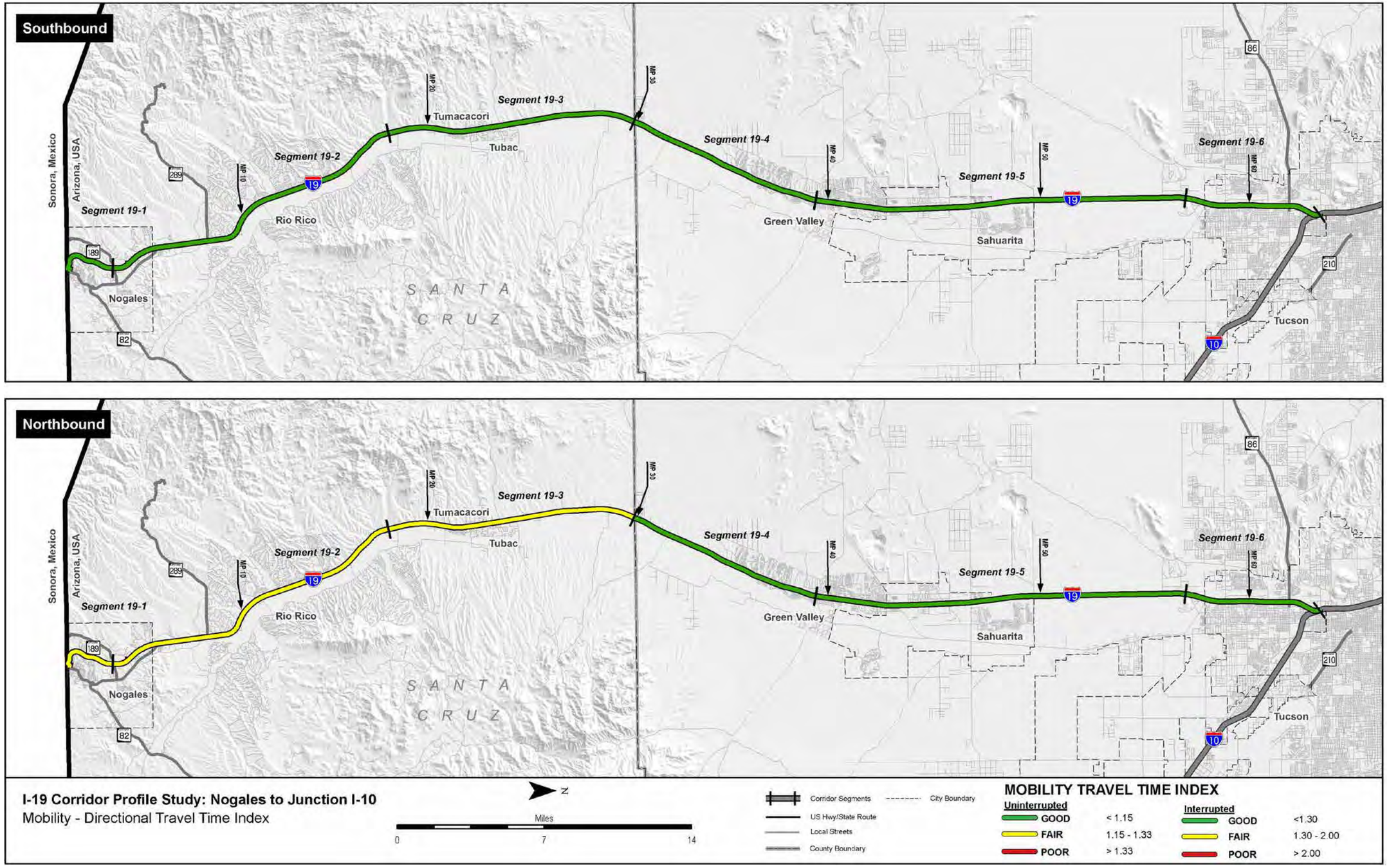

Sonora, Mexico
Arizona, USA
P I M A
S A N T A C R U Z
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Nogales
Patagonia
Green Valley
Sahuarita
Tucson
I-19 Corridor Segments:
Segment 19-1: US Border to SR 189 TI (MP 0 - 2.95)
Segment 19-2: SR 189 TI to Sanga Gertudis TI (MP 2.95 - 18.22)
Segment 19-3: Santa Gertudis TI to Aravaca Rd TI (MP 18.22 - 30.07)
Segment 19-4: Aravaca Rd TI to Continental Rd TI (MP 30.07 - 39.53)
Segment 19-5: Continental Rd TI to San Xavier Rd TI (MP 39.53 - 57.19)
Segment 19-6: San Xavier Rd TI to I-10 (MP 57.19 - 63.70)
I-19 Corridor Profile Study: Nogales to Junction I-10
Bridge - Bridge Rating
2013 Data
N
Miles
0
7
14
Corridor Segments
City Boundary
US Hwy/State Route
Local Streets
County Boundary
BRIDGE RATING
GOOD ≥ 7
FAIR 5 - 6
POOR ≤ 4

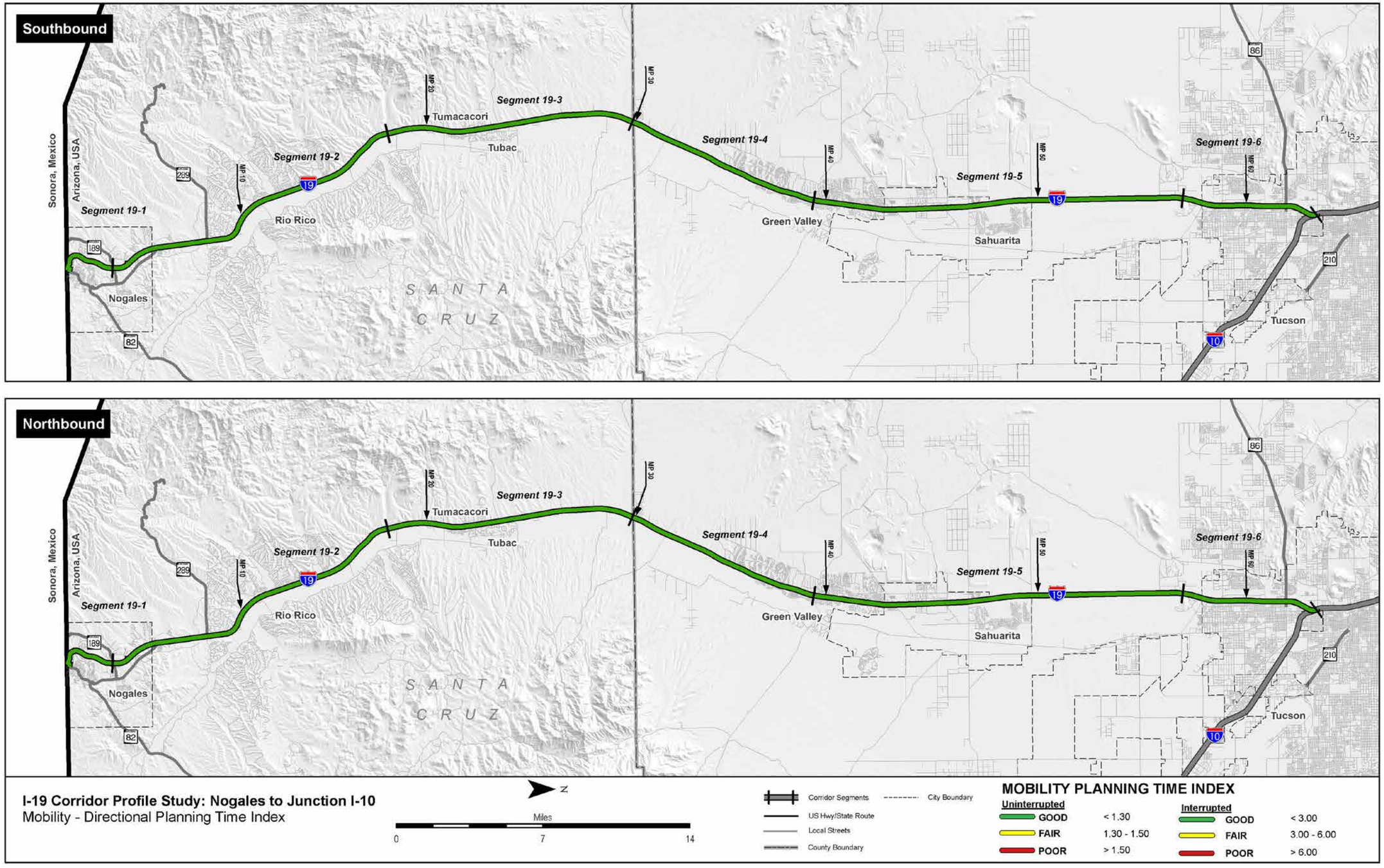

Sonora, Mexico
Arizona, USA
P I M A
S A N T A C R U Z
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Nogales
Green Valley
Sahuarita
Tucson
Patagonia
189
289
82
19
86
210
10
83
I-19 Corridor Segments:
Segment 19-1: US Border to SR 189 TI (MP 0 - 2.95)
Segment 19-2: SR 189 TI to Sanga Gertudis TI (MP 2.95 - 18.22)
Segment 19-3: Santa Gertudis TI to Aravaca Rd TI (MP 18.22 - 30.07)
Segment 19-4: Aravaca Rd TI to Continental Rd TI (MP 30.07 - 39.53)
Segment 19-5: Continental Rd TI to San Xavier Rd TI (MP 39.53 - 57.19)
Segment 19-6: San Xavier Rd TI to I-10 (MP 57.19 - 63.70)
I-19 Corridor Profile Study: Nogales to Junction I-10
Mobility - Mobility Index
2013 Data
N
Miles
0
7
14
Corridor Segments
City Boundary
US Hwy/State Route
Local Streets
County Boundary
MOBILITY INDEX
URBAN and FRINGE URBAN
GOOD / LOS A-C V/C ≤ 0.71
FAIR / LOS D V/C > 0.71 & ≤ 0.89
POOR / LOS E or less V/C > 0.89
RURAL
GOOD / LOS A-C V/C ≤ 0.56
FAIR / LOS D V/C > 0.56 & ≤ 0.76
POOR / LOS E or less V/C > 0.76

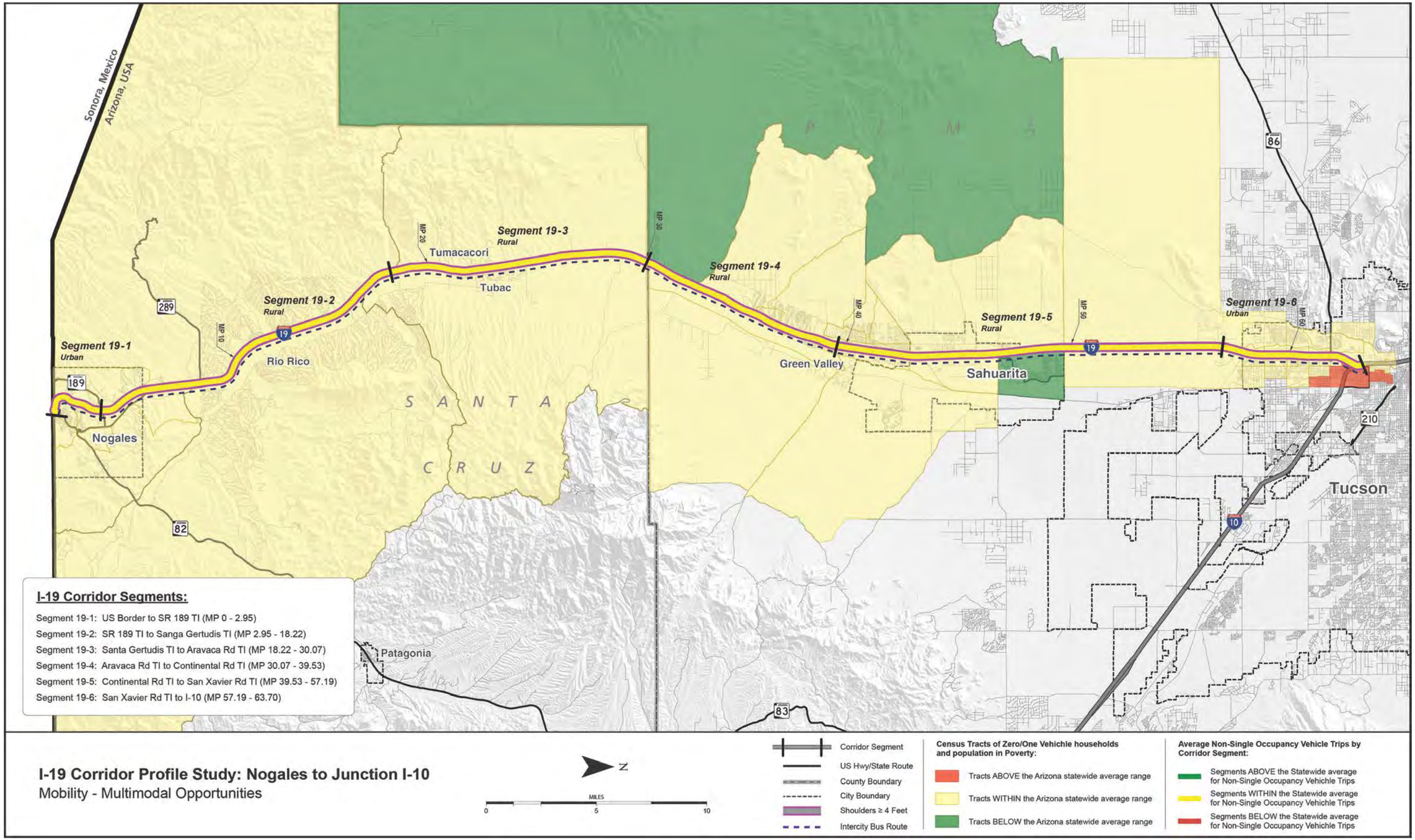

Sonora, Mexico
Arizona, USA
P I M A
S A N T A
C R U Z
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Nagales
Green Valley
Sahuarita
Tucson
Patagonia
189
82
19
86
210
10
83
I-19 Corridor Segments:
Segment 19-1: US Border to SR 189 TI (MP 0 - 2.95)
Segment 19-2: SR 189 TI to Sanga Gertudis TI (MP 2.95 - 18.22)
Segment 19-3: Santa Gertudis TI to Aravaca Rd TI (MP 18.22 - 30.07)
Segment 19-4: Aravaca Rd TI to Continental Rd TI (MP 30.07 - 39.53)
Segment 19-5: Continental Rd TI to San Xavier Rd TI (MP 39.53 - 57.19)
Segment 19-6: San Xavier Rd TI to I-10 (MP 57.19 - 63.70)
I-19 Corridor Profile Study: Nogales to Junction I-10
Mobility - Future Congestion
2013 Data
N
Miles
0
7
14
Corridor Segments
City Boundary
US Hwy/State Route
Local Streets
County Boundary
FUTURE V/C RATIO
URBAN and FRINGE URBAN
GOOD / LOS A-C V/C ≤ 0.71
FAIR / LOS D V/C > 0.71 & ≤ 0.89
POOR / LOS E or less V/C > 0.89
RURAL
GOOD / LOS A-C V/C ≤ 0.56
FAIR / LOS D V/C > 0.56 & ≤ 0.76
POOR / LOS E or less V/C > 0.76

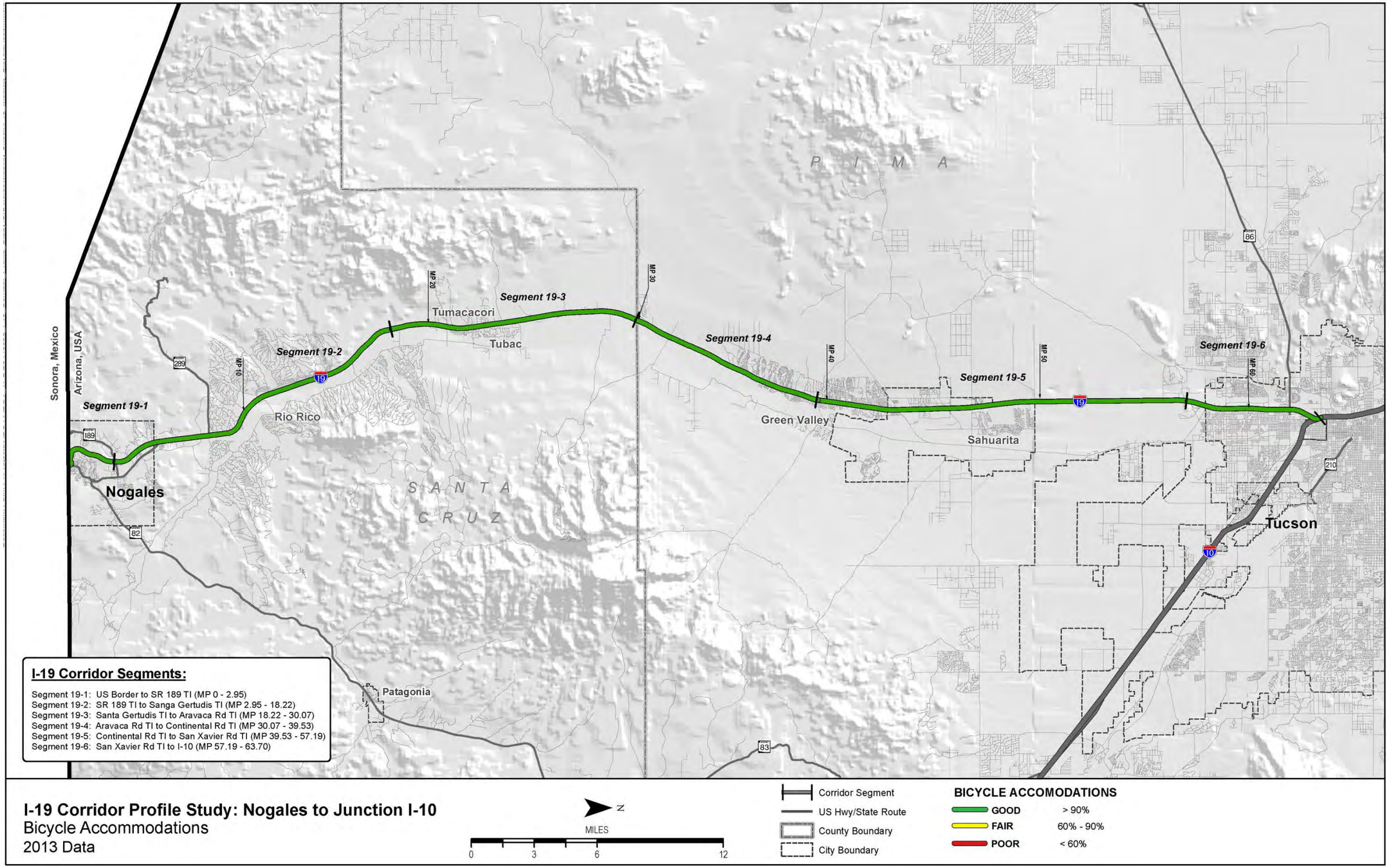

Southbound
Northbound
Sonora, Mexico
Arizona, USA
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Nogales
Tucson
SANTA CRUZ
189
289
82
19
86
210
10
I-19 Corridor Profile Study: Nogales to Junction I-10
Mobility - Directional Peak Congestion
N
Miles
0
7
14
Corridor Segments
US Hwy/State Route
Local Streets
County Boundary
City Boundary
CURRENT PEAK HOUR V/C
URBAN AND FRINGE URBAN
GOOD / LOS A-C < 0.71
FAIR / LOS D 0.71 - 0.89
POOR / LOS E or less > 0.89
RURAL
GOOD / LOS A-B < 0.56
FAIR / LOS C 0.56 - 0.76
POOR / LOS D or less > 0.76

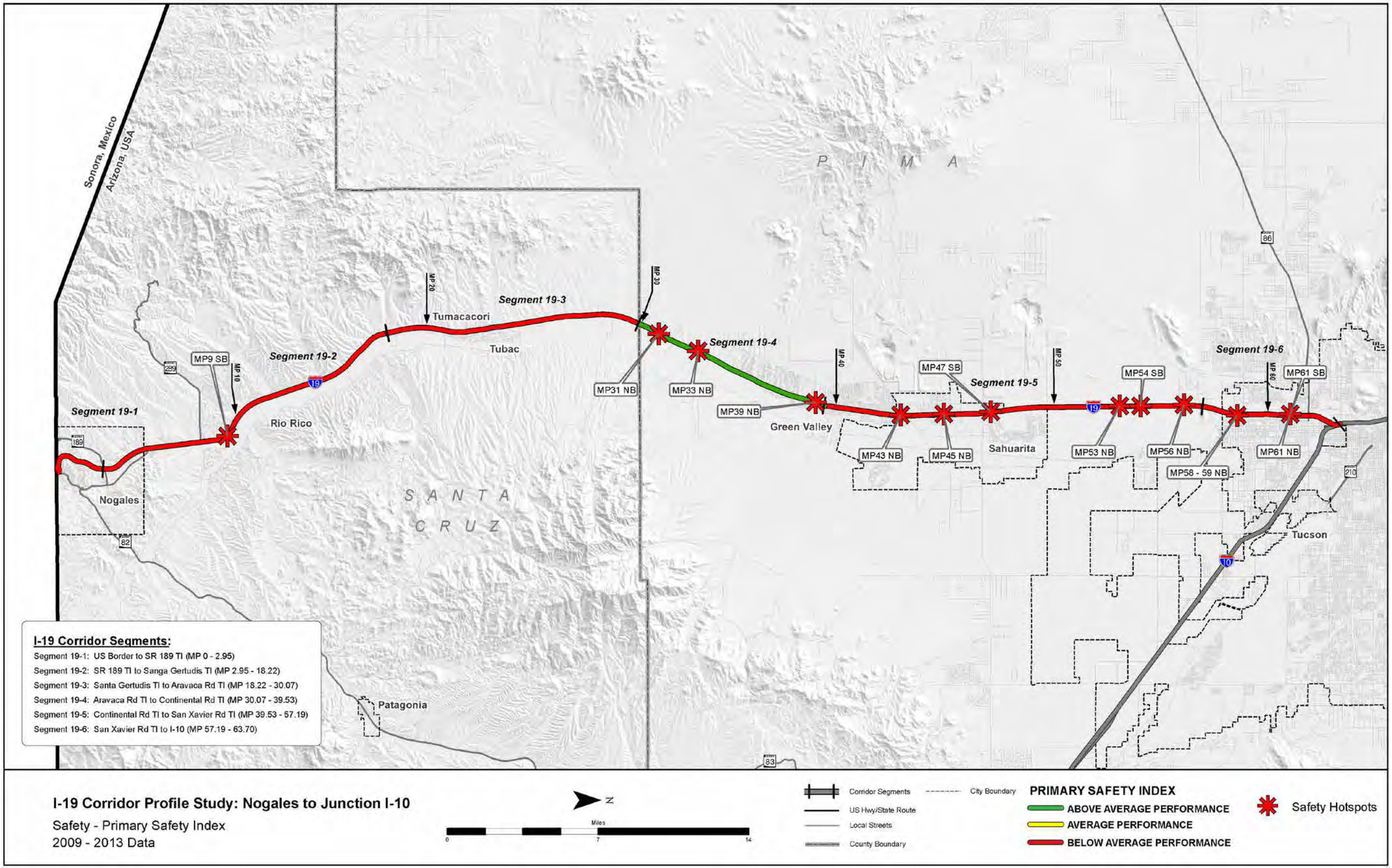

Southbound
Sonora, Mexico
Arizona, USA
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Nogales
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Tucson
SANTA CRUZ
Northbound
Sonora, Mexico
Arizona, USA
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Nogales
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Tucson
SANTA CRUZ
I-19 Corridor Profile Study: Nogales to Junction I-10
Mobility - Directional Peak Congestion
N
Miles
0
7
14
Corridor Segments
City Boundary
US Hwy/State Route
Local Streets
County Boundary
CURRENT PEAK HOUR V/C
URBAN AND FRINGE URBAN
GOOD / LOS A-C < 0.71
FAIR / LOS D 0.71 - 0.89
POOR / LOS E or less > 0.89
RURAL
GOOD / LOS A-B < 0.56
FAIR / LOS C 0.56 - 0.76
POOR / LOS D or less > 0.76

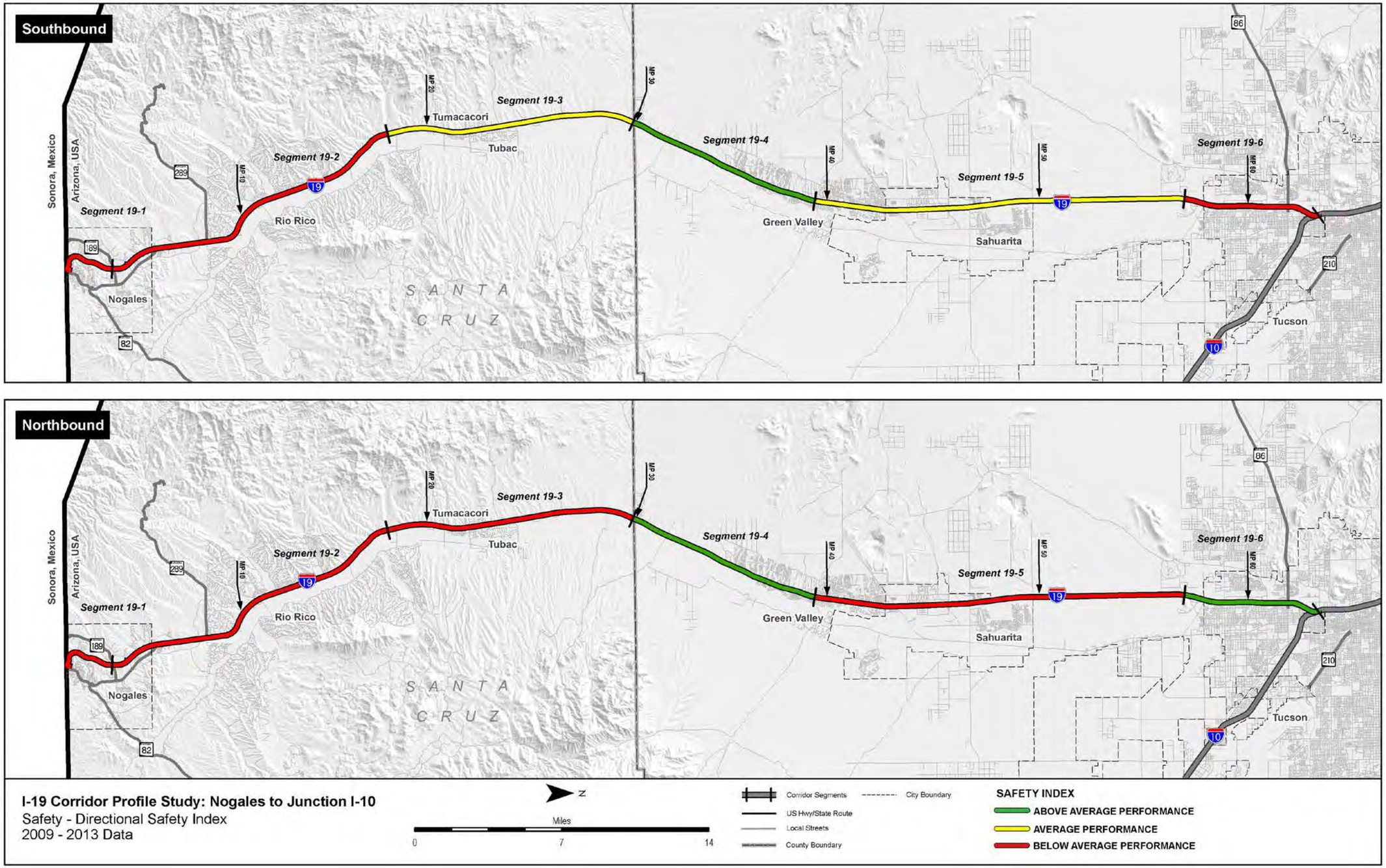

Southbound
Northbound
Sonora, Mexico
Arizona, USA
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 0
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Nogales
Tucson
SANTA CRUZ
189
289
82
19
86
210
10
I-19 Corridor Profile Study: Nogales to Junction I-10
Mobility - Directional Travel Time Index
N
Miles
0
7
14
Corridor Segments
City Boundary
US Hwy/State Route
Local Streets
County Boundary
MOBILITY TRAVEL TIME INDEX
Uninterrupted
GOOD < 1.15
FAIR 1.15 - 1.33
POOR > 1.33
Interrupted
GOOD <1.30
FAIR 1.30 - 2.00
POOR > 2.00

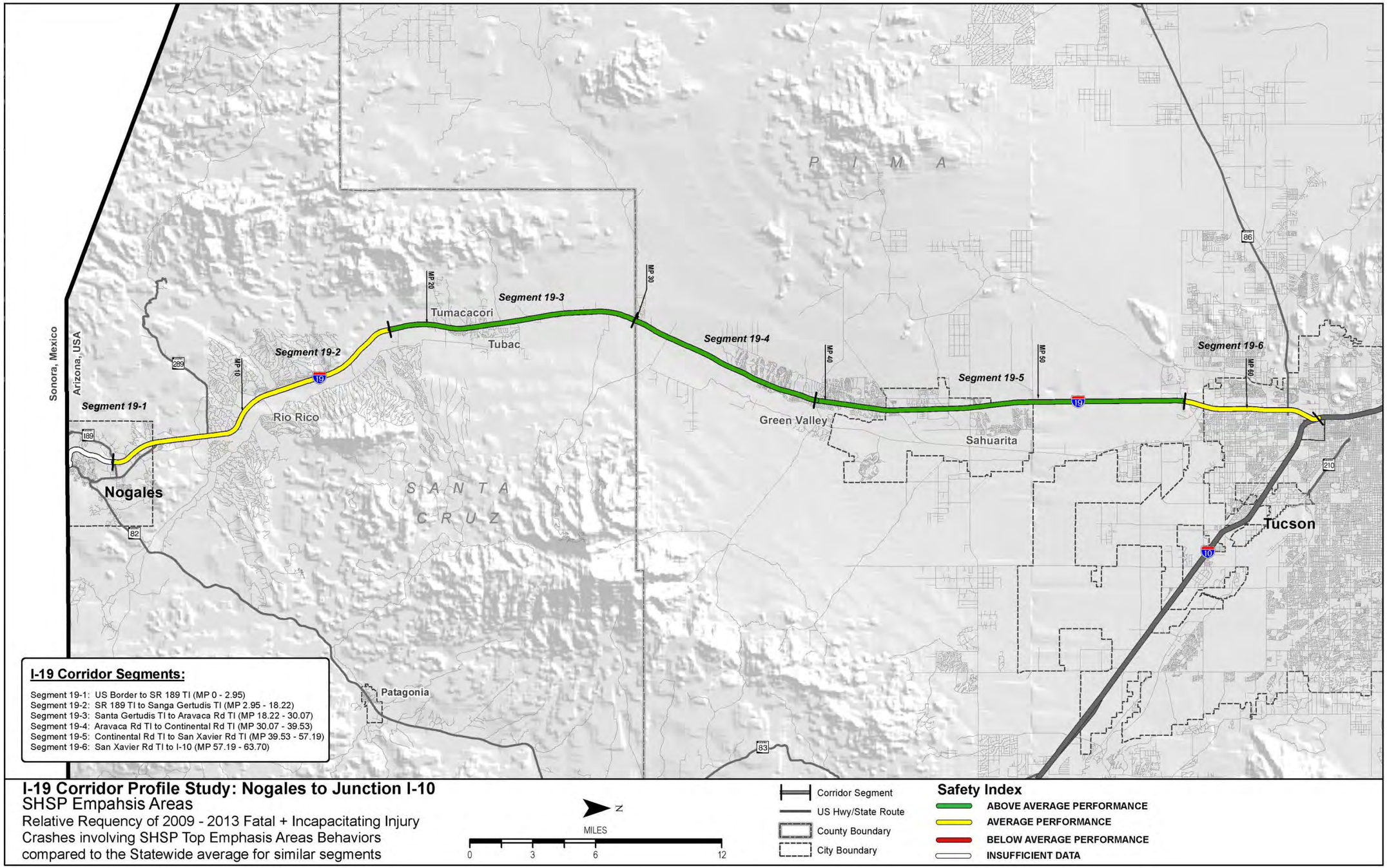

Southbound
Northbound
Sonora, Mexico
Arizona, USA
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Nogales
Tucson
SANTA CRUZ
289
189
82
19
86
210
10
I-19 Corridor Profile Study: Nogales to Junction I-10
Mobility - Directional Planning Time Index
N
Miles
0
7
14
Corridor Segments
City Boundary
US Hwy/State Route
Local Streets
County Boundary
MOBILITY PLANNING TIME INDEX
Uninterrupted
GOOD < 1.30
FAIR 1.30 - 1.50
POOR > 1.50
Interrupted
GOOD < 3.00
FAIR 3.00 - 6.00
POOR > 6.00

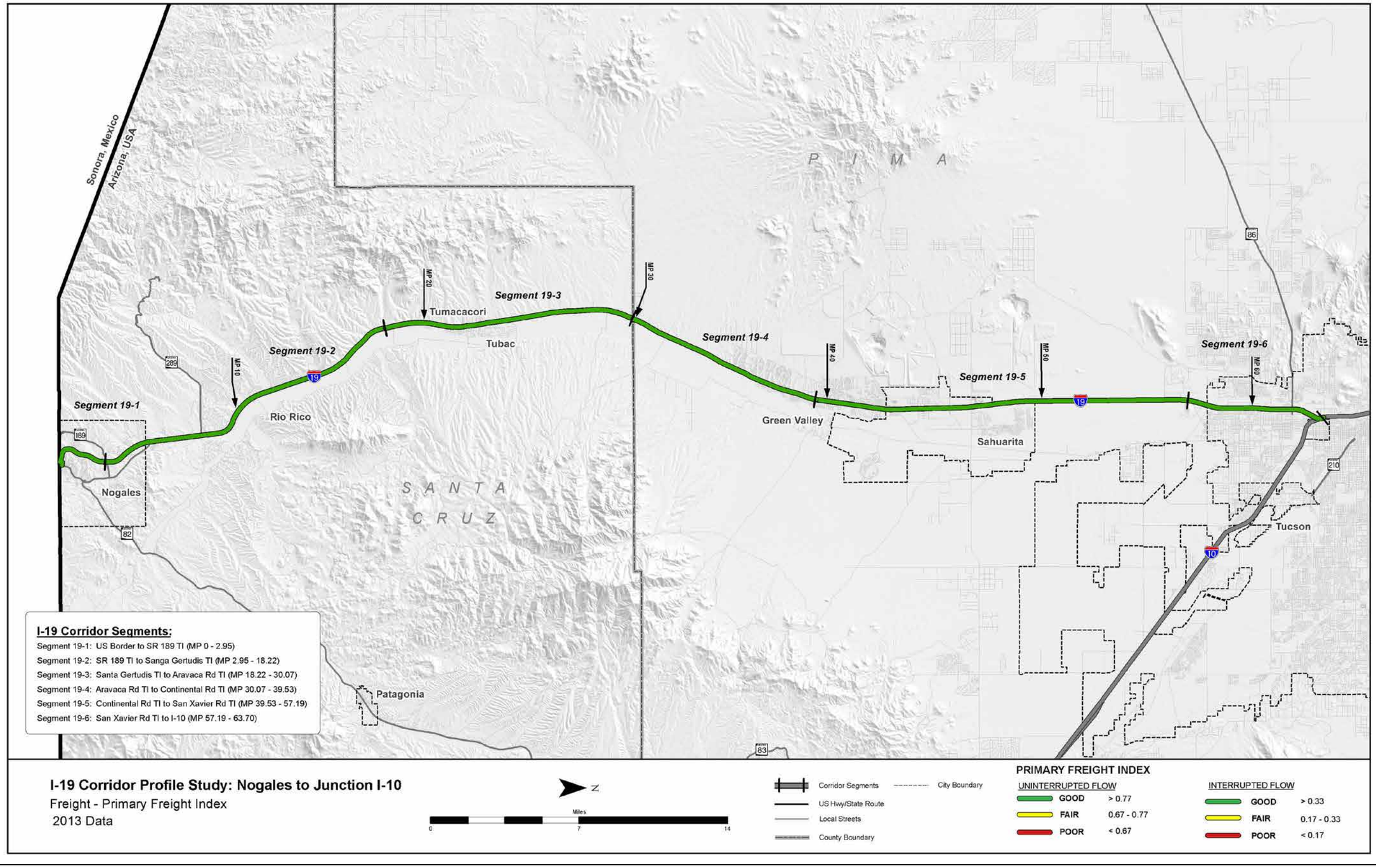

Sonora, Mexico
Arizona, USA
Segment 19-1
Urban
Segment 19-2
Rural
Segment 19-3
Rural
Segment 19-4
Rural
Segment 19-5
Rural
Segment 19-6
Urban
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Nogales
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Tucson
Patagonia
SANTA CRUZ
PIMA
189
289
19
82
83
86
210
10
I-19 Corridor Segments:
Segment 19-1: US Border to SR 189 TI (MP 0 - 2.95)
Segment 19-2: SR 189 TI to Sanga Gertudis TI (MP 2.95 - 18.22)
Segment 19-3: Santa Gertudis TI to Aravaca Rd TI (MP 18.22 - 30.07)
Segment 19-4: Aravaca Rd TI to Continental Rd TI (MP 30.07 - 39.53)
Segment 19-5: Continental Rd TI to San Xavier Rd TI (MP 39.53 - 57.19)
Segment 19-6: San Xavier Rd TI to I-10 (MP 57.19 - 63.70)
I-19 Corridor Profile Study: Nogales to Junction I-10
Mobility - Multimodal Opportunities
N
MILES
0
5
10
Corridor Segment
US Hwy/State Route
County Boundary
City Boundary
Shoulders ≥ 4 Feet
Intercity Bus Route
Census Tracts of Zero/One Vehicle households and population in Poverty:
Tracts ABOVE the Arizona statewide average range
Tracts WITHIN the Arizona statewide average range
Tracts BELOW the Arizona statewide average range
Average Non-Single Occupancy Vehicle Trips by Corridor Segment:
Segments ABOVE the Statewide average for Non-Single Occupancy Vehicle Trips
Segments WITHIN the Statewide average for Non-Single Occupancy Vehicle Trips
Segments BELOW the Statewide average for Non-Single Occupancy Vehicle Trips

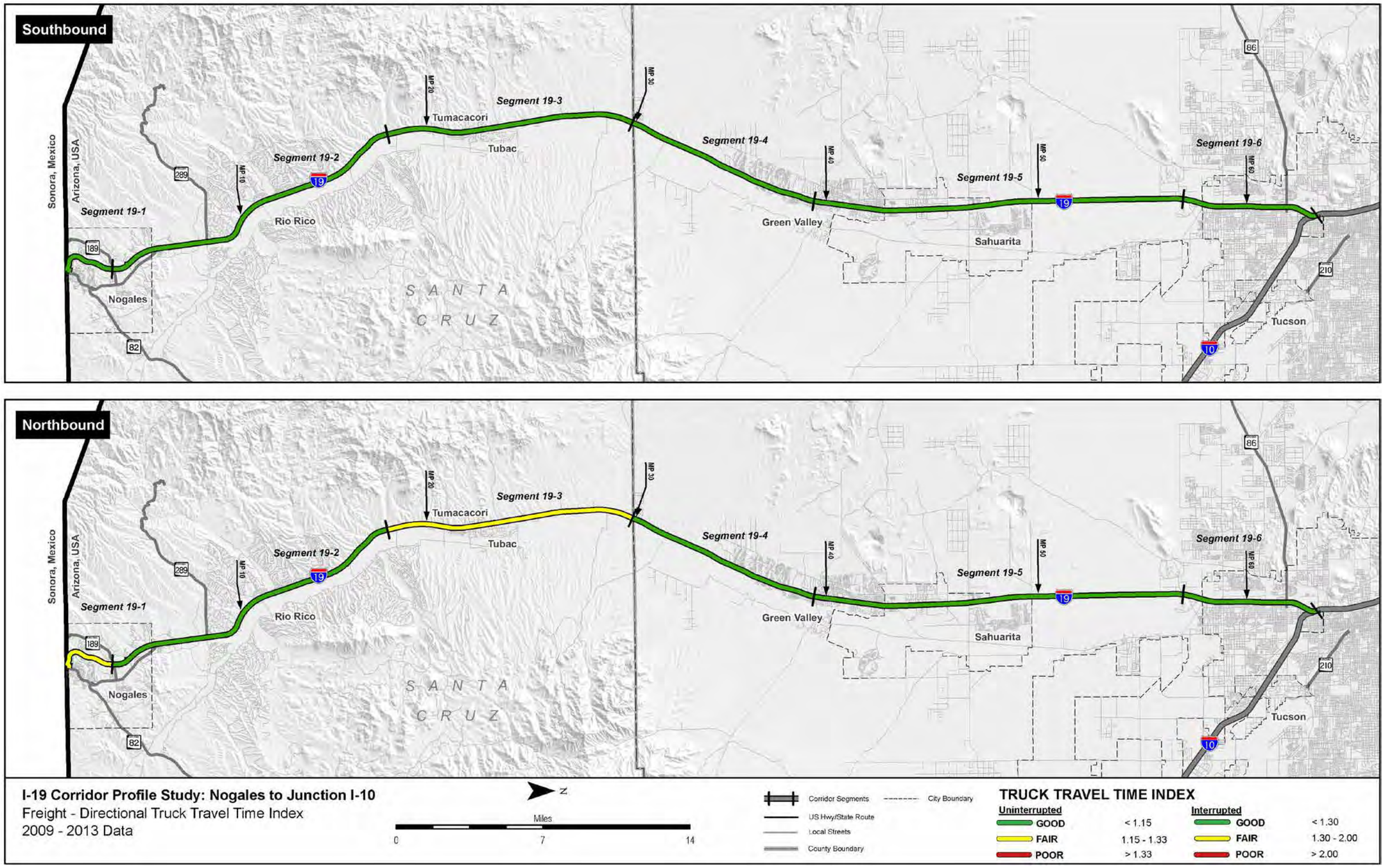

P I M A
S A N T A C R U Z
Sonora, Mexico
Arizona, USA
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Nogales
Green Valley
Sahuarita
Tucson
Patagonia
189
289
82
19
86
210
10
83
I-19 Corridor Segments:
Segment 19-1: US Border to SR 189 TI (MP 0 - 2.95)
Segment 19-2: SR 189 TI to Sanga Gertudis TI (MP 2.95 - 18.22)
Segment 19-3: Santa Gertudis TI to Aravaca Rd TI (MP 18.22 - 30.07)
Segment 19-4: Aravaca Rd TI to Continental Rd TI (MP 30.07 - 39.53)
Segment 19-5: Continental Rd TI to San Xavier Rd TI (MP 39.53 - 57.19)
Segment 19-6: San Xavier Rd TI to I-10 (MP 57.19 - 63.70)
I-19 Corridor Profile Study: Nogales to Junction I-10
Bicycle Accommodations
2013 Data
N
MILES
0
3
6
12
Corridor Segment
US Hwy/State Route
County Boundary
City Boundary
BICYCLE ACCOMODATIONS
GOOD > 90%
FAIR 60% - 90%
POOR < 60%

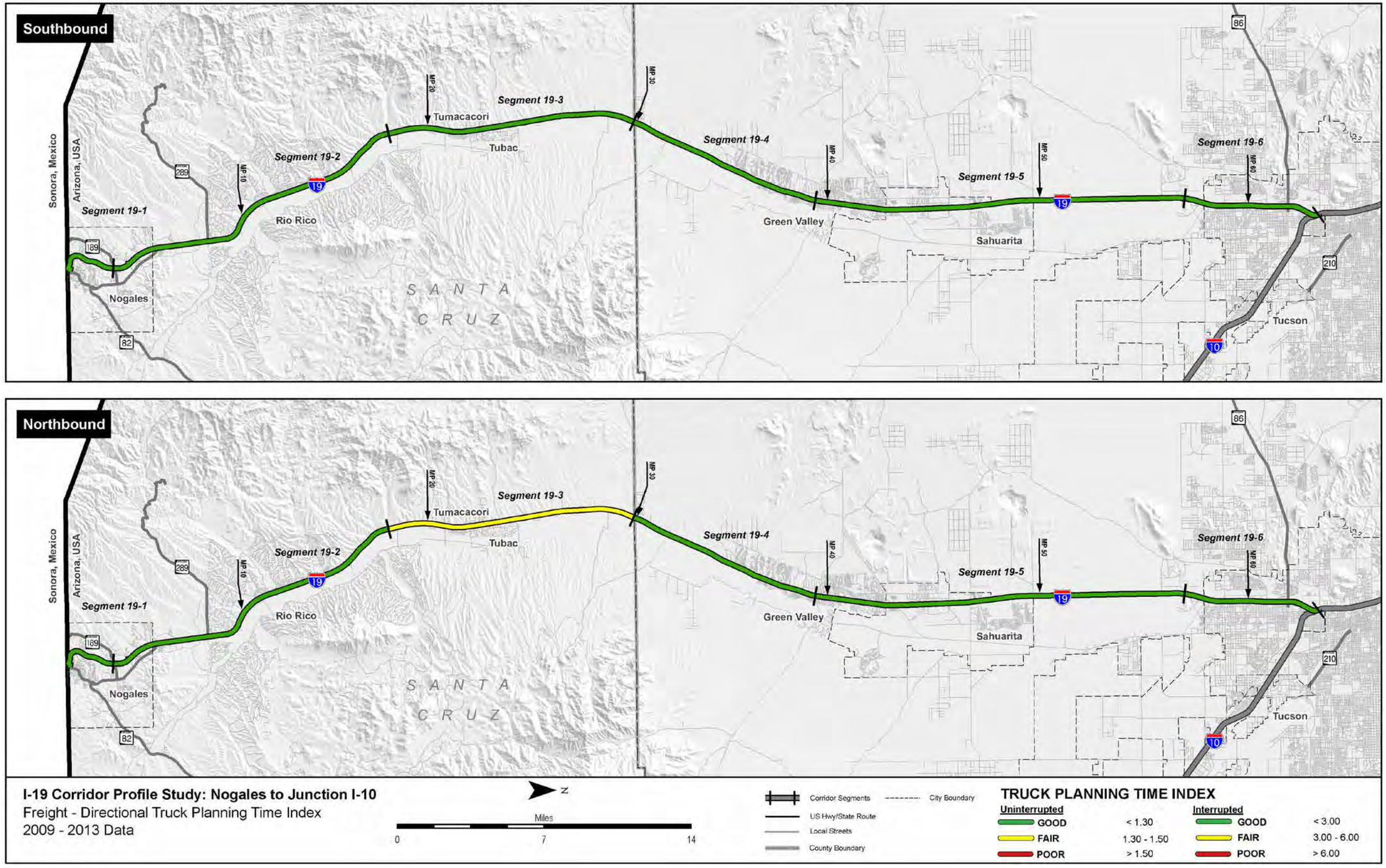

Sonora, Mexico
Arizona, USA
P I M A
S A N T A
C R U Z
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
MP9 SB
MP31 NB
MP33 NB
MP39 NB
MP43 NB
MP45 NB
MP47 SB
MP53 NB
MP54 SB
MP56 NB
MP58 - 59 NB
MP61 SB
MP61 NB
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Nogales
Patagonia
Tucson
I-19 Corridor Segments:
Segment 19-1: US Border to SR 189 TI (MP 0 - 2.95)
Segment 19-2: SR 189 TI to Sanga Gertudis TI (MP 2.95 - 18.22)
Segment 19-3: Santa Gertudis TI to Aravaca Rd TI (MP 18.22 - 30.07)
Segment 19-4: Aravaca Rd TI to Continental Rd TI (MP 30.07 - 39.53)
Segment 19-5: Continental Rd TI to San Xavier Rd TI (MP 39.53 - 57.19)
Segment 19-6: San Xavier Rd TI to I-10 (MP 57.19 - 63.70)
I-19 Corridor Profile Study: Nogales to Junction I-10
Safety - Primary Safety Index
2009 - 2013 Data
N
Miles
0
7
14
Corridor Segments
US Hwy/State Route
Local Streets
County Boundary
City Boundary
PRIMARY SAFETY INDEX
ABOVE AVERAGE PERFORMANCE
AVERAGE PERFORMANCE
BELOW AVERAGE PERFORMANCE
Safety Hotspots

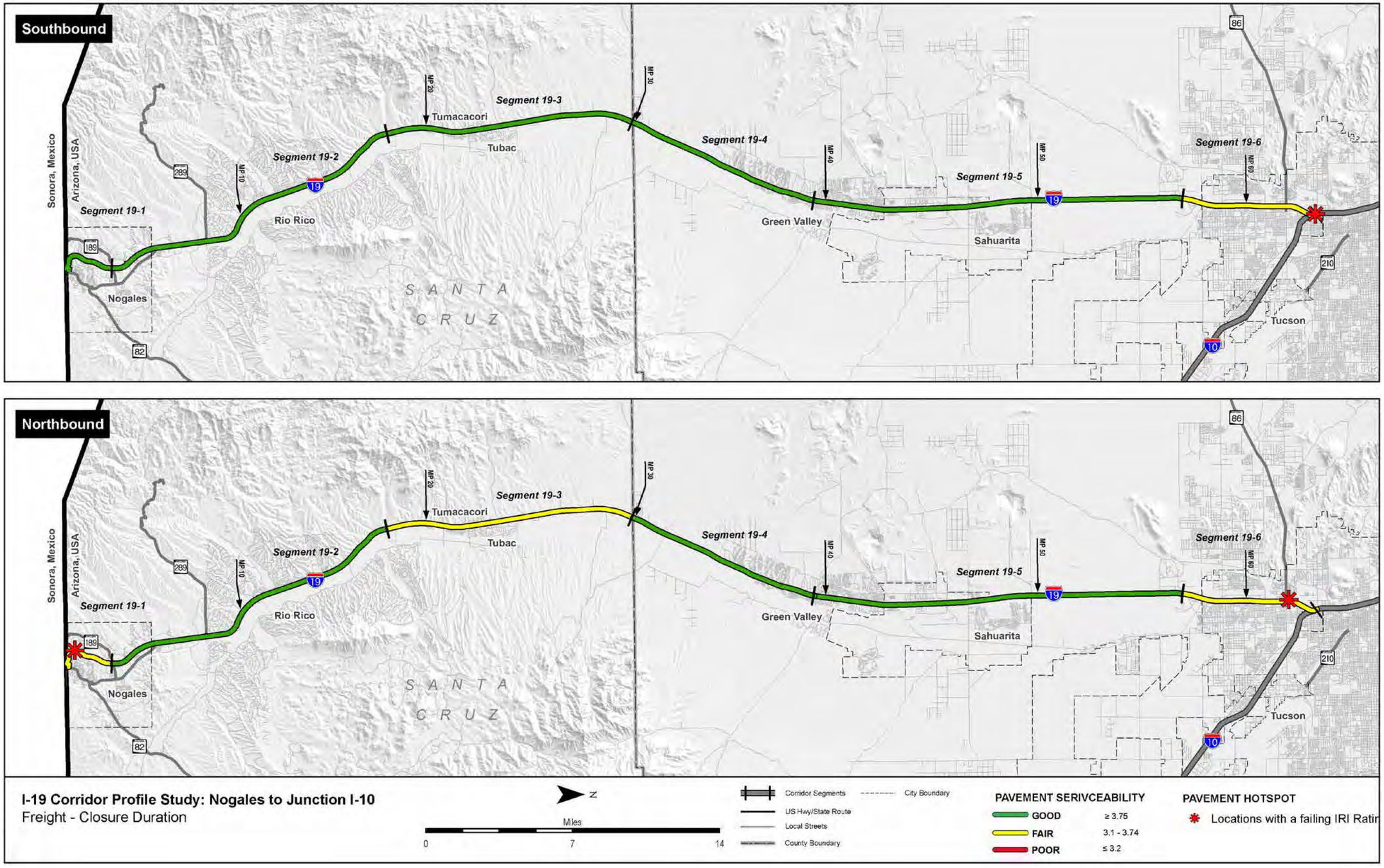

Southbound
Northbound
Sonora, Mexico
Arizona, USA
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Nogales
Tucson
SANTA CRUZ
289
189
82
19
86
210
10
I-19 Corridor Profile Study: Nogales to Junction I-10
Safety - Directional Safety Index
2009 - 2013 Data
N
Miles
0
7
14
Corridor Segments
US Hwy/State Route
Local Streets
County Boundary
City Boundary
SAFETY INDEX
ABOVE AVERAGE PERFORMANCE
AVERAGE PERFORMANCE
BELOW AVERAGE PERFORMANCE

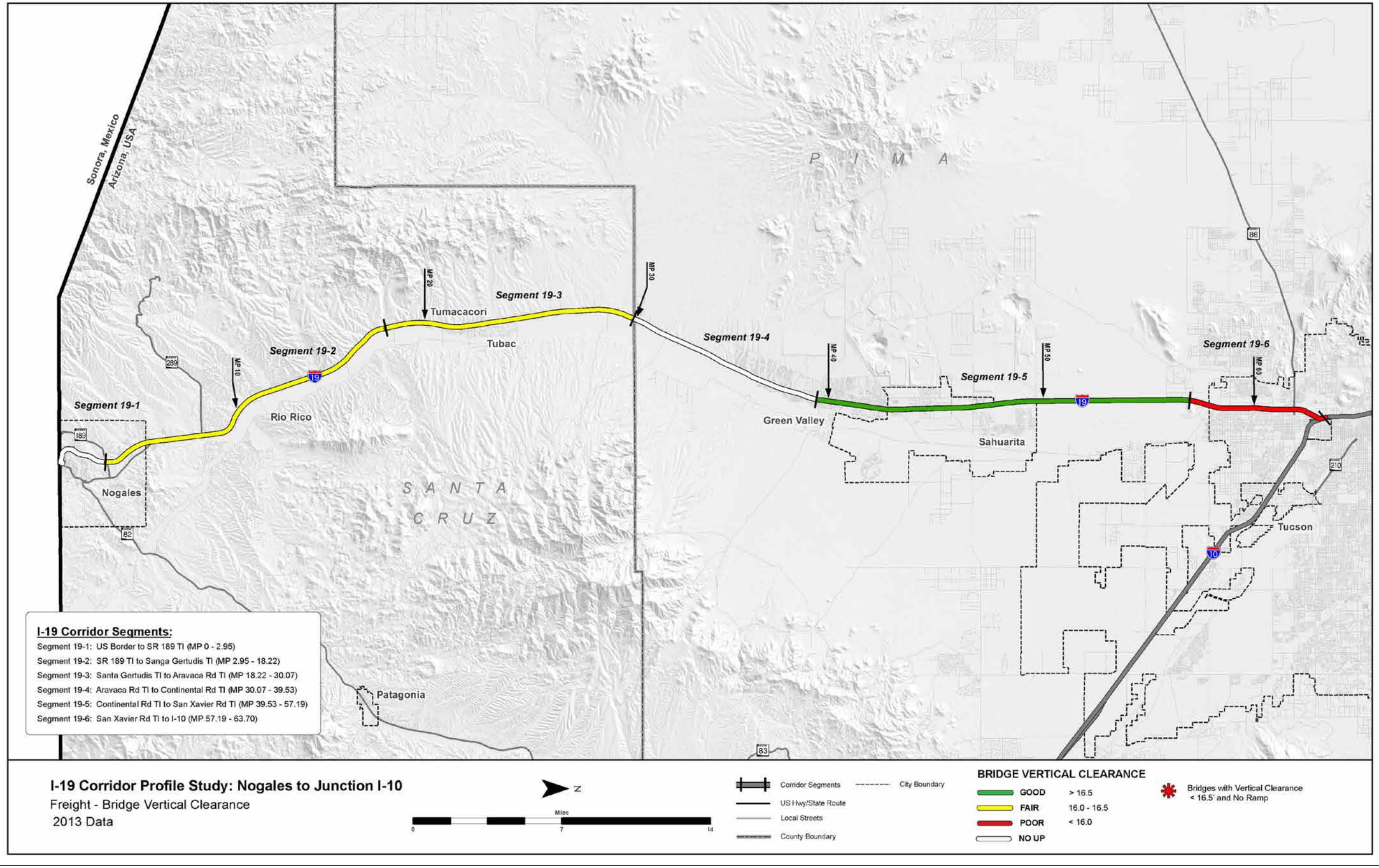

Sonora, Mexico
Arizona, USA
P I M A
S A N T A
C R U Z
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Nogales
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Tucson
Patagonia
189
289
19
82
83
86
210
10
I-19 Corridor Segments:
Segment 19-1: US Border to SR 189 TI (MP 0 - 2.95)
Segment 19-2: SR 189 TI to Sanga Gertudis TI (MP 2.95 - 18.22)
Segment 19-3: Santa Gertudis TI to Aravaca Rd TI (MP 18.22 - 30.07)
Segment 19-4: Aravaca Rd TI to Continental Rd TI (MP 30.07 - 39.53)
Segment 19-5: Continental Rd TI to San Xavier Rd TI (MP 39.53 - 57.19)
Segment 19-6: San Xavier Rd TI to I-10 (MP 57.19 - 63.70)
I-19 Corridor Profile Study: Nogales to Junction I-10
SHSP Empahsis Areas
Relative Requency of 2009 - 2013 Fatal + Incapacitating Injury Crashes involving SHSP Top Emphasis Areas Behaviors compared to the Statewide average for similar segments
N
MILES
0
3
6
12
Corridor Segment
US Hwy/State Route
County Boundary
City Boundary
Safety Index
ABOVE AVERAGE PERFORMANCE
AVERAGE PERFORMANCE
BELOW AVERAGE PERFORMANCE
INSUFFICIENT DATA


Sonora, Mexico
Arizona, USA
P I M A
S A N T A
C R U Z
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Nagales
Green Valley
Sahuarita
Tucson
Patagonia
I-19 Corridor Segments:
Segment 19-1: US Border to SR 189 TI (MP 0 - 2.95)
Segment 19-2: SR 189 TI to Sanga Gertudis TI (MP 2.95 - 18.22)
Segment 19-3: Santa Gertudis TI to Aravaca Rd TI (MP 18.22 - 30.07)
Segment 19-4: Aravaca Rd TI to Continental Rd TI (MP 30.07 - 39.53)
Segment 19-5: Continental Rd TI to San Xavier Rd TI (MP 39.53 - 57.19)
Segment 19-6: San Xavier Rd TI to I-10 (MP 57.19 - 63.70)
I-19 Corridor Profile Study: Nogales to Junction I-10
Freight - Primary Freight Index
2013 Data
N
Miles
0
7
14
Corridor Segments
City Boundary
US Hwy/State Route
Local Streets
County Boundary
PRIMARY FREIGHT INDEX
UNINTERRUPTED FLOW
GOOD > 0.77
FAIR 0.67 - 0.77
POOR < 0.67
INTERRUPTED FLOW
GOOD > 0.33
FAIR 0.17 - 0.33
POOR < 0.17


Southbound
Northbound
Sonora, Mexico
Arizona, USA
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Nogales
Tucson
SANTA CRUZ
289
189
82
19
10
86
210
I-19 Corridor Profile Study: Nogales to Junction I-10
Freight - Directional Truck Travel Time Index
2009 - 2013 Data
N
Miles
0
7
14
Corridor Segments
City Boundary
US Hwy/State Route
Local Streets
County Boundary
TRUCK TRAVEL TIME INDEX
Uninterrupted
GOOD < 1.15
FAIR 1.15 - 1.33
POOR > 1.33
Interrupted
GOOD < 1.30
FAIR 1.30 - 2.00
POOR > 2.00


Southbound
Northbound
Sonora, Mexico
Arizona, USA
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Nogales
Tucson
SANTA CRUZ
289
189
82
19
86
210
10
I-19 Corridor Profile Study: Nogales to Junction I-10
Freight - Directional Truck Planning Time Index
2009 - 2013 Data
N
Miles
0
7
14
Corridor Segments
US Hwy/State Route
Local Streets
County Boundary
City Boundary
TRUCK PLANNING TIME INDEX
Uninterrupted
GOOD < 1.30
FAIR 1.30 - 1.50
POOR > 1.50
Interrupted
GOOD < 3.00
FAIR 3.00 - 6.00
POOR > 6.00

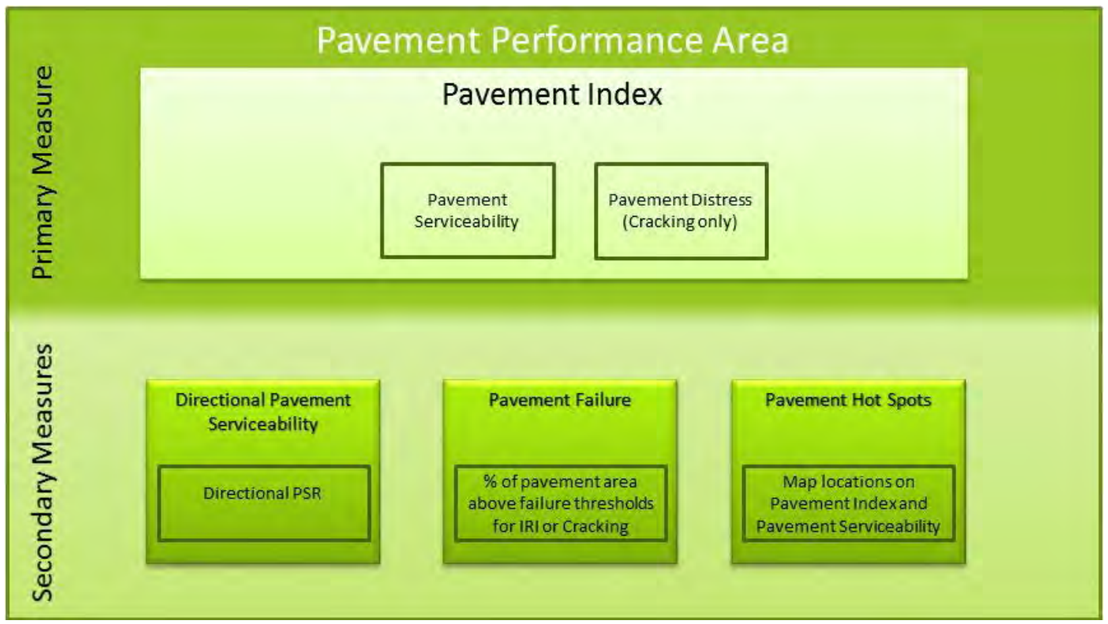

Southbound
Northbound
Sonora, Mexico
Arizona, USA
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Green Valley
Sahuarita
Nogales
Tucson
SANTA CRUZ
289
189
82
19
86
210
10
I-19 Corridor Profile Study: Nogales to Junction I-10
Freight - Closure Duration
N
Miles
0
7
14
Corridor Segments
City Boundary
US Hwy/State Route
Local Streets
County Boundary
PAVEMENT SERIVCEABILITY
GOOD ≥ 3.75
FAIR 3.1 - 3.74
POOR ≤ 3.2
PAVEMENT HOTSPOT
Locations with a failing IRI Ratir


Sonora, Mexico
Arizona, USA
P I M A
S A N T A
C R U Z
Segment 19-1
Segment 19-2
Segment 19-3
Segment 19-4
Segment 19-5
Segment 19-6
MP 10
MP 20
MP 30
MP 40
MP 50
MP 60
Rio Rico
Tumacacori
Tubac
Nogales
Patagonia
Green Valley
Sahuarita
Tucson
I-19 Corridor Segments:
Segment 19-1: US Border to SR 189 TI (MP 0 - 2.95)
Segment 19-2: SR 189 TI to Sanga Gertudis TI (MP 2.95 - 18.22)
Segment 19-3: Santa Gertudis TI to Aravaca Rd TI (MP 18.22 - 30.07)
Segment 19-4: Aravaca Rd TI to Continental Rd TI (MP 30.07 - 39.53)
Segment 19-5: Continental Rd TI to San Xavier Rd TI (MP 39.53 - 57.19)
Segment 19-6: San Xavier Rd TI to I-10 (MP 57.19 - 63.70)
I-19 Corridor Profile Study: Nogales to Junction I-10
Freight - Bridge Vertical Clearance
2013 Data
N
Miles
0
7
14
Corridor Segments
City Boundary
US Hwy/State Route
Local Streets
County Boundary
BRIDGE VERTICAL CLEARANCE
GOOD > 16.5
FAIR 16.0 - 16.5
POOR < 16.0
NO UP
Bridges with Vertical Clearance < 16.5' and No Ramp

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 two pavement condition ratings from the ADOT Pavement Database. The two ratings are the International Roughness Index (IRI) and the Cracking 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. To facilitate the calculation of the index, the Cracking Rating was converted to a Pavement Distress Index (PDI) using the following equation:

$$PDI = 5 - (0.345 * C^{0.66})$$

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 (PDI)
Good	<75 (>3.75)	<7 (>3.75)
Fair	75 - 117 (3.20 - 3.75)	7 - 12 (3.22 - 3.75)
Poor	>117 (<3.20)	>12 (<3.22)

Performance Level for Non-Interstates	IRI (PSR)	Cracking (PDI)
Good	<94 (>3.5)	<9 (>3.5)
Fair	94 - 142 (2.9 - 3.5)	9 - 15 (2.9 - 3.5)
Poor	>142 (<2.9)	>15 (<2.9)

The PSR and PDI are calculated for each 1-mile section of roadway. If PSR or PDI falls into a poor rating (<3.2 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 or Cracking 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 or Cracking rating that fall above the failure threshold as identified by ADOT Pavement Group. For interstates, an IRI rating above 105 or a Cracking rating above 15 will be used as the thresholds which are slightly different than the ratings shown previously. For non-interstates, an IRI rating above 142 or a Cracking rating above 15 will be used as the thresholds.

Scoring

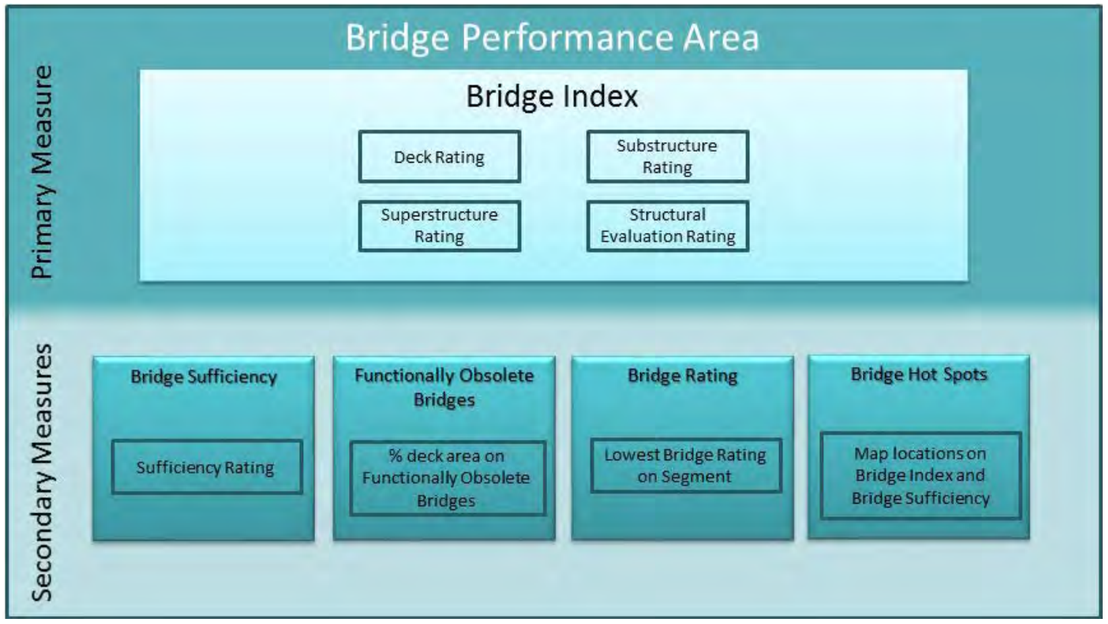
Performance Level	Pavement Index	
	Interstates	Non-Interstates
Good	>3.75	>3.5
Fair	3.2 - 3.75	2.9 - 3.5
Poor	<3.2	<2.9

Performance Level	Directional Pavement Serviceability	
	Interstates	Non-Interstates
Good	>3.75	>3.5
Fair	3.2 - 3.75	2.9 - 3.5
Poor	<3.2	<2.9

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

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

Four secondary measures will be evaluated:

- Bridge Sufficiency
- Functionally Obsolete Bridges
- 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.

Functionally Obsolete Bridges: The percentage of total deck area in a segment that is on functionally obsolete bridges is calculated for each segment. The deck area for each bridge within each segment that has been identified as functionally obsolete is totaled and divided by the total deck area for the segment to calculate the percentage of deck area on functionally obsolete bridges for each segment.

The thresholds for this performance measure are determined based on the Standard score (z-score). 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) average.

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

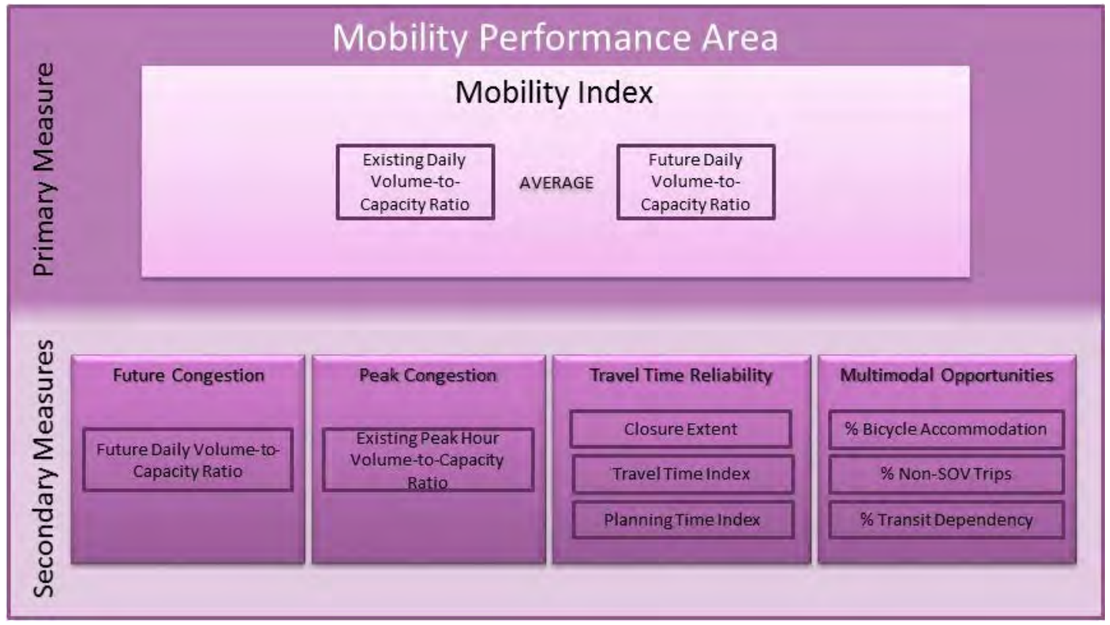
Performance Level	Sufficiency Rating
Good	>80
Fair	50-80
Poor	<50

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

Performance Level	% Functionally Obsolete
Good	< 12%
Fair	12%-40%
Poor	>40%

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 2014 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.

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

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 2035 AADT volume for each segment by the 2014 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 2014 AADT segment volume. The following equation is used to apply the average annual compound growth rate:

2035 AADT = 2014 AADT x ((1+ACGR)^(2035-2014))

The ACGR for each segment is defined by comparing the total volumes in the 2010 Arizona Travel Demand Model (AZTDM2) to the 2035 AZTDM2 traffic volumes at each existing HPMS count station location throughout the corridor. Each 2010 and 2035 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 = ((2035 Volume/2010 Volume)^(1/(2035-2010))))-1

Secondary Mobility Measures

Four secondary measures are evaluated:

- Future Congestion
- Peak Congestion
- Travel Time Reliability
  - Closure Extent
  - Directional Travel Time Index
  - Directional Planning Time Index
- Multimodal Opportunities
  - % Bicycle Accommodation
  - % Non-Single Occupancy Vehicle (SOV) Trips
  - % Transit Dependency

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 three indicators. The three indicators are the number of times a piece of a corridor is closed for any specific reason, the directional Travel Time Index (TTI), and the directional Planning Time Index (PTI).

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 Travel Time and Planning Time Index: In terms of overall mobility, the TTI is the relationship of the mean peak period travel time in a specific section of the corridor to the free-flow travel time in the same location. The PTI is the relationship of the 95th percentile highest travel time to the free-flow travel time (based on the posted speed limit) in a specific section of the corridor. The TTI and PTI can be converted into speed-based indices by recognizing that speed is equal to distance traveled divided by travel time. The inverse relationship between travel time and speed means that the 95th percentile highest travel time corresponds to the 5th percentile lowest speed.

Using HERE 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). Using the mean speeds and 5th percentile lowest mean speeds collected over 2014 for these time periods for each data location, four TTI and PTI calculations were made using the following formulas:

TTI = Posted Speed Limit/Mean Peak Hour Speed

PTI = Posted Speed Limit/5th Percentile Lowest Speed

The highest value of the four time periods calculation is defined as the TTI for that data point. The average TTI is calculated within each segment based on the number of data points collected. The value of the average TTI across each entry is used as the TTI 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: 2008-2012 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	TTI on Uninterrupted Flow Facilities
Good	< 1.15
Fair	≥ 1.15 & < 1.33
Poor	≥ 1.33

Performance Level	TTI on Interrupted Flow Facilities
Good	< 1.30
Fair	≥ 1.30 & < 1.2.00
Poor	≥ 2.00

Performance Level	PTI on Uninterrupted Flow Facilities
Good	< 1.30
Fair	≥ 1.30 & < 1.50
Poor	≥ 1.50

Performance Level	PTI Interrupted Flow Facilities
Good	< 3.00
Fair	≥ 3.00 & < 6.00
Poor	≥ 6.00

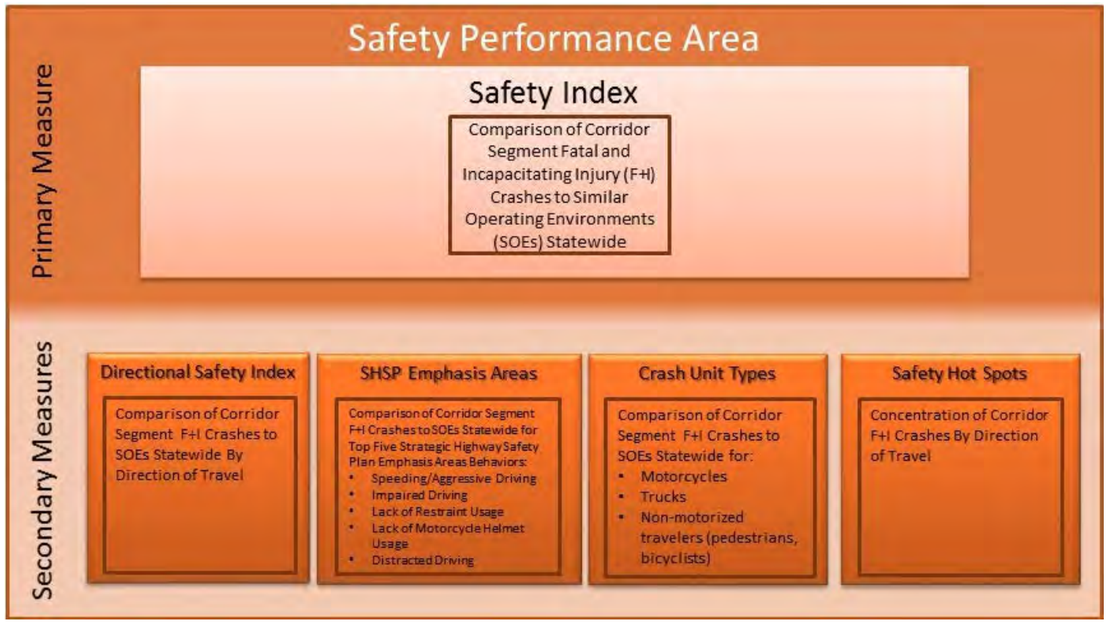
Performance Level	Percent Bicycle Accommodation
Good	≥ 90%
Fair	> 60% & ≤ 90%
Poor	< 60%

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

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 incapacitating injury crashes, the relative cost of those types of crashes, and crash occurrences on similar roadways in Arizona. According to ADOT's 2010 Highway Safety Improvement Program Manual, fatal crashes have an estimated cost that is 14.5 times the estimated cost of incapacitating injury crashes ($5.8 million compared to $400,000).

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

*CSS = 14.5 * (Normalized Fatal Crash Rate + Frequency) + (Normalized Incapacitating 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	0.94	1.06
2 or 3 or 4 Lane Divided Highway	0.77	1.23
4 or 5 Lane Undivided Highway	0.80	1.20
6 Lane Highway	0.56	1.44
Rural 4 Lane Freeway with Daily Volume < 25,000	0.73	1.27
Rural 4 Lane Freeway with Daily Volume > 25,000	0.68	1.32
Urban 4 Lane Freeway	0.79	1.21
Urban or Rural 6 Lane Freeway	0.82	1.18
Urban > 6 Lane Freeway	0.80	1.20

** 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 incapacitating 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 incapacitating 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 incapacitating injury crashes:

- Directional Safety Index
- Strategic Highway Safety Plan (SHSP) Behavior Emphasis Areas
- Crash Unit Types
- Safety Hot Spots

Directional Safety Index: The Direction 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 incapacitating 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”

SHSP Behavior Emphasis Areas: ADOT’s 2014 SHSP identifies several emphasis areas for reducing fatal and incapacitating injury crashes. The top five SHSP emphasis areas relate to the following driver behaviors:

- Speeding and aggressive driving
- Impaired driving
- Lack of restraint usage
- Lack of motorcycle helmet usage
- Distracted driving

To develop a performance measure that reflects these five emphasis areas, the percentage of total fatal and incapacitating injury crashes that involves at least one of the emphasis area driver behaviors on a particular segment is compared to the statewide average percentage of crashes involving at least one of the emphasis area driver behaviors on roads with similar operating environments in a process similar to how the Safety Index is developed.

To increase the crash sample size for this performance measure, the five behavior emphasis areas are combined to identify fatal and incapacitating injury crashes that exhibit one or more of the behavior emphasis areas.

The SHSP behavior emphasis areas performance is calculated using the following formula:

% Crashes Involving SHSP Behavior Emphasis Areas = Segment Crashes Involving SHSP Behavior Emphasis Areas / Total Segment Crashes

The percentage of total crashes involving SHSP behavior 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 SHSP behavior emphasis areas, the more the frequency of crashes involving SHSP behavior 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 SHSP behavior emphasis areas performance depends on the crash history on similar statewide operating environments, as shown in the table below:

Similar Operating Environment	Crashes in SHSP Top 5 Emphasis Areas	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	51.2%	57.5%
2 or 3 or 4 Lane Divided Highway	44.4%	54.4%
4 or 5 Lane Undivided Highway	42.4%	51.1%
6 Lane Highway	35.3%	46.5%
Rural 4 Lane Freeway with Daily Volume < 25,000	42.8%	52.9%
Rural 4 Lane Freeway with Daily Volume > 25,000	40.8%	57.1%
Urban 4 Lane Freeway	49.1%	59.4%
Urban or Rural 6 Lane Freeway	33.5%	57.2%
Urban > 6 Lane Freeway	42.6%	54.8%

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

The SHSP behavior emphasis areas secondary safety performance measure for the Safety performance area includes proportions of specific types of crashes within the total fatal and incapacitating injury crash frequencies. This more detailed categorization of fatal and incapacitating 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 SHSP behavior emphasis areas secondary safety performance measure. If any of these criteria are met for a segment, that segment has “insufficient data” to reliably rate the SHSP behavior emphasis areas performance:

- If the crash sample size (total fatal plus incapacitating 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 the SHSP behavior emphasis areas performance measure is less than two crashes over the five-year analysis period, the entire SHSP behavior emphasis areas performance measure has “insufficient data” and performance ratings are unreliable.

Crash Unit Type Emphasis Areas: ADOT’s SHSP also identifies emphasis areas that relate to the following “unit-involved” crashes:

- Heavy vehicle (trucks)-involved crashes
- Motorcycle-involved crashes
- Non-motorized traveler (pedestrians and bicyclists)-involved crashes

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

The SHSP crash unit type emphasis areas 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 crash unit types 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. 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.

Scoring:

Similar Operating Environment	Crashes Involving Trucks	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	5.2%	7.1%
2 or 3 or 4 Lane Divided Highway	3.5%	7.3%
4 or 5 Lane Undivided Highway	6.1%	9.6%
6 Lane Highway	0.3%	8.7%
Rural 4 Lane Freeway with Daily Volume < 25,000	13.2%	17.0%
Rural 4 Lane Freeway with Daily Volume > 25,000	7.2%	12.9%
Urban 4 Lane Freeway	6.8%	10.9%
Urban or Rural 6 Lane Freeway	6.2%	11.0%
Urban > 6 Lane Freeway	2.5%	6.0%

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

Similar Operating Environment	Crashes Involving Motorcycles	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	18.5%	26.5%
2 or 3 or 4 Lane Divided Highway	16.3%	26.3%
4 or 5 Lane Undivided Highway	6.4%	9.4%
6 Lane Highway	0.0%	20.0%
Rural 4 Lane Freeway with Daily Volume < 25,000	5.0%	8.5%
Rural 4 Lane Freeway with Daily Volume > 25,000	7.7%	17.1%
Urban 4 Lane Freeway	9.3%	11.5%
Urban or Rural 6 Lane Freeway	6.7%	12.9%
Urban > 6 Lane Freeway	12.6%	20.5%

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

Similar Operating Environment	Crashes Involving Non-Motorized Travelers	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	2.2%	4.2%
2 or 3 or 4 Lane Divided Highway	2.4%	4.5%
4 or 5 Lane Undivided Highway	4.7%	7.9%
6 Lane Highway	8.4%	17.4%
Rural 4 Lane Freeway with Daily Volume < 25,000	1.7%	2.5%
Rural 4 Lane Freeway with Daily Volume > 25,000	0.0%	0.0%
Urban 4 Lane Freeway	4.8%	10.3%
Urban or Rural 6 Lane Freeway	0.9%	6.7%
Urban > 6 Lane Freeway	0.5%	1.5%

** 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 SHSP behavior emphasis areas.

Safety Hot Spots: A hot spot analysis was conducted that identified abnormally high concentrations of fatal and incapacitating 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 planning time index for truck travel. The industry standard definition for the Truck Planning Time Index (TPTI) is the ratio of total travel time needed for 95% on-time arrival to free-flow travel time. The TPTI reflects the extra buffer time needed for on-time delivery while accounting for non-recurring delay. Non-recurring delay refers to unexpected or abnormal delay due to closures or restrictions resulting from circumstances such as crashes, inclement weather, and construction activities.

The TPTI can be converted into a speed-based index by recognizing that speed is equal to distance traveled divided by travel time. The inverse relationship between travel time and speed means that the 95th percentile highest travel time corresponds to the 5th percentile lowest speed. The speed-based TPTI is calculated using the following formula:

TPTI = Free-Flow Truck Speed / Observed 5th Percentile Lowest Truck Speed

Observed 5th percentile lowest truck speeds are available in the 2014 American Digital Cartography, Inc. HERE (formerly NAVTEQ) database to which ADOT has access. The free-flow truck speed is assumed to be 65 miles per hour or the posted speed, whichever is less. This upper limit of 65 mph accounts for governors that trucks often have that restrict truck speeds to no more than 65 mph, even when the speed limit may be higher.

For each corridor segment, the TPTI is calculated for each direction of travel and then averaged to create a bi-directional TPTI. When assessing performance using TPTI, the higher the TPTI value is above 1.0, the more buffer time is needed to ensure on-time delivery.

The Freight Index is calculated using the following formula to invert the overall TPTI:

Freight Index = 1 / Bi-directional TPTI

Inversion of the TPTI allows the Freight Index to have a scale where the higher the value, the better the performance, which is similar to the directionality of the scales of most of the other primary measures. This Freight Index scale is based on inverted versions of TPTI scales created previously by ADOT. The scale for rating the Freight Index differs between uninterrupted and interrupted flow facilities.

Secondary Freight Measures

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

- Recurring Delay (Directional TTTI)
- Non-Recurring Delay (Directional TPTI)
- Closure Duration
- Bridge Vertical Clearance
- Bridge Vertical Clearance Hot Spots

Recurring Delay (Directional TTTI): The performance measure for recurring delay is the Directional Truck Travel Time Index (TTTI). The industry standard definition for TTTI is the ratio of average peak period travel time to free-flow travel time. The TTTI reflects the extra time spent in traffic during peak times due to recurring delay. Recurring delay refers to expected or normal delay due to roadway capacity constraints or traffic control devices.

Similar to the TPTI, the TTTI can be converted into a speed-based index by recognizing that speed is equal to distance traveled divided by travel time. The speed-based TTTI can be calculated using the following formula:

TTTI = Free-Flow Truck Speed / Observed Average Peak Period Truck Speed

Observed average peak period truck speeds are available in the 2014 American Digital Cartography, Inc. HERE (formerly NAVTEQ) database to which ADOT has access. The free-flow truck speed is assumed to be 65 mph or the posted speed, whichever is less.

For each corridor segment, the TTTI is calculated for each direction of travel. With the TTTI, the higher the TTTI value is above 1.0, the more time is spent in traffic during peak times. TTTI values are generally lower than TPTI values. The Directional TTTI scale is based on TTTI scales created previously by ADOT.

Non-Recurring Delay (Directional TPTI): The performance measure for non-recurring delay is the Directional TPTI. Directional TPTI is calculated as described previously as an interim step in the development of the Freight Index.

For each corridor segment, the TPTI is calculated for each direction of travel. With the TPTI, the higher the TPTI value is above 1.0, the more buffer time is needed to ensure on-time delivery.

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 for 2010-2014 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	> 0.77	> 0.33
Fair	0.67 – 0.77	0.17 – 0.33
Poor	< 0.67	< 0.17

Performance Level	TTTI	
	Uninterrupted Flow Facilities	Interrupted Flow Facilities
Good	< 1.15	< 1.30
Fair	1.15 – 1.33	1.30 – 2.00
Poor	> 1.33	> 2.00

Performance Level	TPTI	
	Uninterrupted Flow Facilities	Interrupted Flow Facilities
Good	< 1.30	< 3.00
Fair	1.30 – 1.50	3.00 – 6.00
Poor	> 1.50	> 6.00

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

				Eastbound (NB)			Westbound (SB)			EB/NB		WB/SB		Composite		Pavement Index	% Pavement Failure	
				# of Lanes	IRI	Cracking	# of Lanes	IRI	Cracking	PSR	PDI	PSR	PDI	NB	SB		NB	SB
Segment 1		***Interstate?***		**Yes**														
Mile 1	0	to	1	2	142.76	15	2	91.86	5	2.91	2.9	3.53	4.0	2.91	3.67		2	0
Mile 2	1	to	2	2	47.88	0	2	44.44	0	4.17	5.0	4.22	5.0	4.42	4.46		0	0
Mile 3	2	to	3	2	54.12	0	2	50.59	0	4.07	5.0	4.13	5.0	4.35	4.39		0	0
			Total	6			6											2
			Weighted Average							3.72	4.31	3.96	4.67	3.89	4.17			
			Factor							1.00		1.00						
			Indicator Score							**3.72**		**3.96**						**16.7%**
			Pavement Index													**4.03**		
Segment 2		***Interstate?***		**Yes**														
Mile 1	3	to	4	2	37.32	0	2	45.12	0	4.34	5.0	4.21	5.0	4.54	4.45		0	0
Mile 2	4	to	5	2	40.63	0	2	51.61	0	4.28	5.0	4.11	5.0	4.50	4.38		0	0
Mile 3	5	to	6	2	39.62	0	2	39.89	1	4.30	5.0	4.30	4.7	4.51	4.40		0	0
Mile 4	6	to	7	2	36.88	2	2	34.72	0	4.35	4.5	4.38	5.0	4.38	4.57		0	0
Mile 5	7	to	8	2	39.80	0	2	39.08	0	4.30	5.0	4.31	5.0	4.51	4.52		0	0
Mile 6	8	to	9	2	37.35	0	2	33.80	0	4.34	5.0	4.40	5.0	4.54	4.58		0	0
Mile 7	9	to	10	2	38.11	0	2	28.95	0	4.33	5.0	4.48	5.0	4.53	4.64		0	0
Mile 8	10	to	11	2	36.73	0	2	39.40	0	4.35	5.0	4.30	5.0	4.54	4.51		0	0
Mile 9	11	to	12	2	32.78	0	2	34.15	0	4.41	5.0	4.39	5.0	4.59	4.57		0	0
Mile 10	12	to	13	2	36.64	0	2	34.68	0	4.35	5.0	4.38	5.0	4.55	4.57		0	0
Mile 11	13	to	14	2	50.14	0	2	40.63	0	4.13	5.0	4.28	5.0	4.39	4.50		0	0
Mile 12	14	to	15	2	32.52	0	2	40.12	0	4.42	5.0	4.29	5.0	4.59	4.51		0	0
Mile 13	15	to	16	2	30.68	0	2	38.18	0	4.45	5.0	4.32	5.0	4.61	4.53		0	0
Mile 14	16	to	17	2	61.25	3	2	63.40	1	3.96	4.3	3.93	4.7	4.06	4.15		0	0
Mile 15	17	to	18	2	70.82	20	2	72.45	10	3.82	2.5	3.80	3.4	2.51	3.54		2	0
			Total	30			30											2
			Weighted Average							4.28	4.75	4.26	4.85	4.36	4.43			
			Factor							1.00		1.00						
			Indicator Score							**4.28**		**4.26**						**3.3%**
			Pavement Index													**4.39**		

				Eastbound (NB)			Westbound (SB)			EB/NB		WB/SB		Composite		Pavement Index	% Pavement Failure	
				# of Lanes	IRI	Cracking	# of Lanes	IRI	Cracking	PSR	PDI	PSR	PDI	NB	SB		NB	SB
Segment 3		***Interstate?***	**Yes**															
Mile 1	18	to	19	2	60.27	15	2	79.09	7	3.98	2.9	3.70	3.8	2.94	3.72		0	0
Mile 2	19	to	20	2	68.35	5	2	68.96	7	3.86	4.0	3.85	3.8	3.90	3.78		0	0
Mile 3	20	to	21	2	69.13	7	2	66.15	15	3.84	3.8	3.89	2.9	3.78	2.94		0	0
Mile 4	21	to	22	2	72.92	5	2	64.61	12	3.79	4.0	3.91	3.2	3.85	3.43		0	0
Mile 5	22	to	23	2	104.98	6	2	56.77	8	3.36	3.9	4.03	3.6	3.51	3.76		0	0
Mile 6	23	to	24	2	84.81	10	2	65.17	5	3.62	3.4	3.90	4.0	3.48	3.93		0	0
Mile 7	24	to	25	2	71.37	12	2	63.52	4	3.81	3.2	3.93	4.1	3.40	3.99		0	0
Mile 8	25	to	26	2	81.95	4	2	63.73	5	3.66	4.1	3.92	4.0	3.81	3.95		0	0
Mile 9	26	to	27	2	68.93	10	2	56.71	8	3.85	3.4	4.03	3.6	3.55	3.76		0	0
Mile 10	27	to	28	2	57.72	15	2	51.20	12	4.02	2.9	4.12	3.2	2.94	3.49		0	0
Mile 11	28	to	29	2	90.02	12	2	65.19	12	3.55	3.2	3.90	3.2	3.32	3.43		0	0
Mile 12	29	to	30	2	87.00	9	2	82.54	10	3.59	3.5	3.65	3.4	3.55	3.49		0	0
			Total	24			24											0
			Weighted Average							3.74	3.54	3.90	3.58	3.50	3.64			
			Factor							1.00		1.00						
			Indicator Score							**3.74**		**3.90**						**0.0%**
			Pavement Index													**3.57**		
Segment 4		***Interstate?***	**Yes**															
Mile 1	30	to	31	2	81.81	9	2	74.89	10	3.66	3.5	3.76	3.4	3.57	3.52		0	0
Mile 2	31	to	32	2	68.92	9	2	66.62	10	3.85	3.5	3.88	3.4	3.62	3.56		0	0
Mile 3	32	to	33	2	67.39	15	2	59.06	8	3.87	2.9	3.99	3.6	2.94	3.75		0	0
Mile 4	33	to	34	2	67.41	9	2	63.59	7	3.87	3.5	3.93	3.8	3.63	3.81		0	0
Mile 5	34	to	35	2	68.54	9	2	58.97	8	3.85	3.5	4.00	3.6	3.63	3.75		0	0
Mile 6	35	to	36	2	71.07	5	2	71.31	12	3.82	4.0	3.81	3.2	3.87	3.40		0	0
Mile 7	36	to	37	2	71.83	8	2	60.81	12	3.81	3.6	3.97	3.2	3.69	3.45		0	0
Mile 8	37	to	38	2	86.20	12	2	60.03	12	3.60	3.2	3.98	3.2	3.34	3.45		0	0
Mile 9	38	to	39	2	83.38	9	2	63.91	9	3.64	3.5	3.92	3.5	3.56	3.65		0	0
Mile 10	39	to	40	2	82.57	8	2	72.98	15	3.65	3.6	3.79	2.9	3.64	2.94		0	0
			Total	20			20											0
			Weighted Average							3.76	3.51	3.90	3.40	3.55	3.53			
			Factor							1.00		1.00						
			Indicator Score							**3.76**		**3.90**						**0.0%**
			Pavement Index													**3.54**		

				Eastbound (NB)			Westbound (SB)			EB/NB		WB/SB		Composite		Pavement Index	% Pavement Failure	
				# of Lanes	IRI	Cracking	# of Lanes	IRI	Cracking	PSR	PDI	PSR	PDI	NB	SB		NB	SB
Segment 5		***Interstate?***		**Yes**														
Mile 1	40	to	41	2	88.69	6	2	69.12	10	3.57	3.9	3.85	3.4	3.66	3.55		0	0
Mile 2	41	to	42	2	74.40	5	2	66.89	4	3.77	4.0	3.88	4.1	3.84	3.96		0	0
Mile 3	42	to	43	2	62.22	4	2	60.27	9	3.95	4.1	3.98	3.5	4.00	3.66		0	0
Mile 4	43	to	44	2	65.09	5	2	68.88	2	3.90	4.0	3.85	4.5	3.93	4.03		0	0
Mile 5	44	to	45	2	49.86	1	2	52.11	2	4.14	4.7	4.10	4.5	4.29	4.21		0	0
Mile 6	45	to	46	2	62.84	1	2	72.29	1	3.94	4.7	3.80	4.7	4.15	4.06		0	0
Mile 7	46	to	47	2	46.55	1	2	52.25	1	4.19	4.7	4.10	4.7	4.33	4.27		0	0
Mile 8	47	to	48	2	57.36	1	2	49.20	0	4.02	4.7	4.15	5.0	4.21	4.40		0	0
Mile 9	48	to	49	2	65.12	0	2	56.07	4	3.90	5.0	4.04	4.1	4.23	4.07		0	0
Mile 10	49	to	50	2	88.70	12	2	68.68	1	3.57	3.2	3.85	4.7	3.33	4.09		0	0
Mile 11	50	to	51	2	48.05	2	2	42.78	2	4.17	4.5	4.25	4.5	4.25	4.31		0	0
Mile 12	51	to	52	2	33.71	1	2	35.40	2	4.40	4.7	4.37	4.5	4.48	4.40		0	0
Mile 13	52	to	53	2	36.45	0	2	34.20	3	4.35	5.0	4.39	4.3	4.55	4.32		0	0
Mile 14	53	to	54	2	36.02	1	2	43.46	0	4.36	4.7	4.24	5.0	4.45	4.47		0	0
Mile 15	54	to	55	2	65.50	3	2	61.20	4	3.90	4.3	3.96	4.1	4.02	4.02		0	0
Mile 16	55	to	56	2	66.20	5	2	59.44	7	3.89	4.0	3.99	3.8	3.92	3.82		0	0
Mile 17	56	to	57	2	97.97	3	2	87.59	3	3.45	4.3	3.58	4.3	3.70	3.80		0	0
			Total	34			34											0
			Weighted Average							3.97	4.36	4.02	4.32	4.08	4.08			
			Factor							1.00		1.00						
			Indicator Score							**3.97**		**4.02**						**0.0%**
			Pavement Index													**4.08**		
Segment 6		***Interstate?***		**Yes**														
Mile 1	57	to	58	2	77.45	5	2	69.06	3	3.73	4.0	3.85	4.3	3.81	3.98		0	0
Mile 2	58	to	59	2	84.90	6	2	73.25	4	3.62	3.9	3.79	4.1	3.70	3.89		0	0
Mile 3	59	to	60	2	84.89	8	2	69.30	4	3.62	3.6	3.84	4.1	3.63	3.93		0	0
Mile 4	60	to	61	2	93.90	5	2	83.75	10	3.50	4.0	3.64	3.4	3.65	3.49		0	0
Mile 5	61	to	62	2	83.32	4	2	84.68	4	3.64	4.1	3.62	4.1	3.79	3.78		0	0
Mile 6	62	to	63	3	117.57	0.1	3	104.03	0.1	3.20	-	3.37	-	3.20	3.37		3	0
Mile 7	63	to	64	3	86.28	0.1	3	116.74	0.1	3.60	-	3.21	-	3.60	3.21		0	3
			Total	16			16											6
			Weighted Average							3.54	2.46	3.57	2.52	3.60	3.62			
			Factor							1.00		1.00						
			Indicator Score							**3.54**		**3.57**						**18.8%**
			Pavement Index													**3.61**		

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)	Super (N59)	Sub (N60)	Eval (N67)	Lowest	Deck Area on Func Obsolete		
Segment 1 0 - 3												
Western Ave TI OP NB	1545	1.17	5,156	83.00	6	5	6	5	5.0	5,156		
Western Ave TI OP SB	1546	1.17	4,872	82.00	5	5	6	5	5.0	4,872		
Mariposa TI OP NB	2410	2.95	9,492	94.00	7	7	7	7	7.0	9,492		
Mariposa TI OP SB	2411	2.95	9,492	94.00	6	7	7	7	6.0	9,492		
Total			29,012									
Weighted Average				90.03					5.98	100.00%		
Factor				1.00					1.00	1.00		
Indicator Score				**90.03**						**100.00%**	**5**	
Bridge Index									**5.98**			
Segment 2 3 - 18												
Pajarito Rd OP NB	1298	3.67	4,182	81.91	6	5	6	5	5.0	4,182		
Pajarito Rd OP SB	1299	3.67	4,750	81.91	6	5	7	5	5.0	4,750		
Country Club OP NB	1300	4.93	8,971	92.06	7	6	6	6	6.0	0		
Country Club OP SB	1301	4.93	8,971	94.07	7	6	6	6	6.0	0		
Potrero TI SB Ramp UP	1302	5.30	3,909	95.32	8	8	7	7	7.0	0		
Ruby Road TI UP	1240	7.70	19,298	95.00	6	6	7	6	6.0	19,298		
Rio Rico EB TI UP	933	10.96	7,862	85.46	5	5	6	5	5.0	0		
Rio Rico WB TI UP	2727	10.97	11,592	97.54	7	7	6	6	6.0	0		
Agua Fria Cyn Br NB	353	11.97	4,158	84.51	5	5	6	5	5.0	0		
Agua Fria Cyn Br SB	906	11.97	3,818	84.50	5	5	5	5	5.0	0		
Peck Canyon TI UP	935	13.96	8,366	86.88	6	5	6	5	5.0	0		
Peck Cyn Wash Br NB	907	14.37	3,800	96.58	6	6	6	6	6.0	0		
Peck Cyn Wash Br SB	354	14.37	4,158	96.58	6	6	6	6	6.0	0		
Palo Parado TI UP	937	15.65	8,366	83.99	5	5	6	5	5.0	8,366		
Arroyo Angulo Agudo NB	1735	17.75	8,965	96.48	7	7	6	6	6.0	0		
Arroyo Angulo Agudo SB	1736	17.75	9,065	96.44	7	7	7	7	7.0	0		
Tumacacori TI OP NB	1737	18.19	6,824	97.33	7	6	8	6	6.0	0		
Tumacacori TI OP SB	1738	18.19	6,824	97.33	7	6	7	6	6.0	0		
Total			133,879									
Weighted Average				92.24					5.79	27.34%		
Factor				1.00					1.00	1.00		
Indicator Score				**92.24**						**27.34%**	**5**	

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)	Super (N59)	Sub (N60)	Eval (N67)	Lowest	Deck Area on Func Obsolete		
Bridge Index									**5.79**			
Segment 3 18 - 30												
Tubac TI OP NB	1875	21.64	5,976	96.48	7	6	7	6	6.0	0		
Tubac TI OP SB	1876	21.64	5,976	97.44	7	7	6	6	6.0	0		
Chavez TI OP NB	1877	24.82	5,976	96.48	6	6	6	6	6.0	0		
Chavez TI OP SB	1878	24.82	5,976	96.44	7	7	6	6	6.0	0		
Agua Linda TI UP	1739	26.54	8,231	98.94	6	6	7	7	6.0	0		
Sopori River Br NB	1743	29.70	14,625	77.17	7	6	7	6	6.0	14,625		
Sopori River Br SB	1744	29.70	14,250	96.35	6	6	7	6	6.0	0		
Arivaca TI OP NB	1746	30.00	6,556	97.00	7	7	7	7	7.0	0		
Arivaca TI OP SB	1747	30.00	6,556	97.00	7	7	7	7	7.0	0		
Total			74,122									
Weighted Average				93.08					6.18	19.73%		
Factor				1.00					1.00	1.00		
Indicator Score				**93.08**						**19.73%**	**6**	
Bridge Index									**6.18**			
Segment 4 30 - 40												
Old Jct Wash Br NB	1740	30.70	5,753	96.25	7	6	7	7	6.0	0		
Old Jct Wash Br SB	1741	30.70	5,753	96.25	6	6	7	7	6.0	0		
Tinaja Wash Br NB	1748	31.03	5,753	96.25	7	7	7	7	7.0	0		
Tinaja Wash Br SB	1749	31.03	5,753	96.25	6	6	7	6	6.0	0		
Canoa Ranch TI OP NB	1752	34.85	4,817	93.00	7	7	7	7	7.0	4,817		
Canoa Ranch TI OP SB	1753	34.85	4,817	93.00	7	7	7	7	7.0	4,817		
Esperanza Wash Br NB	397	35.92	8,264	96.36	7	7	7	7	7.0	0		
Esperanza Wash Br SB	1751	35.92	7,537	93.36	6	6	7	7	6.0	0		
Continental TI OP NB	1754	39.44	6,422	96.00	7	7	7	7	7.0	0		
Continental TI OP SB	1755	39.44	6,422	96.00	7	7	7	7	7.0	0		
Total			61,291									
Weighted Average				95.35					6.60	15.72%		
Factor				1.00					1.00	1.00		
Indicator Score				**95.35**						**15.72%**	**6**	
Bridge Index									**6.60**			

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)	Super (N59)	Sub (N60)	Eval (N67)	Lowest	Deck Area on Func Obsolete		
Segment 5 40 - 57												
Esperanza Blvd TI NB	1354	40.65	6,577	92.72	7	6	7	6	6.0	6,577		
Esperanza Blvd TI SB	1355	40.65	6,577	92.72	7	6	7	7	6.0	6,577		
Duval Mine Rd TI UP	2800	43.10	34,086	81.65	7	8	7	7	7.0	0		
Anaconda Pipe OP NB	1568	43.80	3,026	90.17	7	6	7	6	6.0	3,026		
Anaconda Pipe OP SB	1569	43.80	3,033	90.17	6	6	7	6	6.0	3,033		
Quartz Wash Br NB	1570	45.15	4,507	95.71	6	6	7	7	6.0	0		
Quartz Wash Br SB	1571	45.15	4,507	95.71	6	6	7	6	6.0	0		
El Toro Rd OP NB	1572	45.80	10,028	90.63	4	8	7	7	4.0	0		
El Toro Rd OP SB	1573	45.80	10,028	91.64	4	7	7	7	4.0	0		
Helmet Peak TI UP	1356	46.81	14,515	96.32	5	6	7	6	5.0	0		
Pima Mine TI OP NB	1303	49.62	8,554	93.00	4	7	7	7	4.0	0		
Pima Mine TI OP SB	1304	49.62	10,659	91.00	4	7	6	7	4.0	0		
Pima OP NB	1305	53.10	2,795	95.15	6	6	7	6	6.0	0		
Pima OP SB	1306	53.10	2,795	95.15	6	6	7	6	6.0	0		
Papago Res TI OP NB	1307	54.40	4,982	96.61	6	6	7	6	6.0	0		
Papago Res TI OP SB	1308	54.40	4,982	96.61	6	6	7	6	6.0	0		
San Xavier OP NB	1241	55.78	2,801	90.21	7	7	7	7	7.0	2,801		
San Xavier OP SB	1242	55.78	2,801	90.21	7	7	7	7	7.0	2,801		
Santa Cruz Riv Br NB	1243	56.80	23,368	92.73	4	7	6	6	4.0	0		
Santa Cruz Riv Br SB	1244	56.80	18,577	92.73	4	6	6	6	4.0	0		
San Xavier TI OP NB	1245	56.95	8,570	90.89	6	7	7	7	6.0	8,570		
San Xavier TI OP SB	1246	56.95	8,483	90.89	6	7	7	7	6.0	8,483		
Total			196,251									
Weighted Average				90.92					5.30	21.33%		
Factor				1.00					1.00	1.00		
Indicator Score				**90.92**						**21.33%**	**4**	
Bridge Index									**5.30**			

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)	Super (N59)	Sub (N60)	Eval (N67)	Lowest	Deck Area on Func Obsolete		
Segment 6 57 - 64												
Bridge SB	1248	57.82	4,404	96.52	7	6	6	6	6.0	0		
Bridge NB	1247	57.82	4,404	96.52	7	6	6	6	6.0	0		
Valencia Road TI UP	1943	58.82	55,774	69.00	7	8	7	7	7.0	0		
Drexel Road UP	1120	59.90	9,625	71.41	5	7	7	7	5.0	9,625		
Airport Wash Br NB	1121	60.32	6,350	83.34	5	5	6	5	5.0	0		
Airport Wash Br SB	1122	60.32	6,350	83.51	5	5	6	5	5.0	0		
Irvington Rd TI UP	1123	60.95	20,500	62.71	5	5	7	5	5.0	20,500		
Pedestrian UP	1124	61.40	2,002	-1.00	6	6	6	6	6.0	0		
Ajo Way UP	1125	61.90	18,147	83.00	5	6	6	6	5.0	0		
Julian Wash Bridge SB	2595	62.71	13,188	94.74	6	7	7	7	6.0	0		
Julian Wash Bridge NB	2596	62.72	14,280	94.59	7	7	7	7	7.0	0		
Total			155,024									
Weighted Average				77.36					6.06	19.43%		
Factor				1.00					1.00	1.00		
Indicator Score				**77.36**						**19.43%**	**5**	
Bridge Index									**6.06**			

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)	Posted Speed Limit (mph)	Divided or Undivided	Access Points (per mile)	% No-Passing Zone	Street Parking
1	0	3	3	Fringe Urban	Interrupted	Rolling	4	Freeway Segment	12.00	60	Divided	N/A	0%	N/A
2	3	18	15	Rural	Uninterrupted	Level	4	Freeway Segment	12.00	75	Divided	N/A	0%	N/A
3	18	30	12	Rural	Interrupted	Level	4	Freeway Segment	12.00	75	Divided	N/A	0%	N/A
4	30	40	10	Fringe Urban	Uninterrupted	Level	4	Freeway Segment	12.00	70	Divided	N/A	0%	N/A
5	40	57	17	Fringe Urban	Uninterrupted	Level	4	Freeway Segment	12.00	72	Divided	N/A	0%	N/A
6	57	64	7	Urban	Uninterrupted	Level	4	Freeway Segment	12.00	60	Divided	N/A	0%	N/A

All Vehicle TTI and PTI/Truck TTTI and TPTI – Southbound

Segment	TMC	timeperiod	week_type	road_direction	cars_mean	cars_P05	Speed limit	Assumed truck free-flow speed	Cars_TTI	Cars_PTI	Cars_PeakTTI	Cars_PeakPTI
1	115N04892	1 AM Peak	Weekday	Southbound	54.4125	47.5	45	45	1.00	1.00	1.00	1.00
1	115N04892	2 Mid Day	Weekday	Southbound	58.1204	52	45	45	1.00	1.00		
1	115N04892	3 PM Peak	Weekday	Southbound	57.7788	52	45	45	1.00	1.00		
1	115N04892	4 Off Peak	Weekday	Southbound	53.8617	49	45	45	1.00	1.00		
1	115N04893	1 AM Peak	Weekday	Southbound	64	59	65	65	1.01	1.10	1.04	1.12
1	115N04893	2 Mid Day	Weekday	Southbound	65	61	65	65	1.00	1.07		
1	115N04893	3 PM Peak	Weekday	Southbound	65	61	65	65	1.01	1.07		
1	115N04893	4 Off Peak	Weekday	Southbound	62	58	65	65	1.04	1.12		
1	115N11106	1 AM Peak	Weekday	Southbound	28	14	25	25	1.00	1.79	1.00	1.79
1	115N11106	2 Mid Day	Weekday	Southbound	31	17	25	25	1.00	1.47		
1	115N11106	3 PM Peak	Weekday	Southbound	28	14	25	25	1.00	1.79		
1	115N11106	4 Off Peak	Weekday	Southbound	27	15	25	25	1.00	1.67		
2	115N04894	1 AM Peak	Weekday	Southbound	64	58	75	65	1.17	1.29	1.21	1.34
2	115N04894	2 Mid Day	Weekday	Southbound	65	60	75	65	1.15	1.25		
2	115N04894	3 PM Peak	Weekday	Southbound	63	58	75	65	1.18	1.29		
2	115N04894	4 Off Peak	Weekday	Southbound	62	56	75	65	1.21	1.34		
2	115N04895	1 AM Peak	Weekday	Southbound	67	62	75	65	1.12	1.21	1.16	1.23
2	115N04895	2 Mid Day	Weekday	Southbound	66	63	75	65	1.13	1.19		
2	115N04895	3 PM Peak	Weekday	Southbound	65	62	75	65	1.15	1.21		
2	115N04895	4 Off Peak	Weekday	Southbound	65	61	75	65	1.16	1.23		
2	115N04896	1 AM Peak	Weekday	Southbound	68	63	75	65	1.11	1.19	1.11	1.19

Segment	TMC	timeperiod	week_type	road_direction	cars_mean	cars_P05	Speed limit	Assumed truck free-flow speed	Cars_TTI	Cars_PTI	Cars_PeakTTI	Cars_PeakPTI
2	115N04896	2 Mid Day	Weekday	Southbound	68	65	75	65	1.10	1.15		
2	115N04896	3 PM Peak	Weekday	Southbound	68	65	75	65	1.10	1.15		
2	115N04896	4 Off Peak	Weekday	Southbound	67	63	75	65	1.11	1.19		
2	115N04897	1 AM Peak	Weekday	Southbound	68	63	75	65	1.11	1.19	1.11	1.19
2	115N04897	2 Mid Day	Weekday	Southbound	69	65	75	65	1.09	1.15		
2	115N04897	3 PM Peak	Weekday	Southbound	68	65	75	65	1.10	1.15		
2	115N04897	4 Off Peak	Weekday	Southbound	68	63	75	65	1.11	1.19		
2	115N04898	1 AM Peak	Weekday	Southbound	68	64	75	65	1.10	1.17	1.11	1.19
2	115N04898	2 Mid Day	Weekday	Southbound	69	65	75	65	1.09	1.15		
2	115N04898	3 PM Peak	Weekday	Southbound	68	65	75	65	1.10	1.15		
2	115N04898	4 Off Peak	Weekday	Southbound	68	63	75	65	1.11	1.19		
2	115N04899	1 AM Peak	Weekday	Southbound	68	64	75	65	1.10	1.17	1.11	1.19
2	115N04899	2 Mid Day	Weekday	Southbound	69	65	75	65	1.09	1.15		
2	115N04899	3 PM Peak	Weekday	Southbound	68	65	75	65	1.10	1.15		
2	115N04899	4 Off Peak	Weekday	Southbound	68	63	75	65	1.11	1.19		
3	115N04900	1 AM Peak	Weekday	Southbound	69	65	75	65	1.09	1.15	1.10	1.17
3	115N04900	2 Mid Day	Weekday	Southbound	69	65	75	65	1.09	1.15		
3	115N04900	3 PM Peak	Weekday	Southbound	69	65	75	65	1.09	1.15		
3	115N04900	4 Off Peak	Weekday	Southbound	68	64	75	65	1.10	1.17		
3	115N04901	1 AM Peak	Weekday	Southbound	68	64	75	65	1.10	1.17	1.11	1.17
3	115N04901	2 Mid Day	Weekday	Southbound	68	65	75	65	1.10	1.15		
3	115N04901	3 PM Peak	Weekday	Southbound	68	65	75	65	1.10	1.15		
3	115N04901	4 Off Peak	Weekday	Southbound	67	64	75	65	1.11	1.17		
3	115N04902	1 AM Peak	Weekday	Southbound	69	65	75	65	1.08	1.15	1.09	1.15
3	115N04902	2 Mid Day	Weekday	Southbound	69	65	75	65	1.08	1.15		
3	115N04902	3 PM Peak	Weekday	Southbound	69	65	75	65	1.09	1.15		
3	115N04902	4 Off Peak	Weekday	Southbound	69	65	75	65	1.09	1.15		
4	115N04742	1 AM Peak	Weekday	Southbound	68	64	75	65	1.10	1.17	1.12	1.19
4	115N04742	2 Mid Day	Weekday	Southbound	68	64	75	65	1.11	1.17		
4	115N04742	3 PM Peak	Weekday	Southbound	68	64	75	65	1.11	1.17		
4	115N04742	4 Off Peak	Weekday	Southbound	67	63	75	65	1.12	1.19		
4	115N04743	1 AM Peak	Weekday	Southbound	66	63	65	65	1.00	1.03	1.00	1.05
4	115N04743	2 Mid Day	Weekday	Southbound	65	63	65	65	1.00	1.03		
4	115N04743	3 PM Peak	Weekday	Southbound	65	63	65	65	1.00	1.03		
4	115N04743	4 Off Peak	Weekday	Southbound	65	62	65	65	1.00	1.05		
5	115N04332	1 AM Peak	Weekday	Southbound	68	64	75	65	1.10	1.17	1.13	1.19
5	115N04332	2 Mid Day	Weekday	Southbound	68	64	75	65	1.11	1.17		
5	115N04332	3 PM Peak	Weekday	Southbound	68	64	75	65	1.10	1.17		
5	115N04332	4 Off Peak	Weekday	Southbound	67	63	75	65	1.13	1.19		

Segment	TMC	timeperiod	week_type	road_direction	cars_mean	cars_P05	Speed limit	Assumed truck free-flow speed	Cars_TTI	Cars_PTI	Cars_PeakTTI	Cars_PeakPTI
5	115N04744	1 AM Peak	Weekday	Southbound	66	63	65	65	1.00	1.03	1.01	1.05
5	115N04744	2 Mid Day	Weekday	Southbound	65	63	65	65	1.00	1.03		
5	115N04744	3 PM Peak	Weekday	Southbound	65	63	65	65	1.00	1.03		
5	115N04744	4 Off Peak	Weekday	Southbound	65	62	65	65	1.01	1.05		
5	115N04746	1 AM Peak	Weekday	Southbound	70	66	75	65	1.07	1.14	1.10	1.17
5	115N04746	2 Mid Day	Weekday	Southbound	69	65	75	65	1.09	1.15		
5	115N04746	3 PM Peak	Weekday	Southbound	69	65	75	65	1.08	1.15		
5	115N04746	4 Off Peak	Weekday	Southbound	68	64	75	65	1.10	1.17		
5	115N04747	1 AM Peak	Weekday	Southbound	70	66	75	65	1.08	1.14	1.11	1.19
5	115N04747	2 Mid Day	Weekday	Southbound	69	65	75	65	1.09	1.15		
5	115N04747	3 PM Peak	Weekday	Southbound	69	65	75	65	1.08	1.15		
5	115N04747	4 Off Peak	Weekday	Southbound	68	63	75	65	1.11	1.19		
6	115N04334	1 AM Peak	Weekday	Southbound	63	59	65	65	1.04	1.10	1.06	1.14
6	115N04334	2 Mid Day	Weekday	Southbound	62	59	65	65	1.04	1.10		
6	115N04334	3 PM Peak	Weekday	Southbound	62	58	65	65	1.05	1.12		
6	115N04334	4 Off Peak	Weekday	Southbound	61	57	65	65	1.06	1.14		
6	115N04335	1 AM Peak	Weekday	Southbound	59	56	55	55	1.00	1.00	1.02	1.12
6	115N04335	2 Mid Day	Weekday	Southbound	58	56	55	55	1.00	1.00		
6	115N04335	3 PM Peak	Weekday	Southbound	54	49	55	55	1.02	1.12		
6	115N04335	4 Off Peak	Weekday	Southbound	56	53	55	55	1.00	1.04		
6	115N04336	1 AM Peak	Weekday	Southbound	59	55	55	55	1.00	1.00	1.08	1.22
6	115N04336	2 Mid Day	Weekday	Southbound	58	55	55	55	1.00	1.00		
6	115N04336	3 PM Peak	Weekday	Southbound	51	45	55	55	1.08	1.22		
6	115N04336	4 Off Peak	Weekday	Southbound	55	53	55	55	1.01	1.04		
6	115N04337	1 AM Peak	Weekday	Southbound	57.5721	54	55	55	1.00	1.02	1.01	1.08
6	115N04337	2 Mid Day	Weekday	Southbound	57.2454	54	55	55	1.00	1.02		
6	115N04337	3 PM Peak	Weekday	Southbound	54.6931	51	55	55	1.01	1.08		
6	115N04337	4 Off Peak	Weekday	Southbound	55.4243	52	55	55	1.00	1.06		

All Vehicle TTI and PTI/Truck TTTI and TPTI – Northbound

Segment	TMC	timeperiod	week_type	road_direction	cars_mean	cars_P05	Speed limit	Assumed truck free-flow speed	Cars_TTI	Cars_PTI	Cars_PeakTTI	Cars_PeakPTI
1	115P04892	1 AM Peak	Weekday	Northbound	33	16.5	55	55	1.68	3.33	1.69	3.33
1	115P04892	2 Mid Day	Weekday	Northbound	33	17	55	55	1.66	3.24		
1	115P04892	3 PM Peak	Weekday	Northbound	37	20	55	55	1.49	2.75		
1	115P04892	4 Off Peak	Weekday	Northbound	33	19	55	55	1.69	2.89		
1	115P04893	1 AM Peak	Weekday	Northbound	61	53	65	65	1.07	1.23	1.11	1.23
1	115P04893	2 Mid Day	Weekday	Northbound	61	56	65	65	1.07	1.16		
1	115P04893	3 PM Peak	Weekday	Northbound	61	56	65	65	1.07	1.16		
1	115P04893	4 Off Peak	Weekday	Northbound	59	54	65	65	1.11	1.20		
2	115P04894	1 AM Peak	Weekday	Northbound	63	56	75	65	1.20	1.34	1.21	1.34
2	115P04894	2 Mid Day	Weekday	Northbound	64	58	75	65	1.17	1.29		
2	115P04894	3 PM Peak	Weekday	Northbound	64	58	75	65	1.17	1.29		
2	115P04894	4 Off Peak	Weekday	Northbound	62	56	75	65	1.21	1.34		
2	115P04895	1 AM Peak	Weekday	Northbound	66	62	75	65	1.14	1.21	1.18	1.29
2	115P04895	2 Mid Day	Weekday	Northbound	66	62	75	65	1.13	1.21		
2	115P04895	3 PM Peak	Weekday	Northbound	66	61	75	65	1.14	1.23		
2	115P04895	4 Off Peak	Weekday	Northbound	64	58	75	65	1.18	1.29		
2	115P04896	1 AM Peak	Weekday	Northbound	67	62	75	65	1.12	1.21	1.18	1.29
2	115P04896	2 Mid Day	Weekday	Northbound	67	63	75	65	1.12	1.19		
2	115P04896	3 PM Peak	Weekday	Northbound	66	61	75	65	1.14	1.23		
2	115P04896	4 Off Peak	Weekday	Northbound	63	58	75	65	1.18	1.29		
2	115P04897	1 AM Peak	Weekday	Northbound	70	64	75	65	1.08	1.17	1.13	1.21
2	115P04897	2 Mid Day	Weekday	Northbound	69	65	75	65	1.09	1.15		
2	115P04897	3 PM Peak	Weekday	Northbound	68	63	75	65	1.11	1.19		
2	115P04897	4 Off Peak	Weekday	Northbound	66	62	75	65	1.13	1.21		
2	115P04898	1 AM Peak	Weekday	Northbound	70	65	75	65	1.08	1.15	1.13	1.19
2	115P04898	2 Mid Day	Weekday	Northbound	68	65	75	65	1.10	1.15		
2	115P04898	3 PM Peak	Weekday	Northbound	68	63	75	65	1.11	1.19		
2	115P04898	4 Off Peak	Weekday	Northbound	67	63	75	65	1.13	1.19		
2	115P04899	1 AM Peak	Weekday	Northbound	69	64	75	65	1.09	1.17	1.13	1.19
2	115P04899	2 Mid Day	Weekday	Northbound	69	64	75	65	1.09	1.17		
2	115P04899	3 PM Peak	Weekday	Northbound	68	63	75	65	1.11	1.19		
2	115P04899	4 Off Peak	Weekday	Northbound	66	63	75	65	1.13	1.19		
3	115P04900	1 AM Peak	Weekday	Northbound	71	65	75	65	1.06	1.15	1.11	1.15
3	115P04900	2 Mid Day	Weekday	Northbound	70	65	75	65	1.08	1.15		
3	115P04900	3 PM Peak	Weekday	Northbound	69	65	75	65	1.09	1.15		
3	115P04900	4 Off Peak	Weekday	Northbound	68	65	75	65	1.11	1.15		
3	115P04901	1 AM Peak	Weekday	Northbound	64	58	75	65	1.17	1.29	1.26	1.42
3	115P04901	2 Mid Day	Weekday	Northbound	64	58	75	65	1.18	1.29		

Segment	TMC	timeperiod	week_type	road_direction	cars_mean	cars_P05	Speed limit	Assumed truck free-flow speed	Cars_TTI	Cars_PTI	Cars_PeakTTI	Cars_PeakPTI
3	115P04901	3 PM Peak	Weekday	Northbound	63	57	75	65	1.20	1.32		
3	115P04901	4 Off Peak	Weekday	Northbound	60	53	75	65	1.26	1.42		
3	115P04902	1 AM Peak	Weekday	Northbound	35	16	75	65	2.17	4.69	2.85	6.25
3	115P04902	2 Mid Day	Weekday	Northbound	31	14	75	65	2.43	5.36		
3	115P04902	3 PM Peak	Weekday	Northbound	29	13	75	65	2.58	5.77		
3	115P04902	4 Off Peak	Weekday	Northbound	26	12	75	65	2.85	6.25		
3	115P04903	1 AM Peak	Weekday	Northbound	71	65	75	65	1.06	1.15	1.12	1.17
3	115P04903	2 Mid Day	Weekday	Northbound	70	65	75	65	1.08	1.15		
3	115P04903	3 PM Peak	Weekday	Northbound	69	64	75	65	1.09	1.17		
3	115P04903	4 Off Peak	Weekday	Northbound	67	64	75	65	1.12	1.17		
4	115P04742	1 AM Peak	Weekday	Northbound	71	66	75	65	1.06	1.14	1.11	1.15
4	115P04742	2 Mid Day	Weekday	Northbound	70	65	75	65	1.08	1.15		
4	115P04742	3 PM Peak	Weekday	Northbound	69	65	75	65	1.08	1.15		
4	115P04742	4 Off Peak	Weekday	Northbound	68	65	75	65	1.11	1.15		
4	115P04743	1 AM Peak	Weekday	Northbound	69	65	65	65	1.00	1.00	1.00	1.02
4	115P04743	2 Mid Day	Weekday	Northbound	68	64	65	65	1.00	1.02		
4	115P04743	3 PM Peak	Weekday	Northbound	68	65	65	65	1.00	1.00		
4	115P04743	4 Off Peak	Weekday	Northbound	67	64	65	65	1.00	1.02		
5	115P04332	1 AM Peak	Weekday	Northbound	73	69	75	65	1.03	1.09	1.08	1.14
5	115P04332	2 Mid Day	Weekday	Northbound	71	67	75	65	1.05	1.12		
5	115P04332	3 PM Peak	Weekday	Northbound	71	68	75	65	1.06	1.10		
5	115P04332	4 Off Peak	Weekday	Northbound	69	66	75	65	1.08	1.14		
5	115P04744	1 AM Peak	Weekday	Northbound	66	63	65	65	1.00	1.03	1.00	1.05
5	115P04744	2 Mid Day	Weekday	Northbound	66	62	65	65	1.00	1.05		
5	115P04744	3 PM Peak	Weekday	Northbound	66	62	65	65	1.00	1.05		
5	115P04744	4 Off Peak	Weekday	Northbound	65	62	65	65	1.00	1.05		
5	115P04745	1 AM Peak	Weekday	Northbound	66	63	65	65	1.00	1.03	1.00	1.03
5	115P04745	2 Mid Day	Weekday	Northbound	66	63	65	65	1.00	1.03		
5	115P04745	3 PM Peak	Weekday	Northbound	66	63	65	65	1.00	1.03		
5	115P04745	4 Off Peak	Weekday	Northbound	65	63	65	65	1.00	1.03		
5	115P04746	1 AM Peak	Weekday	Northbound	70	65	75	65	1.08	1.15	1.12	1.19
5	115P04746	2 Mid Day	Weekday	Northbound	68	64	75	65	1.10	1.17		
5	115P04746	3 PM Peak	Weekday	Northbound	68	65	75	65	1.10	1.15		
5	115P04746	4 Off Peak	Weekday	Northbound	67	63	75	65	1.12	1.19		
5	115P04747	1 AM Peak	Weekday	Northbound	72	67	75	65	1.04	1.12	1.10	1.15
5	115P04747	2 Mid Day	Weekday	Northbound	70	66	75	65	1.07	1.14		
5	115P04747	3 PM Peak	Weekday	Northbound	70	66	75	65	1.07	1.14		
5	115P04747	4 Off Peak	Weekday	Northbound	68	65	75	65	1.10	1.15		
6	115P04333	1 AM Peak	Weekday	Northbound	70	66	65	65	1.00	1.00	1.00	1.02

Segment	TMC	timeperiod	week_type	road_direction	cars_mean	cars_P05	Speed limit	Assumed truck free-flow speed	Cars_TTI	Cars_PTI	Cars_PeakTTI	Cars_PeakPTI
6	115P04333	2 Mid Day	Weekday	Northbound	69	65	65	65	1.00	1.00		
6	115P04333	3 PM Peak	Weekday	Northbound	69	65	65	65	1.00	1.00		
6	115P04333	4 Off Peak	Weekday	Northbound	67	64	65	65	1.00	1.02		
6	115P04334	1 AM Peak	Weekday	Northbound	65	63	65	65	1.00	1.03	1.02	1.07
6	115P04334	2 Mid Day	Weekday	Northbound	65	62	65	65	1.00	1.05		
6	115P04334	3 PM Peak	Weekday	Northbound	65	62	65	65	1.00	1.05		
6	115P04334	4 Off Peak	Weekday	Northbound	64	61	65	65	1.02	1.07		
6	115P04335	1 AM Peak	Weekday	Northbound	59	56	55	55	1.00	1.00	1.00	1.00
6	115P04335	2 Mid Day	Weekday	Northbound	61	58	55	55	1.00	1.00		
6	115P04335	3 PM Peak	Weekday	Northbound	61	58	55	55	1.00	1.00		
6	115P04335	4 Off Peak	Weekday	Northbound	60	56	55	55	1.00	1.00		
6	115P04336	1 AM Peak	Weekday	Northbound	56	52	55	55	1.00	1.06	1.00	1.06
6	115P04336	2 Mid Day	Weekday	Northbound	58	55	55	55	1.00	1.00		
6	115P04336	3 PM Peak	Weekday	Northbound	57	54	55	55	1.00	1.02		
6	115P04336	4 Off Peak	Weekday	Northbound	57	55	55	55	1.00	1.00		
6	115P04337	1 AM Peak	Weekday	Northbound	58	55	55	55	1.00	1.00	1.00	1.02
6	115P04337	2 Mid Day	Weekday	Northbound	58	55	55	55	1.00	1.00		
6	115P04337	3 PM Peak	Weekday	Northbound	57	54	55	55	1.00	1.02		
6	115P04337	4 Off Peak	Weekday	Northbound	57	54	55	55	1.00	1.02		

Closure Data

				Total miles of closures		Mobility Avg Occurances/Mile/Year		Total minutes of closures		Freight Avg Mins/Mile/Year	
Segment	Length (miles)	# of closures		NB	SB	NB	SB	NB	SB	NB	SB
1	2.95	7		4.0	3.0	0.27	0.20	443.0	690.0	30.03	46.78
2	15.27	24		16.9	13.0	0.22	0.17	3442.7	2579.0	45.09	33.78
3	11.85	14		17.7	10.1	0.30	0.17	5208.1	3196.2	87.90	53.94
4	9.46	7		9.6	1.0	0.20	0.02	1079.4	348.0	22.82	7.36
5	17.66	35		22.0	13.0	0.25	0.15	3516.0	2097.0	39.82	23.75
6	6.51	14		12.5	2.0	0.38	0.06	2163.5	736.0	66.47	22.61
total	63.70										

	ITIS Category Description											
	Closures		Incidents/Accidents		Incidents/Crashes		Obstruction Hazards		Winds		Winter Storm Codes	
Segment	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
1	0	0	4	2	0	0	0	0	0	0	0	1
2	0	0	11	13	0	0	0	0	0	0	0	0
3	0	0	8	4	0	0	1	1	0	0	0	0
4	0	0	5	1	0	0	1	0	0	0	0	0
5	0	0	22	13	0	0	0	0	0	0	0	0
6	0	0	12	2	0	0	0	0	0	0	0	0

HPMS Data

SEGMENT	MP_FROM	MP_TO	WEIGHTED AVERAGE NB/EB AADT	WEIGHTED AVERAGE SB/WB AADT	WEIGHTED AVERAGE AADT	NB/EB AADT	SB/WB AADT	2014 AADT	K Factor	D-Factor	T-Factor
1	0	3	5837	5674	11512	5273	4742	10015	10	53	9
2	3	18	10822	11184	22006	10040	10555	20595	8	51	12
3	18	30	8142	8208	16350	7970	8100	16071	9	50	16
4	30	40	10696	10696	21392	10745	10745	21491	9	50	15
5	40	57	18299	18503	36801	18282	18574	36855	8	51	19
6	57	64	32963	32109	65071	34273	33165	67438	10	51	6

SEGMENT	Loc ID	BMP	EMP	Length	Pos Dir AADT	Neg Dir AADT	Corrected Pos Dir AADT	Corrected Neg Dir AADT	2014 AADT	K Factor	D-Factor	D-Factor Adjusted	T-Factor
1	100451	0.00	1.18	1.18	4349	4099	4349	4099	8448	10	53	51	9
	100452	1.18	2.95	1.77	5889	5171	5889	5171	11060	10	60	53	9
2	100453	2.95	5.31	2.36	8893	10963	8893	10963	19856	10	55	55	9
	100454	5.31	7.72	2.41	15255	14965	15255	14965	30220	9	55	50	9
	100455	7.72	10.88	3.16	12045	13053	12045	13053	25098	8	55	52	9
	100456	10.88	13.96	3.08	8266	8334	8266	8334	16600	8	57	50	16
	100457	13.96	15.63	1.67	7240	7265	7240	7265	14505	8	54	50	16
	100458	15.63	18.13	2.50	7615	7695	7615	7695	15310	8	51	50	16
3	100459	18.13	21.62	3.49	7586	0	7586	7586	15172	9	52	50	16
	100460	21.62	24.82	3.20	7449	7786	7449	7786	15236	9	53	51	16
	100461	24.82	26.54	1.72	0	0	8600	8600	17200	9	53	50	16
	100462	26.54	29.99	3.45	8529	8662	8529	8662	17193	10	54	50	16
4	100463	29.99	34.88	4.89	0	0	9947	9947	19894	9	53	50	15
	100464	34.88	39.46	4.58	0	0	11598	11598	23196	8	53	50	16
5	100465	39.46	40.76	1.30	13416	15600	13416	15600	29016	8	54	54	16
	100466	40.76	43.25	2.49	14741	16375	14741	16375	31116	8	52	53	16
	100467	43.25	46.82	3.57	0	0	16611	16611	33222	8	52	50	18
	100468	46.82	49.62	2.80	0	0	18901	18901	37802	8	53	50	20
	100469	49.62	54.39	4.77	21005	20625	21005	20625	41630	8	52	50	21
	100470	54.39	56.90	2.51	21001	20467	20824	20824	41648	9	53	50	21
6	100471	56.90	58.82	1.92	21508	22612	21508	22612	44120	9	52	51	5
	100472	58.82	60.85	2.03	33792	32176	33792	32176	65967	10	57	51	5
	100473	60.85	61.85	1.00	43298	39667	43298	39667	82962	10	58	52	5
	100474	61.85	63.09	1.24	47548	45883	47548	45883	93432	11	52	51	13

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
1	0	3	Divided	8.9	9.0	3.6	3.6	2.7	2.7	90%
2	3	18	Divided	10.1	9.9	3.9	3.9	15.0	15.0	100%
3	18	30	Divided	9.7	9.7	3.7	3.7	12.0	12.0	100%
4	30	40	Divided	9.5	9.5	3.5	3.5	10.0	10.0	100%
5	40	57	Divided	9.9	9.9	3.9	3.9	17.0	17.0	100%
6	57	64	Divided	10.0	10.0	4.0	4.0	6.7	6.7	95%

AZTDM Data

SEGMENT	Growth Rate	% Non-SOV
1	2.13%	14.0%
2	2.06%	17.0%
3	2.19%	15.0%
4	2.05%	16.0%
5	1.65%	13.0%
6	1.96%	15.0%

HERS Capacity Calculation Data

Segment	Capacity Environment Type	Facility Type	Terrain	Lane Width (Rounded, feet)	NB/EB Rt. Shoulder	SB/WB Rt. Shoulder	Freeway	Multilane	Signalized / Urban Highway	Shoulder Index	Rural 2-Lane	F_{lw} or f_w or f_{LS}	NB/EB F_{lc}	SB/WB F_{lc}	Total Ramp Density[1]	PHF	E_T	f_{HV}	f_M	f_A	g/C^2	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[3]
1	1	Fringe Urban	Rolling	12.00	8.88	9.02	0.0	0.0	1.0	4	0.0	0.0	0	0	1.4	0.94	1.5	0.957	N/A							71.13	71.13	4318	4318	N/A	82,242
2	1	Rural	Level	12.00	10.13	9.93	0.0	0.0	1.0	4	0.0	0.0	0	0	0	0.94	1.5	0.943	N/A							75.40	75.40	4257	4257	N/A	81,078
3	1	Rural	Level	12.00	9.68	9.68	0.0	0.0	1.0	4	0.0	0.0	0	0	0	0.94	1.5	0.926	N/A							75.40	75.40	4178	4178	N/A	79,577
4	1	Fringe Urban	Level	12.00	9.50	9.50	0.0	0.0	1.0	4	0.0	0.0	0	0	1.4	0.94	1.5	0.930	N/A							71.13	71.13	4197	4197	N/A	79,947
5	1	Fringe Urban	Level	12.00	9.92	9.92	0.0	0.0	1.0	4	0.0	0.0	0	0	1.4	0.94	1.5	0.913	N/A							71.13	71.13	4121	4121	N/A	78,487
6	1	Urban	Level	12.00	10.00	10.00	0.0	0.0	1.0	4	0.0	0.0	0	0	1.52	0.94	1.5	0.971	N/A							70.82	70.82	4381	4381	N/A	83,440

Safety Performance Area Data

Segment	Operating Environment	Segment Length (miles)	NB/EB Fatal Crashes 2010-2014	SB/WB Fatal Crashes 2010-2014	NB/EB Incapacitating Injury Crashes	SB/WB Incapacitating Injury Crashes	Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors
1	Urban 4 Lane Freeway	3	1	1	1	0	2
2	Urban 4 Lane Freeway	15	5	5	6	6	13
3	Rural 4 Lane Freeway with Daily Volume < 25,000	12	3	2	3	4	4
4	Urban 4 Lane Freeway	9	1	1	6	1	4
5	Urban 4 Lane Freeway	18	13	5	6	7	12
6	Urban 4 Lane Freeway	7	2	6	7	4	10

Segment	Operating Environment	Fatal + Incapacitating Injury Crashes Involving Trucks	Fatal + Incapacitating Injury Crashes Involving Motorcycles	Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers	Weighted 5-Year (2010-2014) Average NB/EB AADT	Weighted 5-Year (2010-2014) Average SB/WB AADT	Weighted 5-Year (2010-2014) Average Total AADT
1	Urban 4 Lane Freeway	0	0	0	5837	5674	11512
2	Urban 4 Lane Freeway	4	0	1	10822	11184	22006
3	Rural 4 Lane Freeway with Daily Volume < 25,000	0	0	1	8142	8208	16350
4	Urban 4 Lane Freeway	1	0	1	10696	10696	21392
5	Urban 4 Lane Freeway	3	0	0	18299	18503	36801
6	Urban 4 Lane Freeway	1	2	4	32963	32109	65071

HPMS Data for Safety

WEIGHTED AVERAGES for Safety						2014			2013			2012			2011			2010		
SEGMENT	MP FROM	MP TO	WEIGHTED AVERAGE NB/EB AADT	WEIGHTED AVERAGE SB/WB AADT	WEIGHTED AVERAGE AADT	NB/EB AADT	SB/WB AADT	2014 AADT	NB/EB AADT	SB/WB AADT	2013 AADT	NB/EB AADT	SB/WB AADT	2012 AADT	NB/EB AADT	SB/WB AADT	2011 AADT	NB/EB AADT	SB/WB AADT	2010 AADT
1	0	3	5837	5674	11512	5273	4742	10015	5628	5319	10947	5164	5189	10353	6671	6671	13343	6450	6450	12900
2	3	18	10822	11184	22006	10040	10555	20595	10693	10927	21620	10818	11549	22367	11144	11264	22408	11417	11625	23042
3	18	30	8142	8208	16350	7970	8100	16071	8293	8327	16620	7855	7855	15710	8153	8317	16470	8440	8440	16879
4	30	40	10696	10696	21392	10745	10745	21491	11065	11065	22129	10552	10552	21104	10513	10513	21025	10605	10605	21209
5	40	57	18299	18503	36801	18282	18574	36855	19013	19455	38468	18303	18303	36607	17161	17161	34323	18734	19019	37753
6	57	64	32963	32109	65071	34273	33165	67438	34330	33486	67817	33046	32158	65205	31366	30835	62201	31797	30899	62696

Freight Performance Area Data

*See **Mobility Performance Area Data** section for TTTI and TPTI Data*

Bridge Vertical Clearance Data

Structure Name (A209)	Structure # (N8)	Milepost (A232)	Type	N10 or N10two	N54b	N54 only UP	N10 only UP	minimum
Segment 1								
Western Ave TI OP NB	1,545	1	OP	19.33	19.33	0.00	0.00	-
Western Ave TI OP SB	1,546	1	OP	18.13	17.95	0.00	0.00	-
Mariposa TI OP NB	2,410	3	OP	17.84	17.24	0.00	0.00	-
Mariposa TI OP SB	2,411	3	OP	17.17	16.59	0.00	0.00	-
								0.00
Segment 2								
Pajarito Rd OP NB	1,298	4	op	15.61	15.60	0.00	0.00	-
Pajarito Rd OP SB	1,299	4	op	19.10	19.05	0.00	0.00	-
Country Club OP NB	1,300	5	op	15.20	14.57	0.00	0.00	-
Country Club OP SB	1,301	5	op	17.31	16.79	0.00	0.00	-
Potrero TI SB Ramp UP	1,302	5	up	16.71	16.61	16.61	16.71	16.61
Ruby Road TI UP	1,240	8	up	18.48	16.36	16.36	18.48	16.36
Rio Rico EB TI UP	933	11	up	17.37	16.46	16.46	17.37	16.46
Rio Rico WB TI UP	2,727	11	up	17.66	16.46	16.46	17.66	16.46
Agua Fria Cyn Br NB	353	12	op	0.00	0.00	0.00	0.00	-
Agua Fria Cyn Br SB	906	12	op	0.00	0.00	0.00	0.00	-
Peck Canyon TI UP	935	14	up	16.42	16.15	16.15	16.42	16.15
Peck Cyn Wash Br NB	907	14	op	0.00	0.00	0.00	0.00	-
Peck Cyn Wash Br SB	354	14	op	0.00	0.00	0.00	0.00	-
Palo Parado TI UP	937	16	up	17.72	16.35	16.35	17.72	16.35
Arroyo Angulo Agudo NB	1,735	18	op	24.45	24.45	0.00	0.00	-
Arroyo Angulo Agudo SB	1,736	18	op	23.56	23.56	0.00	0.00	-
Tumacacori TI OP NB	1,737	18	op	21.25	20.74	0.00	0.00	-
Tumacacori TI OP SB	1,738	18	op	16.45	16.30	0.00	0.00	-
								16.15

Structure Name (A209)	Structure # (N8)	Milepost (A232)	Type	N10 or N10two	N54b	N54 only UP	N10 only UP	minimum
Segment 3								
Tubac TI OP NB	1,875	22	op	17.65	17.63	0.00	0.00	-
Tubac TI OP SB	1,876	22	op	17.34	17.25	0.00	0.00	-
Chavez TI OP NB	1,877	25	op	17.84	17.74	0.00	0.00	-
Chavez TI OP SB	1,878	25	op	17.65	17.58	0.00	0.00	-
Agua Linda TI UP	1,739	27	up	19.05	16.13	16.13	19.05	16.13
Sopori River Br NB	1,743	30	op	0.00	0.00	0.00	0.00	-
Sopori River Br SB	1,744	30	op	0.00	0.00	0.00	0.00	-
Arivaca TI OP NB	1,746	30	op	17.95	17.94	0.00	0.00	-
Arivaca TI OP SB	1,747	30	op	17.53	17.53	0.00	0.00	-
								16.13
Segment 4								
Old Jct Wash Br NB	1,740	31	op	0.00	0.00	0.00	0.00	-
Old Jct Wash Br SB	1,741	31	op	0.00	0.00	0.00	0.00	-
Tinaja Wash Br NB	1,748	31	op	0.00	0.00	0.00	0.00	-
Tinaja Wash Br SB	1,749	31	op	0.00	0.00	0.00	0.00	-
Canoa Ranch TI OP NB	1,752	35	op	18.43	18.43	0.00	0.00	-
Canoa Ranch TI OP SB	1,753	35	op	17.49	17.49	0.00	0.00	-
Esperanza Wash Br NB	397	36	op	0.00	0.00	0.00	0.00	-
Esperanza Wash Br SB	1,751	36	op	0.00	0.00	0.00	0.00	-
Continental TI OP NB	1,754	39	op	18.68	17.94	0.00	0.00	-
Continental TI OP SB	1,755	39	op	17.70	16.88	0.00	0.00	-
								0.00

Structure Name (A209)	Structure # (N8)	Milepost (A232)	Type	N10 or N10two	N54b	N54 only UP	N10 only UP	minimum
Segment 5								
Esperanza Blvd TI NB	1,354	41	op	17.39	17.17	0.00	0.00	-
Esperanza Blvd TI SB	1,355	41	op	15.50	15.08	0.00	0.00	-
Duval Mine Rd TI UP	2,800	43	up	17.56	16.78	16.78	17.56	16.78
Anaconda Pipe OP NB	1,568	44	op	10.72	10.92	0.00	0.00	-
Anaconda Pipe OP SB	1,569	44	op	11.92	11.92	0.00	0.00	-
Quartz Wash Br NB	1,570	45	op	0.00	0.00	0.00	0.00	-
Quartz Wash Br SB	1,571	45	op	0.00	0.00	0.00	0.00	-
El Toro Rd OP NB	1,572	46	op	25.94	23.43	0.00	0.00	-
El Toro Rd OP SB	1,573	46	op	26.23	23.50	0.00	0.00	-
Helmet Peak TI UP	1,356	47	up	17.36	16.81	16.81	17.36	16.81
Pima Mine TI OP NB	1,303	50	op	25.88	25.36	0.00	0.00	-
Pima Mine TI OP SB	1,304	50	op	25.12	24.91	0.00	0.00	-
Pima OP NB	1,305	53	op	0.00	0.00	0.00	0.00	-
Pima OP SB	1,306	53	op	0.00	0.00	0.00	0.00	-
Papago Res TI OP NB	1,307	54	op	15.38	15.38	0.00	0.00	-
Papago Res TI OP SB	1,308	54	op	15.29	15.29	0.00	0.00	-
San Xavier OP NB	1,241	56	op	14.46	14.46	0.00	0.00	-
San Xavier OP SB	1,242	56	op	15.98	15.98	0.00	0.00	-
Santa Cruz Riv Br NB	1,243	57	op	0.00	0.00	0.00	0.00	-
Santa Cruz Riv Br SB	1,244	57	op	0.00	0.00	0.00	0.00	-
San Xavier TI OP NB	1,245	57	op	15.65	15.34	0.00	0.00	-
San Xavier TI OP SB	1,246	57	op	15.72	15.44	0.00	0.00	-
								16.78
Segment 6								
Bridge SB	1,248	58	op	0.00	0.00	0.00	0.00	-
Bridge NB	1,247	58	op	0.00	0.00	0.00	0.00	-
Valencia Road TI UP	1,943	59	up	18.83	17.75	17.75	18.83	17.75
Drexel Road UP	1,120	60	up	17.69	16.56	16.56	17.69	16.56
Airport Wash Br NB	1,121	60	op	0.00	0.00	0.00	0.00	-
Airport Wash Br SB	1,122	60	op	0.00	0.00	0.00	0.00	-
Irvington Rd TI UP	1,123	61	up	16.88	16.16	16.16	16.88	16.16
Pedestrian UP	1,124	61	up	17.16	17.10	17.10	17.16	17.10
Ajo Way UP	1,125	62	up	16.82	15.98	15.98	16.82	15.98
Julian Wash Bridge SB	2,595	63	op	16.90	16.91	0.00	0.00	-
Julian Wash Bridge NB	2,596	63	op	15.45	15.45	0.00	0.00	-
								15.98

Appendix D: Needs Analysis Contributing Factors and Scores

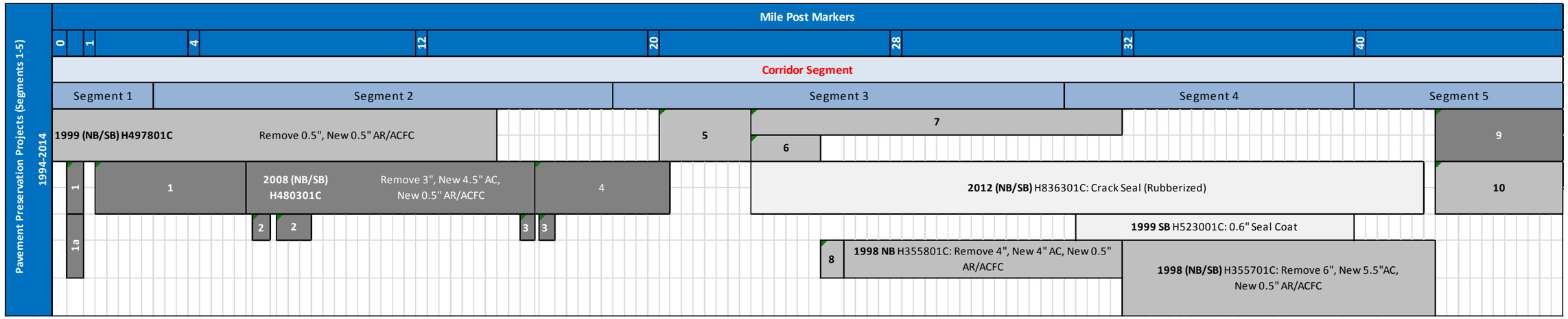
Pavement Performance Area - Needs Analysis Step 1

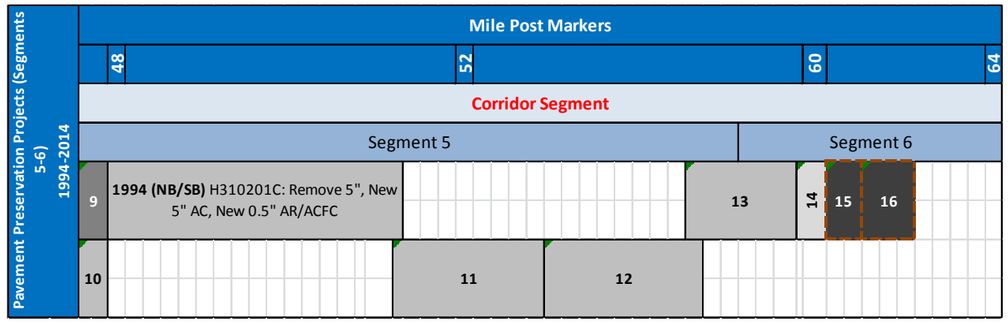
Segment	Segment Length (miles)	Segment Mileposts (MP)	Facility Type	Pavement Index			Directional PSR					% Pavement Failure			Initial Need
				Performance Score	Performance Objective	Level of Need	Performance Score		Performance Objective	Level of Need		Performance Score	Performance Objective	Level of Need	
							NB	SB		NB	SB				
19-1	3	0-3	Interstate	4.03	Fair or Better	None	3.72	3.96	Fair or Better	None	None	16.7%	Fair or Better	Medium	Low
19-2	15	3-18	Interstate	4.39	Fair or Better	None	4.28	4.26	Fair or Better	None	None	3.3%	Fair or Better	None	Low
19-3	12	18-36	Interstate	3.57	Fair or Better	None	3.74	3.90	Fair or Better	None	None	0.0%	Fair or Better	None	Low
19-4	10	32-54	Interstate	3.54	Fair or Better	Low	3.76	3.90	Fair or Better	None	None	0.0%	Fair or Better	None	Low
19-5	17	54-71	Interstate	4.08	Fair or Better	None	3.97	4.02	Fair or Better	None	None	0.0%	Fair or Better	None	None
19-6	7	71-82	Interstate	3.61	Fair or Better	None	3.54	3.57	Fair or Better	Low	None	18.8%	Fair or Better	Medium	Low

Pavement Performance Area – Needs Analysis Step 2

Segment	Segment Length (miles)	Segment Mileposts (MP)	Final Need	Historical Investment	Contributing Factors and Comments
1	3	0 - 3	Low	Medium	Failure hot spot NB (MP 0-1); Medium level of historical investment; Project is programmed in FY 15 should mitigate issues
2	15	3 - 18	Low	High	Failure hot spot NB (MP 17-18); High level of historical investment; Project is programmed in FY 15 should mitigate issues
3	12	18 - 30	None	Low	
4	9	30 - 40	Low	High	Failure hot spot NB (MP 32-33) and SB (MP 39-40); Medium level of previous investment; PECOS data shows high level of maintenance costs which push 'Historical Investment Level' from 'Medium' to 'High'; Project is programmed in FY 19 should mitigate issues
5	18	40 - 57	None		
6	7	57 - 65	Low	High	Failure hot spot NB and SB (MP 62-63); High level of historical investment; No future projects currently programmed

I-19 Pavement History





Legend

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

Pavement Treatment Reference Numbers

1. 2007 (NB/SB) H636701C: .26 -.27 Remove 3.5", New 3" AC New 2" AR - AC, New 0.5" AR/ACFC

1a. 2007 (NB/SB) H636701C: .27 -.35 Remove 2", New 2" AR-AC New 0.5" AR/ACFC

2. 2003 (SB) H625401C: 6-6.3 Remove 2", New 2" AC,

3. 1996 (NB) H322801C: Remove 4**",** 6.5" AC, New 0.5" AR?ACFC

4. 1996 (NB/SB) H322801C: Remove 3.25", New 5.75" AC, New 0.5" AR/ACFC

5. 1998 (NB/SB) H379801C: Remove 4", New 4" AC, New 0.5" AR/ACFC

6. 1998 (NB) H355801C: Remove 4", New 4" AC, New " AC/ARACFC

7. 1998 (SB) H355801C: Remove 4" New 4" AC, New 4" AR/ACFC

8. 1998 (NB) H355801C: Remove 6.5**",** New 4" AC, New 0.5" AR/ACFC

9. 1994 (NB/SB) H310201C: New 2" AC, New 0.5" AR/ACFC:

10. 1994 (NB/SB) H310201C: Remove 3.5", New 5.5" AC, New 0.5" AR/ACFC

11. 2001 (NB/SB) H480401C: Remove 4.5", New 4" AC, New 2" AR-AC, New 0.5" AR/ACFC

12. 2001 (NB/SB) H480401C: New 1" AR/ACFC

13. 2002 (NB/SB) H260901C: Remove 0.5", New 0.5" AR/ACFC

14. 2006 (NB/SB) H659501C: New 1" Recycled AC Overlay

15. 2005 (NB/SB) H319003C: New 4" AC New 15.25" PCCP

16. 2005 (NB/SB) H661301C: New 4" AC New 15.25" PCCP

Pavement Historical Investment Levels

Segment Number													
Value	Level	1		2		3		4		5		6	
		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						70%	95%	100%		20%		10%
1													
1													
1													
1													
3	L2		100%		70%	70%		20%	20%		30%		40%
3						30%			80%		40%		
3						25%	50%				20%		
3						5%					20%		
3											10%		
4	L3		50%		30%						30%		
4			5%	25%	40%								
4			5%	10%	30%								
4													
4													
6	L4												50%
6													
6													
6													
6													
Sub-Total		0	5.4	1.4	6.1	3.9	2.2	1.55	4	0	5	0	4.3
Total		**5.4**		**6.8**		**4.15**		**4.775**		**5**		**4.3**	

Pavement Historical Investment

Segment	Segment Length (miles)	Segment Mileposts (MP)	Pavement History Value (bid projects)	Pavement History Score (bid projects)	Bid History Investment	PeCos ($/mile/yr)	PeCos Score	PeCos History Investment	Resulting Historical Investment
1	11	0-11	4.80	-0.52	Medium	$46.86	-0.89	Low	Medium
2	32	11-43	6.80	0.49	High	$2,331.74	-0.34	Medium	High
3	12	43-55	4.15	-0.84	Low	$2,219.16	-0.37	Medium	Low
4	19	55-74	4.78	-0.53	Medium	$21,684.40	4.33	High	High
5	6	74-80	5.00	-0.41	Medium	$4,357.66	0.15	High	High
6	18	80-98	5.68	-0.07	Medium	$7,994.26	1.03	High	High

Pavement Performance Area- Needs Analysis Step 3

Segment	Segment Length (miles)	Segment Mileposts (MP)	Final Need	Historical Investment	Contributing Factors and Comments
1	3	0 - 3	Low	Medium	Failure hot spot NB (MP 0-1); Medium level of historical investment; Project is programmed in FY 15 should mitigate issues
2	15	3 - 18	Low	High	Failure hot spot NB (MP 17-18); High level of historical investment; Project is programmed in FY 15 should mitigate issues
3	12	18 - 30	None	Low	
4	9	30 - 40	Low	High	Failure hot spot NB (MP 32-33) and SB (MP 39-40); Medium level of previous investment; PECOS data shows high level of maintenance costs which push 'Historical Investement Level' from 'Medium' to 'High'; Project is programmed in FY 19 should mitigate issues
5	18	40 - 57	None		
6	7	57 - 65	Low	Medium	Failure hot spot NB and SB (MP 62-63); Medium level of historical investment; No future projects currently programmed

Bridge Performance Area - Needs Analysis Step 1

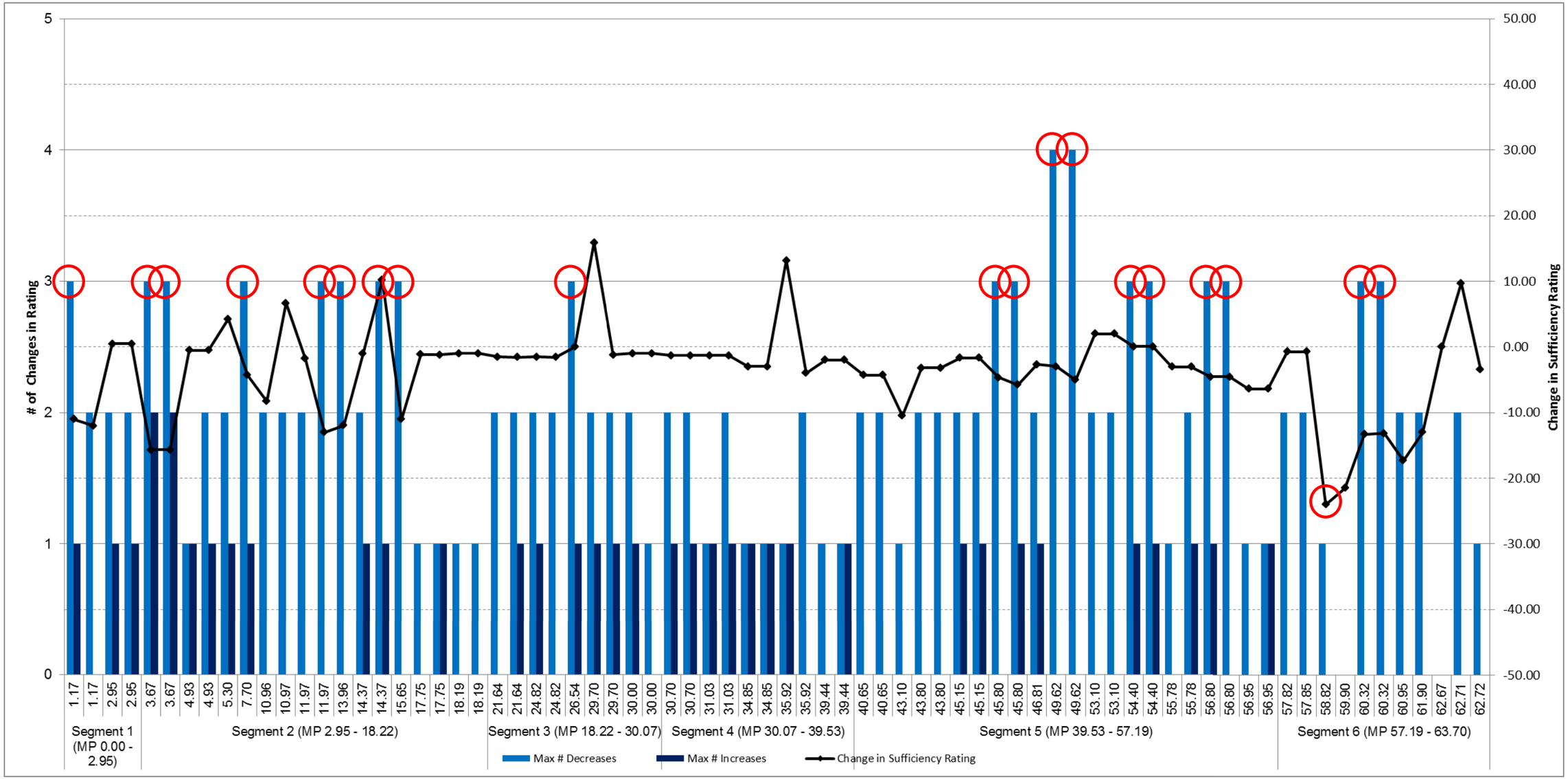
Segment	Segment Length (miles)	Segment Mileposts (MP)	Number of Bridges in Segment	Bridge Index			Bridge Rating			Bridge Sufficiency			% Functionally Obsolete Bridges			Initial Need
				Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	Performance Score	Performance Objective	Level of Need	
19-1	3	0-3	4	5.98	Fair or Better	Low	5	Fair or Better	Low	90.0	Fair or Better	None	100.0%	Fair or Better	High	Low
19-2	15	3-18	18	5.79	Fair or Better	Low	5	Fair or Better	Low	92.2	Fair or Better	None	27.3%	Fair or Better	Low	Low
19-3	12	18-30	9	6.18	Fair or Better	None	6	Fair or Better	None	93.1	Fair or Better	None	19.7%	Fair or Better	None	Low
19-4	9	30-40	10	6.60	Fair or Better	None	6	Fair or Better	None	95.4	Fair or Better	None	15.7%	Fair or Better	None	Low
19-5	18	40-57	22	5.30	Fair or Better	Medium	4	Fair or Better	Medium	90.9	Fair or Better	None	21.3%	Fair or Better	Low	Medium
19-6	7	57-64	11	6.06	Fair or Better	None	5	Fair or Better	Low	77.4	Fair or Better	None	19.4%	Fair or Better	None	Low

Bridge Performance Area – Needs Analysis Step 2

Segment	Segment Length (Miles)	Segment Mileposts (MP)	Number of Bridges in Segment	# Functionally Obsolete Bridges	Final Need	Contributing Factors			Comments
						Bridge	Current Ratings	Historical Review	
19-1	3	0 - 3	4	4	Medium	**Western Ave TI OP NB (#1545) (MP 1.17)**	Superstructure Rating of 5	Could have a repetitive insevtment issue	
						Western Ave TI OP SB (#1546) (MP 1.17)	Deck and Superstructure Ratings of 5	This structure was not identified in historical review	
19-2	15	3 - 18	18	4	Low	**Pajarito Rd OP NB (#1298) (MP 3.67)**	Superstructure Rating of 5	Could have a repetitive insevtment issue	
						Pajarito Rd OP SB (#1299) (MP 3.67)	Superstructure Rating of 5	Could have a repetitive insevtment issue	
						Ruby Road TI UP (#1240) (MP 7.70)	No Current Ratings less than 6	Could have a repetitive insevtment issue	
						Rio Rico EB TI UP (#933) (MP 10.96)	Deck and Superstructure Ratings of 5	This structure was not identified in historical review	Listed for imporvement in the Unified Nogales Santa Cruz County Transportation Plan.
						Agua Fria Cyn Br NB (#353) (MP 11.97)	Deck and Superstructure Ratings of 5	This structure was not identified in historical review	
						Agua Fria Cyn Br SB (#906) (MP 11.97)	Deck, Superstructure, and Substructure Ratings of 5	Could have a repetitive insevtment issue	
						Peck Canyon TI UP (#935) (MP 13.96)	Superstructure Rating of 5	Could have a repetitive insevtment issue	Listed for imporvement in the Unified Nogales Santa Cruz County Transportation Plan.
						Peck Cyn Wash Br SB (#354) (MP 14.37)	No Current Ratings less than 6	Could have a repetitive insevtment issue	
						Palo Parado TI UP (#937) (MP 15.65)	Deck and Superstructure Ratings of 5	Could have a repetitive insevtment issue	
19-3	12	18 - 30	9	1	None	**Agua Linda TI UP (#1739) (MP 26.54)**	No Current Ratings less than 6	Could have a repetitive insevtment issue	
19-4	9	30 - 40	10	2	None	No bridges with current ratings less than 6 and no historical issues			

Segment	Segment Length (Miles)	Segment Mileposts (MP)	Number of Bridges in Segment	# Functionally Obsolete Bridges	Final Need	Contributing Factors			Comments
						Bridge	Current Ratings	Historical Review	
19-5	18	40 - 57	22	8	High	**El Toro Rd OP NB (#1572) (MP 45.80)**	Deck Rating of 4	Could have a repetitive insevtment issue	Programmed project FY 16
						El Toro Rd OP SB (#1576) (MP 45.80)	Deck Rating of 4	Could have a repetitive insevtment issue	
						Sahurita Rd TI UP (#1356) (MP 46.81)	Deck Rating of 5	This structure was not identified in historical review	Identified for reconstruction in PAG 2040 RTP
						Pima Mine TI OP NB (#1303) (MP 49.62)	Deck Rating of 4	Could have a repetitive insevtment issue	Programmed project FY 16
						Pima Mine TI OP SB (#1304) (MP 49.62)	Deck Rating of 4	Could have a repetitive insevtment issue	
						Papago Res TI OP NB (#1307) (MP 54.40)	No Current Ratings less than 6	Could have a repetitive insevtment issue	Identified for reconstruction in I-19 Corridor Study
						Papago Res TI OP SB (#1308) (MP 54.40)	No Current Ratings less than 6	Could have a repetitive insevtment issue	
						Santa Cruz River Br NB (#1243) (MP 56.80)	Deck Rating of 4	Could have a repetitive insevtment issue	Programmed project FY 16
						Santa Cruz River Br SB (#1244) (MP 56.80)	Deck Rating of 4	Could have a repetitive insevtment issue	
19-6	7	57 - 64	11	2	Low	**Valencia Rd TI UP (#1943) (MP 58.82)**	No Current Ratings less than 6	Could have a repetitive insevtment issue	
						Drexel Rd UP (#1120) (MP 59.90)	Deck Rating of 5	Could have a repetitive insevtment issue	Listed for reconstruction in I-19 San Xavier to I-10 DCR
						Airport Wash Br NB (#1121) (MP 60.32)	Deck and Superstructure Ratings of 5	Could have a repetitive insevtment issue	
						Airport Wash Br SB (#1122) (MP 60.32)	Deck and Superstructure Ratings of 5	Could have a repetitive insevtment issue	
						Irvington Rd TI UP (#1123) (MP 60.95)	Deck and Superstructure Ratings of 5	This structure was not identified in historical review	Listed for reconstruction in I-19 San Xavier to I-10 DCR
						Ajo Way UP (#1125) (MP 61.90)	Deck Rating of 5	This structure was not identified in historical review	Programmed project FY 18

I-19 Bridge History



Maximum # 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 # 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)

○ Indicates the bridge is of concern from a historical rating perspective

Bridge Performance Area – Needs Analysis Step 3

Segment	Segment Length (Miles)	Segment Mileposts (MP)	Number of Bridges in Segment	# Functionally Obsolete Bridges	Final Need	Contributing Factors			Comments
						Bridge	Current Ratings	Historical Review	
19-1	3	0 - 3	4	4	Medium	**Western Ave TI OP NB (#1545) (MP 1.17)**	Superstructure Rating of 5	Could have a repetitive insevtment issue	
						Western Ave TI OP SB (#1546) (MP 1.17)	Deck and Superstructure Ratings of 5	This structure was not identified in historical review	
19-2	15	3 - 18	18	4	Low	**Pajarito Rd OP NB (#1298) (MP 3.67)**	Superstructure Rating of 5	Could have a repetitive insevtment issue	
						Pajarito Rd OP SB (#1299) (MP 3.67)	Superstructure Rating of 5	Could have a repetitive insevtment issue	
						Ruby Road TI UP (#1240) (MP 7.70)	No Current Ratings less than 6	Could have a repetitive insevtment issue	
						Rio Rico EB TI UP (#933) (MP 10.96)	Deck and Superstructure Ratings of 5	This structure was not identified in historical review	Listed for imporvement in the Unified Nogales Santa Cruz County Transportation Plan.
						Agua Fria Cyn Br NB (#353) (MP 11.97)	Deck and Superstructure Ratings of 5	This structure was not identified in historical review	
						Agua Fria Cyn Br SB (#906) (MP 11.97)	Deck, Superstructure, and Substructure Ratings of 5	Could have a repetitive insevtment issue	
						Peck Canyon TI UP (#935) (MP 13.96)	Superstructure Rating of 5	Could have a repetitive insevtment issue	Listed for imporvement in the Unified Nogales Santa Cruz County Transportation Plan.
						Peck Cyn Wash Br SB (#354) (MP 14.37)	No Current Ratings less than 6	Could have a repetitive insevtment issue	
						Palo Parado TI UP (#937) (MP 15.65)	Deck and Superstructure Ratings of 5	Could have a repetitive insevtment issue	
19-3	12	18 - 30	9	1	None	**Agua Linda TI UP (#1739) (MP 26.54)**	No Current Ratings less than 6	Could have a repetitive insevtment issue	
19-4	9	30 - 40	10	2	None	No bridges with current ratings less than 6 and no historical issues			

Segment	Segment Length (Miles)	Segment Mileposts (MP)	Number of Bridges in Segment	# Functionally Obsolete Bridges	Final Need	Contributing Factors			Comments
						Bridge	Current Ratings	Historical Review	
19-5	18	40 - 57	22	8	High	**El Toro Rd OP NB (#1572) (MP 45.80)**	Deck Rating of 4	Could have a repetitive insevtment issue	Programmed project FY 16
						El Toro Rd OP SB (#1576) (MP 45.80)	Deck Rating of 4	Could have a repetitive insevtment issue	
						Sahurita Rd TI UP (#1356) (MP 46.81)	Deck Rating of 5	This structure was not identified in historical review	Identified for reconstruction in PAG 2040 RTP
						Pima Mine TI OP NB (#1303) (MP 49.62)	Deck Rating of 4	Could have a repetitive insevtment issue	Programmed project FY 16
						Pima Mine TI OP SB (#1304) (MP 49.62)	Deck Rating of 4	Could have a repetitive insevtment issue	
						Papago Res TI OP NB (#1307) (MP 54.40)	No Current Ratings less than 6	Could have a repetitive insevtment issue	Identified for reconstruction in I-19 Corridor Study
						Papago Res TI OP SB (#1308) (MP 54.40)	No Current Ratings less than 6	Could have a repetitive insevtment issue	
						Santa Cruz River Br NB (#1243) (MP 56.80)	Deck Rating of 4	Could have a repetitive insevtment issue	Programmed project FY 16
						Santa Cruz River Br SB (#1244) (MP 56.80)	Deck Rating of 4	Could have a repetitive insevtment issue	
19-6	7	57 - 64	11	2	Low	**Valencia Rd TI UP (#1943) (MP 58.82)**	No Current Ratings less than 6	Could have a repetitive insevtment issue	
						Drexel Rd UP (#1120) (MP 59.90)	Deck Rating of 5	Could have a repetitive insevtment issue	Listed for reconstruction in I-19 San Xavier to I-10 DCR
						Airport Wash Br NB (#1121) (MP 60.32)	Deck and Superstructure Ratings of 5	Could have a repetitive insevtment issue	
						Airport Wash Br SB (#1122) (MP 60.32)	Deck and Superstructure Ratings of 5	Could have a repetitive insevtment issue	
						Irvington Rd TI UP (#1123) (MP 60.95)	Deck and Superstructure Ratings of 5	This structure was not identified in historical review	Listed for reconstruction in I-19 San Xavier to I-10 DCR
						Ajo Way UP (#1125) (MP 61.90)	Deck Rating of 5	This structure was not identified in historical review	Programmed project FY 18

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		EB	WB	NB	SB		NB	SB
19-1	0-3	3	Urban	Interrupted	0.16	Fair or Better	None	0.19	Fair or Better	None	0.12	0.11	Fair or Better	None	None	0.27	0.20	Fair or Better	None	None
19-2	3-18	15	Rural	Uninterrupted	0.32	Fair or Better	None	0.39	Fair or Better	None	0.19	0.20	Fair or Better	None	None	0.22	0.17	Fair or Better	None	None
19-3	18-30	12	Rural	Interrupted	0.26	Fair or Better	None	0.32	Fair or Better	None	0.17	0.17	Fair or Better	None	None	0.30	0.17	Fair or Better	None	None
19-4	30-40	9	Urban	Uninterrupted	0.34	Fair or Better	None	0.41	Fair or Better	None	0.23	0.23	Fair or Better	None	None	0.20	0.02	Fair or Better	None	None
19-5	40-57	18	Urban	Uninterrupted	0.56	Fair or Better	None	0.66	Fair or Better	None	0.35	0.36	Fair or Better	None	None	0.25	0.15	Fair or Better	None	None
19-6	**57-64**	**7**	**Urban**	**Uninterrupted**	**1.01**	**Fair or Better**	**High**	**1.21**	**Fair or Better**	**High**	**0.78**	**0.76**	**Fair or Better**	**Low**	**None**	**0.25**	**0.04**	**Fair or Better**	**None**	**None**
Mobility Emphasis Area		Yes	Weighted Average		0.45	Good	None													

Segment	Segment Mileposts	Segment Length (miles)	Environment Type	Facility Operation	Directional TTI (all vehicles)					Directional PTI (all vehicles)					Bicycle Accommodation			Initial Need
					Performance Score		Performance Objective	Level of Need		Performance Score		Performance Objective	Level of Need		Performance Score	Performance Objective	Level of Need	
					NB	SB		EB	WB	NB	SB		EB	WB				
19-1	0-3	3	Urban	Interrupted	1.40	1.01	Fair or Better	None	None	2.28	1.30	Fair or Better	None	None	90%	Fair or Better	None	Low
19-2	3-18	15	Rural	Uninterrupted	1.16	1.13	Fair or Better	None	None	1.25	1.22	Fair or Better	None	None	100%	Fair or Better	None	Low
19-3	18-30	12	Rural	Interrupted	1.58	1.10	Fair or Better	Low	None	2.50	1.17	Fair or Better	None	None	100%	Fair or Better	None	Low
19-4	30-40	9	Urban	Uninterrupted	1.06	1.06	Fair or Better	None	None	1.08	1.12	Fair or Better	None	None	100%	Fair or Better	None	Low
19-5	40-57	18	Urban	Uninterrupted	1.06	1.07	Fair or Better	None	None	1.11	1.12	Fair or Better	None	None	100%	Fair or Better	None	Low
19-6	57-64	7	Urban	Uninterrupted	1.00	1.04	Fair or Better	None	None	1.03	1.12	Fair or Better	None	None	95%	Fair or Better	None	High

Segment	Segment Mileposts (MP)	Segment Length (miles)	Refined Need	Roadway Variables								Traffic Variables					Relevant Mobility Related Existing Infrastructure
				Functional Classification	Environmental Type (Urban/Rural)	Terrain	# of Lanes/ Direction	Speed Limit	Aux Lanes	Divided/ Non-Divided	% No Passing	Existing LOS	Future 2035 LOS	% Trucks	NB Buffer Index (PTI-TTI)	SB Buffer Index (PTI-TTI)	
19-1	0-3	3	None	Interstate	FringeUrban	Rolling	2	25-65	None	Both	0%	A-C	A-C	7%	0.88	0.29	1/4 mile non-divived in Nogales
19-2	3-18	15	None	Interstate	Rural	Level	2	75	None	Divided	0%	A/B	A/B	8%	0.09	0.09	None
19-3	18-30	12	Low	Interstate	Rural	Level	2	75	None	Divided	0%	A/B	A/B	11%	0.92	0.06	None
19-4	30-40	9	None	Interstate	FringeUrban	Level	2	65-75	None	Divided	0%	A-C	A-C	13%	0.03	0.06	None
19-5	40-57	18	None	Interstate	FringeUrban	Level	2	65-75	None	Divided	0%	A-C	A-C	14%	0.05	0.07	None
19-6	57-64	7	High	Interstate	Urban	Level	2	55-65	None	Divided	0%	A-C	E/F	7%	0.03	0.10	3 lanes each directon between Ajo (SR 86) TI and I-19/I-10 Interchange

Mobility Performance Area – Needs Analysis Step 2

Segment	Segment Mileposts (MP)	Segment Length (miles)	Refined Need	Closure Extent									Non-Actionable Conditions	Contributing Factors
				Total Number of Closures	# of Closures	% Closures	# Incidents/ Accidents	% Incidents/ Accidents	# Obstructions/ Hazards	% Obstructions/ Hazards	# Weather Related	% Weather Related		
19-1	0-3	3	None	6	0	0%	5	83%	0	0%	1	17%	1/4 mile of Non-freeway urban section	• Urban portion of I-19 within Nogales, beginning as a low-speed non-divided cross-section and transitioning to a higher-speed controlled access 4-lane interstate. • Existing and future traffic LOS is good, but the urban environment and rolling terrain may contribute to accident and weather-related closures. • High deficiencies in northbound TTI and PTI are likely related to lower posted speed limits on the non-divided section.
19-2	3-18	15	None	30	0	0%	29	97%	1	3%	0	0%	None	• Elevated incident/accident-related closures not sufficient to lower the TTI/PTI, but may be associated with periodic congestion at I-19/US 189 TI.
19-3	18-30	12	Low	9	0	0%	7	78%	2	22%	0	0%	Border Checkpoint in NB direction	• Elevated northbound TTI/PTI Need related to Border Patrol checkpoint near Tubac causes temporary delays and slower average speeds for length of segment. Non-actionable condition. • 78% of closures related to incidents/accidents.
19-4	30-40	9	None	12	1	8%	10	83%	1	8%	0	0%	None	• No reported performance deficiencies. • 83% of closures incidents/accidents-related.
19-5	40-57	18	None	42	0	0%	42	100%	0	0%	0	0%	None	• Elevated number of closures 100% incident/accident-related • Multiple TI and ramp improvement projects planned for near-term expected to help maintain acceptable LOS and reduce accidents.
19-6	57-64	7	High	21	7	33%	14	67%	0	0%	0	0%	None	• High Mobility Index performance Need, based on heavy northbound flows entering Tucson urban area. • Congested levels existing peak hour V/C and future daily V/C. • The number of weekdays vs. weekend days in which traffic volumes exceed acceptable LOS are nearly equal. There is no spike in traffic that can be attributed to work-related (week day) or recreational (weekend) traffic. • 67% of closures incidents/accidents-related, with 33% unidentified. May be related to increased congestion in urban area.

Mobility Performance Area – Needs Analysis Step 3

Segment	Segment Mileposts (MP)	Segment Length (miles)	Refined Need	Roadway Variables								Traffic Variables				
				Functional Classification	Environmental Type (Urban/Rural)	Terrain	# of Lanes/ Direction	Speed Limit	Aux Lanes	Divided/ Non-Divided	% No Passing	Existing LOS	Future 2035 LOS	% Trucks	NB Buffer Index (PTI-TTI)	SB Buffer Index (PTI-TTI)
19-1	0-3	3	None	Interstate	FringeUrban	Rolling	2	25-65	None	Both	0%	A-C	A-C	7%	0.88	0.29
19-2	3-18	15	None	Interstate	Rural	Level	2	75	None	Divided	0%	A/B	A/B	8%	0.09	0.09
19-3	18-30	12	Low	Interstate	Rural	Level	2	75	None	Divided	0%	A/B	A/B	11%	0.92	0.06
19-4	30-40	9	None	Interstate	FringeUrban	Level	2	65-75	None	Divided	0%	A-C	A-C	13%	0.03	0.06
19-5	40-57	18	None	Interstate	FringeUrban	Level	2	65-75	None	Divided	0%	A-C	A-C	14%	0.05	0.07
19-6	57-64	7	High	Interstate	Urban	Level	2	55-65	None	Divided	0%	A-C	E/F	7%	0.03	0.10
XX-7	0	0	0												0.00	0.00

Segment	Segment Mileposts (MP)	Segment Length (miles)	Refined Need	Closure Extent									Non-Actionable Conditions	Contributing Factors
				Total Number of Closures	# of Closures	% Closures	# Incidents/ Accidents	% Incidents/ Accidents	# Obstructions/ Hazards	% Obstructions/ Hazards	# Weather Related	% Weather Related		
19-1	0-3	3	None	6	0	0%	5	83%	0	0%	1	17%	1/4 mile of Non-freeway urban section	• Urban portion of I-19 within Nogales, beginning as a low-speed non-divided cross-section and transitioning to a higher-speed controlled access 4-lane interstate. • Existing and future traffic LOS is good, but the urban environment and rolling terrain may contribute to accident and weather-related closures. • High deficiencies in northbound TTI and PTI are likely related to lower posted speed limits on the non-divided section.
19-2	3-18	15	None	30	0	0%	29	97%	1	3%	0	0%	None	• Elevated incident/accident-related closures not sufficient to lower the TTI/PTI, but may be associated with periodic congestion at I-19/US 189 TI.
19-3	18-30	12	Low	9	0	0%	7	78%	2	22%	0	0%	Border Checkpoint in NB direction	• Elevated northbound TTI/PTI Need related to Border Patrol checkpoint near Tubac causes temporary delays and slower average speeds for length of segment. Non-actionable condition. • 78% of closures related to incidents/accidents.
19-4	30-40	9	None	12	1	8%	10	83%	1	8%	0	0%	None	• No reported performance deficiencies. • 83% of closures incidents/accidents-related.
19-5	40-57	18	None	42	0	0%	42	100%	0	0%	0	0%	None	• Elevated number of closures 100% incident/accident-related • Multiple TI and ramp improvement projects planned for near-term expected to help maintain acceptable LOS and reduce accidents.
19-6	57-64	7	High	21	7	33%	14	67%	0	0%	0	0%	None	• High Mobility Index performance Need, based on heavy northbound flows entering Tucson urban area. • Congested levels existing peak hour V/C and future daily V/C. • The number of weekdays vs. weekend days in which traffic volumes exceed acceptable LOS are nearly equal. There is no spike in traffic that can be attributed to work-related (week day) or recreational (weekend) traffic. • 67% of closures incidents/accidents-related, with 33% unidentified. May be related to increased congestion in urban area.

Safety Performance Area – Needs Analysis Step 1

Segment	Operating Environment	Segment Length (miles)	Segment Mileposts (MP)	Safety Index			Safety Index Scale			Directional Safety Index					% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors		
				Performance Score	Performance Objective	Level of Need	None <=	Low <=	High >=	NB Performance Score	SB Performance Score	Performance Objective	NB/WB Level of Need	SB/EB Level of Need	Performance Score	Performance Objective	Level of Need
19-1	Urban 4 Lane Freeway	3	0-3	1.94	Average or Better	High	0.93	1.07	1.35	1.99	1.90	Average or Better	High	High	*Insufficient Data*	Average or Better	N/A
19-2	Urban 4 Lane Freeway	15	3-18	1.33	Average or Better	Medium	0.93	1.07	1.35	1.34	1.32	Average or Better	Medium	Medium	59%	Average or Better	Medium
19-3	Rural 4 Lane Freeway with Daily Volume < 25,000	12	18-30	1.36	Average or Better	Medium	0.91	1.09	1.45	1.59	1.12	Average or Better	High	Medium	33%	Average or Better	None
19-4	Urban 4 Lane Freeway	9	30-40	0.52	Average or Better	None	0.93	1.07	1.35	0.59	0.44	Average or Better	None	None	44%	Average or Better	None
19-5	Urban 4 Lane Freeway	18	40-57	1.48	Average or Better	High	0.93	1.07	1.35	2.11	0.86	Average or Better	High	None	39%	Average or Better	None
19-6	Urban 4 Lane Freeway	7	57-65	1.42	Average or Better	High	0.93	1.07	1.35	0.80	2.04	Average or Better	None	High	53%	Average or Better	Low
Safety Emphasis Area?		Yes	Weighted Corridor Average	1.30	Above Average	High											

Segment	Operating Environment	Segment Length (miles)	Segment Mileposts (MP)	% of Fatal + Incapacitating Injury Crashes Involving Trucks			% of Fatal + Incapacitating Injury Crashes Involving Trucks Scale			% of Fatal + Incapacitating Injury Crashes Involving Motorcycles			% of Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers			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	
19-1	Urban 4 Lane Freeway	3	0-3	8%	Average or Better	None	8%	9%	12%		Average or Better			Average or Better		High
19-2	Urban 4 Lane Freeway	15	3-18	*Insufficient Data*	Average or Better	N/A	8%	9%	12%		Average or Better			Average or Better		High
19-3	Rural 4 Lane Freeway with Daily Volume < 25,000	12	18-30	15%	Average or Better	Low	14%	15%	18%		Average or Better			Average or Better		High
19-4	Urban 4 Lane Freeway	9	30-40	11%	Average or Better	Medium	8%	9%	12%		Average or Better			Average or Better		Low
19-5	Urban 4 Lane Freeway	18	40-57	35%	Average or Better	High	8%	9%	12%		Average or Better			Average or Better		N/A
19-6	Urban 4 Lane Freeway	7	57-65	17%	Average or Better	High	8%	9%	12%		Average or Better			Average or Better		N/A

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)
1	3	0 - 3	High	None	None	High	Planned I-19, I-19B Terminus to West Street - Roadway Improvements for Future Capacity I-19 and Mariposa TI reconfiguration
2	15	3 - 18	High	SB MP 9	None	High	Planned I-19, SR 189/Mariposa Road TI to Tumacocori TI – Roadway Improvements for Future Capacity I-19, Exit 22 (Peck Canyon Rd) to Exit 48 (Arivaca Road) – Interchange Improvements I-19 Safety Corridor Improvements MP 8.4 - 9.4
3	12	18 - 30	High	None	None	High	Programmed (FY 2015) Canoa Shooulders - Construct Shoulder Widening
4	10	30 - 40	None	NB MP 31, 33, 39	Ongoing Pavement Preservation MP 31.8-42.5	Low	Nothing planned or programmed in this segment
5	17	40 - 57	High	NB MP 43, 45, 53, 56 SB MP 47, 54	None	High	Planned Esperanza, Duval Mine Rd, Helmet Peak, Pima Mine Rd, Papago TI reconstruction projects listed in various planning documents Widen to six lanes MP 39 - 58 in PAG 2040 RTP
6	7	57 - 64	High	NB MP 58, 59, 61 SB MP 61	None	High	Programmed Ajo Way TI - Reconstruct TI and Mainline (2015, 2018) Irvington Road and I-19 – Design and reconstruct new TI (SPUI) Planned Capacity expansion planned entire segment listed in various planning documents Reconstruct I-19 to four lanes in each direction between San Xavier Road and I-10 (I-19 DCR) All interchanges planned for upgrade

Safety Performance Area – Needs Analysis Step 3

		1	2	3	4	5	6	Corridor-Wide Crash Characteristics
Segment Number		1	2	3	4	5	6	
Segment Length (miles)		3	15	12	10	17	7	
Segment Milepost (MP)		0 - 3	3 - 18	18 - 30	30 - 40	40 - 57	57 - 64	
Final Need		High	High	High	Low	High	High	
Segment Crash Overview		**2** Crashes were fatal **1** Crashes had incapacitating injuries **0** Crashes involve trucks	**10** Crashes were fatal **12** Crashes had incapacitating injuries **4** Crashes involve trucks	**5** Crashes were fatal **7** Crashes had incapacitating injuries **0** Crashes involve trucks	**2** Crashes were fatal **7** Crashes had incapacitating injuries **1** Crashes involve trucks	**18** Crashes were fatal **13** Crashes had incapacitating injuries **3** Crashes involve trucks	**8** Crashes were fatal **11** Crashes had incapacitating injuries **1** Crashes involve trucks	45 Crashes were fatal 51 Crashes had incapacitating injuries 9 Crashes involve trucks
Segment Crash Summaries (Fatal and Serious Injury Crashes)	**First Harmful Event Type**	33% Involve Collision with Motor Vehicle 33% Involve Collision with Motor Vehicle 33% Involve Collision with Motor Vehicle	55% Involve Overturning 18% Involve Collision with Motor Vehicle 18% Involve Collision with Motor Vehicle	33% Involve Collision with Motor Vehicle 33% Involve Collision with Motor Vehicle 17% Involve Collision with Fixed Object	60% Involve Overturning 40% Involve Collision with Pedestrian 0% Involve Collision with Motor Vehicle	40% Involve Overturning 35% Involve Collision with Motor Vehicle 20% Involve Collision with Fixed Object	38% Involve Collision with Motor Vehicle 31% Involve Collision with Fixed Object 19% Involve Collision with Pedestrian	33% Involve Overturning 32% Involve Collision with Motor Vehicle 20% Involve Collision with Fixed Object
	Collision Type	67% Involve Single Vehicle 33% Involve Rear End 0% Involve Angle	77% Involve Single Vehicle 5% Involve Angle 5% Involve Angle	50% Involve Single Vehicle 17% Involve Rear End 17% Involve Rear End	60% Involve Single Vehicle 40% Involve Other 0% Involve Angle	65% Involve Single Vehicle 15% Involve Rear End 5% Involve Head On	38% Involve Single Vehicle 31% Involve Rear End 25% Involve Other	57% Involve Single Vehicle 18% Involve Rear End 10% Involve Other
	Violation or Behavior	33% Involve Speed too Fast for Conditions 33% Involve Speed too Fast for Conditions 33% Involve Speed too Fast for Conditions	27% Involve Speed too Fast for Conditions 18% Involve No Improper Action 18% Involve No Improper Action	33% Involve No Improper Action 25% Involve Unknown 17% Involve Speed too Fast for Conditions	40% Involve Speed too Fast for Conditions 20% Involve No Improper Action 20% Involve No Improper Action	25% Involve No Improper Action 20% Involve Failure to Keep in Proper Lane 15% Involve Speed too Fast for Conditions	31% Involve Speed too Fast for Conditions 19% Involve Inattention/Distraction 19% Involve Inattention/Distraction	25% Involve Speed too Fast for Conditions 21% Involve No Improper Action 14% Involve Unknown
	Lighting Conditions	100% Occur in Daylight Conditions 0% Occur in Dawn Conditions 0% Occur in Dawn Conditions	59% Occur in Daylight Conditions 36% Occur in Dark-Unlighted Conditions 5% Occur in Dusk Conditions	58% Occur in Dark-Unlighted Conditions 42% Occur in Daylight Conditions 0% Occur in Dawn Conditions	60% Occur in Daylight Conditions 40% Occur in Dark-Unlighted Conditions 0% Occur in Dawn Conditions	75% Occur in Daylight Conditions 25% Occur in Dark-Unlighted Conditions 0% Occur in Dawn Conditions	44% Occur in Daylight Conditions 44% Occur in Daylight Conditions 13% Occur in Dark-Lighted Conditions	58% Occur in Daylight Conditions 35% Occur in Dark-Unlighted Conditions 5% Occur in Dark-Lighted Conditions
	Surface Conditions	67% Involve Dry Conditions 33% Involve Wet Conditions 0% Involve Snow Conditions	77% Involve Dry Conditions 18% Involve Wet Conditions 5% Involve Water (standing or moving) Conditions	75% Involve Dry Conditions 25% Involve Wet Conditions 0% Involve Snow Conditions	100% Involve Dry Conditions 0% Involve Wet Conditions 0% Involve Wet Conditions	100% Involve Dry Conditions 0% Involve Wet Conditions 0% Involve Wet Conditions	88% Involve Dry Conditions 13% Involve Wet Conditions 0% Involve Snow Conditions	88% Involve Dry Conditions 11% Involve Wet Conditions 1% Involve Water (standing or moving) Conditions
	First Unit Event	67% Involve a first unit event of Ran Off the Road (Left) 33% Involve a first unit event of Motor Vehicle in Transport 0% Involve a first unit event of Collision with Animal	27% Involve a first unit event of Ran Off the Road (Left) 27% Involve a first unit event of Ran Off the Road (Left) 18% Involve a first unit event of Motor Vehicle in Transport	42% Involve a first unit event of Motor Vehicle in Transport 33% Involve a first unit event of Equipment Failure 8% Involve a first unit event of Ran Off the Road (Left)	80% Involve a first unit event of Motor Vehicle in Transport 20% Involve a first unit event of Collision with Pedestrian 0% Involve a first unit event of Collision with Animal	30% Involve a first unit event of Ran Off the Road (Left) 25% Involve a first unit event of Motor Vehicle in Transport 25% Involve a first unit event of Motor Vehicle in Transport	50% Involve a first unit event of Motor Vehicle in Transport 13% Involve a first unit event of Ran Off the Road (Left) 13% Involve a first unit event of Ran Off the Road (Left)	34% Involve a first unit event of Motor Vehicle in Transport 23% Involve a first unit event of Ran Off the Road (Left) 17% Involve a first unit event of Equipment Failure
	Driver Physical Condition	33% Under the Influence of Drugs or Alcohol 33% Under the Influence of Drugs or Alcohol 33% Under the Influence of Drugs or Alcohol	45% No Apparent Influence 32% Unknown 14% Under the Influence of Drugs or Alcohol	50% No Apparent Influence 33% Unknown 17% Under the Influence of Drugs or Alcohol	60% Unknown 40% No Apparent Influence 0% Under the Influence of Drugs or Alcohol	75% No Apparent Influence 15% Under the Influence of Drugs or Alcohol 10% Unknown	44% No Apparent Influence 31% Under the Influence of Drugs or Alcohol 25% Unknown	52% No Apparent Influence 26% Unknown 18% Under the Influence of Drugs or Alcohol
	Safety Device Usage	67% Shoulder And Lap Belt Used 33% None Used 0% Child Restraint System Used	41% None Used 36% Shoulder And Lap Belt Used 9% Air Bag Deployed/Shoulder-Lap Belt	58% Shoulder And Lap Belt Used 17% None Used 8% Air Bag Deployed	40% Shoulder And Lap Belt Used 20% None Used 20% None Used	75% Shoulder And Lap Belt Used 15% None Used 10% Air Bag Deployed/Shoulder-Lap Belt	44% Shoulder And Lap Belt Used 19% None Used 19% None Used	53% Shoulder And Lap Belt Used 24% None Used 7% Unknown
Hot Spot Crash Summaries		None	NB MP 9	None	NB MP 30, 33, 38, 39	NB MP 43, 44, 53, 55, 56 SB MP 47, 54	NB MP 58, 59, 61, 62 SB MP 61, 62	
Previously Completed Safety-Related Projects		None	None	None	Pavement Preservation MP 31-42	None	None	
District Interviews/Discussions			Elevated number of crashes due to demographics and age of vehicles	Elevated number of crashes due to demorgraphics and age of vehicles		High number of fatal crashes near Green Valley; increased nubmer of crashes due to alcohol		
Contributing Factors		Insufficent data to determine trends	Single vehicle crashes Vehicle in transport	Single vehicle Traffic control device refelctivity	Traffic control device reflectivity Vehicle in transport Comment: Conoa Shoulders project may help safety	Vehicle in transport Improper lane changes Higher traffic volumes Urban operating conditions Comment: Five planned intersection improvements as well as planed added capacity may help safety	Vehicle in transport Traffic control device refelctivity Improper lane changes Higher traffic volumes Urban operating conditions Comment: Planned and programmed added capacity and TI reconstruction may help safety	

Freight Performance Area – Needs Analysis 1

Segment	Facility Operations	Segment Mileposts (MP)	Segment Length (miles)	Freight Index			Directional TTI (trucks only)					Directional PTI (trucks only)				
				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
19-1	Interrupted	0-3	3	0.46	Fair or Better	None	1.54	1.08	Fair or Better	Low	None	2.37	1.96	Fair or Better	None	None
19-2	Uninterrupted	3-18	15	0.92	Fair or Better	None	1.04	1.04	Fair or Better	None	None	1.09	1.08	Fair or Better	None	None
19-3	Interrupted	18-30	12	0.34	Fair or Better	None	1.43	1.03	Fair or Better	None	None	4.91	1.06	Fair or Better	Low	None
19-4	Uninterrupted	30-40	10	0.95	Fair or Better	None	1.02	1.03	Fair or Better	None	None	1.05	1.06	Fair or Better	None	None
19-5	Uninterrupted	40-57	17	0.94	Fair or Better	None	1.03	1.03	Fair or Better	None	None	1.05	1.06	Fair or Better	None	None
19-6	Uninterrupted	57-64	7	0.88	Fair or Better	None	1.02	1.08	Fair or Better	None	None	1.06	1.20	Fair or Better	None	None
Emphasis Area?	Yes	**Weighted Average**		0.80	Good	None										

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	SB		NB	SB				
19-1	Interrupted	0-3	3	30.03	46.78	Fair or Better	None	None	18.00	Fair or Better	None	Low
19-2	Uninterrupted	3-18	15	45.09	33.78	Fair or Better	None	None	16.15	Fair or Better	Medium	Low
19-3	Interrupted	18-30	12	87.90	53.94	Fair or Better	Low	None	16.13	Fair or Better	Medium	Low
19-4	Uninterrupted	30-40	10	22.82	7.36	Fair or Better	None	None	18.00	Fair or Better	None	Low
19-5	Uninterrupted	40-57	17	39.82	23.75	Fair or Better	None	None	16.78	Fair or Better	None	Low
19-6	Uninterrupted	57-64	7	66.47	22.61	Fair or Better	None	None	15.98	Fair or Better	Medium	Low

Freight Performance Area – Needs Analysis 2

Segment	Segment Length (miles)	Segment Mileposts (MP)	Initial Need	Truck Height Restriction Hot Spots (Clearance < 16')	Relevant Recently Completed or Under Construction Projects (which supersede performance data)*	Final Need
1	3	0-3	Low	None	None	Low
2	15	3-18	Low	None	None	Low
3	12	18-30	Low	None	None	Low
4	10	30-40	None	None	None	None
5	17	40-57	None	None	None	None
6	7	57-64	Low	None	None	Low

Freight Performance Area – Needs Analysis 3

Segment	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Roadway Variables								Traffic Variables					Relevant Freight Related Existing Infrastructure
				Functional Classification	Environmental Type (Urban/Rural)	Terrain	# of Lanes/ Direction	Speed Limit	Aux Lanes	Divided/ Non-Divided	% No Passing	Existing LOS	Future 2035 LOS	% Trucks	NB/EB Buffer Index (TPTI-TTTI)	SB/WB Buffer Index (TPTI-TTTI)	
1	0-3	3	Low	Interstate	Fringe Urban	Rolling	2	25-65	No	Divided	0%	A-C	A-C	7%	0.83	0.88	Mariposa Land Port of Entry in Nogales on SR 189 MP 0.12 DMS
2	3-18	15	Low	Interstate	Rural	Level	2	75	No	Divided	0%	A-C	A-C	8%	0.05	0.04	None
3	18-30	12	Low	Interstate	Rural	Level	2	75	No	Divided	0%	A-C	A-C	11%	3.48	0.03	None
4	30-40	10	None	Interstate	Fringe Urban	Level	2	65-75	No	Divided	0%	A-C	A-C	13%	0.03	0.03	None
5	40-57	17	None	Interstate	Fringe Urban	Level	2	65-75	No	Divided	0%	A-C	A-C	14%	0.02	0.03	None
6	57-64	7	Low	Interstate	Urban	Level	2	55-65	No	Divided	0%	A-C	E/F	7%	0.04	0.12	MP 58.10 DMS

Appendix E: Life-Cycle Cost Analysis

AGUA FRIA CANYON (#906) / I-19 / MP 11.97

Bridge Information	
Bridge Deck Area (A225)	3754 SF
Year Built (N27)	1967
Exp Service Life	75 YR
Total Bridge Length (N49)	92 LF
Number of Spans (N45+N46)	4
Skew Angle (N34)	0 DEG
Average Elevation	3413 FT
Max Pier Height	12 FT
* Amount of Widening for Bridge	4 FT
Revised Deck Area (Bridge Replace)	4122 FT
**Scour Critical Rating (N113)	7

Deterioration Slope

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000480x	-0.175x	5.71
Superstr	y =	-0.000410x	-0.150x	6.68
Deck	y =	-0.000481x	-0.176x	5.70

***Input 0 if no widening. Input should include widening on both sides of bridge if applicable.**

****If scour critical rating is 3 or lower, Option 2 should consider the implementation of scour countermeasures.**

Notes:

1. Widening is intended only to correct lane and/or shoulder width deficiencies. It is not intended for adding traffic capacity (i.e. adding general purpose lanes).

Cost Multipliers		
Elevation > 4000ft	3413	1.00
Pier Height > 30ft	12	1.00
Length to # span ratio	23.00	1.25
Skew > 30degrees	0.00	1.00

L to # Span Multiplier

L/ # Span Ratio	Multiplier
=>100	1.00
=>60	1.10
<60	1.25

Skew Multiplier

Skew	Multiplier
<30	1.00
=>30	1.10

Adjusted Bridge Replace Cost	
Base Bridge Replacement Cost (Per SF)	$125.00
Bridge Replacement Cost w/ Multipliers (Per SF)	$156.25

Elevation Multiplier

Elev	Multiplier
<4000	1.00
=>4000	1.25

Pier H Multiplier

Pier H	Multiplier
<30	1.00
=>30	1.10

User input cell

Only manipulate cell value after consulting with team

Bridge History (Inspections/As-builts)

Description	Category	Year
Bridge was originally built in 1967 (I-19-1(22)).		1967
Additional bank protection was added in 1969 (I-19-1-905).	Rehab (Substr - Scour)	1969
Flood damage repair was performed on the banks in 1983. (19-1(90))	Repair (Substr - Scour)	1983
A scour protection slab was added in 1984. (19-1-916 RD).	Rehab (Substr - Scour)	1984
The barriers were replaced in 1987. (19-1(89)).	Repair (Deck)	1987
Current inspection notes AC wearing surface looks ok, but soffit area has multiple cracks (transverse/longitudinal/random hairline). South		
abutment has narrow to medium sized vertical/horizontal cracks with heavy water stains. North abutment exhibits cracking as well with a		
patched area. Localized scour was aboserved at west end of north abutment.		

Replace / Rehab / Repair Information

BRIDGE DECK

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Deck)	Full Deck Replacement	$78.13	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	$10.00	15	+ 2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	$5.00	10	+ 1
Repair (Deck)	Patch Spalls / Seal Cracks	$3.00	See Deterioration Slope	+ 0
Replace (Bridge)	Full Bridge Replacement	$156.25	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 0
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 0

SUPERSTRUCTURE - STEEL

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Stl)	Full SuperStr Replacement	$78.13	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	$39.06	15	+ 2
Repair (Supr - Stl)	Weld Repair / Crack Relief	$5.00	See Deterioration Slope	+ 1

SUPERSTRUCTURE - CONCRETE

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Conc)	Full SuperStr Replacement	$78.13	50	Rating = 8
Rehab (Supr - Conc)	Replace Structural Component	$39.06	15	+ 2
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1
Replace (Bridge)	Full Bridge Replacement	$156.25	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 1
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 1

SUBSTRUCTURE - STRUCTURAL

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Substr)	Full SubStr Replacement	$78.13	75	Rating = 8
Rehab (Substr)	Replace Structural Component	$39.06	50	+ 2
Repair (Substr)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1

SUBSTRUCTURE - SCOUR

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Rehab (Substr - Scour)	Add scour protection slabs	$39.06	50	+ 2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1
Replace (Bridge)	Full Bridge Replacement	$156.25	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 1
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 1

Notes:

1. Individual replacements assume 50% of total bridge replacement costs

2. Individual rehabs (in cells that are not highlighted) assume 25% of total bridge replacement costs

3. When superstructure replacement is selected, either deck replacement or deck rehab should be selected as well.

AGUA FRIA CANYON (#906) / I-19 / MP 11.97

Option 1 - Replace Bridge Now

Bridge Deck Area =	3754 SF
Widen Deck Area =	4122 SF
Year Built =	1967
Exp Service Life =	75 YR

Notes:

1. Red fill in "Year" column means current bridge is nearing the end of its expected service life.
2. When superstructure replacement is selected, deck replacement should be selected as well.
3. Deck Rehab does not account for any deck widening during replacement.
4. Widened deck area applies to bridge replacement only.
5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years.

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000480x	-0.175x	5.71
Superstr	y =	-0.000410x	-0.150x	6.68
Deck	y =	-0.000481x	-0.176x	5.70

		Substructure						*Superstructure*						*Deck*						*Summary*	
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year	Present Value at 3%
0	2015	5						5						5								
1	2016	5						5						5								
2	2017	5						5						5								
3	2018	5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.							
4	2019	5						5						5								
5	2020	4						5						5								
6	2021	8	Replace (Bridge)	$156.25	$644,062.50	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	$644,062.50	$539,392.20
7	2022	8						8						8						8		
8	2023	8						8						8						8		
9	2024	8						8						8						8		
10	2025	8						8						8						8		
11	2026	8						8						8						8		
12	2027	8						8						8						8		
13	2028	8						8						8						8		
14	2029	8						8						8						8		
15	2030	8						8						8						8		
16	2031	7						7						7						7		
17	2032	7						7						7						7		
18	2033	7						7						7						7		
19	2034	7						7						7						7		
20	2035	7						7						7						7		
21	2036	7						7						7						7		
22	2037	7						7						7						7		
23	2038	7						7						7						7		
24	2039	7						7						7						7		
25	2040	6						6						6						6		
26	2041	7	Repair (After Bridge Replace)	$3.00	$12,366.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$12,366.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$12,366.00	20	+ 0	7	$37,098.00	$17,202.15
27	2042	7						7						7						7		
28	2043	7						7						7						7		
29	2044	7						7						7						7		
30	2045	7						7						7						7		
31	2046	7						7						7						7		
32	2047	7						7						7						7		
33	2048	7						7						7						7		
34	2049	7						7						7						7		
35	2050	7						7						7						7		
36	2051	6						6						6						6		
37	2052	6						6						6						6		
38	2053	6						6						6						6		
39	2054	6						6						6						6		
40	2055	6						6						6						6		
41	2056	6						6						6						6		
42	2057	6						6						6						6		
43	2058	6						6						6						6		
44	2059	6						6						6						6		
45	2060	5						5						5						5		
46	2061	6	Repair (After Bridge Replace)	$3.00	$12,366.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$12,366.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$12,366.00	20	+ 0	6	$37,098.00	$9,524.41
47	2062	6						6						6						6		
48	2063	6						6						6						6		
49	2064	6						6						6						6		
50	2065	6						6						6						6		
51	2066	6						6						6						6		
52	2067	6						6						6						6		
53	2068	6						6						6						6		
54	2069	6						6						6						6		
55	2070	5						5						5						5		
56	2071	5						5						5						5		
57	2072	5						5						5						5		
58	2073	5						5						5						5		
59	2074	5						5						5						5		
60	2075	5						5						5						5		
61	2076	5						5						5						5		
62	2077	5						5						5						5		
63	2078	5						5						5						5		
64	2079	5						5						5						5		
65	2080	5						5						5						5		
																				Total Cost =	**$718,258.50**	**$566,118.76**

Average Rating =	6.45
End Rating =	5

Comments:

AGUA FRIA CANYON (#906) / I-19 / MP 11.97

Option 2 - Perform Bridge Rehabilitiation Then Replace

Bridge Deck Area =	3754 SF
Widen Deck Area =	4122 SF
Year Built =	1967
Exp Service Life =	75 YR

Notes:

1. Red fill in "Year" column means current bridge is nearing the end of its expected service life.
2. When superstructure replacement is selected, deck replacement should be selected as well.
3. Deck Rehab does not account for any deck widening during replacement.
4. Widened deck area applies to bridge replacement only.
5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years. Repair (Deck) should maintain deck rating for life of repair, if the rating would otherwise drop a point (i.e., if the rating would drop from a "5" to a "4", Repair Deck would maintain a "5" at that year.)
6. For other repair items, the "+" value rating should be applied to improve the bridge rating's value for that year.

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000480x	-0.175x	5.71
Superstr	y =	-0.000410x	-0.150x	6.68
Deck	y =	-0.000481x	-0.176x	5.70

		Substructure						*Superstructure*						*Deck*						*Summary*	
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year	Present Value at 3%
0	2015	5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.							
1	2016	5						5						5								
2	2017	5						5						5								
3	2018	5						5						5								
4	2019	5						5						5								
5	2020	4						4						4								
6	2021	6	Rehab (Substr)	$39.06	$146,640.63	50	+ 2	6	Rehab (Supr - Conc)	$39.06	$146,640.63	15	+ 2	6	Rehab (Deck Concrete Overlay)	$10.00	$37,540.00	15	+ 2	6	$330,821.25	$277,057.59
7	2022	6						6						6						6		
8	2023	6						6						6						6		
9	2024	6						6						6						6		
10	2025	6						6						6						6		
11	2026	6						6						6						6		
12	2027	6						6						6						6		
13	2028	6						6						6						6		
14	2029	6						5						5						5		
15	2030	6						5						5						5		
16	2031	6						5						5						5		
17	2032	6						5						5						5		
18	2033	6						5						5						5		
19	2034	6						5						5						5		
20	2035	6						5						5						5		
21	2036	6						5						5						5		
22	2037	6						4						4						4		
23	2038	6						5	Repair (After Rehab)	$3.00	$11,262.00	10	+ 1	5	Repair (After Rehab)	$3.00	$11,262.00	10	+ 0	5	$22,524.00	$11,412.72
24	2039	6						5						5						5		
25	2040	6						5						5						5		
26	2041	6						5						5						5		
27	2042	8	Replace (Bridge)	$156.25	$644,062.50	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	$644,062.50	$289,949.89
28	2043	8						8						8						8		
29	2044	8						8						8						8		
30	2045	8						8						8						8		
31	2046	8						8						8						8		
32	2047	8						8						8						8		
33	2048	8						8						8						8		
34	2049	8						8						8						8		
35	2050	8						8						8						8		
36	2051	8						8						8						8		
37	2052	7						7						7						7		
38	2053	7						7						7						7		
39	2054	7						7						7						7		
40	2055	7						7						7						7		
41	2056	7						7						7						7		
42	2057	7						7						7						7		
43	2058	7						7						7						7		
44	2059	7						7						7						7		
45	2060	7						7						7						7		
46	2061	6						6						6						6		
47	2062	7	Repair (After Bridge Replace)	$3.00	$12,366.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$12,366.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$12,366.00	20	+ 0	7	$37,098.00	$9,247.00
48	2063	7						7						7						7		
49	2064	7						7						7						7		
50	2065	7						7						7						7		
51	2066	7						7						7						7		
52	2067	7						7						7						7		
53	2068	7						7						7						7		
54	2069	7						7						7						7		
55	2070	7						7						7						7		
56	2071	7						7						7						7		
57	2072	6						6						6						6		
58	2073	6						6						6						6		
59	2074	6						6						6						6		
60	2075	6						6						6						6		
61	2076	6						6						6						6		
62	2077	6						6						6						6		
63	2078	6						6						6						6		
64	2079	6						6						6						6		
65	2080	6						6						6						6		
																				Total Cost =	**$1,034,505.75**	**$587,667.20**

Average Rating =	6.42
End Rating =	6

Comments:

AGUA FRIA CANYON (#906) / I-19 / MP 11.97

Option 3 - Perform Minimum Repairs Then Replace

Bridge Deck Area =	3754 SF
Widen Deck Area =	4122 SF
Year Built =	1967
Exp Service Life =	75 YR

Notes:

1. Red fill in "Year" column means current bridge is nearing the end of its expected service life.
2. When superstructure replacement is selected, deck replacement should be selected as well.
3. Deck Rehab does not account for any deck widening during replacement.
4. Widened deck area applies to bridge replacement only.
5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years. Repair (Deck) should maintain deck rating for life of repair, if the rating would otherwise drop a point (i.e., if the rating would drop from a "5" to a "4", Repair Deck would maintain a "5" at that year.
6. For other repair items, the "+" value rating should be applied to improve the bridge rating's value for that year.

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000480x	-0.175x	5.71
Superstr	y =	-0.000410x	-0.150x	6.68
Deck	y =	-0.000481x	-0.176x	5.70

		Substructure						*Superstructure*						*Deck*						*Summary*	
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year	Present Value at 3%
0	2015	5						5						5								
1	2016	5						5						5								
2	2017	5						5						5								
3	2018	5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.							
4	2019	5						5						5								
5	2020	4						5						5								
6	2021	4						5						5	Repair (Deck)	$3.00	$11,262.00	6	+ 0	4	$11,262.00	$9,431.75
7	2022	4						4						5						4		
8	2023	5	Repair (Substr)	$5.00	$18,770.00	6	+ 1	5	Repair (Supr - Conc)	$5.00	$18,770.00	7	+ 1	5						5	$37,540.00	$29,634.42
9	2024	5						5						5						5		
10	2025	5						5						5						5		
11	2026	5						5						5						5		
12	2027	5						5						5	Repair (Deck)	$3.00	$11,262.00	6	+ 0	5	$11,262.00	$7,898.94
13	2028	4						5						5						4		
14	2029	5	Repair (Substr)	$5.00	$18,770.00	6	+ 1	4						5						4	$18,770.00	$12,409.18
15	2030	5						5	Repair (Supr - Conc)	$5.00	$18,770.00	7	+ 1	5						5	$18,770.00	$12,047.75
16	2031	5						5						5						5		
17	2032	5						5						5						5		
18	2033	5						5						5	Repair (Deck)	$3.00	$11,262.00	6	+ 0	5	$11,262.00	$6,615.24
19	2034	4						5						5						4		
20	2035	5	Repair (Substr)	$5.00	$18,770.00	6	+ 1	5						5						5	$18,770.00	$10,392.49
21	2036	5						5						5						5		
22	2037	5						4	Repair (Supr - Conc)	$5.00	$18,770.00	7	+ 1	5						4	$18,770.00	$9,795.92
23	2038	5						5						5						5		
24	2039	5						5						5	Repair (Deck)	$3.00	$11,262.00	6	+ 0	5	$11,262.00	$5,540.16
25	2040	4						5						5						4		
26	2041	5	Repair (Substr)	$5.00	$18,770.00	6	+ 1	5						5						5	$18,770.00	$8,703.55
27	2042	8	Replace (Bridge)	$156.25	$644,062.50	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	$644,062.50	$289,949.89
28	2043	8						8						8						8		
29	2044	8						8						8						8		
30	2045	8						8						8						8		
31	2046	8						8						8						8		
32	2047	8						8						8						8		
33	2048	8						8						8						8		
34	2049	8						8						8						8		
35	2050	8						8						8						8		
36	2051	8						8						8						8		
37	2052	7						7						7						7		
38	2053	7						7						7						7		
39	2054	7						7						7						7		
40	2055	7						7						7						7		
41	2056	7						7						7						7		
42	2057	7						7						7						7		
43	2058	7						7						7						7		
44	2059	7						7						7						7		
45	2060	7						7						7						7		
46	2061	6						6						6						6		
47	2062	7	Repair (After Bridge Replace)	$3.00	$12,366.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$12,366.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$12,366.00	20	+ 0	7	$37,098.00	$9,247.00
48	2063	7						7						7						7		
49	2064	7						7						7						7		
50	2065	7						7						7						7		
51	2066	7						7						7						7		
52	2067	7						7						7						7		
53	2068	7						7						7						7		
54	2069	7						7						7						7		
55	2070	7						7						7						7		
56	2071	7						7						7						7		
57	2072	6						6						6						6		
58	2073	6						6						6						6		
59	2074	6						6						6						6		
60	2075	6						6						6						6		
61	2076	6						6						6						6		
62	2077	6						6						6						6		
63	2078	6						6						6						6		
64	2079	6						6						6						6		
65	2080	6						6						6						6		
																				Total Cost =	**$857,598.50**	**$411,666.29**

Average Rating =	6.18
End Rating =	6

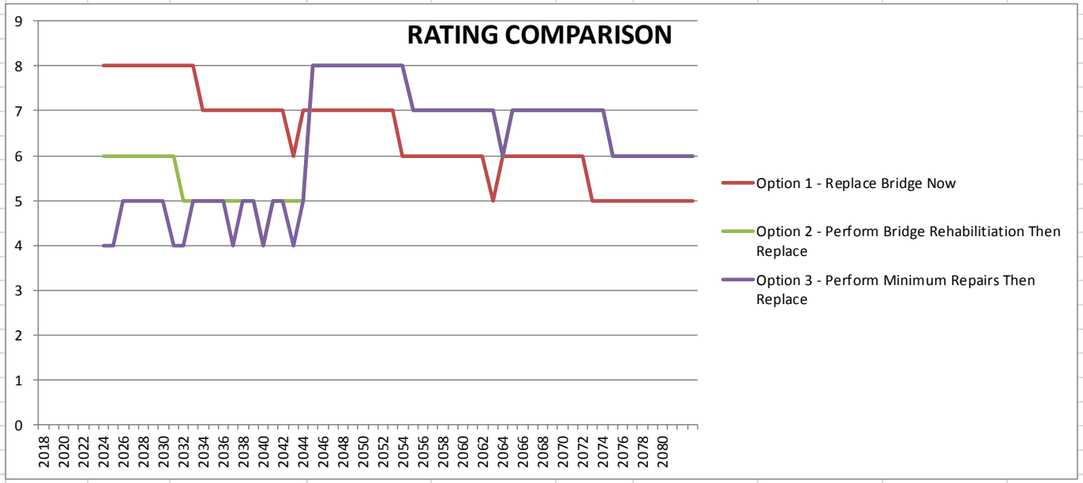
Comments:

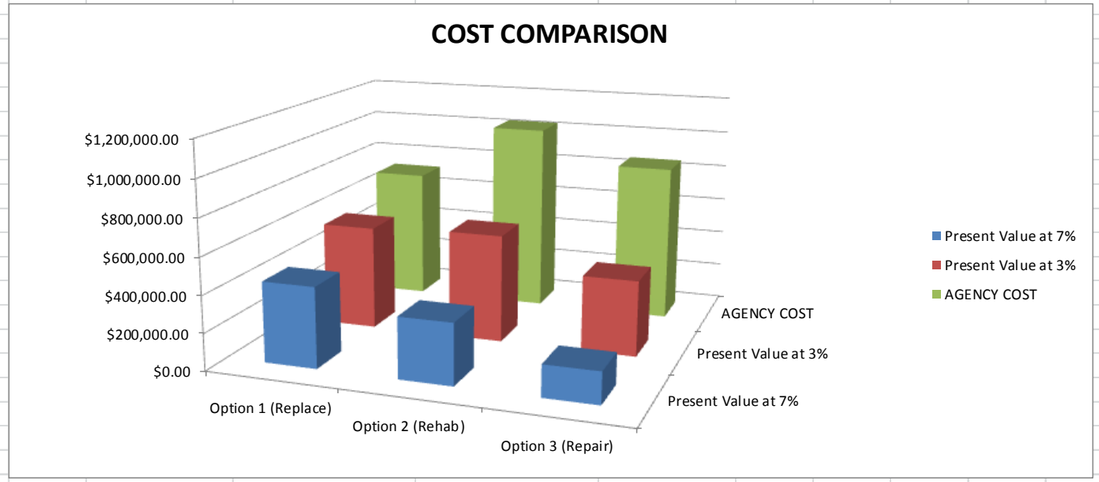
AGUA FRIA CANYON (#906) / I-19 / MP 11.97

COST COMPARISON Present Value Dollars			
OPTION	AGENCY COST	3%	7%
Option 1 (Replace)	$ 718,258.50	$566,118.76	$437,204.96
Option 2 (Rehab)	$ 1,034,505.75	$587,667.20	$330,383.56
Option 3 (Repair)	$ 857,598.50	$411,666.29	$171,499.45

Comparison to Replacement			
Option	Agency Cost	3%	7%
2 (Rehab)	69.43%	96.33%	132.33%
3 (Repair)	83.75%	137.52%	254.93%

Bridge Ratings Per Option		
OPTION	AVG RATING	END RATING
Option 1 (Replace)	6.45	5
Option 2 (Rehab)	6.42	6
Option 3 (Repair)	6.18	6





	Present Value at 7%	Present Value at 3%	AGENCY COST
Option 1 (Replace)	$437,204.96	$566,118.76	$ 718,258.50
Option 2 (Rehab)	$330,383.56	$587,667.20	$ 1,034,505.75
Option 3 (Repair)	$171,499.45	$411,666.29	$ 857,598.50

PALO PARADO ROAD (#937) / I-19 / MP 15.65

Bridge Information	
Bridge Deck Area (A225)	8366 SF
Year Built (N27)	1966
Exp Service Life	75 YR
Total Bridge Length (N49)	252 LF
Number of Spans (N45+N46)	4
Skew Angle (N34)	0 DEG
Average Elevation	3372 FT
Max Pier Height	22 FT
* Amount of Widening for Bridge	8 FT
Revised Deck Area (Bridge Replace)	10382 FT
**Scour Critical Rating (N113)	N/A

Deterioration Slope

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000557x	-0.203x	4.92
Superstr	y =	-0.000293x	-0.107x	9.35
Deck	y =	-0.000515x	-0.188x	5.32

***Input 0 if no widening. Input should include widening on both sides of bridge if applicable.**

****If scour critical rating is 3 or lower, Option 2 should consider the implementation of scour countermeasures.**

Notes:

1. Widening is intended only to correct lane and/or shoulder width deficiencies. It is not intended for adding traffic capacity (i.e. adding general purpose lanes).

Cost Multipliers		
Elevation > 4000ft	3372	1.00
Pier Height > 30ft	22	1.00
Length to # span ratio	63.00	1.1
Skew > 30degrees	0.00	1.00

L to # Span Multiplier

L/ # Span Ratio	Multiplier
=>100	1.00
=>60	1.10
<60	1.25

Skew Multiplier

Skew	Multiplier
<30	1.00
=>30	1.10

Adjusted Bridge Replace Cost	
Base Bridge Replacement Cost (Per SF)	$125.00
Bridge Replacement Cost w/ Multipliers (Per SF)	$137.50

Elevation Multiplier

Elev	Multiplier
<4000	1.00
=>4000	1.25

Pier H Multiplier

Pier H	Multiplier
<30	1.00
=>30	1.10

User input cell

Only manipulate cell value after consulting with team

Bridge History (Inspections/As-builts)		
Description	**Category**	**Year**
Bridge has had no work performed to it since original construction.		
Current inspection records note deck surface has extensive narrow to medium size transverse and map cracks with pop outs and delaminations.		
Soffit area also has hairline sized transverse/longitudinal/random cracks with exposed tips of steel stirrups at overhangs.		
Repair recommendations currently only state "monitor transverse and map cracks on the top deck."		

Replace / Rehab / Repair Information

BRIDGE DECK				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Replace (Deck)	Full Deck Replacement	$68.75	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	$10.00	15	+ 2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	$5.00	10	+ 1
Repair (Deck)	Patch Spalls / Seal Cracks	$3.00	See Deterioration Slope	+ 0
Replace (Bridge)	Full Bridge Replacement	$137.50	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 0
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 0

SUPERSTRUCTURE - STEEL				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Replace (Supr - Stl)	Full SuperStr Replacement	$68.75	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	$34.38	15	+ 2
Repair (Supr - Stl)	Weld Repair / Crack Relief	$5.00	See Deterioration Slope	+ 1

SUPERSTRUCTURE - CONCRETE				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Replace (Supr - Conc)	Full SuperStr Replacement	$68.75	50	Rating = 8
Rehab (Supr - Conc)	Replace Structural Component	$34.38	15	+ 2
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1
Replace (Bridge)	Full Bridge Replacement	$137.50	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 1
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 1

SUBSTRUCTURE - STRUCTURAL				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Replace (Substr)	Full SubStr Replacement	$68.75	75	Rating = 8
Rehab (Substr)	Replace Structural Component	$34.38	50	+ 2
Repair (Substr)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1

SUBSTRUCTURE - SCOUR				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Rehab (Substr - Scour)	Add scour protection slabs	$34.38	50	+ 2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1
Replace (Bridge)	Full Bridge Replacement	$137.50	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 1
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 1

Notes:

1. Individual replacements assume 50% of total bridge replacement costs

2. Individual rehabs (in cells that are not highlighted) assume 25% of total bridge replacement costs

3. When superstructure replacement is selected, either deck replacement or deck rehab should be selected as well.

PALO PARADO ROAD (#937) / I-19 / MP 15.65

Option 1 - Replace Bridge Now

Bridge Deck Area =	8366 SF
Widen Deck Area =	10382 SF
Year Built =	1966
Exp Service Life =	75 YR

Notes:

1. Red fill in "Year" column means current bridge is nearing the end of its expected service life.
2. When superstructure replacement is selected, deck replacement should be selected as well.
3. Deck Rehab does not account for any deck widening during replacement.
4. Widened deck area applies to bridge replacement only.
5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years.

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000557x	-0.203x	4.92
Superstr	y =	-0.000293x	-0.107x	9.35
Deck	y =	-0.000515x	-0.188x	5.32

		Substructure						*Superstructure*						*Deck*						*Summary*	
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year	Present Value at 3%
0	2015	6	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.							
1	2016	6						5						5								
2	2017	6						5						5								
3	2018	6						5						5								
4	2019	6						5						5								
5	2020	5						5						5								
6	2021	8	Replace (Bridge)	$137.50	$1,427,525.00	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	$1,427,525.00	$1,195,529.71
7	2022	8						8						8						8		
8	2023	8						8						8						8		
9	2024	8						8						8						8		
10	2025	8						8						8						8		
11	2026	8						8						8						8		
12	2027	8						8						8						8		
13	2028	8						8						8						8		
14	2029	8						8						8						8		
15	2030	8						8						8						8		
16	2031	7						7						7						7		
17	2032	7						7						7						7		
18	2033	7						7						7						7		
19	2034	7						7						7						7		
20	2035	7						7						7						7		
21	2036	7						7						7						7		
22	2037	7						7						7						7		
23	2038	7						7						7						7		
24	2039	7						7						7						7		
25	2040	6						6						6						6		
26	2041	7	Repair (After Bridge Replace)	$3.00	$31,146.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$31,146.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$31,146.00	20	+ 0	7	$93,438.00	$43,326.71
27	2042	7						7						7						7		
28	2043	7						7						7						7		
29	2044	7						7						7						7		
30	2045	7						7						7						7		
31	2046	7						7						7						7		
32	2047	7						7						7						7		
33	2048	7						7						7						7		
34	2049	7						7						7						7		
35	2050	7						7						7						7		
36	2051	6						6						6						6		
37	2052	6						6						6						6		
38	2053	6						6						6						6		
39	2054	6						6						6						6		
40	2055	6						6						6						6		
41	2056	6						6						6						6		
42	2057	6						6						6						6		
43	2058	6						6						6						6		
44	2059	6						6						6						6		
45	2060	5						5						5						5		
46	2061	6	Repair (After Bridge Replace)	$3.00	$31,146.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$31,146.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$31,146.00	20	+ 0	6	$93,438.00	$23,988.95
47	2062	6						6						6						6		
48	2063	6						6						6						6		
49	2064	6						6						6						6		
50	2065	6						6						6						6		
51	2066	6						6						6						6		
52	2067	6						6						6						6		
53	2068	6						6						6						6		
54	2069	6						6						6						6		
55	2070	5						5						5						5		
56	2071	5						5						5						5		
57	2072	5						5						5						5		
58	2073	5						5						5						5		
59	2074	5						5						5						5		
60	2075	5						5						5						5		
61	2076	5						5						5						5		
62	2077	5						5						5						5		
63	2078	5						5						5						5		
64	2079	5						5						5						5		
65	2080	5						5						5						5		
																				Total Cost =	**$1,614,401.00**	**$1,262,845.37**

Average Rating =	6.45
End Rating =	5

Comments:

PALO PARADO ROAD (#937) / I-19 / MP 15.65

Option 2 - Perform Bridge Rehabilitiation Then Replace

Bridge Deck Area =	8366 SF
Widen Deck Area =	10382 SF
Year Built =	1966
Exp Service Life =	75 YR

Notes:

1. Red fill in "Year" column means current bridge is nearing the end of its expected service life.
2. When superstructure replacement is selected, deck replacement should be selected as well.
3. Deck Rehab does not account for any deck widening during replacement.
4. Widened deck area applies to bridge replacement only.
5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years. Repair (Deck) should maintain deck rating for life of repair, if the rating would otherwise drop a point (i.e., if the rating would drop from a "5" to a "4", Repair Deck would maintain a "5" at that year.)
6. For other repair items, the "+" value rating should be applied to improve the bridge rating's value for that year.

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000557x	-0.203x	4.92
Superstr	y =	-0.000293x	-0.107x	9.35
Deck	y =	-0.000515x	-0.188x	5.32

		Substructure						*Superstructure*						*Deck*						*Summary*		
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year	Present Value at 3%
0	2015	6						5						5								
1	2016	6						5						5								
2	2017	6						5						5								
3	2018	6						5						5								
4	2019	6						5						5								
5	2020	5						5						5								
6	2021	5						7	Rehab (Supr - Conc)	$34.38	$287,581.25	15	+ 2	7	Rehab (Deck Concrete Overlay)	$10.00	$83,660.00	15	+ 2	5	$371,241.25	$310,908.70
7	2022	5						7						7						5		
8	2023	5						7						7						5		
9	2024	5						7						7						5		
10	2025	4						7						7						4		
11	2026	5	Repair (Substr)	$5.00	$41,830.00	5	+ 1	7						7						5	$41,830.00	$30,218.88
12	2027	5						7						7						5		
13	2028	5						7						7						5		
14	2029	5						7						7						5		
15	2030	5						6						6						5		
16	2031	4						6						6						4		
17	2032	5	Repair (Substr)	$5.00	$41,830.00	5	+ 1	6						6						5	$41,830.00	$25,307.84
18	2033	5						6						6						5		
19	2034	5						6						6						5		
20	2035	5						6						6						5		
21	2036	5						6						6						5		
22	2037	4						6						6						4		
23	2038	5	Repair (Substr)	$5.00	$41,830.00	5	+ 1	5						5						5	$41,830.00	$21,194.92
24	2039	5						5						5						5		
25	2040	5						5						5						5		
26	2041	8	Replace (Bridge)	$137.50	$1,427,525.00	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	$1,427,525.00	$661,935.82
27	2042	8						8						8						8		
28	2043	8						8						8						8		
29	2044	8						8						8						8		
30	2045	8						8						8						8		
31	2046	8						8						8						8		
32	2047	8						8						8						8		
33	2048	8						8						8						8		
34	2049	8						8						8						8		
35	2050	8						8						8						8		
36	2051	7						7						7						7		
37	2052	7						7						7						7		
38	2053	7						7						7						7		
39	2054	7						7						7						7		
40	2055	7						7						7						7		
41	2056	7						7						7						7		
42	2057	7						7						7						7		
43	2058	7						7						7						7		
44	2059	7						7						7						7		
45	2060	6						6						6						6		
46	2061	7	Repair (After Bridge Replace)	$3.00	$31,146.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$31,146.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$31,146.00	20	+ 0	7	$93,438.00	$23,988.95
47	2062	7						7						7						7		
48	2063	7						7						7						7		
49	2064	7						7						7						7		
50	2065	7						7						7						7		
51	2066	7						7						7						7		
52	2067	7						7						7						7		
53	2068	7						7						7						7		
54	2069	7						7						7						7		
55	2070	7						7						7						7		
56	2071	6						6						6						6		
57	2072	6						6						6						6		
58	2073	6						6						6						6		
59	2074	6						6						6						6		
60	2075	6						6						6						6		
61	2076	6						6						6						6		
62	2077	6						6						6						6		
63	2078	6						6						6						6		
64	2079	6						6						6						6		
65	2080	5						5						5						5		
																				Total Cost =	**$2,017,694.25**	**$1,073,555.10**

Average Rating =	6.25
End Rating =	5

Comments:

PALO PARADO ROAD (#937) / I-19 / MP 15.65

Option 3 - Perform Minimum Repairs Then Replace

Bridge Deck Area =	8366 SF
Widen Deck Area =	10382 SF
Year Built =	1966
Exp Service Life =	75 YR

Notes:

1. Red fill in "Year" column means current bridge is nearing the end of its expected service life.
2. When superstructure replacement is selected, deck replacement should be selected as well.
3. Deck Rehab does not account for any deck widening during replacement.
4. Widened deck area applies to bridge replacement only.
5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years. Repair (Deck) should maintain deck rating for life of repair, if the rating would otherwise drop a point (i.e., if the rating would drop from a "5" to a "4", Repair Deck would maintain a "5" at that year.
6. For other repair items, the "+" value rating should be applied to improve the bridge rating's value for that year.

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000557x	-0.203x	4.92
Superstr	y =	-0.000293x	-0.107x	9.35
Deck	y =	-0.000515x	-0.188x	5.32

		Substructure						*Superstructure*						*Deck*						*Summary*	
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year	Present Value at 3%
0	2015	6	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.							
1	2016	6						5						5								
2	2017	6						5						5								
3	2018	6						5						5								
4	2019	6						5						5								
5	2020	5						5						5								
6	2021	5						5						5	Repair (Deck)	$3.00	$25,098.00	5	+ 0	5	$25,098.00	$21,019.18
7	2022	5						5						5						5		
8	2023	5						4						5						4		
9	2024	4						5	Repair (Supr - Conc)	$5.00	$41,830.00	9	+ 1	5						4	$41,830.00	$32,059.21
10	2025	5	Repair (Substr)	$5.00	$41,830.00	5	+ 1	5						5						5	$41,830.00	$31,125.45
11	2026	5						5						5	Repair (Deck)	$3.00	$25,098.00	5	+ 0	5	$25,098.00	$18,131.33
12	2027	5						5						5						5		
13	2028	5						5						5						5		
14	2029	4						5						5						4		
15	2030	5	Repair (Substr)	$5.00	$41,830.00	5	+ 1	5						5						5	$41,830.00	$26,849.09
16	2031	5						5						5	Repair (Deck)	$3.00	$25,098.00	5	+ 0	5	$25,098.00	$15,640.24
17	2032	5						4						5						4		
18	2033	5						5	Repair (Supr - Conc)	$5.00	$41,830.00	9	+ 1	5						5	$41,830.00	$24,570.72
19	2034	4						5						5						4		
20	2035	5	Repair (Substr)	$5.00	$41,830.00	5	+ 1	5						5						5	$41,830.00	$23,160.26
21	2036	5						5						5	Repair (Deck)	$3.00	$25,098.00	5	+ 0	5	$25,098.00	$13,491.41
22	2037	5						5						5						5		
23	2038	5						5						5						5		
24	2039	4						5						5						4		
25	2040	5	Repair (Substr)	$5.00	$41,830.00	5	+ 1	5						5						5	$41,830.00	$19,978.24
26	2041	8	Replace (Bridge)	$137.50	$1,427,525.00	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	$1,427,525.00	$661,935.82
27	2042	8						8						8						8		
28	2043	8						8						8						8		
29	2044	8						8						8						8		
30	2045	8						8						8						8		
31	2046	8						8						8						8		
32	2047	8						8						8						8		
33	2048	8						8						8						8		
34	2049	8						8						8						8		
35	2050	8						8						8						8		
36	2051	7						7						7						7		
37	2052	7						7						7						7		
38	2053	7						7						7						7		
39	2054	7						7						7						7		
40	2055	7						7						7						7		
41	2056	7						7						7						7		
42	2057	7						7						7						7		
43	2058	7						7						7						7		
44	2059	7						7						7						7		
45	2060	6						6						6						6		
46	2061	7	Repair (After Bridge Replace)	$3.00	$31,146.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$31,146.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$31,146.00	20	+ 0	7	$93,438.00	$23,988.95
47	2062	7						7						7						7		
48	2063	7						7						7						7		
49	2064	7						7						7						7		
50	2065	7						7						7						7		
51	2066	7						7						7						7		
52	2067	7						7						7						7		
53	2068	7						7						7						7		
54	2069	7						7						7						7		
55	2070	7						7						7						7		
56	2071	6						6						6						6		
57	2072	6						6						6						6		
58	2073	6						6						6						6		
59	2074	6						6						6						6		
60	2075	6						6						6						6		
61	2076	6						6						6						6		
62	2077	6						6						6						6		
63	2078	6						6						6						6		
64	2079	6						6						6						6		
65	2080	5						5						5						5		
																				Total Cost =	**$1,872,335.00**	**$911,949.89**

Average Rating =	6.20
End Rating =	5

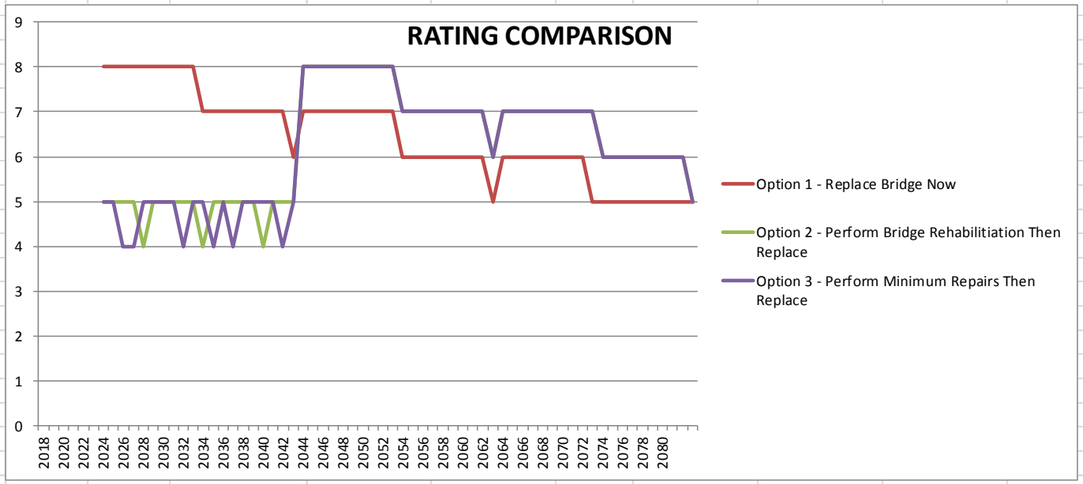
Comments:

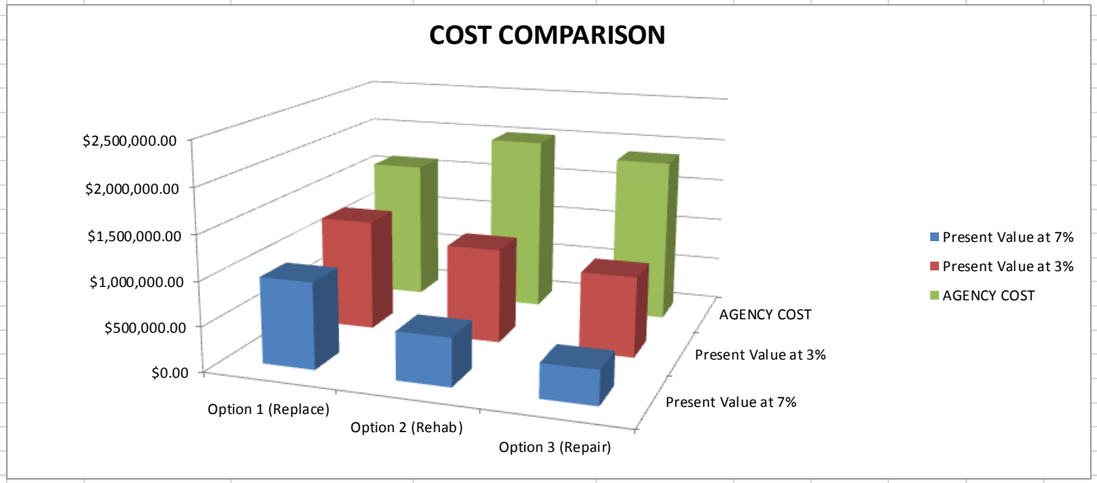
PALO PARADO ROAD (#937) / I-19 / MP 15.65

COST COMPARISON Present Value Dollars			
OPTION	AGENCY COST	3%	7%
Option 1 (Replace)	$ 1,614,401.00	$1,262,845.37	$971,467.64
Option 2 (Rehab)	$ 2,017,694.25	$1,073,555.10	$539,284.30
Option 3 (Repair)	$ 1,872,335.00	$911,949.89	$383,252.94

Comparison to Replacement			
Option	Agency Cost	3%	7%
2 (Rehab)	80.01%	117.63%	180.14%
3 (Repair)	86.22%	138.48%	253.48%

Bridge Ratings Per Option		
OPTION	AVG RATING	END RATING
Option 1 (Replace)	6.45	5
Option 2 (Rehab)	6.25	5
Option 3 (Repair)	6.20	5





	Present Value at 7%	Present Value at 3%	AGENCY COST
Option 1 (Replace)	$971,467.64	$1,262,845.37	$ 1,614,401.00
Option 2 (Rehab)	$539,284.30	$1,073,555.10	$ 2,017,694.25
Option 3 (Repair)	$383,252.94	$911,949.89	$ 1,872,335.00

AIRPORT WASH (#1121) / I-19 / MP 60.32

Bridge Information	
Bridge Deck Area (A225)	6350 SF
Year Built (N27)	1965
Exp Service Life	75 YR
Total Bridge Length (N49)	147 LF
Number of Spans (N45+N46)	4
Skew Angle (N34)	34 DEG
Average Elevation	2454 FT
Max Pier Height	16 FT
* Amount of Widening for Bridge	4 FT
Revised Deck Area (Bridge Replace)	6938 FT
**Scour Critical Rating (N113)	7

Deterioration Slope

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000550x	-0.201x	4.98
Superstr	y =	-0.000380x	-0.139x	7.21
Deck	y =	-0.000380x	-0.139x	7.21

***Input 0 if no widening. Input should include widening on both sides of bridge if applicable.**

****If scour critical rating is 3 or lower, Option 2 should consider the implementation of scour countermeasures.**

Notes:

1. Widening is intended only to correct lane and/or shoulder width deficiencies. It is not intended for adding traffic capacity (i.e. adding general purpose lanes).

Cost Multipliers		
Elevation > 4000ft	2454	1.00
Pier Height > 30ft	16	1.00
Length to # span ratio	36.75	1.25
Skew > 30degrees	34.00	1.10

L to # Span Multiplier

L/ # Span Ratio	Multiplier
=>100	1.00
=>60	1.10
<60	1.25

Skew Multiplier

Skew	Multiplier
<30	1.00
=>30	1.10

Adjusted Bridge Replace Cost	
Base Bridge Replacement Cost (Per SF)	$125.00
Bridge Replacement Cost w/ Multipliers (Per SF)	$171.88

Elevation Multiplier

Elev	Multiplier
<4000	1.00
=>4000	1.25

Pier H Multiplier

Pier H	Multiplier
<30	1.00
=>30	1.10

User input cell

Only manipulate cell value after consulting with team

Bridge History (Inspections/As-builts)		
Description	**Category**	**Year**
Bridge was originally constructed in 1965 (19-1(5)RD).		1965
Scour slab was added in 2003 (I-019-A-504).	Rehab (Substr - Scour)	2003
Inspection notes wide sized transverse, diagonal, longitudinal and map cracks in deck.		
Soffit has narrow to medium sized longitudinal and random clocks…east edge of deck has minor spall.		
Abutments/piers have few narrow/medium sized vertical cracks.		
Inspection only recommends rehab of top deck surface.		

Replace / Rehab / Repair Information

BRIDGE DECK				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Replace (Deck)	Full Deck Replacement	$85.94	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	$10.00	15	+ 2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	$5.00	10	+ 1
Repair (Deck)	Patch Spalls / Seal Cracks	$3.00	See Deterioration Slope	+ 0
Replace (Bridge)	Full Bridge Replacement	$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 0
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 0

SUPERSTRUCTURE - STEEL				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Replace (Supr - Stl)	Full SuperStr Replacement	$85.94	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	$42.97	15	+ 2
Repair (Supr - Stl)	Weld Repair / Crack Relief	$5.00	See Deterioration Slope	+ 1

SUPERSTRUCTURE - CONCRETE				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Replace (Supr - Conc)	Full SuperStr Replacement	$85.94	50	Rating = 8
Rehab (Supr - Conc)	Replace Structural Component	$42.97	15	+ 2
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1
Replace (Bridge)	Full Bridge Replacement	$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 1
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 1

SUBSTRUCTURE - STRUCTURAL				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Replace (Substr)	Full SubStr Replacement	$85.94	75	Rating = 8
Rehab (Substr)	Replace Structural Component	$42.97	50	+ 2
Repair (Substr)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1

SUBSTRUCTURE - SCOUR				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Rehab (Substr - Scour)	Add scour protection slabs	$42.97	50	+ 2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1
Replace (Bridge)	Full Bridge Replacement	$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 1
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 1

Notes:

1. Individual replacements assume 50% of total bridge replacement costs

2. Individual rehabs (in cells that are not highlighted) assume 25% of total bridge replacement costs

3. When superstructure replacement is selected, either deck replacement or deck rehab should be selected as well.

AIRPORT WASH (#1121) / I-19 / MP 60.32

Option 1 - Replace Bridge Now

Bridge Deck Area =	6350 SF
Widen Deck Area =	6938 SF
Year Built =	1965
Exp Service Life =	75 YR

Notes:

1. Red fill in "Year" column means current bridge is nearing the end of its expected service life.
2. When superstructure replacement is selected, deck replacement should be selected as well.
3. Deck Rehab does not account for any deck widening during replacement.
4. Widened deck area applies to bridge replacement only.
5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years.

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000550x	-0.201x	4.98
Superstr	y =	-0.000380x	-0.139x	7.21
Deck	y =	-0.000380x	-0.139x	7.21

		Substructure						*Superstructure*						*Deck*						*Summary*	
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year	Present Value at 3%
0	2015	6	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.							
1	2016	6						5						5								
2	2017	6						5						5								
3	2018	6						5						5								
4	2019	6						5						5								
5	2020	5						5						5								
6	2021	8	Replace (Bridge)	$171.88	$1,192,503.44	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	$1,192,503.44	$998,702.86
7	2022	8						8						8						8		
8	2023	8						8						8						8		
9	2024	8						8						8						8		
10	2025	8						8						8						8		
11	2026	8						8						8						8		
12	2027	8						8						8						8		
13	2028	8						8						8						8		
14	2029	8						8						8						8		
15	2030	8						8						8						8		
16	2031	7						7						7						7		
17	2032	7						7						7						7		
18	2033	7						7						7						7		
19	2034	7						7						7						7		
20	2035	7						7						7						7		
21	2036	7						7						7						7		
22	2037	7						7						7						7		
23	2038	7						7						7						7		
24	2039	7						7						7						7		
25	2040	6						6						6						6		
26	2041	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 0	7	$62,442.00	$28,954.03
27	2042	7						7						7						7		
28	2043	7						7						7						7		
29	2044	7						7						7						7		
30	2045	7						7						7						7		
31	2046	7						7						7						7		
32	2047	7						7						7						7		
33	2048	7						7						7						7		
34	2049	7						7						7						7		
35	2050	7						7						7						7		
36	2051	6						6						6						6		
37	2052	6						6						6						6		
38	2053	6						6						6						6		
39	2054	6						6						6						6		
40	2055	6						6						6						6		
41	2056	6						6						6						6		
42	2057	6						6						6						6		
43	2058	6						6						6						6		
44	2059	6						6						6						6		
45	2060	5						5						5						5		
46	2061	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 0	6	$62,442.00	$16,031.14
47	2062	6						6						6						6		
48	2063	6						6						6						6		
49	2064	6						6						6						6		
50	2065	6						6						6						6		
51	2066	6						6						6						6		
52	2067	6						6						6						6		
53	2068	6						6						6						6		
54	2069	6						6						6						6		
55	2070	5						5						5						5		
56	2071	5						5						5						5		
57	2072	5						5						5						5		
58	2073	5						5						5						5		
59	2074	5						5						5						5		
60	2075	5						5						5						5		
61	2076	5						5						5						5		
62	2077	5						5						5						5		
63	2078	5						5						5						5		
64	2079	5						5						5						5		
65	2080	5						5						5						5		
																				Total Cost =	**$1,317,387.44**	**$1,043,688.03**

Average Rating =	6.45
End Rating =	5

Comments:

AIRPORT WASH (#1121) / I-19 / MP 60.32

Option 2 - Perform Bridge Rehabilitiation Then Replace

Bridge Deck Area =	6350 SF
Widen Deck Area =	6938 SF
Year Built =	1965
Exp Service Life =	75 YR

Notes:

1. Red fill in "Year" column means current bridge is nearing the end of its expected service life.
2. When superstructure replacement is selected, deck replacement should be selected as well.
3. Deck Rehab does not account for any deck widening during replacement.
4. Widened deck area applies to bridge replacement only.
5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years. Repair (Deck) should maintain deck rating for life of repair, if the rating would otherwise drop a point (i.e., if the rating would drop from a "5" to a "4", Repair Deck would maintain a "5" at that year.)
6. For other repair items, the "+" value rating should be applied to improve the bridge rating's value for that year.

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000550x	-0.201x	4.98
Superstr	y =	-0.000380x	-0.139x	7.21
Deck	y =	-0.000380x	-0.139x	7.21

		Substructure						*Superstructure*						*Deck*						*Summary*	
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year	Present Value at 3%
0	2015	6	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.							
1	2016	6						5						5								
2	2017	6						5						5								
3	2018	6						5						5								
4	2019	6						5						5								
5	2020	5						5						5								
6	2021	5						5						4						4		
7	2022	5						6	Rehab (Supr - Conc)	$42.97	$272,859.50	15	+ 2	6	Rehab (Deck Concrete Overlay)	$10.00	$63,500.00	15	+ 2	5	$336,359.50	$273,491.05
8	2023	5						6						6						5		
9	2024	5						6						6						5		
10	2025	4						6						6						4		
11	2026	5	Repair (Substr)	$5.00	$31,750.00	5	+ 1	6						6						5	$31,750.00	$22,936.88
12	2027	5						6						6						5		
13	2028	5						6						6						5		
14	2029	5						6						6						5		
15	2030	5						6						6						5		
16	2031	4						5						5						4		
17	2032	5	Repair (Substr)	$5.00	$31,750.00	5	+ 1	5						5						5	$31,750.00	$19,209.27
18	2033	5						5						5						5		
19	2034	5						5						5						5		
20	2035	5						5						5						5		
21	2036	5						5						5						5		
22	2037	4						5						5						4		
23	2038	5	Repair (Substr)	$5.00	$31,750.00	5	+ 1	5						5						5	$31,750.00	$16,087.46
24	2039	5						5						5						5		
25	2040	8	Replace (Bridge)	$171.88	$1,192,503.44	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	$1,192,503.44	$569,546.28
26	2041	8						8						8						8		
27	2042	8						8						8						8		
28	2043	8						8						8						8		
29	2044	8						8						8						8		
30	2045	8						8						8						8		
31	2046	8						8						8						8		
32	2047	8						8						8						8		
33	2048	8						8						8						8		
34	2049	8						8						8						8		
35	2050	7						7						7						7		
36	2051	7						7						7						7		
37	2052	7						7						7						7		
38	2053	7						7						7						7		
39	2054	7						7						7						7		
40	2055	7						7						7						7		
41	2056	7						7						7						7		
42	2057	7						7						7						7		
43	2058	7						7						7						7		
44	2059	6						6						6						6		
45	2060	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 0	7	$62,442.00	$16,512.08
46	2061	7						7						7						7		
47	2062	7						7						7						7		
48	2063	7						7						7						7		
49	2064	7						7						7						7		
50	2065	7						7						7						7		
51	2066	7						7						7						7		
52	2067	7						7						7						7		
53	2068	7						7						7						7		
54	2069	7						7						7						7		
55	2070	6						6						6						6		
56	2071	6						6						6						6		
57	2072	6						6						6						6		
58	2073	6						6						6						6		
59	2074	6						6						6						6		
60	2075	6						6						6						6		
61	2076	6						6						6						6		
62	2077	6						6						6						6		
63	2078	6						6						6						6		
64	2079	5						5						5						5		
65	2080	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 0	6	$62,442.00	$9,142.34
																				Total Cost =	**$1,748,996.94**	**$926,925.36**

Average Rating =	6.25
End Rating =	6

Comments:

AIRPORT WASH (#1121) / I-19 / MP 60.32

Option 3 - Perform Minimum Repairs Then Replace

Bridge Deck Area =	6350 SF
Widen Deck Area =	6938 SF
Year Built =	1965
Exp Service Life =	75 YR

Notes:

1. Red fill in "Year" column means current bridge is nearing the end of its expected service life.
2. When superstructure replacement is selected, deck replacement should be selected as well.
3. Deck Rehab does not account for any deck widening during replacement.
4. Widened deck area applies to bridge replacement only.
5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years. Repair (Deck) should maintain deck rating for life of repair, if the rating would otherwise drop a point (i.e., if the rating would drop from a "5" to a "4", Repair Deck would maintain a "5" at that year.
6. For other repair items, the "+" value rating should be applied to improve the bridge rating's value for that year.

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000550x	-0.201x	4.98
Superstr	y =	-0.000380x	-0.139x	7.21
Deck	y =	-0.000380x	-0.139x	7.21

		Substructure						*Superstructure*						*Deck*						*Summary*	
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year	Present Value at 3%
0	2015	6	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.							
1	2016	6						5						5								
2	2017	6						5						5								
3	2018	6						5						5								
4	2019	6						5						5								
5	2020	5						5						5								
6	2021	5						4						5						4		
7	2022	5						5	Repair (Supr - Conc)	$5.00	$31,750.00	7	+ 1	5	Repair (Deck)	$3.00	$19,050.00	7	+ 0	5	$50,800.00	$41,305.05
8	2023	5						5						5						5		
9	2024	5						5						5						5		
10	2025	4						5						5						4		
11	2026	5	Repair (Substr)	$5.00	$31,750.00	5	+ 1	5						5						5	$31,750.00	$22,936.88
12	2027	5						5						5						5		
13	2028	5						4						5						4		
14	2029	5						5	Repair (Supr - Conc)	$5.00	$31,750.00	7	+ 1	5	Repair (Deck)	$3.00	$19,050.00	7	+ 0	5	$50,800.00	$33,584.78
15	2030	5						5						5						5		
16	2031	4						5						5						4		
17	2032	5	Repair (Substr)	$5.00	$31,750.00	5	+ 1	5						5						5	$31,750.00	$19,209.27
18	2033	5						5						5						5		
19	2034	5						5						5						5		
20	2035	5						5						5						5		
21	2036	5						4	Repair (Supr - Conc)	$5.00	$31,750.00	7	+ 1	5	Repair (Deck)	$3.00	$19,050.00	7	+ 0	4	$50,800.00	$27,307.50
22	2037	4						5						5						4		
23	2038	5	Repair (Substr)	$5.00	$31,750.00	5	+ 1	5						5						5	$31,750.00	$16,087.46
24	2039	5						5						5						5		
25	2040	8	Replace (Bridge)	$171.88	$1,192,503.44	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	$1,192,503.44	$569,546.28
26	2041	8						8						8						8		
27	2042	8						8						8						8		
28	2043	8						8						8						8		
29	2044	8						8						8						8		
30	2045	8						8						8						8		
31	2046	8						8						8						8		
32	2047	8						8						8						8		
33	2048	8						8						8						8		
34	2049	8						8						8						8		
35	2050	7						7						7						7		
36	2051	7						7						7						7		
37	2052	7						7						7						7		
38	2053	7						7						7						7		
39	2054	7						7						7						7		
40	2055	7						7						7						7		
41	2056	7						7						7						7		
42	2057	7						7						7						7		
43	2058	7						7						7						7		
44	2059	6						6						6						6		
45	2060	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 0	7	$62,442.00	$16,512.08
46	2061	7						7						7						7		
47	2062	7						7						7						7		
48	2063	7						7						7						7		
49	2064	7						7						7						7		
50	2065	7						7						7						7		
51	2066	7						7						7						7		
52	2067	7						7						7						7		
53	2068	7						7						7						7		
54	2069	7						7						7						7		
55	2070	6						6						6						6		
56	2071	6						6						6						6		
57	2072	6						6						6						6		
58	2073	6						6						6						6		
59	2074	6						6						6						6		
60	2075	6						6						6						6		
61	2076	6						6						6						6		
62	2077	6						6						6						6		
63	2078	6						6						6						6		
64	2079	5						5						5						5		
65	2080	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 0	6	$62,442.00	$9,142.34
																				Total Cost =	**$1,565,037.44**	**$755,631.64**

Average Rating =	6.22
End Rating =	6

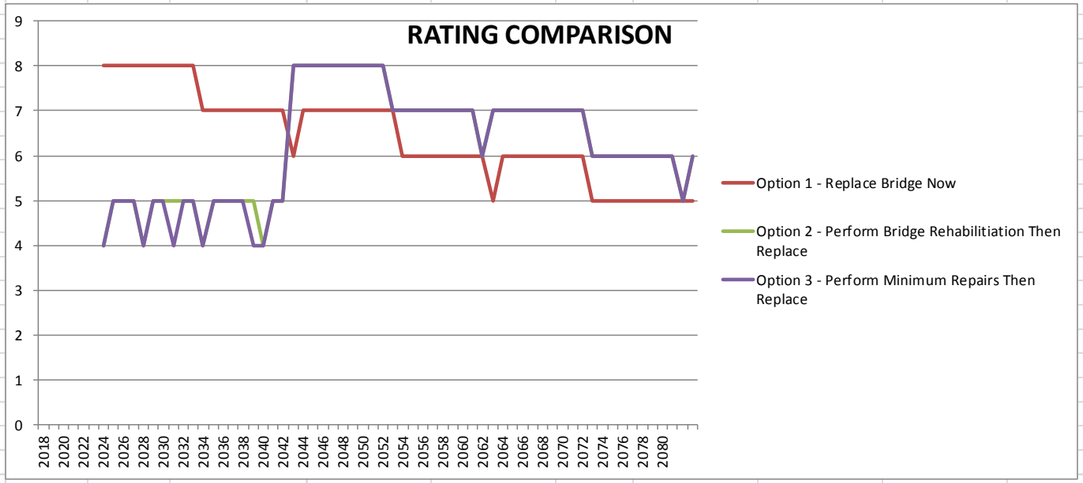
Comments:

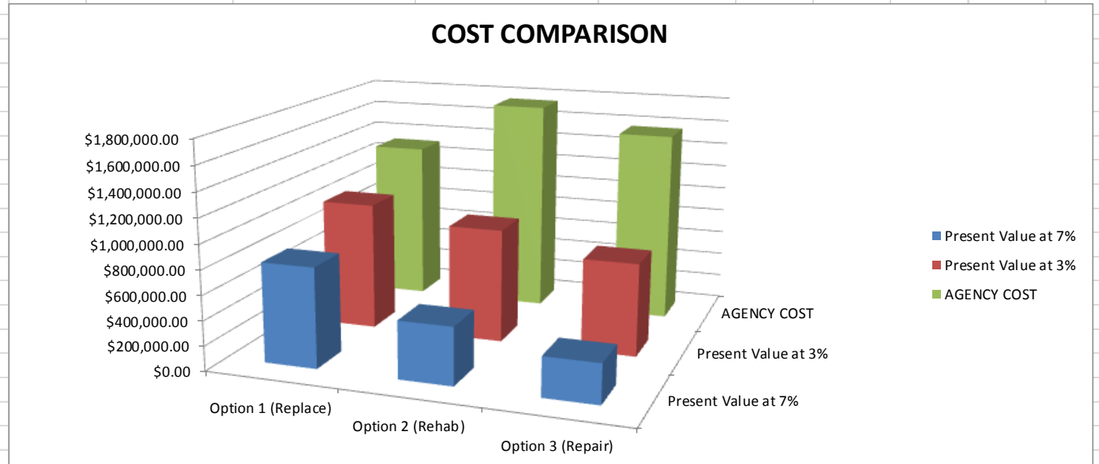
AIRPORT WASH (#1121) / I-19 / MP 60.32

COST COMPARISON Present Value Dollars			
OPTION	AGENCY COST	3%	7%
Option 1 (Replace)	$ 1,317,387.44	$1,043,688.03	$808,146.21
Option 2 (Rehab)	$ 1,748,996.94	$926,925.36	$464,759.95
Option 3 (Repair)	$ 1,565,037.44	$755,631.64	$318,897.82

Comparison to Replacement			
Option	Agency Cost	3%	7%
2 (Rehab)	75.32%	112.60%	173.88%
3 (Repair)	84.18%	138.12%	253.42%

Bridge Ratings Per Option		
OPTION	AVG RATING	END RATING
Option 1 (Replace)	6.45	5
Option 2 (Rehab)	6.25	6
Option 3 (Repair)	6.22	6





	Present Value at 7%	Present Value at 3%	AGENCY COST
Option 1 (Replace)	$808,146.21	$1,043,688.03	$ 1,317,387.44
Option 2 (Rehab)	$464,759.95	$926,925.36	$ 1,748,996.94
Option 3 (Repair)	$318,897.82	$755,631.64	$ 1,565,037.44

AIRPORT WASH (#1122) / I-19 / MP 60.32

Bridge Information	
Bridge Deck Area (A225)	6350 SF
Year Built (N27)	1965
Exp Service Life	75 YR
Total Bridge Length (N49)	147 LF
Number of Spans (N45+N46)	4
Skew Angle (N34)	34 DEG
Average Elevation	2454 FT
Max Pier Height	16 FT
* Amount of Widening for Bridge	4 FT
Revised Deck Area (Bridge Replace)	6938 FT
**Scour Critical Rating (N113)	7

Deterioration Slope

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000594x	-0.217x	4.61
Superstr	y =	-0.000300x	-0.110x	9.13
Deck	y =	-0.000436x	-0.159x	6.28

***Input 0 if no widening. Input should include widening on both sides of bridge if applicable.**

****If scour critical rating is 3 or lower, Option 2 should consider the implementation of scour countermeasures.**

Notes:

1. Widening is intended only to correct lane and/or shoulder width deficiencies. It is not intended for adding traffic capacity (i.e. adding general purpose lanes).

Cost Multipliers		
Elevation > 4000ft	2454	1.00
Pier Height > 30ft	16	1.00
Length to # span ratio	36.75	1.25
Skew > 30degrees	34.00	1.10

L to # Span Multiplier

L/ # Span Ratio	Multiplier
=>100	1.00
=>60	1.10
<60	1.25

Skew Multiplier

Skew	Multiplier
<30	1.00
=>30	1.10

Adjusted Bridge Replace Cost	
Base Bridge Replacement Cost (Per SF)	$125.00
Bridge Replacement Cost w/ Multipliers (Per SF)	$171.88

Elevation Multiplier

Elev	Multiplier
<4000	1.00
=>4000	1.25

Pier H Multiplier

Pier H	Multiplier
<30	1.00
=>30	1.10

User input cell

Only manipulate cell value after consulting with team

Bridge History (Inspections/As-builts)		
Description	**Category**	**Year**
Bridge was originally constructed in 1965 (19-1(5)RD).		1965
Scour slab was added in 2003 (I-019-A-504).	Rehab (Substr - Scour)	2003
Inspection notes wide sized transverse, diagonal, longitudinal and map cracks in deck.		
Soffit has narrow to medium sized longitudinal and random clocks…east edge of deck has minor spall.		
Abutments/piers have few narrow/medium sized vertical cracks.		
Inspection only recommends rehab of top deck surface.		

Replace / Rehab / Repair Information

BRIDGE DECK				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Replace (Deck)	Full Deck Replacement	$85.94	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	$10.00	15	+ 2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	$5.00	10	+ 1
Repair (Deck)	Patch Spalls / Seal Cracks	$3.00	See Deterioration Slope	+ 0
Replace (Bridge)	Full Bridge Replacement	$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 0
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 0

SUPERSTRUCTURE - STEEL				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Replace (Supr - Stl)	Full SuperStr Replacement	$85.94	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	$42.97	15	+ 2
Repair (Supr - Stl)	Weld Repair / Crack Relief	$5.00	See Deterioration Slope	+ 1

SUPERSTRUCTURE - CONCRETE				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Replace (Supr - Conc)	Full SuperStr Replacement	$85.94	50	Rating = 8
Rehab (Supr - Conc)	Replace Structural Component	$42.97	15	+ 2
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1
Replace (Bridge)	Full Bridge Replacement	$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 1
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 1

SUBSTRUCTURE - STRUCTURAL				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Replace (Substr)	Full SubStr Replacement	$85.94	75	Rating = 8
Rehab (Substr)	Replace Structural Component	$42.97	50	+ 2
Repair (Substr)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1

SUBSTRUCTURE - SCOUR				
ITEM	**DESCRIPTION**	**UNIT COST (Per SF)**	**LIFE (YRS)**	**RATING BENEFIT**
Rehab (Substr - Scour)	Add scour protection slabs	$42.97	50	+ 2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1
Replace (Bridge)	Full Bridge Replacement	$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 1
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 1

Notes:

1. Individual replacements assume 50% of total bridge replacement costs

2. Individual rehabs (in cells that are not highlighted) assume 25% of total bridge replacement costs

3. When superstructure replacement is selected, either deck replacement or deck rehab should be selected as well.

AIRPORT WASH (#1122) / I-19 / MP 60.32

Option 1 - Replace Bridge Now

Bridge Deck Area =	6350 SF
Widen Deck Area =	6938 SF
Year Built =	1965
Exp Service Life =	75 YR

Notes:

1. Red fill in "Year" column means current bridge is nearing the end of its expected service life.
2. When superstructure replacement is selected, deck replacement should be selected as well.
3. Deck Rehab does not account for any deck widening during replacement.
4. Widened deck area applies to bridge replacement only.
5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years.

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000594x	-0.217x	4.61
Superstr	y =	-0.000300x	-0.110x	9.13
Deck	y =	-0.000436x	-0.159x	6.28

		Substructure						*Superstructure*						*Deck*						*Summary*	
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year	Present Value at 3%
0	2015	6	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.							
1	2016	6						5						5								
2	2017	6						5						5								
3	2018	6						5						5								
4	2019	6						5						5								
5	2020	5						5						5								
6	2021	8	Replace (Bridge)	$171.88	$1,192,503.44	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	$1,192,503.44	$998,702.86
7	2022	8						8						8						8		
8	2023	8						8						8						8		
9	2024	8						8						8						8		
10	2025	8						8						8						8		
11	2026	8						8						8						8		
12	2027	8						8						8						8		
13	2028	8						8						8						8		
14	2029	8						8						8						8		
15	2030	8						8						8						8		
16	2031	7						7						7						7		
17	2032	7						7						7						7		
18	2033	7						7						7						7		
19	2034	7						7						7						7		
20	2035	7						7						7						7		
21	2036	7						7						7						7		
22	2037	7						7						7						7		
23	2038	7						7						7						7		
24	2039	7						7						7						7		
25	2040	6						6						6						6		
26	2041	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 0	7	$62,442.00	$28,954.03
27	2042	7						7						7						7		
28	2043	7						7						7						7		
29	2044	7						7						7						7		
30	2045	7						7						7						7		
31	2046	7						7						7						7		
32	2047	7						7						7						7		
33	2048	7						7						7						7		
34	2049	7						7						7						7		
35	2050	7						7						7						7		
36	2051	6						6						6						6		
37	2052	6						6						6						6		
38	2053	6						6						6						6		
39	2054	6						6						6						6		
40	2055	6						6						6						6		
41	2056	6						6						6						6		
42	2057	6						6						6						6		
43	2058	6						6						6						6		
44	2059	6						6						6						6		
45	2060	5						5						5						5		
46	2061	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 0	6	$62,442.00	$16,031.14
47	2062	6						6						6						6		
48	2063	6						6						6						6		
49	2064	6						6						6						6		
50	2065	6						6						6						6		
51	2066	6						6						6						6		
52	2067	6						6						6						6		
53	2068	6						6						6						6		
54	2069	6						6						6						6		
55	2070	5						5						5						5		
56	2071	5						5						5						5		
57	2072	5						5						5						5		
58	2073	5						5						5						5		
59	2074	5						5						5						5		
60	2075	5						5						5						5		
61	2076	5						5						5						5		
62	2077	5						5						5						5		
63	2078	5						5						5						5		
64	2079	5						5						5						5		
65	2080	5						5						5						5		
																				Total Cost =	**$1,317,387.44**	**$1,043,688.03**

Average Rating =	6.45
End Rating =	5

Comments:

AIRPORT WASH (#1122) / I-19 / MP 60.32

Option 2 - Perform Bridge Rehabilitiation Then Replace

Bridge Deck Area =	6350 SF
Widen Deck Area =	6938 SF
Year Built =	1965
Exp Service Life =	75 YR

Notes:

1. Red fill in "Year" column means current bridge is nearing the end of its expected service life.
2. When superstructure replacement is selected, deck replacement should be selected as well.
3. Deck Rehab does not account for any deck widening during replacement.
4. Widened deck area applies to bridge replacement only.
5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years. Repair (Deck) should maintain deck rating for life of repair, if the rating would otherwise drop a point (i.e., if the rating would drop from a "5" to a "4", Repair Deck would maintain a "5" at that year.)
6. For other repair items, the "+" value rating should be applied to improve the bridge rating's value for that year.

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000594x	-0.217x	4.61
Superstr	y =	-0.000300x	-0.110x	9.13
Deck	y =	-0.000436x	-0.159x	6.28

		Substructure						*Superstructure*						*Deck*						*Summary*	
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year	Present Value at 3%
0	2015	6	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.							
1	2016	6						5						5								
2	2017	6						5						5								
3	2018	6						5						5								
4	2019	6						5						5								
5	2020	5						5						5								
6	2021	5						5						4						4		
7	2022	5						6	Rehab (Supr - Conc)	$42.97	$272,859.50	15	+ 2	6	Rehab (Deck Concrete Overlay)	$10.00	$63,500.00	15	+ 2	5	$336,359.50	$273,491.05
8	2023	4						6						6						4		
9	2024	5	Repair (Substr)	$5.00	$31,750.00	5	+ 1	6						6						5	$31,750.00	$24,333.73
10	2025	5						6						6						5		
11	2026	5						6						6						5		
12	2027	4						6						6						4		
13	2028	5	Repair (Substr)	$5.00	$31,750.00	5	+ 1	6						6						5	$31,750.00	$21,620.21
14	2029	5						6						6						5		
15	2030	5						6						6						5		
16	2031	4						5						5						4		
17	2032	5	Repair (Substr)	$5.00	$31,750.00	5	+ 1	5						5						5	$31,750.00	$19,209.27
18	2033	5						5						5						5		
19	2034	5						5						5						5		
20	2035	4						5						5						4		
21	2036	5	Repair (Substr)	$5.00	$31,750.00	5	+ 1	5						5						5	$31,750.00	$17,067.19
22	2037	5						5						5						5		
23	2038	5						5						5						5		
24	2039	5						5						5						5		
25	2040	8	Replace (Bridge)	$171.88	$1,192,503.44	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	$1,192,503.44	$569,546.28
26	2041	8						8						8						8		
27	2042	8						8						8						8		
28	2043	8						8						8						8		
29	2044	8						8						8						8		
30	2045	8						8						8						8		
31	2046	8						8						8						8		
32	2047	8						8						8						8		
33	2048	8						8						8						8		
34	2049	8						8						8						8		
35	2050	7						7						7						7		
36	2051	7						7						7						7		
37	2052	7						7						7						7		
38	2053	7						7						7						7		
39	2054	7						7						7						7		
40	2055	7						7						7						7		
41	2056	7						7						7						7		
42	2057	7						7						7						7		
43	2058	7						7						7						7		
44	2059	6						6						6						6		
45	2060	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 0	7	$62,442.00	$16,512.08
46	2061	7						7						7						7		
47	2062	7						7						7						7		
48	2063	7						7						7						7		
49	2064	7						7						7						7		
50	2065	7						7						7						7		
51	2066	7						7						7						7		
52	2067	7						7						7						7		
53	2068	7						7						7						7		
54	2069	7						7						7						7		
55	2070	6						6						6						6		
56	2071	6						6						6						6		
57	2072	6						6						6						6		
58	2073	6						6						6						6		
59	2074	6						6						6						6		
60	2075	6						6						6						6		
61	2076	6						6						6						6		
62	2077	6						6						6						6		
63	2078	6						6						6						6		
64	2079	5						5						5						5		
65	2080	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 0	6	$62,442.00	$9,142.34
																				Total Cost =	**$1,780,746.94**	**$950,922.15**

Average Rating =	6.23
End Rating =	6

Comments:

AIRPORT WASH (#1122) / I-19 / MP 60.32

Option 3 - Perform Minimum Repairs Then Replace

Bridge Deck Area =	6350 SF
Widen Deck Area =	6938 SF
Year Built =	1965
Exp Service Life =	75 YR

Notes:

1. Red fill in "Year" column means current bridge is nearing the end of its expected service life.
2. When superstructure replacement is selected, deck replacement should be selected as well.
3. Deck Rehab does not account for any deck widening during replacement.
4. Widened deck area applies to bridge replacement only.
5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years. Repair (Deck) should maintain deck rating for life of repair, if the rating would otherwise drop a point (i.e., if the rating would drop from a "5" to a "4", Repair Deck would maintain a "5" at that year.
6. For other repair items, the "+" value rating should be applied to improve the bridge rating's value for that year.

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000594x	-0.217x	4.61
Superstr	y =	-0.000300x	-0.110x	9.13
Deck	y =	-0.000436x	-0.159x	6.28

		Substructure						*Superstructure*						*Deck*						*Summary*	
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year	Present Value at 3%
0	2015	6	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.					5	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.							
1	2016	6						5						5								
2	2017	6						5						5								
3	2018	6						5						5								
4	2019	6						5						5								
5	2020	5						5						5								
6	2021	5						4						5	Repair (Deck)	$3.00	$19,050.00	6	+ 0	4	$19,050.00	$15,954.08
7	2022	5						5	Repair (Supr - Conc)	$5.00	$31,750.00	9	+ 1	5						5	$31,750.00	$25,815.66
8	2023	4						5						5						4		
9	2024	5	Repair (Substr)	$5.00	$31,750.00	5	+ 1	5						5						5	$31,750.00	$24,333.73
10	2025	5						5						5						5		
11	2026	5						5						5						5		
12	2027	4						5						5	Repair (Deck)	$3.00	$19,050.00	6	+ 0	4	$19,050.00	$13,361.29
13	2028	5	Repair (Substr)	$5.00	$31,750.00	5	+ 1	5						5						5	$31,750.00	$21,620.21
14	2029	5						4						5						4		
15	2030	5						5	Repair (Supr - Conc)	$5.00	$31,750.00	9	+ 1	5						5	$31,750.00	$20,379.12
16	2031	4						5						5						4		
17	2032	5	Repair (Substr)	$5.00	$31,750.00	5	+ 1	5						5						5	$31,750.00	$19,209.27
18	2033	5						5						5	Repair (Deck)	$3.00	$19,050.00	6	+ 0	5	$19,050.00	$11,189.87
19	2034	5						5						5						5		
20	2035	4						5						5						4		
21	2036	5	Repair (Substr)	$5.00	$31,750.00	5	+ 1	5						5						5	$31,750.00	$17,067.19
22	2037	5						5						5						5		
23	2038	5						4						5						4		
24	2039	5						4						4						4		
25	2040	8	Replace (Bridge)	$171.88	$1,192,503.44	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	$1,192,503.44	$569,546.28
26	2041	8						8						8						8		
27	2042	8						8						8						8		
28	2043	8						8						8						8		
29	2044	8						8						8						8		
30	2045	8						8						8						8		
31	2046	8						8						8						8		
32	2047	8						8						8						8		
33	2048	8						8						8						8		
34	2049	8						8						8						8		
35	2050	7						7						7						7		
36	2051	7						7						7						7		
37	2052	7						7						7						7		
38	2053	7						7						7						7		
39	2054	7						7						7						7		
40	2055	7						7						7						7		
41	2056	7						7						7						7		
42	2057	7						7						7						7		
43	2058	7						7						7						7		
44	2059	6						6						6						6		
45	2060	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	7	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 0	7	$62,442.00	$16,512.08
46	2061	7						7						7						7		
47	2062	7						7						7						7		
48	2063	7						7						7						7		
49	2064	7						7						7						7		
50	2065	7						7						7						7		
51	2066	7						7						7						7		
52	2067	7						7						7						7		
53	2068	7						7						7						7		
54	2069	7						7						7						7		
55	2070	6						6						6						6		
56	2071	6						6						6						6		
57	2072	6						6						6						6		
58	2073	6						6						6						6		
59	2074	6						6						6						6		
60	2075	6						6						6						6		
61	2076	6						6						6						6		
62	2077	6						6						6						6		
63	2078	6						6						6						6		
64	2079	5						5						5						5		
65	2080	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 1	6	Repair (After Bridge Replace)	$3.00	$20,814.00	20	+ 0	6	$62,442.00	$9,142.34
																				Total Cost =	**$1,565,037.44**	**$764,131.10**

Average Rating =	6.18
End Rating =	6

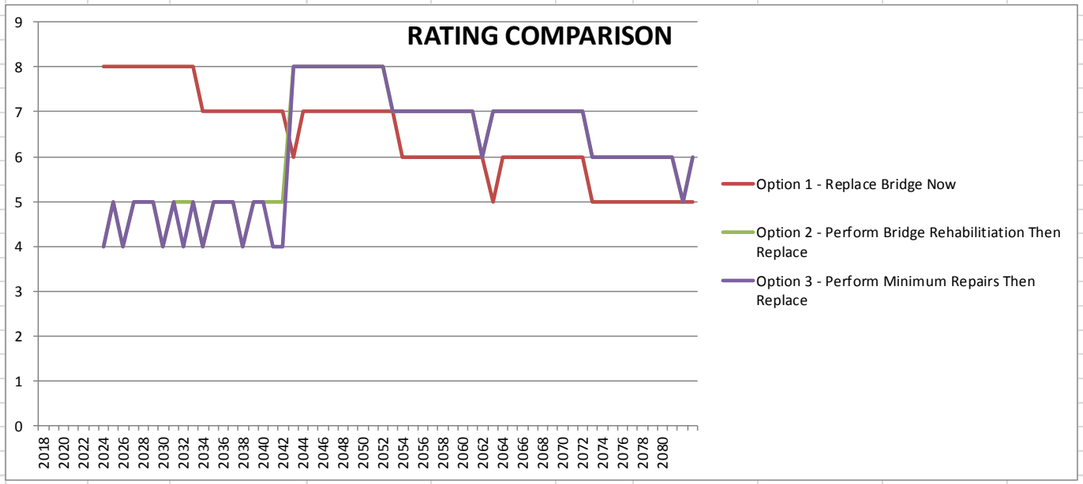
Comments:

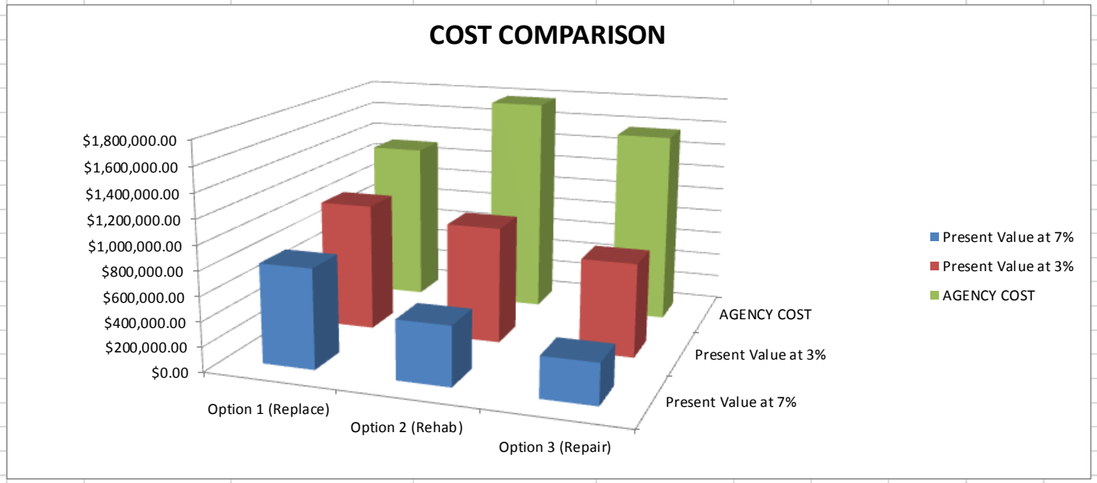
AIRPORT WASH (#1122) / I-19 / MP 60.32

COST COMPARISON Present Value Dollars			
OPTION	AGENCY COST	3%	7%
Option 1 (Replace)	$ 1,317,387.44	$1,043,688.03	$808,146.21
Option 2 (Rehab)	$ 1,780,746.94	$950,922.15	$481,091.25
Option 3 (Repair)	$ 1,565,037.44	$764,131.10	$329,691.88

Comparison to Replacement			
Option	Agency Cost	3%	7%
2 (Rehab)	73.98%	109.76%	167.98%
3 (Repair)	84.18%	136.58%	245.12%

Bridge Ratings Per Option		
OPTION	AVG RATING	END RATING
Option 1 (Replace)	6.45	5
Option 2 (Rehab)	6.23	6
Option 3 (Repair)	6.18	6





	Present Value at 7%	Present Value at 3%	AGENCY COST
Option 1 (Replace)	$808,146.21	$1,043,688.03	$ 1,317,387.44
Option 2 (Rehab)	$481,091.25	$950,922.15	$ 1,780,746.94
Option 3 (Repair)	$329,691.88	$764,131.10	$ 1,565,037.44

Appendix F: Crash Modification Factors and Factored Unit Construction Costs

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
REHABILITATION							
Rehabilitate Pavement (AC)	$276,500	Mile	2.20	$610,000	Mill and replace 1"-3" AC pvmt; accounts for 38' width; for one direction of travel on two lane roadway; includes pavement, striping, delineators, RPMs, rumble strips	0.70	Combination of rehabilitate pavement (0.92), striping, delineators, RPMs (0.77 for combination), and rumble strips (0.89) = 0.70
Rehabilitate Bridge	$65	SF	2.20	$140	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	Mile	2.20	$2,140,000	Includes excavation of approximately 3", pavement replacement (AC), striping, delineators, RPMs, rumble strips, for one direction of travel of 2-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	Mile	2.20	$6,510,000	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 NC DOT
Improve Skid Resistance	$675,000	Mile	2.20	$1,490,000	Average cost of pvmt 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	0.66	Combination of avg of 5 values from clearinghouse (0.77) and calculated value from HSM (0.87) for skid resistance; striping, delineators, RPMs (0.77 for combination), and rumble strips (0.89) = 0.66
INFRASTRUCTURE IMPROVEMENT							
Reconstruct to Urban Section	$1,000,000	Mile	2.20	$2,200,000	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	Mile	2.20	$2,011,000	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	Mile	2.20	$6,600,000	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	Mile	2.20	$4,950,000	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
Construct Climbing Lane (Low)	$1,500,000	Mile	2.20	$3,300,000	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	Lane-Mile	2.20	$5,280,000	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 conc barrier

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Construct Reversible Lane (High)	$4,800,000	Lane-Mile	2.20	$10,560,000	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 conc barrier
Construct Passing Lane	$1,500,000	Mile	2.20	$3,300,000	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	Each	2.20	$1,610,000	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.
Relocate Entry/Exit Ramp	$765,000	Each	2.20	$1,680,000	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	Each	2.20	$93,500	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	Avg 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	Each	2.20	$979,000	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	Each	2.20	$1,361,800	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"
Replace Pavement (AC) (with overexcavation)	$1,446,500	Mile	2.20	$3,180,000	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	Mile	2.20	$3,820,000	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	SF	2.20	$280	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	SF	2.20	$350	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	SF	2.20	$400	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

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Widen Bridge	$175	SF	2.20	$390	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	SF	2.20	$300	Includes cost to construct bridge based on linear feet of the bridge. This costs includes and assumes ramps and sidewalks leading to the structure.	0.1 (ped only)	Assumed direct access on both sides of structure
Implement Automated Bridge De-icing	$115	SF	2.20	$250	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	Each	2.20	$1,430,000	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	Each	2.20	$2,508,000	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	Each	2.20	$616,000	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	Each	2.20	$1,188,000	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
Construct Drainage Structure - Major	$8,000	LF	2.20	$17,600	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	Each	2.20	$280,500	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
OPERATIONAL IMPROVEMENT							
Implement Variable Speed Limits (Wireless, Overhead)	$718,900	Mile	2.20	$1,580,000	In one direction; includes 1 sign assembly per mile (foundation and structure), wireless communication, detectors	0.92	From 1 value from clearinghouse
Implement Variable Speed Limits (Wireless, Ground-mount)	$169,700	Mile	2.20	$373,300	In one direction; includes 2 signs per mile (foundations and posts), wireless communication, detectors	0.92	From 1 value from clearinghouse
Implement Variable Speed Limits (Wireless, Solar, Overhead)	$502,300	Mile	2.20	$1,110,000	In one direction; includes 1 sign assembly per mile (foundation and structure), wireless communication, detectors, solar power	0.92	From 1 value from clearinghouse
Implement Variable Speed Limits (Wireless, Solar, Ground-mount)	$88,400	Mile	2.20	$194,500	In one direction; includes 2 signs per mile (foundations and posts), wireless communication, detectors, solar power	0.92	From 1 value from clearinghouse
Implement Ramp Metering (Low)	$25,000	Each	2.20	$55,000	For each entry ramp location; urban area with existing ITS backbone infrastructure; includes signals, poles, cabinet, detectors, 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	Mile	2.20	$330,000	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	Mile	2.20	$308,000	Includes conduit, conductors, and controllers for 4 intersections that span a total of approximately 2 miles	0.90	Assumed

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Implement Left-Turn Phasing	$7,500	Each	2.20	$16,500	Includes four new signal heads (two in each direction) and associated conductors for one intersection	0.88 (protected) 0.98 (perm/prot or prot/perm)	From HSM; CMF = 0.94 for each protected approach and 0.99 for each perm/prot or prot/perm approach. CMFs of different approaches should be multiplied together. CMF applied to crashes within intersection
ROADSIDE DESIGN							
Install Guardrail	$130,000	Mile	2.20	$286,000	One side of road	0.62 (ROR)	0.62 is avg of 2 values from clearinghouse
Install Cable Barrier	$80,000	Mile	2.20	$176,000	In median	0.81	0.81 is average of 5 values from clearinghouse
Widen Shoulder (AC)	$256,000	Mile	2.20	$563,000	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 avg 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.)
Rehabilitate Shoulder (AC)	$113,000	Mile	2.20	$249,000	One direction of travel (14' total shldr 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 shldr 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	Mile	2.20	$801,000	One direction of travel (14' total shldr 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 shldr 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	Mile	2.20	$12,000	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	Mile	2.20	$6,000	Includes rumble strip only; no pavement rehab or striping	0.85	From HSM
Install Wildlife Fencing	$340,000	Mile	2.20	$748,000	Fencing only plus jump outs for 1 mile (both directions)	0.50 (wildlife)	Assumed
Remove Tree/Vegetation	$200,000	Mile	2.20	$440,000	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
Increase Clear Zone	$59,000	Mile	2.20	$130,000	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	LF	2.20	$33	8' fencing along residential section of roadway	0.10 (ped only)	Equal to ped overpass
Install Rock-Fall Mitigation - Wire Mesh	$1,320,000	Mile	2.20	$2,904,000	Includes wire mesh and rock stabilization (one direction)	0.75 (debris)	Assumed

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Install Rock-Fall Mitigation - Containment Fence & Barrier	$2,112,000	Mile	2.20	$4,646,000	Includes containment fencing, concrete barrier, and rock stabilization (one direction)	0.75 (debris)	Assumed
Install Raised Concrete Barrier in Median	$650,000	Mile	2.20	$1,430,000	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	Each	2.20	$17,000	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	Each	2.20	$61,000	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	Each	2.20	$177,100	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							
Construct Traffic Signal	$150,000	Each	2.20	$330,000	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	Each	2.20	$77,000	4-legged intersection; signal head size upgrade, installation of new back-plates, and installation of additional signal heads on new poles.	0.85	Avg of 7 values from clearinghouse; CMF applied to crashes within intersection only
Install Raised Median	$360,000	Mile	2.20	$792,000	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	Avg from HSM
Install Transverse Rumble Strip/Pavement Markings	$3,000	Each	2.20	$7,000	Includes ped markings and rumble strips only across a 30' wide travelway; no pavement rehab or other striping	0.95	Avg 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	Each	2.20	$3,300,000	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
Construct Double-Lane Roundabout	$1,800,000	Each	2.20	$3,960,000	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
ROADWAY DELINEATION							

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Install High-Visibility Edge Line Striping	$10,800	Mile	2.20	$23,800	2 edge lines and lane line - one direction of travel	0.77	Avg 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	Mile	2.20	$14,300	Both edges - one direction of travel		Avg 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	Mile	2.20	$4,400	Both edges - one direction of travel		Avg of 3 values from clearinghouse. Assumes package of striping, delineators, and RPMs. (If implemented separately, CMF will be higher.)
Install In-Lane Route Markings	$6,000	Each	2.20	$13,200	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	LF	2.20	$200	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	Mile	2.20	$594,000	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	Pole	2.20	$22,000	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	Each	2.20	$550,000	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	Each	2.20	$88,000	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)	Avg of 3 values from FHWA Desktop Reference for Crash Reduction Factors; CMF applies to crashes within 0.25 miles after a sign
Install Dynamic Speed Feedback Signs	$25,000	Each	2.20	$55,000	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	Mile	2.20	$40,500	On one side of road - includes signs, posts, and foundations	0.79	Average of 11 clearinghouse values
Install Curve Warning Signs	$2,500	Each	2.20	$5,500	Includes 2 signs, posts, and foundations	0.83	Average of 4 clearinghouse values; CMF applies to crashes within 0.25 miles after a sign

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Install Traffic Control Device Warning Signs (e.g., stop sign ahead, signal ahead, etc.)	$2,500	Each	2.20	$5,500	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	Each	2.20	$5,500	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	Each	2.20	$356,400	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
Install Warning Sign with Beacons	$15,000	Each	2.20	$33,000	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 Larger Stop Sign with Beacons	$10,000	Each	2.20	$22,000	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
DATA COLLECTION							
Install Roadside Weather Information System (RWIS)	$60,000	Each	2.20	$132,000	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	Each	2.20	$55,000	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
Install Vehicle Detection Stations	$15,000	Each	2.20	$33,000	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	Each	2.20	$33,000	Sensors with activation cabinet to alert through texting (agency)	1.00	Not expected to reduce crashes
Install Flood Sensors (Gates)	$100,000	Each	2.20	$220,000	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	Mile	2.20	$3,830,000	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	Mile	2.20	$2,640,000	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

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Convert a 2-Lane undivided highway to a 5-Lane highway	$1,576,000	Mile	2.20	$3,467,200	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
Install Center Turn Lane	$1,053,000	Mile	2.20	$2,316,600	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	Mile	2.20	$6,600,000	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	Mile	2.20	$13,200,000	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	Each	2.20	$22,000,000	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	Each	2.20	$33,000,000	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
Construct High-Occupancy Vehicle (HOV) Lane	$900,000	Mile	2.20	$1,980,000	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	Mile	2.20	$5,280,000	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	Mile	2.20	$6,600,000	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

^ Factor accounts for traffic control, erosion control, construction surveying and quality control, mobilization, construction engineering, contingencies, indirect cost allocation, and miscellaneous work

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

Performance Area Risk Factors

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)	Truck Buffer Index	Non-Truck Buffer Index	Grade (%)	Interrupted Flow (Y/N)	Outside/ Right Shoulder Width (ft)
19.1-1	20,595	15		3,390				2,471	n	0.04	0.09	0.5	n	10
19.1-2	16,071	12		3,150				2,571	n	0.00	0.00	0.6	y	9.6
19.3-1	20,595	15		3,390				2,471	n	0.04	0.09	0.5	n	10
19.3-2	16,071	12		3,150				2,571	n	0.00	0.00	0.6	y	9.6
19.5-1	36,855	17.5		2,850				7,002	n	0.03	0.05	0.3	n	9.92
19.5-2	67,438	3		2,460				4,046	n	0.08	0.06	0.5	n	10
19.6-1	36,855	17.5		2,850				7,002	n	0.03	0.05	0.3	n	9.92
19.6-2	67,438	7		2,460				4,046	n	0.08	0.06	0.5	n	10
19.9	36,855	0.5		2,850				7,002	n	0.03	0.05	0.3	n	9.92
19.10	36,855	0.5	0	2,850	8	y	16.00	7,002	n	0.03	0.05	0.3	n	9.92
19.11	36,855	0.5		2,850				7,002	n	0.03	0.05	0.3	n	9.92
19.12	67,438	1	1	2,450	7	y	16.00	4,046	n	0.08	0.06	1.5	n	10
19.13	67,438	7		2,450				4,046	n	0.08	0.06	0.7	n	10
19.14	67,438	5	1	2,450	7	y	16.00	4,046	n	0.08	0.06	0.7	n	10
19.15	67,438	2		1,450				4,046	n	0.08	0.06	0.7	n	10

Solution Number	Bridge	Pavement	Mobility	Safety	Freight	Risk Score (0 to 10)				
						Bridge	Pavement	Mobility	Safety	Freight
19.1-1	n	n	y	y	y	0.00	0.00	2.92	1.10	1.36
19.1-2	n	n	y	y	y	0.00	0.00	2.33	3.09	1.19
19.3-1	n	n	y	y	y	0.00	0.00	2.92	1.10	1.36
19.3-2	n	n	y	y	y	0.00	0.00	2.33	3.09	1.19
19.5-1	n	n	y	y	y	0.00	0.00	2.75	1.55	2.22
19.5-2	n	n	y	y	y	0.00	0.00	2.65	1.85	2.00
19.6-1	n	n	y	y	y	0.00	0.00	2.75	1.55	2.22
19.6-2	n	n	y	y	y	0.00	0.00	2.80	1.85	2.00
19.9	n	n	y	y	y	0.00	0.00	0.81	1.55	2.22
19.10	y	n	y	y	y	2.93	0.00	0.81	1.55	2.22
19.11	n	n	y	y	y	0.00	0.00	0.81	1.55	2.22
19.12	y	y	y	y	y	3.71	5.21	1.82	1.85	2.00
19.13	n	n	y	y	y	0.00	0.00	2.80	1.85	2.00
19.14	y	y	y	y	y	3.71	5.21	2.78	1.85	2.00
19.15	n	n	y	y	y	0.00	0.00	2.42	1.85	2.00

Appendix H: Candidate Solution Cost Estimates

Candidate Solution #	Candidate Project Name	Scope	BMP	EMP	Length	Sq Ft	Unit	Factored Construction Unit Cost	Preliminary Engineering Cost (0.03)	Design Cost (0.10)	Right-of-Way Cost	Construction Cost	Total
19.1	Nogales to Tubac Shoulder Improvements	Rehabilitate Shoulder (AC) (NB)	3	30	27	na	mile	$249,000	$202,000	$672,000	$-	$6,723,000	$7,597,000
		Rehabilitate Shoulder (AC) (SB)	3	30	27	na	mile	$249,000	$202,000	$672,000	$-	$6,723,000	$7,597,000
								Solution Total	**$404,000**	**$1,344,000**	**$-**	**$13,446,000**	**$15,194,000**
19.3	Nogales to Tubac Lighting	Install Lighting NB	3	30	27	na	mile	$594,000	$481,000	$1,604,000		$16,038,000	$18,123,000
		Install Lighting SB	3	30	27	na	mile	$594,000	$481,000	$1,604,000		$16,038,000	$18,123,000
								Solution Total	**$962,000**	**$3,208,000**	**$-**	**$32,076,000**	**$36,246,000**
19.5	Sahuarita to Tucson Lighting	Install Lighting NB	39.5	60	20.5	na	mile	$594,000	$365,000	$1,218,000		$12,177,000	$13,760,000
		Install Lighting SB	39.5	60	20.5	na	mile	$594,000	$365,000	$1,218,000		$12,177,000	$13,760,000
								Solution Total	**$730,000**	**$2,436,000**	**$-**	**$24,354,000**	**$27,520,000**
19.6	Sahuarita to Tucson Shoulder Improvements	Rehabilitate Shoulder (AC) NB	39.5	64	24.5	na	mile	$249,000	183,000	$610,000	$-	$6,101,000	$6,894,000
		Rehabilitate Shoulder (AC) SB	39.5	64	24.5	na	mile	$249,000	183,000	$610,000	$-	$6,101,000	$6,894,000
								Solution Total	**$366,000**	**$1,220,000**	**$-**	**$12,202,000**	**$13,788,000**
19.9	Sahuarita TI Ramp Improvements	Modify Entry/Exit Ramp to parallel confirguration	46.8	46.8	< 1.0 m	na	each (4)	$979,000	$117,000	$392,000	$-	$3,916,000	$4,425,000
								Solution Total	**$117,000**	**$392,000**	**$-**	**$3,916,000**	**$ 4,425,000**
19.10	Pima Mine TI Ramp Improvements	Modify Entry/Exit Ramp to parallel configuration	49.6	49.6	< 1.0 m	na	each (4)	$979,000	$117,000	$392,000	$-	$3,916,000	$4,425,000
		Widen Pima Mine TI OP (NB off-ramp)				2664	sf	$390	$31,000	$104,000		$1,038,960	$1,173,960
								Solution Total	**$148,000**	**$496,000**	**$-**	**$4,954,960**	**$ 5,598,960**
19.11	Papago TI Ramp Improvements	Modify entry/exit ramps to parallel configuration	54.4	54.4	< 1.0 m	4	each (4)	$979,000	$117,000	$392,000	$-	$3,916,000	$4,425,000
								Solution Total	**$117,000**	**$392,000**	**$-**	**$3,916,000**	**$ 4,425,000**
19.12	Tucson Area Parallel Ramps	Modify entry/exit ramps to parallel configuration Irvington Rd SB	57.0	61.0	4.0	2	each	$979,000	$59,000	$196,000	$-	$1,958,000	$2,213,000
		Modify entry/exit ramps to parallel configuration Valencia NB				2	each	$979,000	$59,000	$196,000	$-	$1,958,000	$2,213,000
		Modify entry/exit ramps to parallel configuration Valencia SB				2	each	$979,000	$59,000	$196,000	$-	$1,958,000	$2,213,000
		Modify entry/exit ramps to parallel configuration San Xavier NB				2	each	$979,000	$59,000	$196,000	$-	$1,958,000	$2,213,000
		Rehab Airport Wash Bridge NB				6350	sq ft	$140	$27,000	$89,000	$-	$889,000	$1,005,000
		Rehab Airport Wash Bridge SB				6350	sq ft	$140	$27,000	$89,000	$-	$889,000	$1,005,000
		Widen Airport Wash Bridge NB				1800	sq ft	$390	$21,000	$70,000	$-	$702,000	$793,000
		Widen Airport Wash Bridge SB				1800	sq ft	$390	$21,000	$70,000	$-	$702,000	$793,000
		Irvington Rd SB--Implement Ramp Meters (High)				1	each (x1)	$330,000	$10,000	$33,000	$-	$330,000	$373,000
		Valencia Rd NB/SB-- Implement				2	each (x2)	$330,000	$20,000	$66,000	$-	$660,000	$746,000

Candidate Solution #	Candidate Project Name	Scope	BMP	EMP	Length	Sq Ft	Unit	Factored Construction Unit Cost	Preliminary Engineering Cost (0.03)	Design Cost (0.10)	Right-of-Way Cost	Construction Cost	Total
		Ramp Meters (High)											
		San Xavier Rd NB--Implement Ramp Meters (High)				1	each (x1)	$330,000	$10,000	$33,000	$-	$330,000	$373,000
								Solution Total	**$372,000**	**$1,234,000**	**$-**	**$12,334,000**	**$13,940,000**
19.13	Tucson Variable Speed Limits	Implement Variable Speed Limits, wireless, overhead - NB	57	64	7	na	mile	$1,580,000	$332,000	$1,106,000	$-	$11,060,000	$12,498,000
		Implement Variable Speed Limits, wireless, overhead - SB	64	57	7	na	mile	$1,580,000	$332,000	$1,106,000	$-	$11,060,000	$12,498,000
								Solution Total	**$664,000**	**$2,212,000**	**$-**	**$22,120,000**	**$24,996,000**
19.14	Tucson Area GP Widening	Construct New General Purpose Lanes (AC) NB	57.0	62	5.0	na	lane mile	$2,640,000	$396,000	$1,320,000	$-	$13,200,000	$14,916,000
		Construct New General Purpose Lanes (AC) SB	57.0	62	5.0	na	lane mile	$2,640,000	$396,000	$1,320,000	$-	$13,200,000	$14,916,000
		Widen Airport Wash Bridge NB				1800	sq ft	$390	$21,000	$70,000	$-	$702,000	$793,000
		Widen Airport Wash Bridge SB				1800	sq ft	$390	$21,000	$70,000	$-	$702,000	$793,000
		Rehab Airport Wash Bridge SB				6350	sq ft	$140	$27,000	$89,000	$-	$889,000	$1,005,000
		Rehab Airport Wash Bridge NB				6350	sq ft	$140	$27,000	$89,000	$-	$889,000	$1,005,000
								Solution Total	**$888,000**	**$2,958,000**	**$-**	**$29,582,000**	**$33,428,000**
19.15	Drexel/Irvington Ped Overpass	Construct pedestrian overpass	59.5	61.5	2	4900	sf	$300	$44,000	$147,000	$-	$1,470,000	$1,661,000
		Barrier Fencing SB Drexel to Irvington			5280	na	lf	$ 33	$5,000	$17,000	$-	$174,000	$196,000
		Barrier Fencing NB 1/2 mi N of Valencia to 1/2 mi N of Irvington			10560	na	lf	$ 33	$10,000	$35,000		$348,000	$393,000
								Solution Total	**$59,000**	**$199,000**		**$1,992,000**	**$ 2,250,000**

Appendix I: Performance Effectiveness Scores

I-19 Candidate Solution Need Benefit Scoring

LEGEND:

- user entered value
- calculated value for reference only
- calculated value for entry/use in other spreadsheet
- for input into Performance Effectiveness Score spreadsheet
- assumed values (do not modify)

		Notes and Directions	Description	19.1-1 Nogales to Tubac Shoulder Rehab	19.1-2 Nogales to Tubac Shoulder Rehab	19.3-1 Nogales to Tubac Lighting	19.3-2 Nogales to Tubac Lighting	19.5-1 Sahuarita to Tucson Lighting	19.5-2 Sahuarita to Tucson Lighting	19.6-1 Sahuarita to Tucson Shldr Improvements	19.6-2 Sahuarita to Tucson Shldr Improvements	19.9 Sahuartia TI Ramp Improvements	19.10 Pima Mine TI Ramp Improvements	19.11 Papago TI Ramp Improvements	19.12 Tucson Area Parallel Ramps	19.13 Tucson Area Variable Speed Limits	19.14 Tucson Area GP Widening	19.15 Drexel/Irvington Pedestrian Overpass
			Solution #	19.1-1	19.1-2	19.3-1	19.3-2	19.5-1	19.5-2	19.6-1	19.6-2	19.9	19.10	19.11	19.12	19.13	19.14	19.15
			Description	Nogales to Tubac Shoulder Rehab	Nogales to Tubac Shoulder Rehab	Nogales to Tubac Lighting	Nogales to Tubac Lighting	Sahuarita to Tucson Lighting	Sahuarita to Tucson Lighting	Sahuarita to Tucson Shldr Improvements	Sahuarita to Tucson Shldr Improvements	Sahuartia TI Ramp Improvements	Pima Mine TI Ramp Improvements	Papago TI Ramp Improvements	Tucson Area Parallel Ramps	Tucson Area Variable Speed Limits	Tucson Area GP Widening	Drexel/Irvington Pedestrian Overpass
			Project Beg MP	2.95	18.24	2.95	18.24	39.53	57.19	39.53	57.19	46.8	49.6	54.4	57.19	57.19	57.19	59.5
			Project End MP	18.24	30.09	18.24	30.09	57.19	60	57.19	63.7	47.05	49.85	54.65	61.9	63.7	61.9	62
			Project Length (miles)	15.29	11.85	15.29	11.85	17.66	2.81	17.66	6.51	0.25	0.25	0.25	4.71	6.51	4.71	2.5
			Segment Beg MP	2.95	18.24	2.95	18.24	39.53	57.19	39.53	57.19	39.53	39.53	39.53	57.19	57.19	57.19	57.19
			Segment End MP	18.24	30.09	18.24	30.09	57.19	63.7	57.19	63.7	57.19	57.19	57.19	63.7	63.7	63.7	63.7
			Segment Length (miles)	15.29	11.85	15.29	11.85	17.66	6.51	17.66	6.51	17.66	17.66	17.66	6.51	6.51	6.51	6.51
			Segment #	2	3	2	3	5	6	5	6	5	5	5	6	6	6	6
			Current # of Lanes (both directions)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
			Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	two-way	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	0	0	0	0	0	0	0	1	0
			Pro-Rated # of Lanes	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.45	4.00
SAFETY	DIRECTIONAL SAFETY	Input current value from performance system (direction 1)	Orig Segment Directional Safety Index (NB)	1.340	1.590	1.340	1.590	2.110	0.800	2.110	0.800	2.110	2.110	2.110	0.800	0.800	0.800	0.800
		Input current value from performance system (direction 1)	Orig Segment Directional Fatal Crashes (NB)	5	3	5	3	13	2	13	2	13	13	13	2	2	2	2
		Input current value from performance system (direction 1)	Orig Segment Directional Incap Crashes (NB)	6	3	6	3	6	7	6	7	6	6	6	7	7	7	7
		Input current value from performance system (direction 1)	Original Fatal Crashes in project limits (NB)	5	3	2	1	4	1	13	2	0	2	0	0	2	1	1
		Input current value from performance system (direction 1)	Original Incap Crashes in project limits (NB)	6	3	3	1	0	3	6	7	0	0	0	4	7	7	0
		Input CMF value (direction 1) - If no CMF enter 1.0	CMF 1 (NB)(lowest CMF)	0.72	0.72	0.75	0.75	0.75	0.75	0.72	0.72	0.21	0.21	0.21	0.21	0.92	0.9	0.1
		Input CMF value (direction 1) - If no CMF enter 1.0	CMF 2 (NB)	1	1	1	1	1	1	1	1	1	1	1	0.64	1	1	1
		Input CMF value (direction 1) - If no CMF enter 1.1	CMF 3 (NB)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Input CMF value (direction 1) - If no CMF enter 1.2	CMF 4 (NB)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Input CMF value (direction 1) - If no CMF enter 1.0	CMF 5 (NB)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Calculated Value (direction 1)	Total CMF (NB)	0.720	0.720	0.750	0.750	0.750	0.750	0.720	0.720	0.210	0.210	0.210	0.172	0.920	0.900	0.100
		Calculated Value (direction 1)	Fatal Crash reduction (NB)	1.400	0.840	0.500	0.250	1.000	0.250	3.640	0.560	0.000	1.580	0.000	0.000	0.160	0.100	0.900
		Calculated Value (direction 1)	Incap Crash reduction (NB)	1.680	0.840	0.750	0.250	0.000	0.750	1.680	1.960	0.000	0.000	0.000	3.311	0.560	0.700	0.000
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 1)	Post-Project Segment Directional Fatal Crashes (NB)	3.600	2.160	4.500	2.750	12.000	1.750	9.360	1.440	13.000	11.420	13.000	2.000	1.840	1.900	1.100
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 1)	Post-Project Segment Directional Incap Crashes (NB)	4.320	2.160	5.250	2.750	6.000	6.250	4.320	5.040	6.000	6.000	6.000	3.689	6.440	6.300	7.000
		Input value from updated Safety Index spreadsheet (direction 1)	Post-Project Segment Directional Safety Index (NB)	0.95	1.14	1.21	1.46	1.95	0.7	1.52	0.58	2.11	1.86	2.11	0.73	0.74	0.75	0.51
		Enter in Safety Needs spreadsheet to calculate new segment level Safety Need (direction 1)	Post-Project Segment Directional Safety Index (NB)	0.950	1.140	1.210	1.460	1.950	0.700	1.520	0.580	2.110	1.860	2.110	0.730	0.740	0.750	0.510

				Solution #	19.1-1	19.1-2	19.3-1	19.3-2	19.5-1	19.5-2	19.6-1	19.6-2	19.9	19.10	19.11	19.12	19.13	19.14	19.15
		Input current value from performance system (direction 2)	Orig Segment Directional Safety Index (SB)		1.320	1.120	1.320	1.120	0.860	2.040	0.860	2.040	0.860	0.860	0.860	2.040	2.040	2.040	2.040
		Input current value from performance system (direction 2)	Orig Segment Directional Fatal Crashes (SB)		5	2	5	2	5	6	5	6	5	5	5	6	6	6	6
		Input current value from performance system (direction 2)	Orig Segment Directional Incap Crashes (SB)		6	4	6	4	7	4	7	4	7	7	7	4	4	4	4
		Input current value from performance system (direction 2)	Original Fatal Crashes in project limits (SB)		5	2	1	2	3	3	5	6	0	0	1	1	6	4	4
		Input current value from performance system (direction 2)	Original Incap Crashes in project limits (SB)		6	4	3	3	1	0	7	4	1	0	2	1	4	4	0
		Input CMF value (direction 2) - If no CMF enter 1.0	CMF 1 (SB)(lowest CMF)		0.72	0.72	0.75	0.75	0.75	0.75	0.72	0.72	0.21	0.21	0.21	0.21	0.92	0.9	0.1
		Input CMF value (direction 2) - If no CMF enter 1.0	CMF 2 (SB)		1	1	1	1	1	1	1	1	1	1	1	0.64	1	1	1
		Input CMF value (direction 2) - If no CMF enter 1.1	CMF 3 (SB)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Input CMF value (direction 2) - If no CMF enter 1.2	CMF 4 (SB)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Input CMF value (direction 2) - If no CMF enter 1.0	CMF 5 (SB)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Calculated Value (direction 2)	Total CMF (SB)		0.720	0.720	0.750	0.750	0.750	0.750	0.720	0.720	0.210	0.210	0.210	0.172	0.920	0.900	0.100
		Calculated Value (direction 2)	Fatal Crash reduction (SB)		1.400	0.560	0.250	0.500	0.750	0.750	1.400	1.680	0.000	0.000	0.790	0.828	0.480	0.400	3.600
		Calculated Value (direction 2)	Incap Crash reduction (SB)		1.680	1.120	0.750	0.750	0.250	0.000	1.960	1.120	0.790	0.000	1.580	0.828	0.320	0.400	0.000
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 2)	Post-Project Segment Directional Fatal Crashes (SB)		3.600	1.440	4.750	1.500	4.250	5.250	3.600	4.320	5.000	5.000	4.210	5.172	5.520	5.600	2.400
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 2)	Post-Project Segment Directional Incap Crashes (SB)		4.320	2.880	5.250	3.250	6.750	4.000	5.040	2.880	6.210	7.000	5.420	3.172	3.680	3.600	4.000
		Input value from updated Safety Index spreadsheet (direction 2)	Post-Project Segment Directional Safety Index (SB)		1.12	0.81	1.24	0.85	0.74	1.8	0.62	1.47	0.85	0.86	0.72	1.75	1.88	1.9	0.87
		Enter in Safety Needs spreadsheet to calculate new segment level Safety Need (direction 2)	Post-Project Segment Directional Safety Index (SB)		1.120	0.810	1.240	0.850	0.740	1.800	0.620	1.470	0.850	0.860	0.720	1.750	1.880	1.900	0.870
	SAFETY INDEX	Calculated Value - verify that it matches current performance system	Current Safety Index		1.330	1.355	1.330	1.355	1.485	1.420	1.485	1.420	1.485	1.485	1.485	1.420	1.420	1.420	1.420
	SAFETY INDEX	Enter in Safety Needs spreadsheet to calculate new segment level Safety Need	Post-Project Safety Index		1.03500	0.97500	1.225	1.155	1.345	1.250	1.070	1.025	1.480	1.360	1.415	1.240	1.310	1.325	0.690
	Needs	User entered value from Safety Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Safety Need		3.214	2.803	3.214	2.803	3.951	3.835	3.951	3.835	3.951	3.951	3.951	3.835	3.835	3.835	3.835
	Needs	User entered value from Safety Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Safety Need		**1.907**	**1.489**	**2.764**	**2.067**	**3.449**	**3.213**	**2.447**	**2.370**	**3.935**	**3.49**	**3.721**	**3.167**	**3.431**	**3.486**	**1.075**
MOBILITY	MOBILITY INDEX	Input current value from performance system	Original Segment Mobility Index		0.320	0.260	0.320	0.260	0.560	1.010	0.560	1.010	0.560	0.560	0.560	1.010	1.010	1.010	1.010
MOBILITY	MOBILITY INDEX	Enter in Mobility Index Spreadsheet to determine new segment level Mobility Index	Post-Project # of Lanes (both directions)		4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.45	4.00
MOBILITY	MOBILITY INDEX	Input value from updated Mobility Index spreadsheet	Post-Project Segment Mobility Index		0.32	0.26	0.32	0.26	0.56	1.01	0.56	1.01	0.51	0.51	0.51	0.92	0.92	0.74	1.01
MOBILITY	MOBILITY INDEX	Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Mobility Index		0.320	0.260	0.320	0.260	0.560	1.010	0.560	1.010	0.510	0.510	0.510	0.920	0.920	0.740	1.010
MOBILITY	FUT V/C	Input current value from performance system	Original Segment Future V/C		0.390	0.320	0.390	0.320	0.660	1.210	0.660	1.210	0.660	0.660	0.660	1.210	1.210	1.210	1.210
MOBILITY	FUT V/C	Input value from updated Mobility Index spreadsheet	Post-Project Segment Future V/C		0.390	0.320	0.390	0.320	0.660	1.210	0.660	1.210	0.600	0.600	0.600	1.100	1.100	0.890	1.210
MOBILITY	FUT V/C	Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Future V/C		0.390	0.320	0.390	0.320	0.660	1.210	0.660	1.210	0.600	0.600	0.600	1.100	1.100	0.890	1.210
MOBILITY	PEAK HOUR V/C	Input current value from performance system (direction 1)	Original Segment Peak Hour V/C (NB)		0.190	0.170	0.190	0.170	0.350	0.780	0.350	0.780	0.350	0.350	0.350	0.780	0.780	0.780	0.780
MOBILITY	PEAK HOUR V/C	Input current value from performance system (direction 2)	Original Segment Peak Hour V/C (SB)		0.200	0.170	0.200	0.170	0.360	0.760	0.360	0.760	0.360	0.360	0.360	0.760	0.760	0.760	0.760

			Solution #	19.1-1	19.1-2	19.3-1	19.3-2	19.5-1	19.5-2	19.6-1	19.6-2	19.9	19.10	19.11	19.12	19.13	19.14	19.15
		***If One-Way project**, enter in Mobility Index Spreadsheet to determine new segment level Peak Hour V/C. **If Two-Way project,** disregard	Adjusted total # of Lanes for use in directional peak hr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Input value from updated Mobility Index spreadsheet (direction 1)	Post-Project Segement Peak Hr V/C (NB)	0.190	0.170	0.19	0.17	0.35	0.78	0.35	0.78	0.32	0.32	0.32	0.68	0.68	0.57	0.78
		Input value from updated Mobility Index spreadsheet (direction 2)	Post-Project Segement Peak Hr V/C (SB)	0.200	0.170	0.20	0.17	0.36	0.76	0.36	0.76	0.33	0.33	0.33	0.66	0.66	0.56	0.76
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Peak Hr V/C (NB)	0.190	0.170	0.190	0.170	0.350	0.780	0.350	0.780	0.320	0.320	0.320	0.680	0.680	0.570	0.780
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Peak Hr V/C (SB)	0.200	0.170	0.200	0.170	0.360	0.760	0.360	0.760	0.330	0.330	0.330	0.660	0.660	0.560	0.760
	TTI AND PTI	Calculated Value (both directions)	Safety Reduction Factor	0.778	0.720	0.921	0.852	0.906	0.880	0.721	0.722	0.997	0.916	0.953	0.873	0.923	0.933	0.486
		Calculated Value (both directions)	Safety Reduction	0.222	0.280	0.079	0.148	0.094	0.120	0.279	0.278	0.003	0.084	0.047	0.127	0.077	0.067	0.514
		Calculated Value (both directions)	Mobility Reduction Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.911	0.911	0.911	0.911	0.911	0.733	1.000
		Calculated Value (both directions)	Mobility Reduction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.089	0.089	0.089	0.089	0.089	0.267	0.000
		Input current value from performance system (direction 1)	Original Directional Segment TTI (NB)	1.160	1.580	1.160	1.580	1.060	1.000	1.060	1.000	1.060	1.060	1.060	1.000	1.000	1.000	1.000
		Input current value from performance system (direction 1)	Original Directional Segment PTI (NB)	1.250	2.500	1.250	2.500	1.110	1.030	1.110	1.030	1.110	1.110	1.110	1.030	1.030	1.030	1.030
		Input current value from performance system (direction 2)	Original Directional Segment TTI (SB)	1.130	1.100	1.130	1.100	1.070	1.040	1.070	1.040	1.070	1.070	1.070	1.040	1.040	1.040	1.040
		Input current value from performance system (direction 2)	Original Directional Segment PTI (SB)	1.220	1.170	1.220	1.170	1.120	1.120	1.120	1.120	1.120	1.120	1.120	1.120	1.120	1.120	1.120
		Calculated Value (both directions)	Reduction Factor for Segment TTI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.027	0.027	0.027	0.027	0.027	0.080	0.000
		Calculated Value (both directions)	Reduction Factor for Segment PTI	0.067	0.084	0.024	0.044	0.028	0.036	0.084	0.083	0.019	0.043	0.032	0.056	0.041	0.074	0.154
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Directional Segment TTI (NB)	1.160	1.580	1.160	1.580	1.060	1.000	1.060	1.000	1.032	1.032	1.032	1.000	1.000	1.000	1.000
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Directional Segment PTI (NB)	1.167	2.500	1.220	2.500	1.079	1.015	1.017	1.015	1.089	1.062	1.074	1.015	1.015	1.015	1.015
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 2)	Post-Project Directional Segment TTTI (SB)	1.130	1.100	1.130	1.100	1.070	1.040	1.070	1.040	1.041	1.041	1.041	1.012	1.012	1.020	1.040
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 2)	Post-Project Directional Segment TPTI (SB)	1.139	1.170	1.191	1.170	1.088	1.080	1.026	1.027	1.099	1.072	1.084	1.06	1.07	1.038	1.060
	CLOSURE EXTENT	Input current value from performance system (direction 1)	Orig Segment Directional Closure Extent (NB)	0.220	0.300	0.220	0.300	0.250	0.380	0.250	0.380	0.250	0.250	0.250	0.380	0.380	0.380	0.380
		Input current value from performance system (direction 2)	Orig Segment Directional Closure Extent (SB)	0.170	0.170	0.170	0.170	0.150	0.060	0.150	0.060	0.150	0.150	0.150	0.060	0.060	0.060	0.060
		Input value from HCRS	Segment Closures with fatalities/injuries	20	7	20	7	28	9	28	9	28	28	28	9	9	9	9
		Input value from HCRS	Total Segment Closures	24	14	24	14	35	14	35	14	35	35	35	14	14	14	14
		Calculated Value (both directions)	% Closures with Fatality/Injury	0.83	0.50	0.83	0.50	0.80	0.64	0.80	0.64	0.80	0.80	0.80	0.64	0.64	0.64	0.64
		Calculated Value (both directions)	Closure Reduction	0.185	0.140	0.066	0.074	0.075	0.077	0.224	0.179	0.003	0.067	0.038	0.081	0.050	0.043	0.330
		Calculated Value (both directions)	Closure Reduction Factor	0.815	0.860	0.934	0.926	0.925	0.923	0.776	0.821	0.997	0.933	0.962	0.919	0.950	0.957	0.670
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Segment Directional Closure Extent (NB)	0.179	0.25793	0.206	0.278	0.231	0.351	0.194	0.312	0.249	0.233	0.241	0.349	0.361	0.364	0.254
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 2)	Post-Project Segment Directional Closure Extent (SB)	0.139	0.146	0.159	0.157	0.139	0.055	0.116	0.049	0.150	0.140	0.144	0.055	0.057	0.057	0.040
	BICYCLE ACCOM	Input current value from performance system	Orig Segment Bicycle Accomodation %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	95.0%	95.0%	95.0%	95.0%
		Input current value from performance system	Orig Segment Outside Shoulder width	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Input value from updated Mobility Index spreadsheet	Post-Project Segment Outside Shoulder width	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Input value from updated Mobility Index spreadsheet	Post-Project Segment Bicycle Accomodation (%)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	95.0%	95.0%	100.0%	95.0%
		Enter in Mobiity Needs spreadsheet to calculate new segment level Mobility Need	Post-Project Segment Bicycle Accomodation (%)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	95.0%	95.0%	100.0%	95.0%

				Solution #	19.1-1	19.1-2	19.3-1	19.3-2	19.5-1	19.5-2	19.6-1	19.6-2	19.9	19.10	19.11	19.12	19.13	19.14	19.15
FREIGHT	Needs	User entered value from Mobility Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Mobility Need		0.589	0.504	0.589	0.5039	0.722	4.316	0.722	4.316	0.722	0.722	0.722	4.316	4.316	4.316	4.316
		User entered value from Mobility Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Mobility Need		**0.573**	**0.495**	**0.583**	**0.4989**	**0.715**	**4.268**	**0.702**	**4.259**	**0.673**	**0.668**	**0.670**	**3.328**	**3.335**	**1.179**	**4.276**
	TTTI AND TPTI	Input current value from performance system (direction 1)	Original Directional Segment TTTI (NB)		1.040	1.430	1.040	1.430	1.030	1.020	1.030	1.020	1.030	1.030	1.030	1.020	1.020	1.020	1.020
		Input current value from performance system (direction 1)	Original Directional Segment TPTI (NB)		1.090	4.910	1.090	4.910	1.050	1.060	1.050	1.060	1.050	1.050	1.050	1.060	1.060	1.060	1.060
		Input current value from performance system (direction 2)	Original Directional Segment TTTI (SB)		1.040	1.030	1.040	1.030	1.030	1.080	1.030	1.080	1.030	1.030	1.030	1.080	1.080	1.080	1.080
		Input current value from performance system (direction 2)	Original Directional Segment TPTI (SB)		1.080	1.060	1.080	1.060	1.060	1.200	1.060	1.200	1.060	1.060	1.060	1.200	1.200	1.200	1.200
		Calculated Value (both directions)	Reduction Factor for Segment TTTI (both directions)		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.013	0.013	0.013	0.013	0.040	0.000
		Calculated Value (both directions)	Reduction Factor for Segment TPTI (both directions)		0.033	0.042	0.012	0.022	0.014	0.018	0.042	0.042	0.009	0.022	0.016	0.028	0.021	0.037	0.077
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Directional Segment TTTI (NB)		1.040	1.43000	1.040	1.430	1.030	1.020	1.030	1.020	1.016	1.016	1.016	1.006	1.006	1.000	1.020
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Directional Segment TPTI (NB)		1.054	4.91000	1.077	4.910	1.035	1.041	1.006	1.016	1.040	1.027	1.033	1.030	1.038	1.021	1.019
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Directional Segment TTTI (SB)		1.040	1.03000	1.040	1.030	1.030	1.080	1.030	1.080	1.016	1.016	1.016	1.066	1.066	1.037	1.080
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Directional Segment TPTI (SB)		1.044	1.06000	1.067	1.060	1.045	1.178	1.016	1.150	1.050	1.037	1.043	1.166	1.175	1.156	1.107
	FREIGHT INDEX	Value from above	Original Segment TPTI (NB)		1.090	4.910	1.090	4.910	1.050	1.060	1.050	1.060	1.050	1.050	1.050	1.060	1.060	1.060	1.060
		Value from above	Original Segment TPTI (SB)		1.080	1.060	1.080	1.060	1.060	1.200	1.060	1.200	1.060	1.060	1.060	1.200	1.200	1.200	1.200
		Calculated Value	Original Segment Freight Index		0.9217	0.3350	0.922	0.335	0.948	0.885	0.948	0.885	0.948	0.948	0.948	0.885	0.885	0.885	0.885
		Calculated Value	Post-Project Segment TPTI (NB)		1.054	4.910	1.077	4.910	1.035	1.041	1.006	1.016	1.040	1.027	1.033	1.030	1.038	1.021	1.019
		Calculated Value	Post-Project Segment TPTI (SB)		1.044	1.060	1.067	1.060	1.045	1.178	1.016	1.150	1.050	1.037	1.043	1.166	1.175	1.156	1.107
		Enter in Freight Needs spreadsheet to update segment level Freight Need	Post-Project Segment Freight Index		0.953379	0.33501	0.933	0.335	0.961	0.901	0.989	0.923	0.957	0.969	0.963	0.910	0.904	0.919	0.940
	CLOSURE DURATION	Input current value from performance system (direction 1)	Orig Segment Directional Closure Duration (dir 1)		45.090	87.900	45.090	87.900	39.820	66.470	39.820	66.470	39.820	39.820	39.820	66.470	66.470	66.470	66.470
		Input current value from performance system (direction 2)	Orig Segment Directional Closure Duration (dir 2)		33.780	53.940	33.780	53.940	23.750	22.610	23.750	22.610	23.750	23.750	23.750	22.610	22.610	22.610	22.610
		Calculated Value	Segment Closures with fatalities		20	7	20	7	28	9	28	9	28	28	28	9	9	9	9
		Calculated Value	Total Segment Closures		24	14	24	14	35	14	35	14	35	35	35	14	14	14	14
		Calculated Value	% Closures with Fatality		0.83	0.50	0.83	0.50	0.80	0.64	0.80	0.64	0.80	0.80	0.80	0.64	0.64	0.64	0.64
		Calculated Value	Closure Reduction		0.185	0.140	0.066	0.074	0.075	0.077	0.224	0.179	0.003	0.067	0.038	0.081	0.050	0.043	0.330
		Calculated Value	Closure Reduction Factor		0.815	0.860	0.934	0.926	0.925	0.923	0.776	0.821	0.997	0.933	0.962	0.919	0.950	0.957	0.670
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Segment Directional Closure Duration (NB)		36.756	75.575	42.124	81.413	36.817	61.354	30.917	54.584	39.713	37.139	38.318	61.053	63.160	63.611	44.503
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Segment Directional Closure Duration (SB)		27.536	46.376	31.558	49.959	21.959	20.870	18.440	18.567	23.686	22.151	22.854	20.768	21.484	21.638	15.138
	VERT CLR	Input current value from performance system	Original Segment Vertical Clearance		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Input current value from performance system	Original vertical clearance for specific bridge		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Input post-project value (depends on solution)	Post-Project vertical clearance for specific bridge		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Input post-project value (depends on solution)(force segment clearance to equal this specific bridge)	Post-Project Segment Vertical Clearance		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Enter in Freight Needs spreadsheet to update segment level	Post-Project Segment Vertical Clearance		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

				Solution #	19.1-1	19.1-2	19.3-1	19.3-2	19.5-1	19.5-2	19.6-1	19.6-2	19.9	19.10	19.11	19.12	19.13	19.14	19.15
BRIDGE		Freight Need																	
	Needs	User entered value from Freight Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Freight Need		0.531	0.91	0.531	0.91	0.207	0.644	0.207	0.644	0.207	0.207	0.207	0.644	0.644	0.644	0.644
		User entered value from Freight Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Freight Need		**0.518**	**0.882**	**0.528**	**0.907**	**0.203**	**0.638**	**0.194**	**0.629**	**0.205**	**0.201**	**0.203**	**0.636**	**0.638**	**0.636**	**0.619**
	BRIDGE INDEX	Input current value from performance system	Original Segment Bridge Index		NA	NA	NA	NA	NA	NA	NA	NA	NA	5.30	NA	6.06	NA	6.06	NA
		Input current value from performance system	Original lowest rating for specific bridge		NA	NA	NA	NA	NA	NA	NA	NA	NA	4	NA	5	NA	5	NA
		Input post-project value (For repair +1, rehab +2, replace=8)	Post-Project lowest rating for specific bridge		NA	NA	NA	NA	NA	NA	NA	NA	NA	6	NA	7	NA	7	NA
		Enter in Bridge Index spreadsheet to calculate new Bridge Index	Post-Project lowest rating for specific bridge		NA	NA	NA	NA	NA	NA	NA	NA	NA	6	NA	7	NA	7	NA
		Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Bridge Index		NA	NA	NA	NA	NA	NA	NA	NA	NA	5.50	NA	6.14	NA	6.14	NA
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Bridge Index		NA	NA	NA	NA	NA	NA	NA	NA	NA	5.50	NA	6.14	NA	6.14	NA
	SUFF RATING	Input current value from performance system	Original Segment Sufficiency Rating		NA	NA	NA	NA	NA	NA	NA	NA	NA	90.92	NA	77.40	NA	77.40	NA
		Input current value from performance system	Original Sufficiency Rating for specific bridge		NA	NA	NA	NA	NA	NA	NA	NA	NA	91.00	NA	83.43	NA	83.43	NA
		Input post-project value (For repair +10, rehab +20, replace=98)	Post-Project Sufficiency Rating for specific bridge		NA	NA	NA	NA	NA	NA	NA	NA	NA	100.00	NA	100.00	NA	100.00	NA
		Enter in Bridge Index spreadsheet to calculate new Bridge Index	Post-Project Sufficiency Rating for specific bridge		NA	NA	NA	NA	NA	NA	NA	NA	NA	100.00	NA	100.00	NA	100.00	NA
		Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Sufficiency Rating		NA	NA	NA	NA	NA	NA	NA	NA	NA	91.71	NA	78.73	NA	78.73	NA
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Sufficiency Rating		NA	NA	NA	NA	NA	NA	NA	NA	NA	91.71	NA	78.73	NA	78.73	NA
	BR RTNG	Input current value from performance system	Original Segment Bridge Rating		NA	NA	NA	NA	NA	NA	NA	NA	NA	4	NA	5	NA	5	NA
		Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Bridge Rating		NA	NA	NA	NA	NA	NA	NA	NA	NA	4	NA	5	NA	5	NA
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Bridge Rating		NA	NA	NA	NA	NA	NA	NA	NA	NA	4	NA	5	NA	5	NA
	% FUN OB	Input current value from performance system	Original Segment % Functionally Obsolete		NA	NA	NA	NA	NA	NA	NA	NA	NA	21.33 %	NA	19.43 %	NA	19.43 %	NA
		Input updated value from updated Bridge Index spreadsheet (only remove bridge from FO if replace or rehab)	Post-Project Segment % Functionally Obsolete		NA	NA	NA	NA	NA	NA	NA	NA	NA	21.33 %	NA	19.43 %	NA	19.43 %	NA
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment % Functionally Obsolete		NA	NA	NA	NA	NA	NA	NA	NA	NA	21.33 %	NA	19.43 %	NA	19.43 %	NA
	Needs	User entered value from Bridge Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Bridge Need		1.133	0.367	1.133	0.367	2.053	0.612	2.053	0.612	2.053	2.053	2.053	0.612	0.612	0.612	0.612
		User entered value from Bridge Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Bridge Need		1.133	0.367	1.133	0.367	2.053	0.612	2.053	0.612	2.053	1.853	2.053	**0.519**	0.612	**0.519**	0.612
PAVEMENT	**PAVEMENT INDEX**	Input current value from performance system	Original Segment Pavement Index															3.61	
		Input current value from performance system	Original Segment IRI in project limits															118	
		Input current value from performance system	Original Segment Cracking in project limits															0	
		Input post-project value (For rehab, increase to 45; for replace increase to 30)	Post-Project IRI in project limits															45	
		Enter in Pavement Index spreadsheet to calculate new Pavement Index	Post-Project IRI in project limits		0	0	0	0	0	0	0	0	0	0	0	0	0	45	0

			Solution #	19.1-1	19.1-2	19.3-1	19.3-2	19.5-1	19.5-2	19.6-1	19.6-2	19.9	19.10	19.11	19.12	19.13	19.14	19.15
		Input post-project value (Lower to 0 for rehab or replace)	Post-Project Cracking in project limits														0	
		Enter in Pavement Index spreadsheet to calculate new Pavement Index	Post-Project Cracking in project limits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Input updated segment value from updated Pavement Index spreadsheet	Post-Project Segment Pavement Index														3.78	
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Pavement Index	0	0	0	0	0	0	0	0	0	0	0	0	0	3.78	0
	DIRECTION PSR	Input current value from performance system (direction 1)	Original Segment Directional PSR (NB)														3.54	
		Input current value from performance system (direction 2)	Original Segment Directional PSR (SB)														3.57	
		Value from above	Original Segment IRI in project limits	0	0	0	0	0	0	0	0	0	0	0	0	0	118	0
		Value from above	Post-Project directional IRI in project limits	0	0	0	0	0	0	0	0	0	0	0	0	0	45	0
		Input updated segment value from updated Pavement Index spreadsheet (direction 1)	Post-Project Segment Directional PSR (NB)														3.73	
		Input updated segment value from updated Pavement Index spreadsheet (direction 2)	Post-Project Segment Directional PSR (SB)														3.73	
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Directional PSR (NB)	0	0	0	0	0	0	0	0	0	0	0	0	0	3.73	0
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Directional PSR (SB)	0	0	0	0	0	0	0	0	0	0	0	0	0	3.73	0
	% FAIL	Input current value from performance system	Original Segment % Failure														18.8%	
		Input value from updated Pavement Index spreadsheet	Post-Project Segment % Failure														9.4%	
		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%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.4%	0.0%
	Needs	User entered value from Pavement Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Pavement Need	0.033	0.505	0.033	0.505	0	0.887	0	0.887	0	0	0	0.887	0.887	0.887	0.887
		User entered value from Pavement Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Pavement Need	0.033	0.505	0.033	0.505	0	0.887	0	0.887	0	0	0	0.887	0.887	0.110	0.887

Performance Area Scoring

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost ($millions)	Pavement					Bridge					Safety					Mobility					Freight				
				Existing Need	Post-Solution Need	Raw Score	Risk Factor	Factored Score	Existing Need	Post-Solution Need	Raw Score	Risk Factor	Factored Score	Existing Need	Post-Solution Need	Raw Score	Risk Factor	Factored Score	Existing Need	Post-Solution Need	Raw Score	Risk Factor	Factored Score	Existing Need	Post-Solution Need	Raw Score	Risk Factor	Factored Score
19.1	Nogales to Tubac Shoulder Improvements	3 to 30	15.194	0.538	0.538	0.000		0.000	1.500	1.500	0.000		0.000	6.017	3.396	2.621		5.498	1.093	1.068	0.025		0.068	1.441	1.400	0.041		0.051
19.1-1	*Nogales to Tubac Shoulder Improvements*	*3 to 18*	*7.597*	*0.033*	*0.033*	*0.000*	*0.00*	*0.000*	*1.133*	*1.133*	*0.000*	*0.00*	*0.000*	*3.214*	*1.907*	*1.307*	*1.10*	*1.438*	*0.589*	*0.573*	*0.016*	*2.92*	*0.047*	*0.531*	*0.518*	*0.013*	*1.36*	*0.018*
19.1-2	*Nogales to Tubac Shoulder Improvements*	*18 to 30*	*7.597*	*0.505*	*0.505*	*0.000*	*0.00*	*0.000*	*0.367*	*0.367*	*0.000*	*0.00*	*0.000*	*2.803*	*1.489*	*1.314*	*3.09*	*4.060*	*0.504*	*0.495*	*0.009*	*2.33*	*0.021*	*0.910*	*0.882*	*0.028*	*1.19*	*0.033*
19.3	Nogales to Tubac Lighting	3 to 30	36.246	0.538	0.538	0.000		0.000	1.500	1.500	0.000		0.000	6.017	4.831	1.186		2.769	1.093	1.082	0.011		0.029	1.441	1.435	0.006		0.008
19.3-1	*Nogales to Tubac Lighting*	*3 to 18*	*18.123*	*0.033*	*0.033*	*0.000*	*0.00*	*0.000*	*1.133*	*1.133*	*0.000*	*0.00*	*0.000*	*3.214*	*2.764*	*0.450*	*1.10*	*0.495*	*0.589*	*0.583*	*0.006*	*2.92*	*0.018*	*0.531*	*0.528*	*0.003*	*1.36*	*0.004*
19.3-2	*Nogales to Tubac Lighting*	*18 to30*	*18.123*	*0.505*	*0.505*	*0.000*	*0.00*	*0.000*	*0.367*	*0.367*	*0.000*	*0.00*	*0.000*	*2.803*	*2.067*	*0.736*	*3.09*	*2.274*	*0.504*	*0.499*	*0.005*	*2.33*	*0.012*	*0.910*	*0.907*	*0.003*	*1.19*	*0.004*
19.5	Sahuarita to Tucson Lighting	39.5 to 60	27.52	0.000	0.000	0.000		0.000	3.115	3.115	0.000		0.000	7.786	6.662	1.124		1.929	5.038	4.983	0.055		0.146	0.851	0.841	0.010		0.021
19.5-1	*Sahuarita to Tucson Lighting*	*39.5 to 57*	*13.76*	*0.000*	*0.000*	*0.000*	*0.00*	*0.000*	*2.503*	*2.503*	*0.000*	*0.00*	*0.000*	*3.951*	*3.449*	*0.502*	*1.55*	*0.778*	*0.722*	*0.715*	*0.007*	*2.75*	*0.019*	*0.207*	*0.203*	*0.004*	*2.22*	*0.009*
19.5-2	*Sahuarita to Tucson Lighting*	*57 to 60*	*13.76*	*0.000*	*0.000*	*0.000*	*0.00*	*0.000*	*0.612*	*0.612*	*0.000*	*0.00*	*0.000*	*3.835*	*3.213*	*0.622*	*1.85*	*1.151*	*4.316*	*4.268*	*0.048*	*2.65*	*0.127*	*0.644*	*0.638*	*0.006*	*2.00*	*0.012*
19.6	Sahuarita to Tucson Shoulder Rehab	39.5 to 64	13.788	0.887	0.887	0.000		0.000	2.665	2.665	0.000		0.000	7.786	4.817	2.969		5.452	5.038	4.961	0.077		0.359	0.851	0.823	0.028		0.064
19.6-1	*Sahuarita to Tucson Shoulder Rehab*	*39.5 to 57*	*6.89*	*0.000*	*0.000*	*0.000*	*0.00*	*0.000*	*2.053*	*2.053*	*0.000*	*0.00*	*0.000*	*3.951*	*2.447*	*1.504*	*1.55*	*2.738*	*0.722*	*0.702*	*0.020*	*2.75*	*0.200*	*0.207*	*0.194*	*0.013*	*2.22*	*0.034*
19.6-2	*Sahuarita to Tucson Shoulder Rehab*	*57 to 64*	*6.89*	*0.887*	*0.887*	*0.000*	*0.00*	*0.000*	*0.612*	*0.612*	*0.000*	*0.00*	*0.000*	*3.835*	*2.370*	*1.465*	*1.85*	*2.714*	*4.316*	*4.259*	*0.057*	*2.80*	*0.160*	*0.644*	*0.629*	*0.015*	*2.00*	*0.030*
19.9	Sahuarita TI	46.8	4.43	0.000	0.000	0.000	0.00	0.000	2.053	2.053	0.000	0.00	0.000	3.951	3.935	0.016	1.55	0.025	0.722	0.673	0.049	0.81	0.040	0.207	0.205	0.002	2.22	0.004
19.10	Pima Mine TI	49.6	5.60	0.000	0.000	0.000	0.00	0.000	2.053	1.853	0.200	2.93	0.586	3.951	3.490	0.461	1.55	0.715	0.722	0.668	0.054	0.81	0.044	0.207	0.201	0.006	2.22	0.013
19.11	Papago TI	54.4	4.425	0.000	0.000	0.000	0.00	0.000	2.053	2.053	0.000	0.00	0.000	3.951	3.721	0.230	1.55	0.357	0.722	0.670	0.052	0.81	0.042	0.207	0.203	0.004	2.22	0.009

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost ($millions)	Pavement					Bridge					Safety					Mobility					Freight				
				Existing Need	Post-Solution Need	Raw Score	Risk Factor	Factored Score	Existing Need	Post-Solution Need	Raw Score	Risk Factor	Factored Score	Existing Need	Post-Solution Need	Raw Score	Risk Factor	Factored Score	Existing Need	Post-Solution Need	Raw Score	Risk Factor	Factored Score	Existing Need	Post-Solution Need	Raw Score	Risk Factor	Factored Score
19.12	Tucson Area Ramps	57 to 62	13.94	0.887	0.887	0.000	5.21	0.000	0.612	0.519	0.093	3.71	0.345	3.835	3.167	0.668	1.85	1.237	4.316	3.328	0.988	1.82	1.798	0.644	0.636	0.008	2.00	0.016
19.13	Tucson Area Variable Speed Limits	57 to 64	24.996	0.887	0.887	0.000	0.00	0.000	0.612	0.612	0.000	0.00	0.000	3.835	3.431	0.404	1.85	0.748	4.316	3.335	0.981	2.80	2.743	0.644	0.638	0.006	2.00	0.012
19.14	Tucson Area GP Widening	57 to 62	33.428	0.887	0.110	0.777	5.21	4.052	0.612	0.519	0.093	3.71	0.345	3.835	3.486	0.349	1.85	0.646	4.316	1.179	3.137	2.78	8.721	0.644	0.636	0.008	2.00	0.016
19.15	Drexel/Irvington Ped Overpass	59.5 to 61.5	2.25	0.887	0.887	0.000	0.00	0.000	0.612	0.612	0.000	0.00	0.000	3.835	1.075	2.760	1.85	5.112	4.316	4.276	0.040	2.42	0.097	0.644	0.619	0.025	2.00	0.050

Performance Area Scoring- Emphasis Areas

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
19.1	Nogales to Tubac Shoulder Improvements	3 to 30	15.3055	5.206	4.778	0.428		1.50	1.345	0.766	0.766	0.000		1.50	0.000	0.000	0.000	0.000		1.50	0.000
19.1-1	*Nogales to Tubac Shoulder Improvements*	*3 to 30*	*7.6525*	*2.603*	*2.389*	*0.214*	*1.10*	*1.50*	*0.353*	*0.383*	*0.383*	*0.000*	*2.92*	*1.50*	*0.000*	*0.000*	*0.000*	*0.000*	*1.36*	*1.50*	*0.000*
19.1-2	*Nogales to Tubac Shoulder Improvements*	*3 to 30*	*7.653*	*2.603*	*2.389*	*0.214*	*3.09*	*1.50*	*0.992*	*0.383*	*0.383*	*0.000*	*2.51*	*1.50*	*0.000*	*0.000*	*0.000*	*0.000*	*1.86*	*1.50*	*0.000*
19.3	Nogales to Tubac Lighting	3 to 30	36.434	5.206	5.005	0.201		1.50	0.699	0.766	0.766	0.000		1.50	0.000	0.000	0.000	0.000		1.50	0.000
19.3-1	*Nogales to Tubac Lighting*	*3 to 30*	*18.217*	*2.603*	*2.525*	*0.078*	*1.10*	*1.50*	*0.129*	*0.383*	*0.383*	*0.000*	*2.92*	*1.50*	*0.000*	*0.000*	*0.000*	*0.000*	*1.36*	*1.50*	*0.000*
19.3-2	*Nogales to Tubac Lighting*	*3 to 30*	*18.217*	*2.603*	*2.480*	*0.123*	*3.09*	*1.50*	*0.570*	*0.383*	*0.383*	*0.000*	*2.51*	*1.50*	*0.000*	*0.000*	*0.000*	*0.000*	*1.86*	*1.50*	*0.000*
19.5	Sahuarita to Tucson Lighting	39.5 to 60	27.52	5.206	5.024	0.182		1.50	0.450	0.766	0.766	0.000		1.50	0.000	0.000	0.000	0.000		1.50	0.000
19.5-1	*Sahuarita to Tucson Lighting*	*39.5 to 60*	*13.76*	*2.603*	*2.480*	*0.123*	*1.55*	*1.50*	*0.286*	*0.383*	*0.383*	*0.000*	*2.75*	*1.50*	*0.000*	*0.000*	*0.000*	*0.000*	*2.22*	*1.50*	*0.000*
19.5-2	*Sahuarita to Tucson Lighting*	*39.5 to 60*	*13.76*	*2.603*	*2.544*	*0.059*	*1.85*	*1.50*	*0.164*	*0.383*	*0.383*	*0.000*	*2.77*	*1.50*	*0.000*	*0.000*	*0.000*	*0.000*	*2.00*	*1.50*	*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
19.6	Sahuarita to Tucson Shoulder Rehab	39.5 to 60	12.606	5.206	4.738	0.468		1.50	0.762	0.766	0.766	0.000		1.50	0.015	0.000	0.000	0.000		1.50	0.000
19.6-1	*Sahuarita to Tucson Shoulder Rehab*	*39.5 to 60*	*6.303*	*2.603*	*2.270*	*0.333*	*1.55*	*1.50*	*0.387*	*0.383*	*0.383*	*0.000*	*2.75*	*1.50*	*0.015*	*0.000*	*0.000*	*0.000*	*2.22*	*1.50*	*0.000*
19.6-2	*Sahuarita to Tucson Shoulder Rehab*	*39.5 to 60*	*6.303*	*2.603*	*2.468*	*0.135*	*1.85*	*1.50*	*0.375*	*0.383*	*0.383*	*0.000*	*2.77*	*1.50*	*0.000*	*0.000*	*0.000*	*0.000*	*2.00*	*1.50*	*0.000*
19.9	Sahuarita TI	46.8	4.643	2.603	2.598	0.005	1.55	1.50	0.012	0.383	0.371	0.012	0.81	1.50	0.015	0.000	0.000	0.000	2.22	1.50	0.000
19.1	Pima Mine TI	49.6	5.599	2.603	2.496	0.107	1.55	1.50	0.249	0.383	0.371	0.012	0.81	1.50	0.015	0.000	0.000	0.000	2.22	1.50	0.000
19.11	Papago TI	54.4	4.643	2.603	2.540	0.063	1.55	1.50	0.147	0.383	0.371	0.012	0.81	1.50	0.015	0.000	0.000	0.000	2.22	1.50	0.000
19.12	Tucson Area Ramps	57 to 62	18.955	2.603	2.540	0.063	1.85	1.50	0.175	0.383	0.374	0.009	1.82	1.50	0.025	0.000	0.000	0.000	2.00	1.50	0.000
19.13	Tucson Area Variable Speed Limits	57 to 64	24.996	2.603	2.565	0.038	1.85	1.50	0.106	0.383	0.374	0.009	2.80	1.50	0.038	0.000	0.000	0.000	2.00	1.50	0.000
19.14	Tucson Area GP Widening	57 to 62	34.324	2.603	2.570	0.033	1.85	1.50	0.092	0.383	0.358	0.025	2.77	1.50	0.104	0.000	0.000	0.000	2.00	1.50	0.000
19.15	Drexel/Irvington Ped Overpass	59.5 to 62	2.154	2.603	2.368	0.235	1.85	1.50	0.653	0.383	0.383	0.000	0.82	1.50	0.000	0.000	0.000	0.000	2.00	1.50	0.000

I-19 Performance Effectiveness Scoring Results

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost ($millions)	Risk Factored Benefit Score					Risk Factored Emphasis Area Score			Total Factored Benefit Score	F_{VMT}	F_{NPV}	Performance Effectiveness Score
				Pavement	Bridge	Mobility	Safety	Freight	Safety	Mobility	Freight				
19.1	Nogales to Tubac Shoulder Improvements	3 to 30	15.194	0.000	0.000	0.068	5.498	0.051	1.345	0.000	0.000	6.962	5.00	15.3	35.0
19.1-1	*Nogales to Tubac Shoulder Improvements*	*3 to 18*	*7.597*	*0.000*	*0.000*	*0.047*	*1.438*	*0.018*	*0.353*	*0.000*	*0.000*	*1.855*	*4.93*	*15.3*	*18.4*
19.1-2	*Nogales to Tubac Shoulder Improvements*	*18 to 30*	*7.597*	*0.000*	*0.000*	*0.021*	*4.060*	*0.033*	*0.992*	*0.000*	*0.000*	*5.106*	*4.66*	*15.3*	*47.9*
19.3	Nogales to Tubac Lighting	3 to 30	36.246	0.000	0.000	0.029	2.769	0.008	0.699	0.000	0.000	3.505	5.00	15.3	7.4
19.3-1	*Nogales to Tubac Lighting*	*3 to 18*	*18.123*	*0.000*	*0.000*	*0.018*	*0.495*	*0.004*	*0.129*	*0.000*	*0.000*	*0.645*	*4.93*	*15.3*	*2.7*
19.3-2	*Nogales to Tubac Lighting*	*18 to30*	*18.123*	*0.000*	*0.000*	*0.012*	*2.274*	*0.004*	*0.570*	*0.000*	*0.000*	*2.860*	*4.66*	*15.3*	*11.2*
19.5	Sahuarita to Tucson Lighting	39.5 to 60	27.52	0.000	0.000	0.146	1.929	0.021	0.450	0.000	0.000	2.546	5.00	15.3	7.1
19.5-1	*Sahuarita to Tucson Lighting*	*39.5 to 57*	*13.76*	*0.000*	*0.000*	*0.019*	*0.778*	*0.009*	*0.286*	*0.000*	*0.000*	*1.092*	*5.00*	*15.3*	*6.1*
19.5-2	*Sahuarita to Tucson Lighting*	*57 to 60*	*13.76*	*0.000*	*0.000*	*0.127*	*1.151*	*0.012*	*0.164*	*0.000*	*0.000*	*1.454*	*4.70*	*15.3*	*7.6*
19.6	Sahuarita to Tucson Shoulder Rehab	39.5 to 64	13.788	0.000	0.000	0.359	5.452	0.064	0.762	0.015	0.000	6.652	5.00	15.3	36.9
19.6-1	*Sahuarita to Tucson Shoulder Rehab*	*39.5 to 57*	*6.894*	*0.000*	*0.000*	*0.200*	*2.738*	*0.034*	*0.387*	*0.015*	*0.000*	*3.374*	*5.00*	*15.3*	*37.4*
19.6-2	*Sahuarita to Tucson Shoulder Rehab*	*57 to 64*	*6.894*	*0.000*	*0.000*	*0.160*	*2.714*	*0.030*	*0.375*	*0.000*	*0.000*	*3.278*	*4.99*	*15.3*	*36.3*
19.9	Sahuarita TI	46.8	4.425	0.000	0.000	0.040	0.025	0.004	0.012	0.015	0.000	0.095	1.13	20.2	0.5
19.10	Pima Mine TI	49.6	5.599	0.000	0.586	0.044	0.715	0.013	0.249	0.015	0.000	1.622	1.13	20.2	6.6
19.11	Papago TI	54.4	4.425	0.000	0.000	0.042	0.357	0.009	0.147	0.015	0.000	0.569	1.13	20.2	2.9
19.12	Tucson Area Ramps	57 to 62	13.94	0.000	0.345	1.798	1.237	0.016	0.175	0.025	0.000	3.596	3.04	20.2	15.9
19.13	Tucson Area Variable Speed Limits	57 to 64	24.996	0.000	0.000	2.743	0.748	0.012	0.106	0.038	0.000	3.646	4.99	15.3	11.1
19.14	Tucson Area GP Widening	57 to 62	33.428	4.052	0.345	8.721	0.646	0.016	0.092	0.104	0.000	13.976	4.95	20.2	41.8
19.15	Drexel/Irvington Ped Overpass	59.5 to 61.5	2.25	0.000	0.000	0.097	5.112	0.050	0.653	0.000	0.000	5.912	1.04	20.2	55.4

Appendix J: Solution Prioritization Scores

Performance Evaluation Risk Factors and Prioritization

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	Performance Effectiveness Score	Prioritization Score
				Score	%	Score	%	Score	%	Score	%	Score	%		Pavement	Bridge	Safety	Mobility	Freight				
19.1	Nogales to Tubac Shoulder Improvements	3 to 30	15.194	0.000	0.0%	0.000	0.0%	6.843	98.3%	0.068	1.0%	0.051	0.7%	6.962	1.14	1.51	1.78	1.36	1.36	1.773	1.19	35.0	**74**
19.1-1	Nogales to Tubac Shoulder Improvements	3 to 18	7.597	0.000	0.0%	0.000	0.0%	1.791	96.5%	0.047	2.5%	0.018	1.0%	1.855	1.14	1.51	1.78	1.36	1.36	1.765	1.23	*18.4*	**40**
19.1-2	Nogales to Tubac Shoulder Improvements	18 to 30	7.597	0.000	0.0%	0.000	0.0%	5.052	98.9%	0.021	0.4%	0.033	0.7%	5.106	1.14	1.51	1.78	1.36	1.36	1.776	1.15	*47.9*	**98**
19.3	Nogales to Tubac Lighting	3 to 30	36.246	0.000	0.0%	0.000	0.0%	3.468	98.9%	0.029	0.8%	0.008	0.2%	3.505	1.14	1.51	1.78	1.36	1.36	1.776	1.19	7.4	**16**
19.3-1	Nogales to Tubac Lighting	3 to 18	18.123	0.000	0.0%	0.000	0.0%	0.624	96.7%	0.018	2.7%	0.004	0.6%	0.645	1.14	1.51	1.78	1.36	1.36	1.766	1.23	*2.7*	**6**
19.3-2	Nogales to Tubac Lighting	18 to30	18.123	0.000	0.0%	0.000	0.0%	2.844	99.5%	0.012	0.4%	0.004	0.1%	2.860	1.14	1.51	1.78	1.36	1.36	1.778	1.15	*11.2*	**23**
19.5	Sahuarita to Tucson Lighting	39.5 to 60	27.52	0.000	0.0%	0.000	0.0%	2.379	93.4%	0.146	5.8%	0.021	0.8%	2.546	1.14	1.51	1.78	1.36	1.36	1.752	1.26	7.1	**16**
19.5-1	Sahuarita to Tucson Lighting	39.5 to 57	13.76	0.000	0.0%	0.000	0.0%	1.064	97.4%	0.019	1.8%	0.009	0.8%	1.092	1.14	1.51	1.78	1.36	1.36	1.769	1.15	*6.1*	**12**
19.5-2	Sahuarita to Tucson Lighting	57 to 60	13.76	0.000	0.0%	0.000	0.0%	1.314	90.4%	0.127	8.8%	0.012	0.8%	1.454	1.14	1.51	1.78	1.36	1.36	1.740	1.92	*7.6*	**25**
19.6	Sahuarita to Tucson Shoulder Rehab	39.5 to 64	13.788	0.000	0.0%	0.000	0.0%	6.214	93.4%	0.374	5.6%	0.064	1.0%	6.652	1.14	1.51	1.78	1.36	1.36	1.752	1.37	36.9	**89**
19.6-1	Sahuarita to Tucson Shoulder Rehab	39.5 to 57	6.894	0.000	0.0%	0.000	0.0%	3.125	92.6%	0.214	6.3%	0.034	1.0%	3.374	1.14	1.51	1.78	1.36	1.36	1.749	1.15	*37.4*	**75**
19.6-2	Sahuarita to Tucson Shoulder Rehab	57 to 64	6.894	0.000	0.0%	0.000	0.0%	3.089	94.2%	0.160	4.9%	0.030	0.9%	3.278	1.14	1.51	1.78	1.36	1.36	1.756	1.92	*36.3*	**122**
19.9	Sahuarita TI	46.8	4.425	0.000	0.0%	0.000	0.0%	0.036	38.2%	0.055	57.2%	0.004	4.7%	0.095	1.14	1.51	1.78	1.36	1.36	1.520	1.15	0.5	**1**
19.10	Pima Mine TI	49.6	5.599	0.000	0.0%	0.586	36.2%	0.964	59.4%	0.059	3.6%	0.013	0.8%	1.622	1.14	1.51	1.78	1.36	1.36	1.664	1.15	6.6	**13**
19.11	Papago TI	54.4	4.425	0.000	0.0%	0.000	0.0%	0.503	88.4%	0.057	10.0%	0.009	1.6%	0.569	1.14	1.51	1.78	1.36	1.36	1.731	1.15	2.9	**6**
19.12	Tucson Area Ramps	57 to 62	13.94	0.000	0.0%	0.345	9.6%	1.412	39.3%	1.823	50.7%	0.016	0.4%	3.596	1.14	1.51	1.78	1.36	1.36	1.539	1.92	15.9	**47**
19.13	Tucson Area Variable Speed Limits	57 to 64	24.996	0.000	0.0%	0.000	0.0%	0.854	23.4%	2.780	76.3%	0.012	0.3%	3.646	1.14	1.51	1.78	1.36	1.36	1.458	1.92	11.1	**31**
19.14	Tucson Area GP Widening	57 to 62	33.428	4.052	29.0%	0.345	2.5%	0.738	5.3%	8.825	63.1%	0.016	0.1%	13.976	1.14	1.51	1.78	1.36	1.36	1.322	1.92	41.8	**106**
19.15	Drexel/Irvington Ped Overpass	59.5 to 61.5	2.25	0.000	0.0%	0.000	0.0%	5.765	97.5%	0.097	1.6%	0.050	0.8%	5.912	1.14	1.51	1.78	1.36	1.36	1.770	1.92	55.4	**188**

Appendix K: Preliminary Scoping Reports for Prioritized Solutions

PRELIMINARY SCOPING REPORT

GENERAL PROJECT INFORMATION	
Date: March 3, 2017	ADOT Project Manager: n/a
Project Name: Nogales to Tubac Shoulder Improvements	
City/Town Name: Tucson	County: Santa Cruz
Primary Route/Street: I-19	
Beginning Limit: 3	
End Limit: 30	
Project Length: 27 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
A high rate of crashes with fatalities and serious injuries are reported by the Tucson District and confirmed by the Corridor Profile Study. Segments 19-2 and 19-3 show increased levels of safety need. Prevalent crash types include single vehicle crashes, overturning, rear-end, collision with fixed object, and failure to keep in lane. Contributing factors include excess speeds, improper lane changes, and higher traffic volumes.

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☒	Modernization ☐	Expansion ☐
The project will rehabilitate shoulders; improve striping, edge of pavement delineation, and signage from the Mariposa Rd TI (Nogales) to the Aravaca Rd TI (Tubac). The project will assist drivers' awareness of lane and edge of road markings in an effort to reduce associated types of crashes.			

PRELIMINARY SCOPING REPORT

PROJECT TYPE		
Pavement Preservation ☐	Roadway Widening ☐	System Enhancement ☒
Bridge Scour/Rehab ☐	Bridge Replacement ☐	Sign Replacement ☐
Other ☒ : Roadside safety improvements		

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: Serious crashes
Risk Description: *(If a box is checked above, briefly explain the risk)* Temporary traffic controls must be implemented during the construction period. The project is expected to mitigate the risks of continued higher rates of serious crashes.	

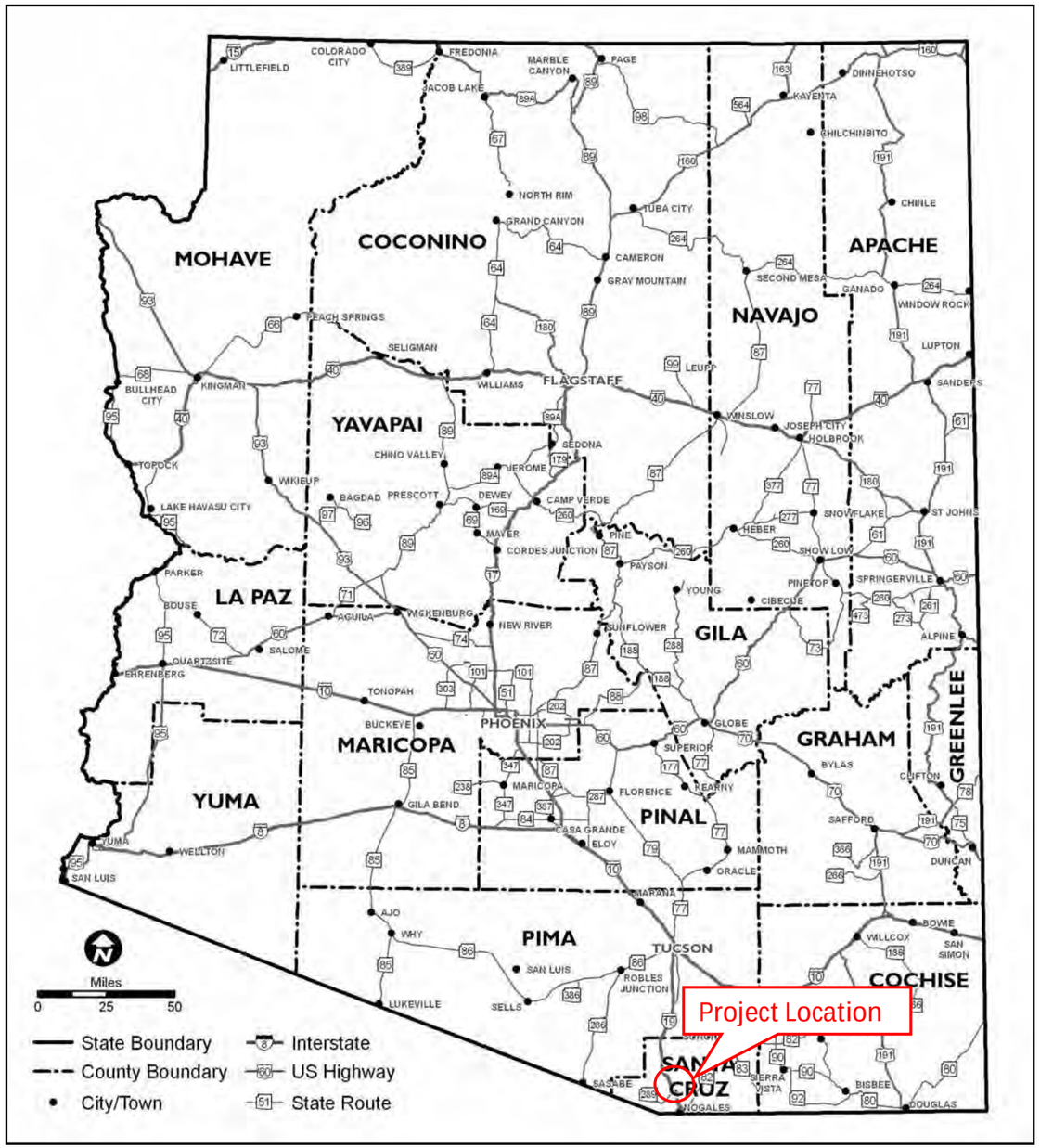
FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STP	☐ TAP	☐ HSIP	☒ State
	☐ Local	☐ Private	☐ Other:	

COST ESTIMATE				
Preliminary Eng	Design	Right-of-Way	Construction	Total
$404,000	$1,344,000	$0	$13,446,000	$15,194,000

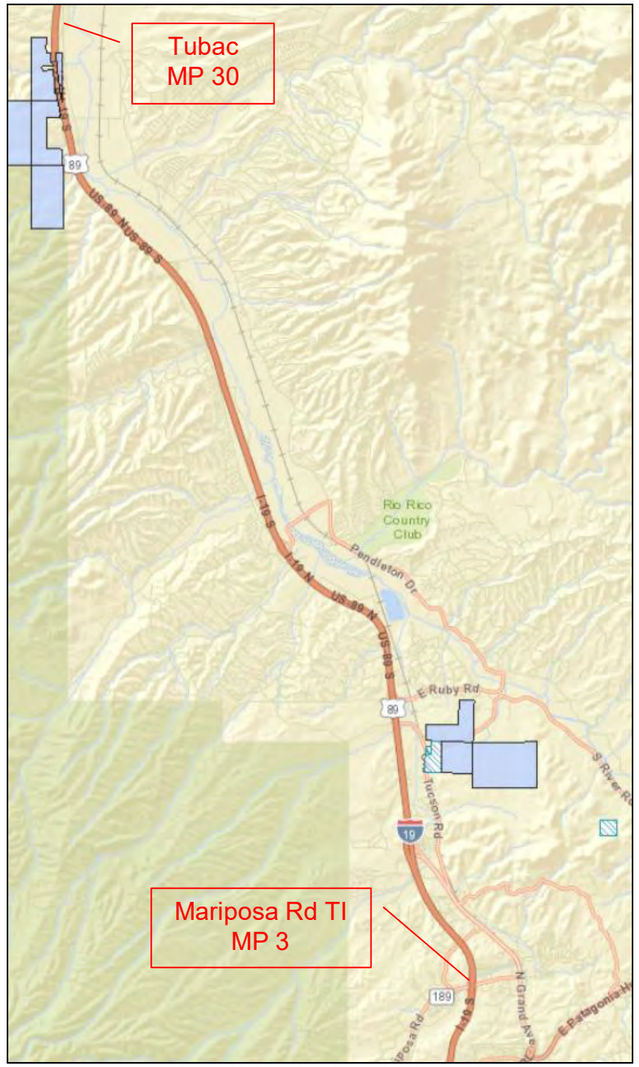
PROJECT DELIVERY
Delivery: ☐ Design-Bid-Build ☐ Design-Build ☐ Other:
Design Program Year: FY
Construction Program Year: FY

ATTACHMENTS
1) State Location Map X 2) Project Vicinity Map X 3) Project Scope of Work 4) Project Schedule 5) Itemized Cost Estimate 6) 15% Design Plan Sheets (as needed)

ATTACHMENT 1 – STATE LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP



Source: http://gis.azland.gov/webapps/parcel

SCOPE OF WORK
(Provide a detailed breakdown of the project's scope of work using bullet format) • Rehabilitate inside and outside shoulder including mill and replace pavement, rumble strip install, raised pavement markers, and necessary striping in both NB and SB direction • Install high-visibility edge line striping including edge line and lane lines in both NB and SB direction · Install high-visibility delineators on both inside and outside edges in both NB and SB direction

GENERAL PROJECT INFORMATION	
Date: March 3, 2017	ADOT Project Manager: n/a
Project Name: Nogales to Tubac Lighting	
City/Town Name: Tucson	County: Santa Cruz
Primary Route/Street: I-19	
Beginning Limit: 3	
End Limit: 30	
Project Length: 27 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
A high rate of crashes with fatalities and serious injuries are reported by the Tucson District and confirmed by the Corridor Profile Study. Segments 19-2 and 19-3 show increased levels of safety need. Prevalent crash types include a large majority occurring in dark conditions.

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☒	Modernization ☐	Expansion ☐
The project will install lighting from the Mariposa Rd TI (Nogales) to the Aravaca Rd TI (Tubac). The project will improve the visibility of the corridor in an effort to reduce associated types of crashes.			

PRELIMINARY SCOPING REPORT

PROJECT TYPE		
Pavement Preservation ☐	Roadway Widening ☐	System Enhancement ☒
Bridge Scour/Rehab ☐	Bridge Replacement ☐	Sign Replacement ☐
Other ☒ : Improve lighting		

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: Serious crashes
Risk Description: *(If a box is checked above, briefly explain the risk)* Temporary traffic controls must be implemented during the construction period. The project is expected to mitigate the risks of continued higher rates of serious crashes.	

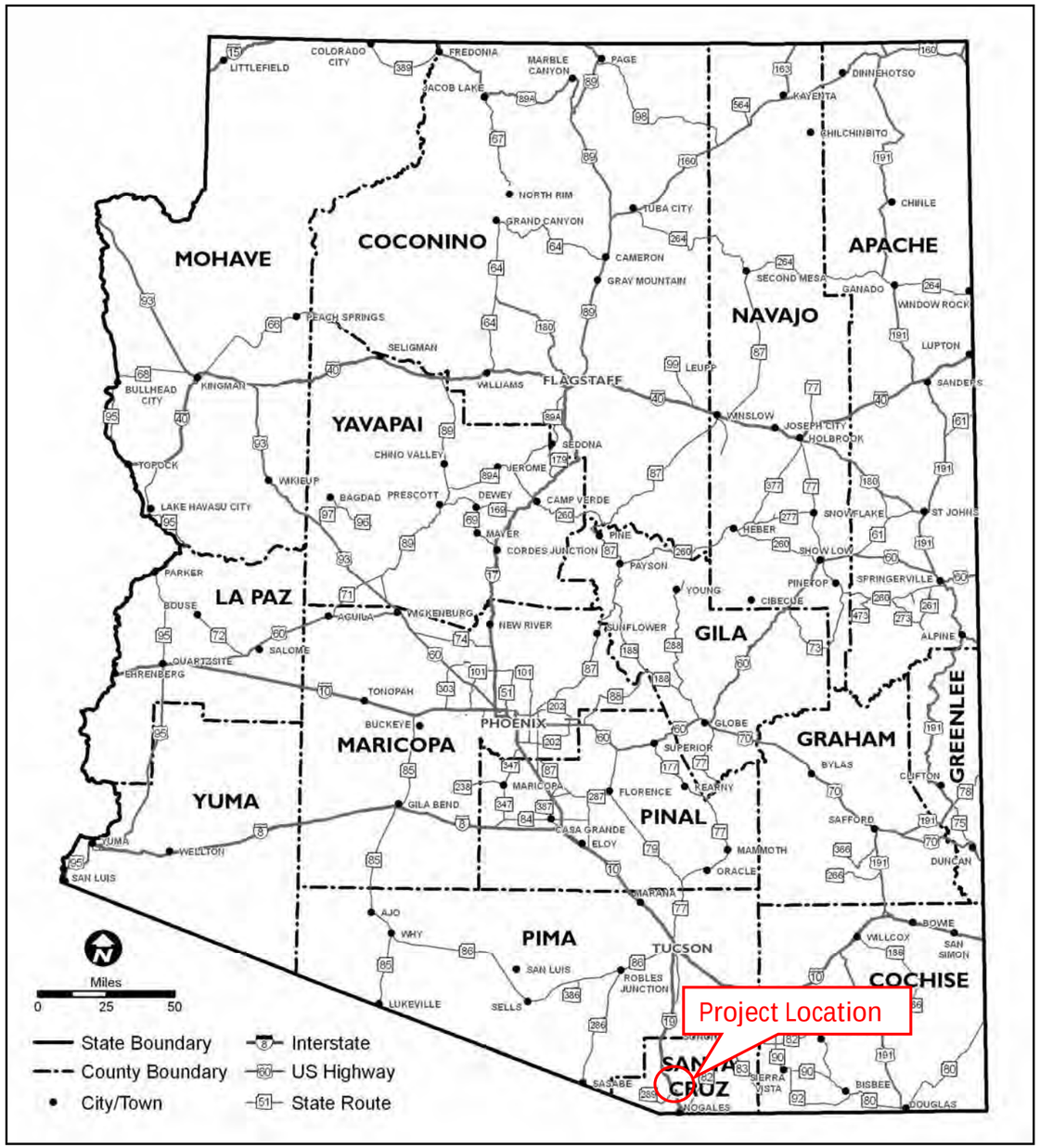
FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STP	☐ TAP	☐ HSIP	☒ State
	☐ Local	☐ Private	☐ Other:	

COST ESTIMATE				
Preliminary Eng	Design	Right-of-Way	Construction	Total
$962,000	$3,208,000	$0	$32,076,000	$36,246,000

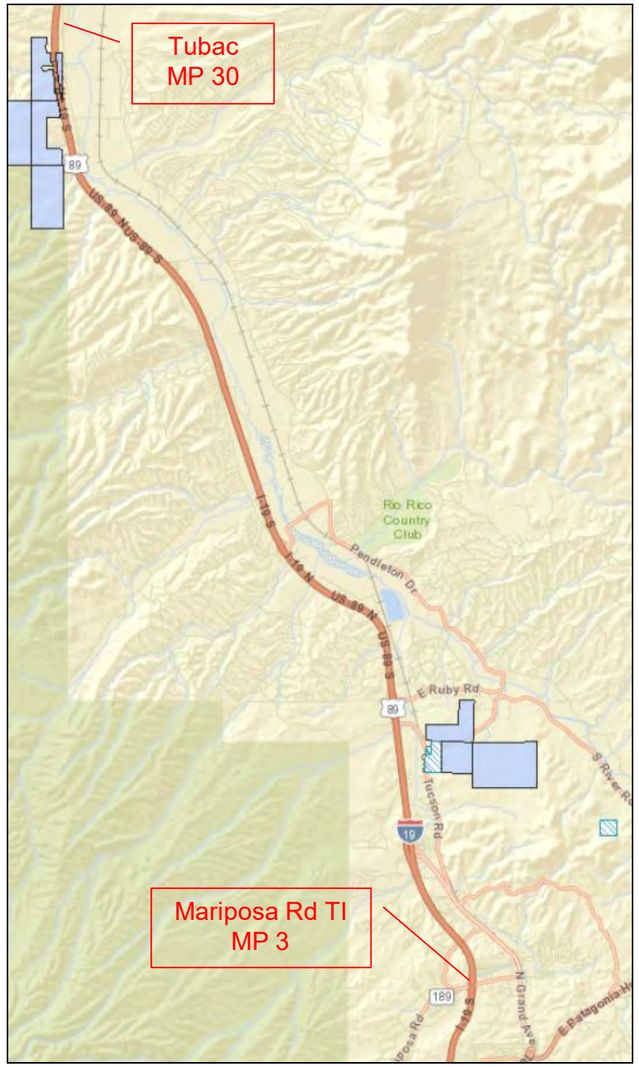
PROJECT DELIVERY
Delivery: ☐ Design-Bid-Build ☐ Design-Build ☐ Other:
Design Program Year: FY
Construction Program Year: FY

ATTACHMENTS
1) State Location Map X 2) Project Vicinity Map X 3) Project Scope of Work 4) Project Schedule 5) Itemized Cost Estimate 6) 15% Design Plan Sheets (as needed)

ATTACHMENT 1 – STATE LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP



SCOPE OF WORK
(Provide a detailed breakdown of the project's scope of work using bullet format) · Install lighting NB from Maricopa Rd TI to Tubac at MP 30 · Install lighting SB from Tubac at MP 30 to Maricopa Rd TI

PRELIMINARY SCOPING REPORT

GENERAL PROJECT INFORMATION	
Date: March 3, 2017	ADOT Project Manager: n/a
Project Name: Sahuarita to Tucson Lighting	
City/Town Name: Tucson	County: Santa Cruz
Primary Route/Street: I-19	
Beginning Limit: MP 39.5	
End Limit: MP 60	
Project Length: 20.5 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
A high rate of crashes with fatalities and serious injuries are reported by the Tucson District and confirmed by the Corridor Profile Study. Segments 19-5 and 19-6 show increased levels of safety need. Prevalent crash types include a large majority occurring in dark conditions.

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☒	Modernization ☐	Expansion ☐
The project will install lighting from Sahuarita at MP 39.5 to Tucson near MP 60. The project will improve the visibility of the corridor in an effort to reduce associated types of crashes.			

PRELIMINARY SCOPING REPORT

PROJECT TYPE		
Pavement Preservation ☐	Roadway Widening ☐	System Enhancement ☒
Bridge Scour/Rehab ☐	Bridge Replacement ☐	Sign Replacement ☐
Other ☒ : Improve lighting		

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: Serious crashes
Risk Description: *(If a box is checked above, briefly explain the risk)* Temporary traffic controls must be implemented during the construction period. The project is expected to mitigate the risks of continued higher rates of serious crashes.	

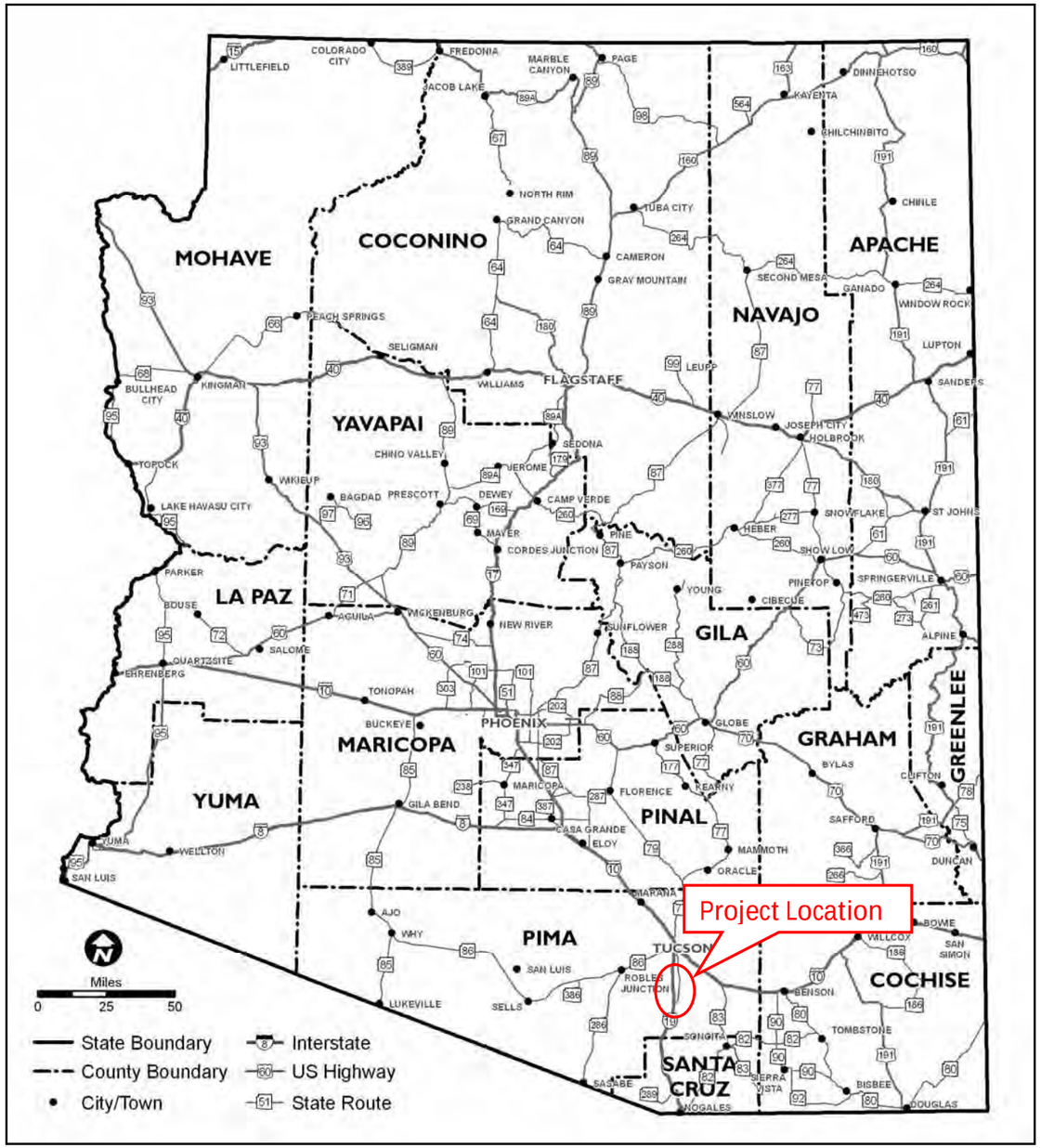
FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STP	☐ TAP	☐ HSIP	☒ State
	☐ Local	☐ Private	☐ Other:	

COST ESTIMATE				
Preliminary Eng	Design	Right-of-Way	Construction	Total
$730,000	$2,436,000	$0	$24,354,000	$27,520,000

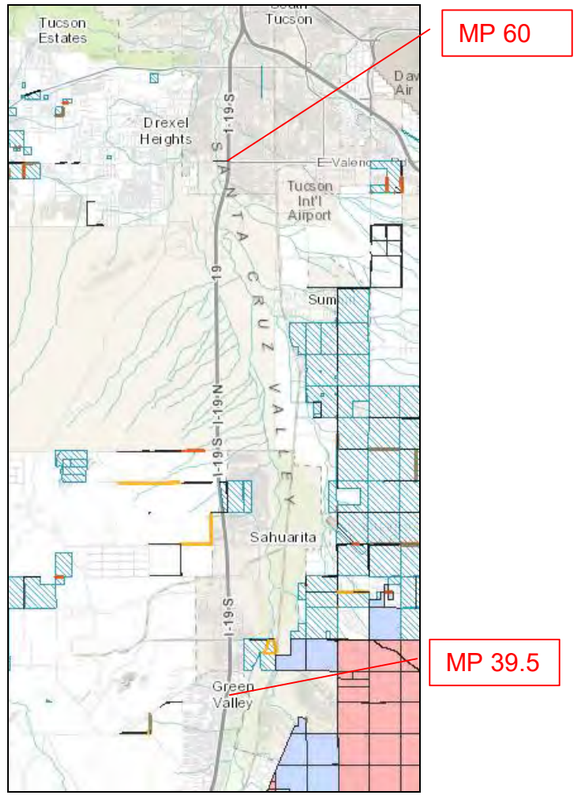
PROJECT DELIVERY
Delivery: ☐ Design-Bid-Build ☐ Design-Build ☐ Other:
Design Program Year: FY
Construction Program Year: FY

ATTACHMENTS
1) State Location Map X 2) Project Vicinity Map X 3) Project Scope of Work 4) Project Schedule 5) Itemized Cost Estimate 6) 15% Design Plan Sheets (as needed)

ATTACHMENT 1 – STATE LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP



Source: http://gis.azland.gov/webapps/parcel

SCOPE OF WORK
(Provide a detailed breakdown of the project's scope of work using bullet format) · Install lighting NB from Sahuarita to Tucson MP 39.5 to MP 60 · Install lighting SB from Tucson to Sahuarita MP 60 to MP 39.5

GENERAL PROJECT INFORMATION	
Date: March 3, 2017	ADOT Project Manager: n/a
Project Name: Sahuarita to Tucson Shoulder and Roadside Improvements	
City/Town Name: n/a	County: Pima
Primary Route/Street: I-19	
Beginning Limit: MP 39.5	
End Limit: MP 64	
Project Length: 24.5 m	
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
A high rate of crashes with fatalities and serious injuries are reported by the Tucson District and confirmed by the Corridor Profile Study. Segments 19-5 and 19-6 show increased levels of safety need. Prevalent crash types include single vehicle crashes, overturning, rear-end, collision with fixed object, and failure to keep in lane. Contributing factors include excess speeds, improper lane changes, and higher traffic volumes. Some of the crashes appear to be alcohol-related, potentially associated with nearby casinos.

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☐	Modernization ☒	Expansion ☐
The project will rehabilitate shoulders; improve striping, edge of pavement delineation, and signage from the Continental RD TI (Green Valley) to the Irvington Rd TI in Tucson. The project will assist drivers' awareness of lane and edge of road markings in an effort to reduce associated types of crashes.			

PROJECT TYPE		
Pavement Preservation ☐	Roadway Widening ☐	System Enhancement ☐
Bridge Scour/Rehab ☐	Bridge Replacement ☐	Sign Replacement ☐
Other ☒ : Roadside safety improvements		

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: Serious crashes
Risk Description: Temporary traffic controls will need to be in place during the construction period. The project is expected to mitigate the risks of continued higher rates of serious crashes.	

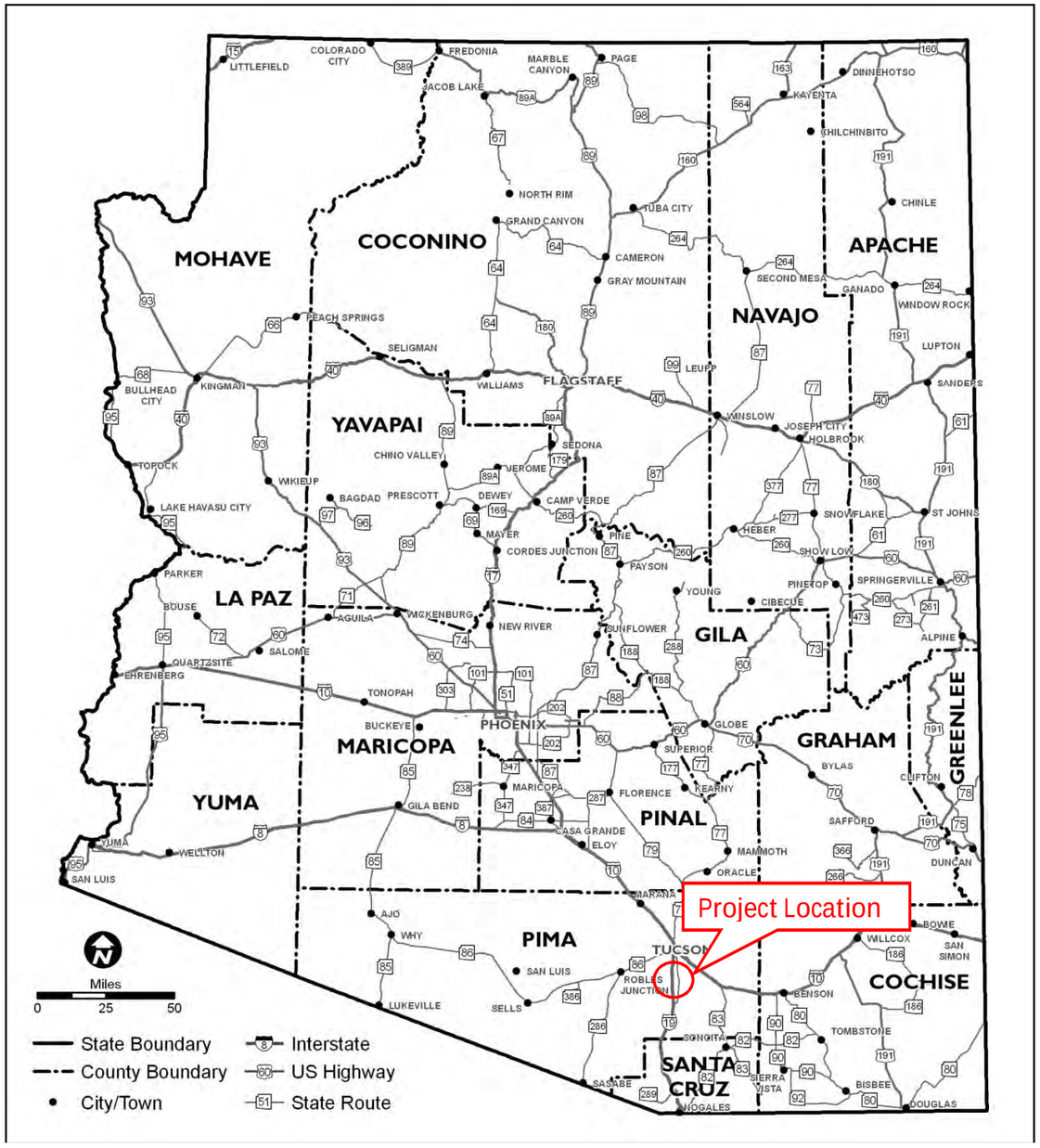
FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STP	☐ TAP	☐ HSIP	☒ State
	☐ Local	☐ Private	☐ Other:	

COST ESTIMATE				
Preliminary Eng	Design	Right-of-Way	Construction	Total
$366,000	$1,220,000	$0	$12,202,000	$13,788,000

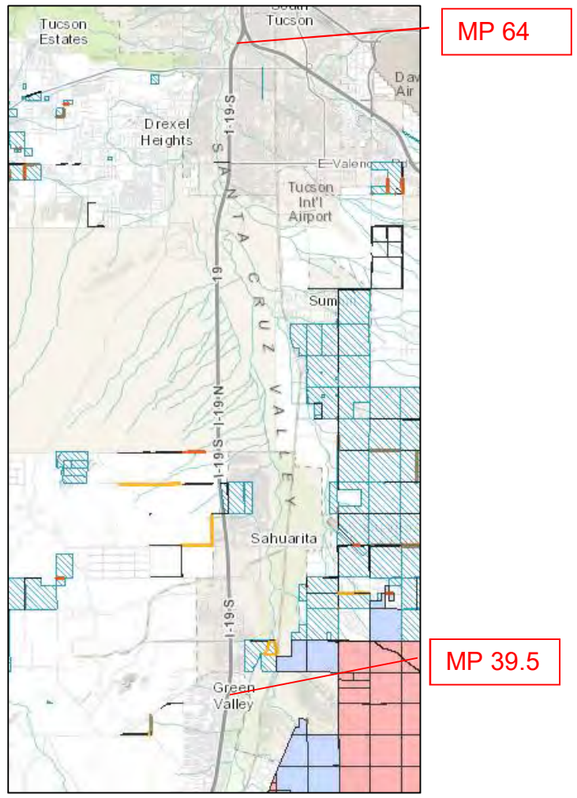
PROJECT DELIVERY			
Delivery: ☐ Design-Bid-Build	☐ Design-Build	☐ Other:	
Design Program Year: FY			
Construction Program Year: FY			

ATTACHMENTS
1) State Location Map X 2) Project Vicinity Map X 3) Project Scope of Work 4) Project Schedule 5) Itemized Cost Estimate 6) 15% Design Plan Sheets (as needed)

ATTACHMENT 1 – STATE LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP



SCOPE OF WORK
(Provide a detailed breakdown of the project's scope of work using bullet format) · Rehabilitate inside and outside shoulder including mill and replace pavement, rumble strip install, raised pavement markers, and necessary striping in both NB and SB direction · Install high-visibility edge line striping including edge line and lane lines in both NB and SB direction · Install high-visibility delineators on both inside and outside edges in both NB and SB direction

GENERAL PROJECT INFORMATION	
Date: March 3, 2017	ADOT Project Manager: n/a
Project Name: Sahuarita TI Ramp Improvements	
City/Town Name: Sahuarita	County: Pima
Primary Route/Street: I-19	
Beginning Limit: (46.8 / Sahuarita Rd)	
End Limit: (46.8 / Sahuarita Rd)	
Project Length: < 1 mile	
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
A high rate of crashes with fatalities and serious injuries are reported by the Tucson District and confirmed by the Corridor Profile Study. Some crashes appear to be correlated with merging movements from on ramps to the travel lane. Congestion is projected to migrate south from Tucson and the volume to capacity ratio is anticipated to fall from Good to Fair, as measured by the Corridor Profile Study.

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☐	Modernization ☒	Expansion ☐
The project will improve the entry and exit associated with the interchange, including the construction of parallel entrance ramps, striping, edge of pavement delineation, and signage. The project will assist drivers in safely merging with high speed traffic, especially as volumes are increase significantly within the next ten years.			

PROJECT TYPE		
Pavement Preservation ☐	Roadway Widening ☐	System Enhancement ☒
Bridge Scour/Rehab ☐	Bridge Replacement ☐	Sign Replacement ☐
Other ☒ : Safety related ramp improvements		

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: Temporary traffic controls will need to be in place during the construction period. The project is expected to mitigate the risks of continued higher rates of serious crashes.	

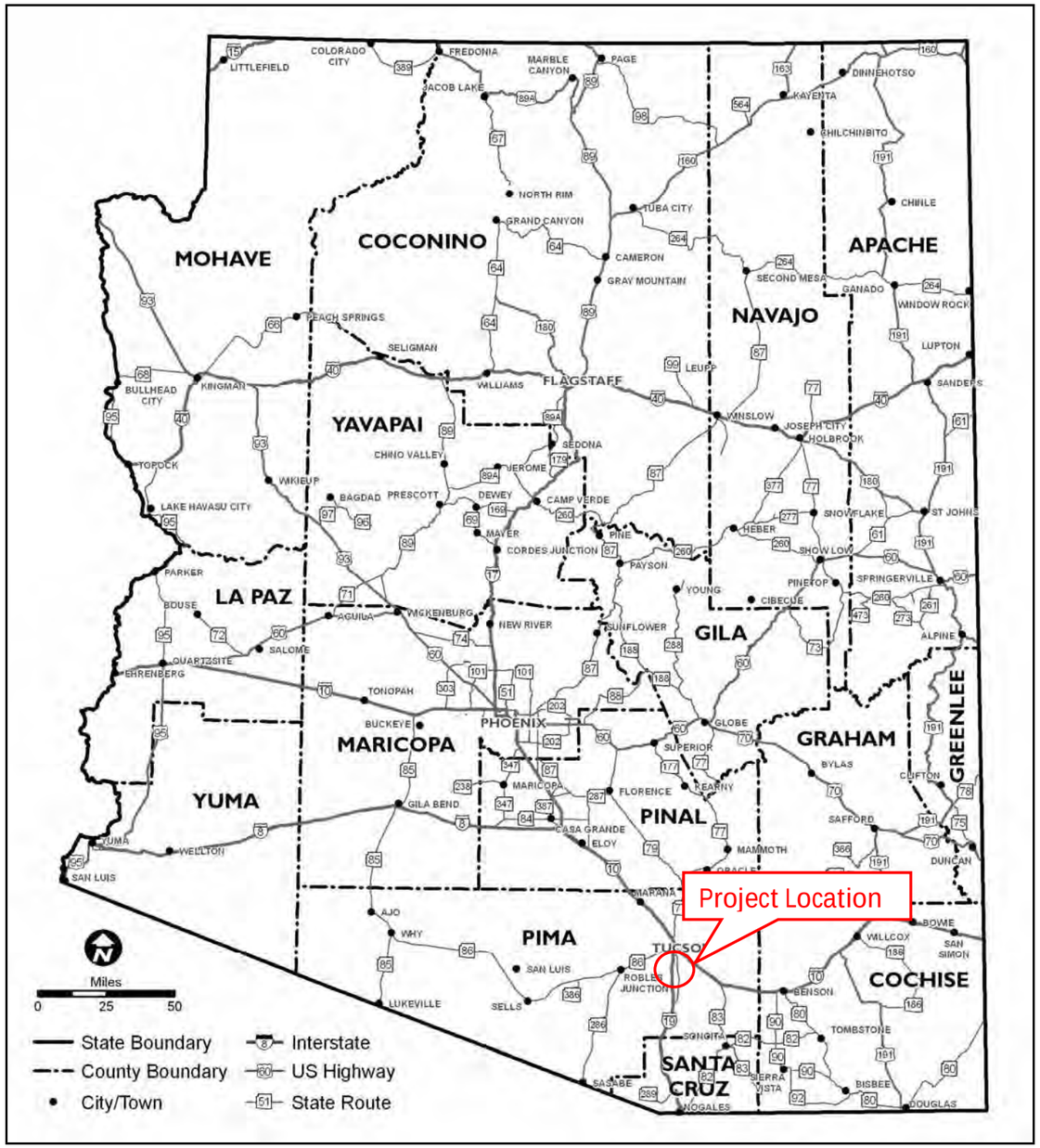
FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STP	☐ TAP	☐ HSIP	☐ State
	☐ Local	☐ Private	☐ Other:	

COST ESTIMATE				
Preliminary Eng	Design	Right-of-Way	Construction	Total
$117,000	$392,000	$0	$3,916,000	$4,425,000

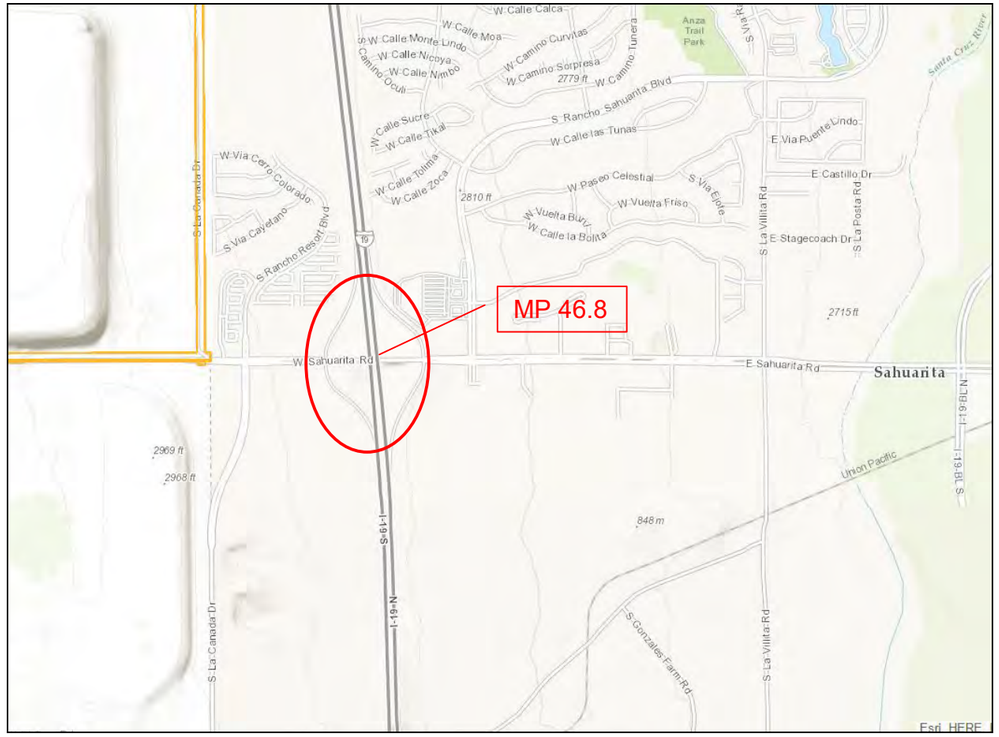
PROJECT DELIVERY
Delivery: ☐ Design-Bid-Build ☐ Design-Build ☐ Other:
Design Program Year: FY
Construction Program Year: FY

ATTACHMENTS
1) State Location Map 2) Project Vicinity Map 3) Project Scope of Work 4) Project Schedule 5) Itemized Cost Estimate 6) 15% Design Plan Sheets (as needed)

ATTACHMENT 1 – STATE LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP



SCOPE OF WORK
(Provide a detailed breakdown of the project's scope of work using bullet format) · Modify the existing NB and SB entry and exit ramps to a parallel configuration · Replace pavement, striping, signing, raised pavement markings, lighting, and earthwork as necessary.

GENERAL PROJECT INFORMATION	
Date: March 3, 2017	ADOT Project Manager: n/a
Project Name: Pima Mine TI Ramp Improvements	
City/Town Name:	County: Pima
Primary Route/Street: I-19	
Beginning Limit: 49.6	
End Limit: 49.6	
Project Length: <1.0 m	
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: Tohono O'odham Nation – San Xavier District		
LPA/Tribal Contact: Mark Pugh, Principal Planner		
Email Address:	Phone Number:	
Administration: ☐ ADOT Administered	☐ Self-Administered	☐ Certification Acceptance

PROJECT NEED
A high rate of crashes with fatalities and serious injuries are reported by the Tucson District and confirmed by the Corridor Profile Study. Crashes appear to be correlated with merging movements from on ramps to the travel lane. Congestion is projected to migrate south from Tucson and the volume to capacity ratio is anticipated to fall from Good to Fair, as measured by the Corridor Profile Study.

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☐	Modernization ☒	Expansion ☐
The project will improve ramps associated with the interchange, including the construction of parallel entrance ramps, striping, edge of pavement delineation, and signage. The project will assist drivers in safely merging with high speed traffic, especially as volumes are increase significantly within the next ten years.			

PROJECT TYPE		
Pavement Preservation ☐	Roadway Widening ☐	System Enhancement ☒
Bridge Scour/Rehab ☐	Bridge Replacement ☐	Sign Replacement ☐
Other ☒ : Safety related ramp improvements		

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: Temporary traffic controls will need to be in place during the construction period. The project is expected to mitigate the risks of continued higher rates of serious crashes.	

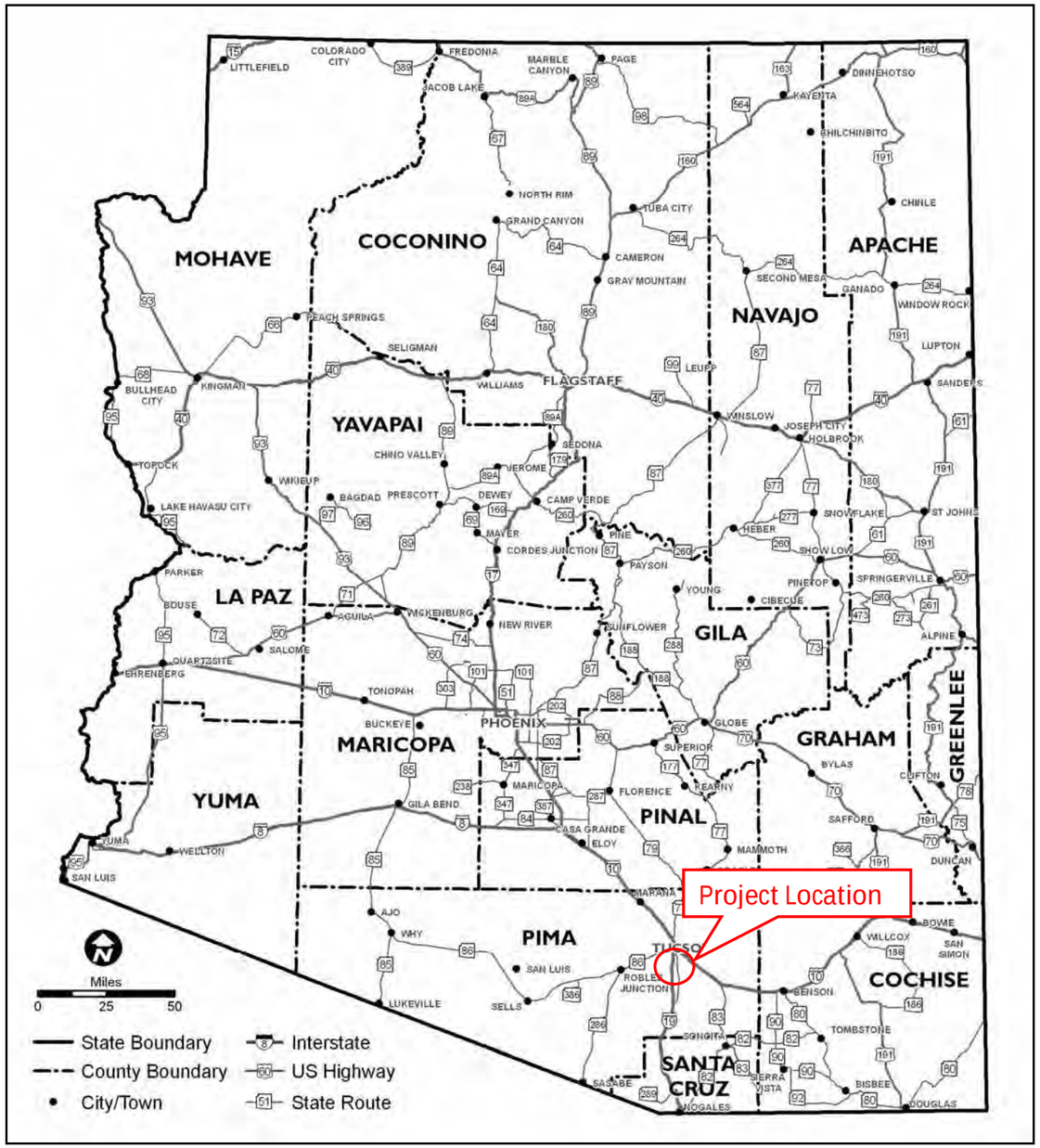
FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STP	☐ TAP	☐ HSIP	☐ State
	☐ Local	☐ Private	☐ Other:	

COST ESTIMATE				
Preliminary Eng	Design	Right-of-Way	Construction	Total
$148,000	$496,000	$0	$4,954,960	$5,598,960

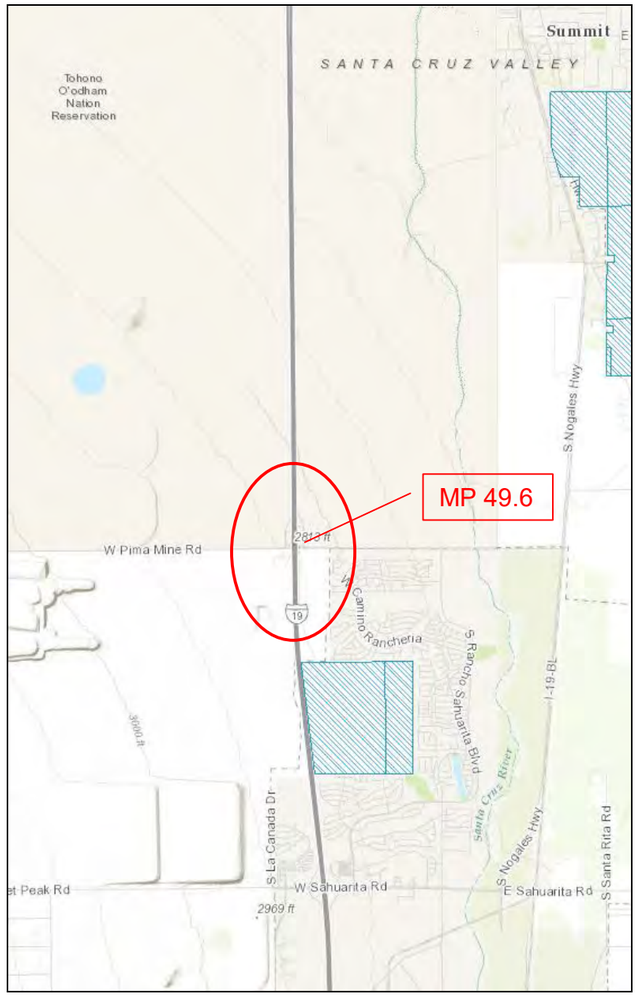
PROJECT DELIVERY
Delivery: ☐ Design-Bid-Build ☐ Design-Build ☐ Other:
Design Program Year: FY
Construction Program Year: FY

ATTACHMENTS
1) State Location Map X 2) Project Vicinity Map X 3) Project Scope of Work 4) Project Schedule 5) Itemized Cost Estimate 6) 15% Design Plan Sheets (as needed)

ATTACHMENT 1 – STATE LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP



SCOPE OF WORK
(Provide a detailed breakdown of the project's scope of work using bullet format) · Modify existing NB/SB entry and exit ramps to a parallel configuration · Include necessary pavement, striping, signage, lighting, and earthwork as necessary · Widen NB Pima Mine OP to accommodate parallel ramp

GENERAL PROJECT INFORMATION	
Date: March 3, 2017	ADOT Project Manager: n/a
Project Name: Papago TI Ramp Improvements	
City/Town Name:	County: Pima
Primary Route/Street: I-19	
Beginning Limit: 54.4	
End Limit: 54.4	
Project Length: <1.0 m	
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: Tohono O'odham Nation – San Xavier District		
LPA/Tribal Contact: Mark Pugh, Principal Planner		
Email Address:	Phone Number:	
Administration: ☒ ADOT Administered	☐ Self-Administered	☐ Certification Acceptance

PROJECT NEED
A high rate of crashes with fatalities and serious injuries are reported by the Tucson District and confirmed by the Corridor Profile Study. Crashes appear to be correlated with merging movements from on ramps to the travel lane. Congestion is projected to migrate south from Tucson and the volume to capacity ratio is anticipated to fall from Good to Fair, as measured by the Corridor Profile Study.

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☐	Modernization ☒	Expansion ☐
The project will improve ramps associated with the interchange, including the construction of parallel entrance ramps, striping, edge of pavement delineation, and signage. The project will assist drivers in safely merging with high speed traffic, especially as volumes are increase significantly within the next ten years.			

PROJECT TYPE		
Pavement Preservation ☐	Roadway Widening ☐	System Enhancement ☒
Bridge Scour/Rehab ☐	Bridge Replacement ☐	Sign Replacement ☐
Other ☒ : Safety related ramp improvements		

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: Temporary traffic controls will need to be in place during the construction period. The project is expected to mitigate the risks of continued higher rates of serious crashes.	

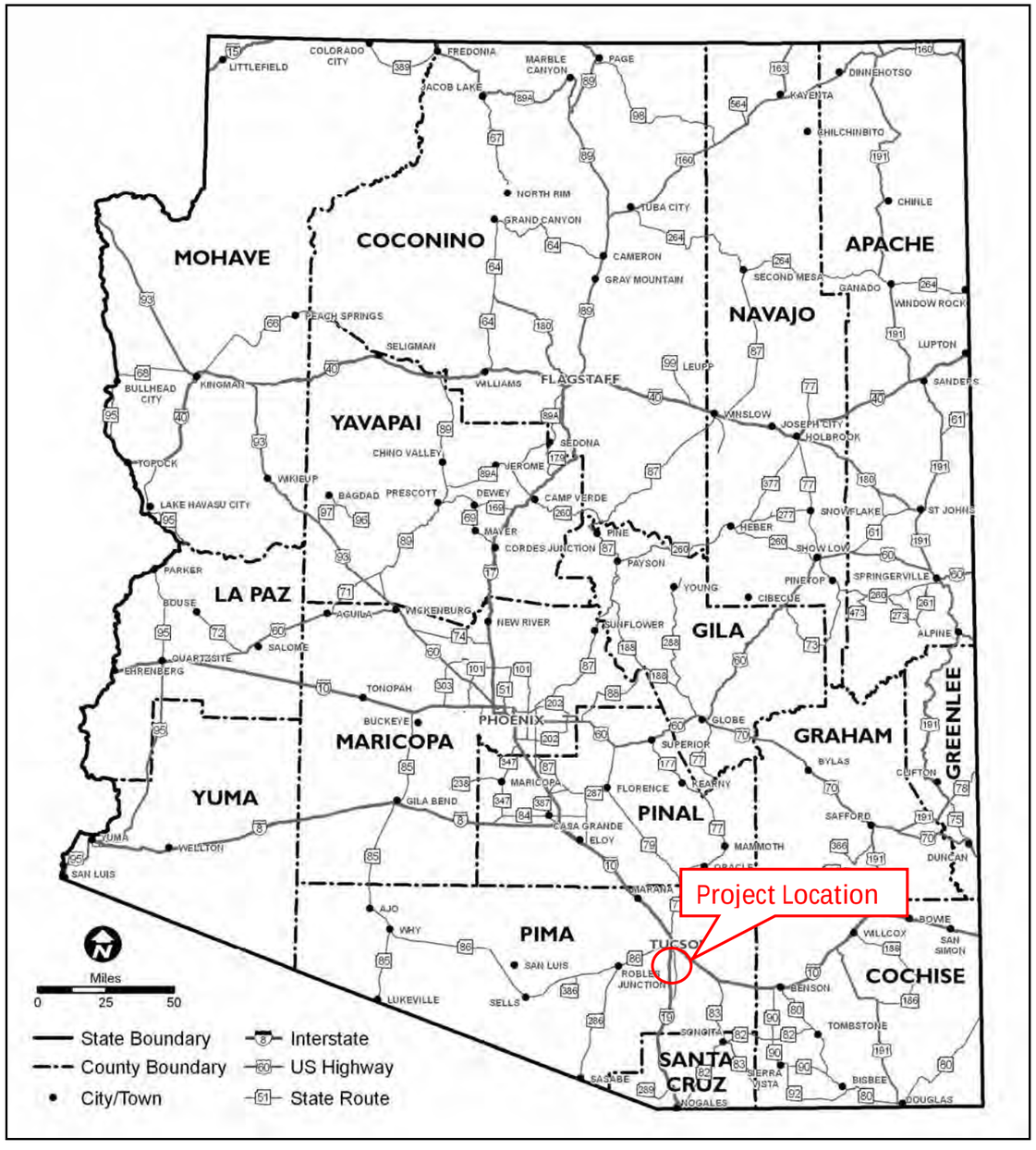
FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STP	☐ TAP	☐ HSIP	☐ State
	☐ Local	☐ Private	☐ Other:	

COST ESTIMATE				
Preliminary Eng	Design	Right-of-Way	Construction	Total
$117,000	$392,000	$0	$3,916,000	$4,425,000

PROJECT DELIVERY
Delivery: ☐ Design-Bid-Build ☐ Design-Build ☐ Other:
Design Program Year: FY
Construction Program Year: FY

ATTACHMENTS
1) State Location Map X 2) Project Vicinity Map X 3) Project Scope of Work 4) Project Schedule 5) Itemized Cost Estimate 6) 15% Design Plan Sheets (as needed)

ATTACHMENT 1 – STATE LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP

SCOPE OF WORK
(Provide a detailed breakdown of the project's scope of work using bullet format) · Modify existing NB/SB entry and exit ramps to a parallel configuration · Update pavement, lane striping, signage, lighting, edge of pavement markings, and earthwork as necessary

PRELIMINARY SCOPING BUDGET

GENERAL PROJECT INFORMATION	
Date: March 3, 2017	ADOT Project Manager: n/a
Project Name: Tucson Area Parallel Ramps	
City/Town Name: Tucson	County: Pima
Primary Route/Street: I-19	
Beginning Limit: 57.0	
End Limit: 61.9	
Project Length: 4.9 m	
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

- High Mobility Index performance deficiency, based on heavy NB flows entering Tucson urban area.
- Congested levels existing peak hour V/C and future daily V/C.
- The number of weekdays vs. weekend days in which traffic volumes exceed acceptable LOS are nearly equal. There is no spike in traffic that can be attributed to week day or weekend traffic.
- The corridor profile study indicates a High Safety need.
- 67% of closures are accident-related, which may be related to increased congestion in urban area.

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☐	Modernization ☒	Expansion ☐
Improve safety and mobility by providing additional buffer in merge/weave area.			

PRELIMINARY SCOPING BUDGET

PROJECT TYPE		
Pavement Preservation ☐	Roadway Widening ☐	System Enhancement ☒
Bridge Scour/Rehab ☐	Bridge Replacement ☐	Sign Replacement ☐
Other ☒ : Improve entry/exit ramps and implement ramp metering at Irvington Rd SB, Valencia Rd NB/SB, and San Xavier Rd NB (Modernization)		

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: *(If a box is checked above, briefly explain the risk)* Temporary traffic controls must be implemented during the construction period. Location and cost of required utilities TBD	

FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STP	☐ TAP	☐ HSIP	☐ State
	☐ Local	☐ Private	☐ Other:	

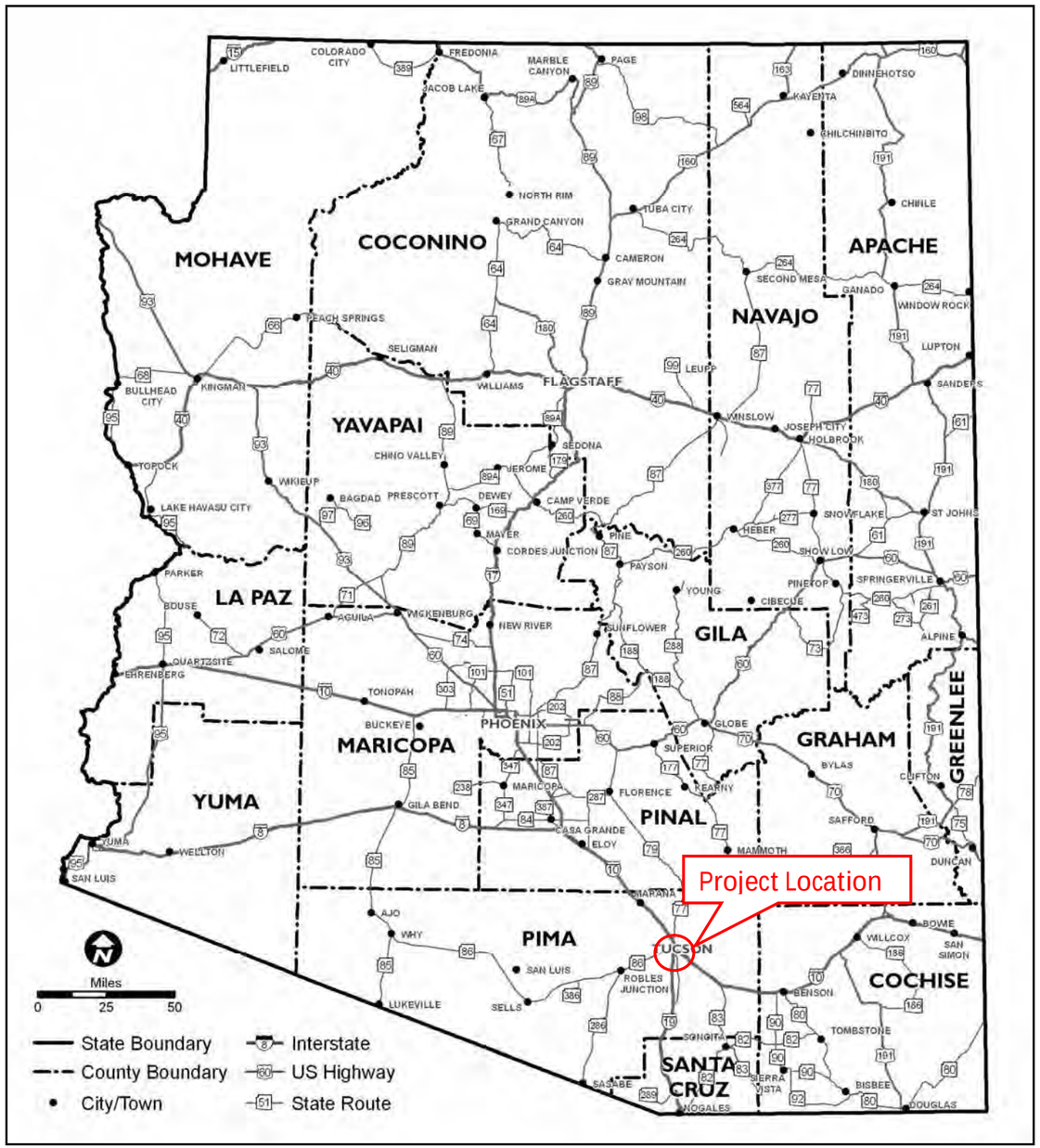
COST ESTIMATE				
Preliminary Eng	Design	Right-of-Way	Construction	Total
$372,000	$1,234,000	$0	$12,334,000	$13,940,000

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
4) Project Schedule
5) Itemized Cost Estimate
6) 15% Design Plan Sheets (as needed)

ATTACHMENT 1 – LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP

SCOPE OF WORK
(Provide a detailed breakdown of the project's scope of work using bullet format) · Modify existing SB entry ramps at Irvington Rd to a parallel configuration · Modify existing NB exit ramps at Irvington Rd to include ramp metering · Widen Airport Wash Bridges (NB/SB) to accommodate parallel ramps · Rehab Airport Wash Bridges (NB/SB) deck in conjunction with bridge widening to improve deck rating · Modify existing NB/SB entry/exit ramps at Valencia Rd to a parallel configuration · Modify existing NB/SB entry/exit ramps at Valencia Rd to include ramp metering · Modify existing NB entrance ramps at San Xavier Rd to a parallel configuration · Modify existing SB exit ramps at San Xavier Rd to include ramp metering

PRELIMINARY SCOPING REPORT

GENERAL PROJECT INFORMATION	
Date: March 3, 2017	ADOT Project Manager: n/a
Project Name: Tucson Variable Speed Limits	
City/Town Name: Tucson	County: Pima
Primary Route/Street: I-19	
Beginning Limit: 57.0	
End Limit: 64.0	
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: *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
• High Mobility Index performance deficiency, based on heavy NB flows entering Tucson urban area. • Congested levels existing peak hour V/C and future daily V/C. • The number of weekdays vs. weekend days in which traffic volumes exceed acceptable LOS are nearly equal. There is no spike in traffic that can be attributed to week day or weekend traffic. • The corridor profile study indicates a High Safety need. • 67% of closures are accident-related, which may be related to increased congestion in urban area.

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☐	Modernization ☒	Expansion ☐
Improve safety and mobility with improved traffic controls			

PRELIMINARY SCOPING REPORT

PROJECT TYPE		
Pavement Preservation ☐	Roadway Widening ☐	System Enhancement ☒
Bridge Scour/Rehab ☐	Bridge Replacement ☐	Sign Replacement ☐
Other ☒ : Implement variable speed limits, wireless, overhead, NB/SB (extend north to MP 64.0)		

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: *(If a box is checked above, briefly explain the risk)* Temporary traffic controls must be implemented during the construction period. Location and cost of required utilities TBD	

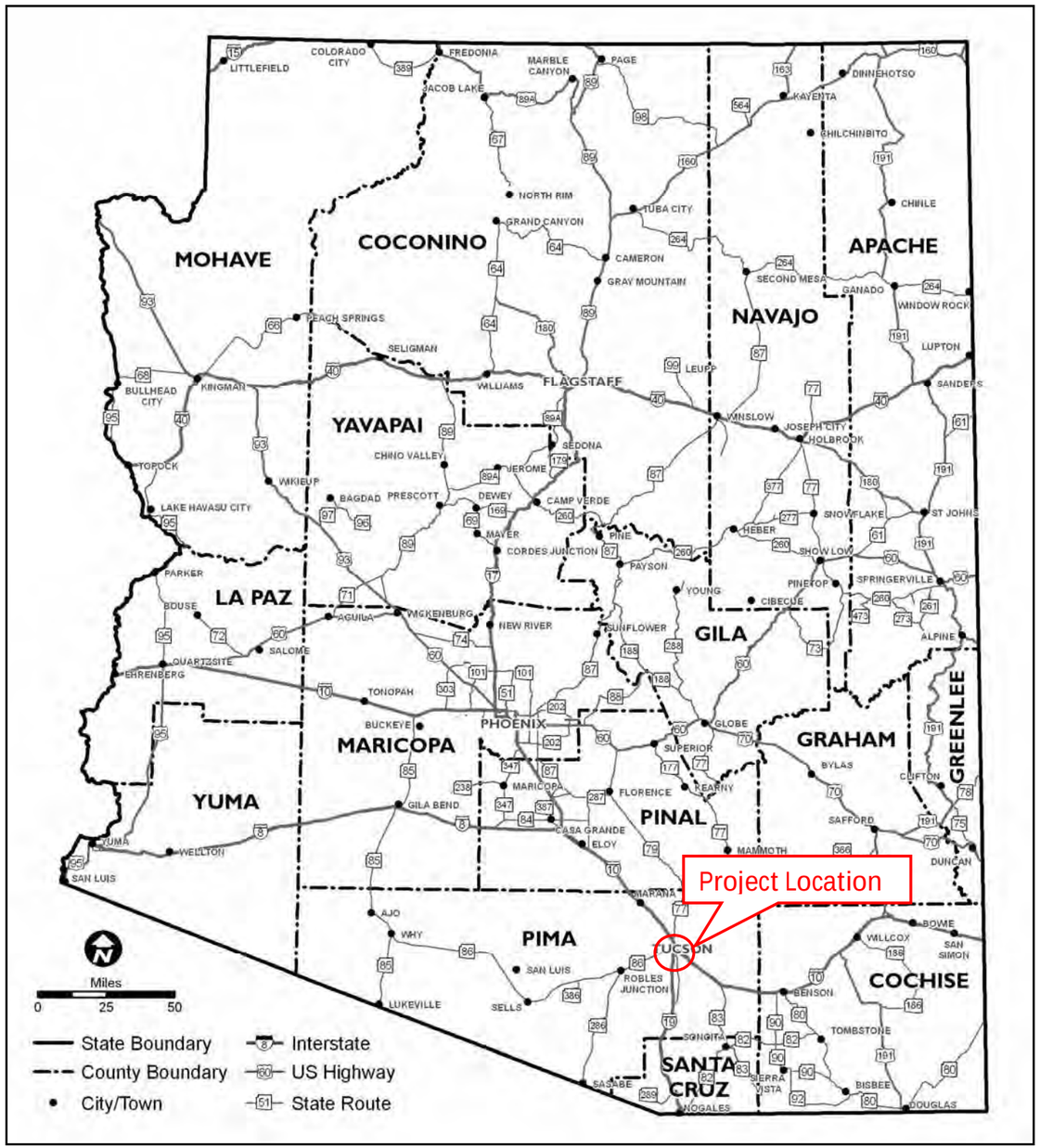
FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STP	☐ TAP	☐ HSIP	☐ State
	☐ Local	☐ Private	☐ Other:	

COST ESTIMATE				
Preliminary Eng	Design	Right-of-Way	Construction	Total
$664,000	$2,212,000	$0	$22,120,000	$24,996,000

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 4) Project Schedule 5) Itemized Cost Estimate 6) 15% Design Plan Sheets (as needed)

ATTACHMENT 1 – LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP

SCOPE OF WORK
(Provide a detailed breakdown of the project's scope of work using bullet format) · Implement variable speed limits in project area, timed to peak hour congestion

PRELIMINARY SCOPING REPORT

GENERAL PROJECT INFORMATION	
Date: March 3, 2017	ADOT Project Manager: n/a
Project Name: I-19/Tucson Widening	
City/Town Name: Tucson	County: Pima
Primary Route/Street: I-19	
Beginning Limit: 57.0	
End Limit: 62	
Project Length: 5 m	
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

- High Mobility Index performance deficiency, based on heavy NB flows entering Tucson urban area.
- Congested levels existing peak hour V/C and future daily V/C.
- The number of weekdays vs. weekend days in which traffic volumes exceed acceptable LOS are nearly equal. There is no spike in traffic that can be attributed to week day or weekend traffic.
- The corridor profile study indicates a High Safety need.
- 67% of closures are accident-related, which may be related to increased congestion in urban area.

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☐	Modernization ☐	Expansion ☒
Improve safety and mobility. Add 1 general purpose lane in each direction from Irvington Rd to San Xavier Rd in increase capacity in Tucson Area.			

PRELIMINARY SCOPING REPORT

PROJECT TYPE		
Pavement Preservation ☐	Roadway Widening ☒	System Enhancement ☐
Bridge Scour/Rehab ☐	Bridge Replacement ☐	Sign Replacement ☐
Other ☐ : Construct new general purpose lane (inside) in NB/SB direction between Irvington Rd and San Xavier Rd (Expansion)		

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: *(If a box is checked above, briefly explain the risk)* Temporary traffic controls must be implemented during the construction period.	

FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STP	☐ TAP	☐ HSIP	☐ State
	☐ Local	☐ Private	☐ Other:	

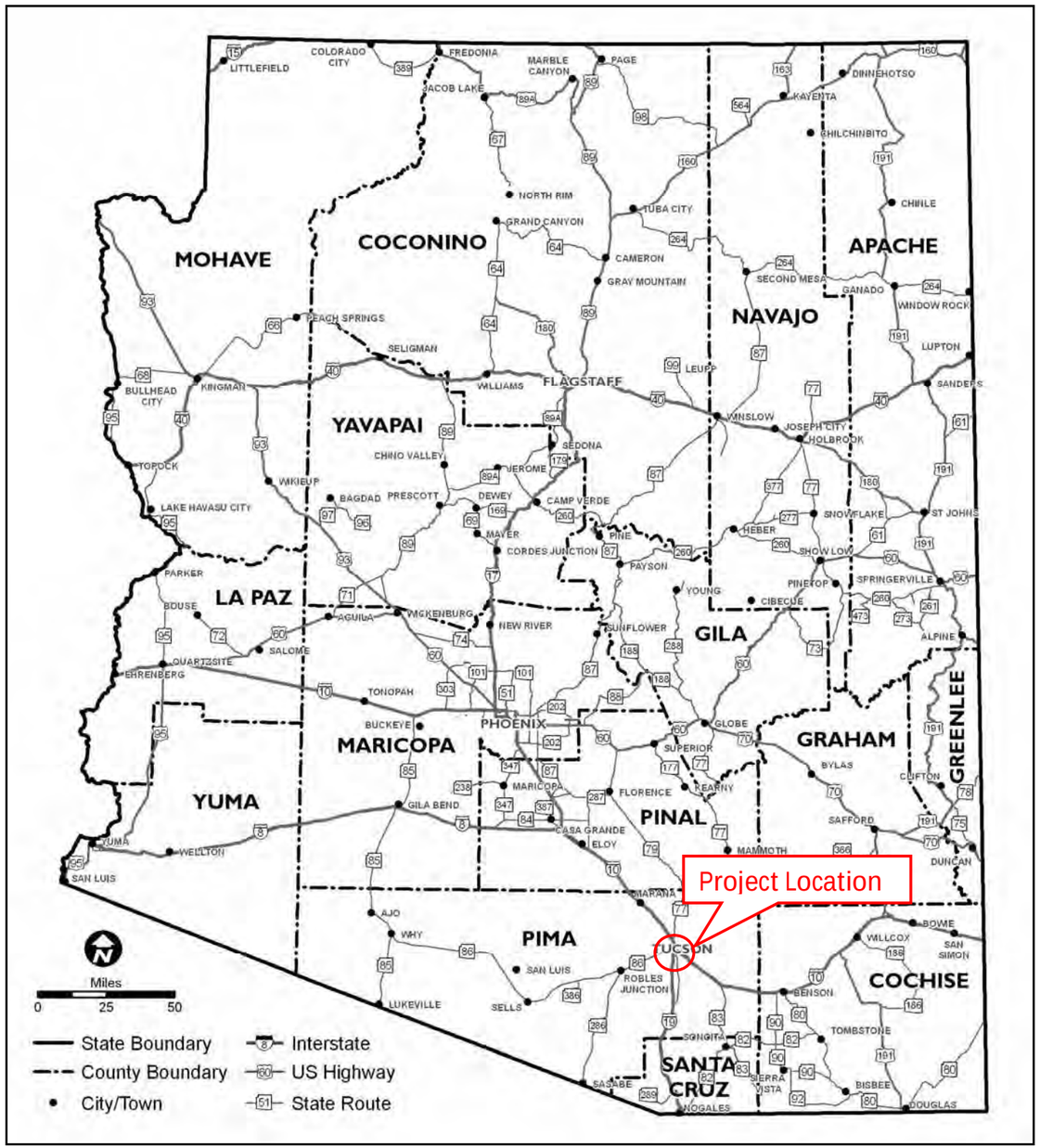
COST ESTIMATE				
Preliminary Eng	Design	Right-of-Way	Construction	Total
$888,000	$2,958,000	$0	$29,582,000	$33,428,000

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
4) Project Schedule
5) Itemized Cost Estimate
6) 15% Design Plan Sheets (as needed)

ATTACHMENT 1 – LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP

SCOPE OF WORK
(Provide a detailed breakdown of the project's scope of work using bullet format) · Construct New NB/SB GP Lanes between Irvington Rd and San Xavier Rd (inside widening) · Widen Airport Wash Bridge to accommodate new GP lanes · Rehab Airport Wash Bridge deck and superstructure in conjunction with bridge widening to improve ratings

PRELIMINARY SCOPING REPORT

GENERAL PROJECT INFORMATION	
Date: March 3, 2017	ADOT Project Manager: n/a
Project Name: I-19/Drexel-Irvington Pedestrian Overpass and Barrier Fencing	
City/Town Name: Tucson	County: Pima
Primary Route/Street: I-19	
Beginning Limit: MP 59.5	
End Limit: MP 61.5	
Project Length: <1.0 mile	
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
• Poor performance in the Safety Index. • High number pedestrian involved serious or fatal crashes possibly resulting from lack of suitable pedestrian facilities in the immediate vicinity • Pedestrians cross I-19 from nearby residential area, separated only by 4' fence

PROJECT PURPOSE			
What is the Primary Purpose of the Project?	Preservation ☐	Modernization ☒	Expansion ☐
Reduce fatal and serious vehicle-pedestrian crashes			

PRELIMINARY SCOPING REPORT

PROJECT TYPE		
Pavement Preservation ☐	Roadway Widening ☐	System Enhancement ☒
Bridge Scour/Rehab ☐	Bridge Replacement ☐	Sign Replacement ☐
Other ☒ : scope of project to be determined pending Performance Effectiveness Analysis		

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: *(If a box is checked above, briefly explain the risk)* Coordination required with local agency to determine appropriate location and connectivity to other pedestrian facilities.	

FUNDING SOURCE(S)				
Anticipated Project Design/Construction Funding Type: *(Check all that apply)*	☐ STP	☐ TAP	☐ HSIP	☒ State
	☒ Local	☐ Private	☐ Other:	

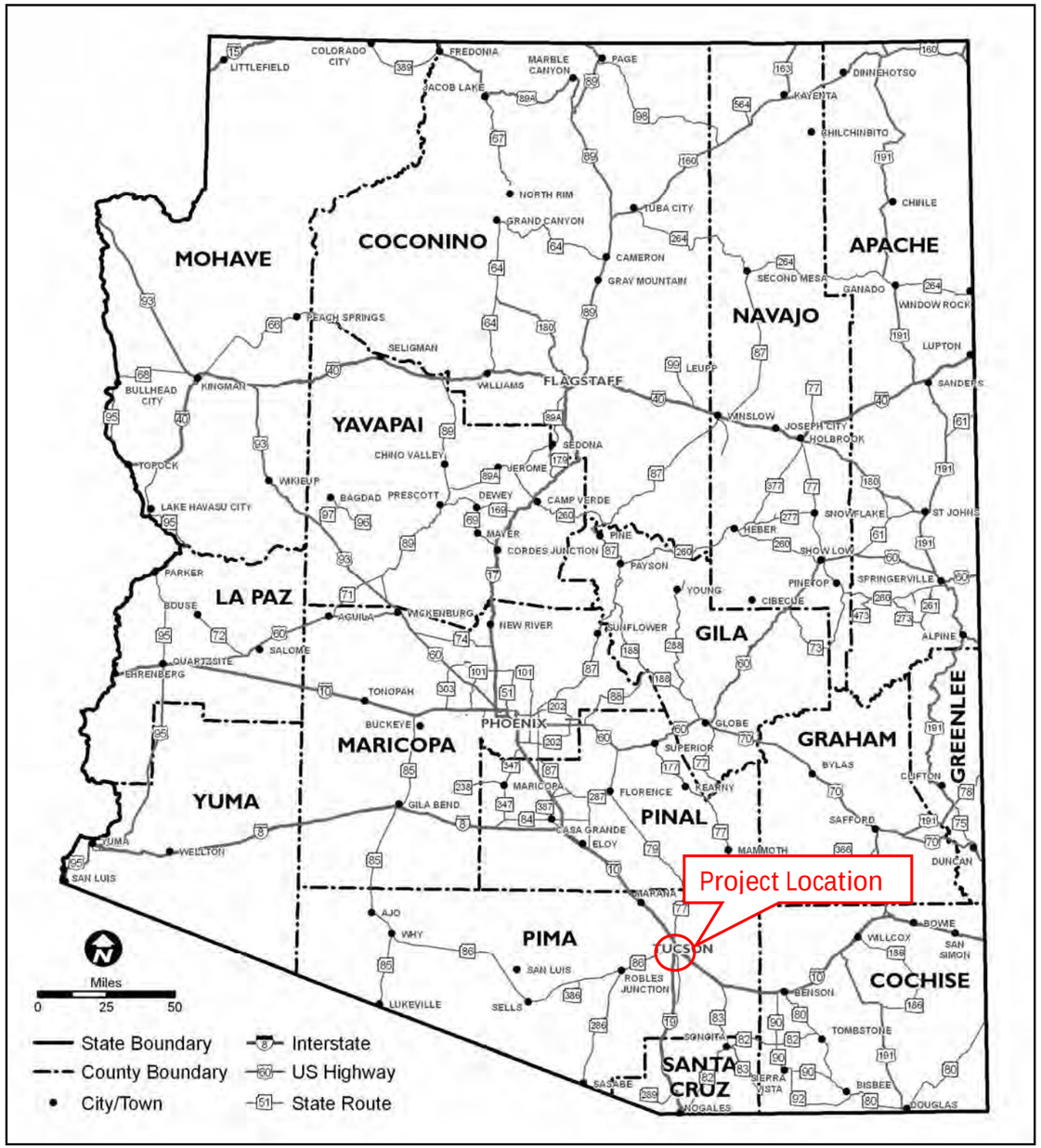
COST ESTIMATE				
Preliminary Eng	Design	Right-of-Way	Construction	Total
$59,000	$199,000	$ -	$1,992,000	$2,250,000

PROJECT DELIVERY			
Delivery: ☐ Design-Bid-Build	☐ Design-Build	☐ Other:	
Design Program Year: FY			
Construction Program Year: FY			

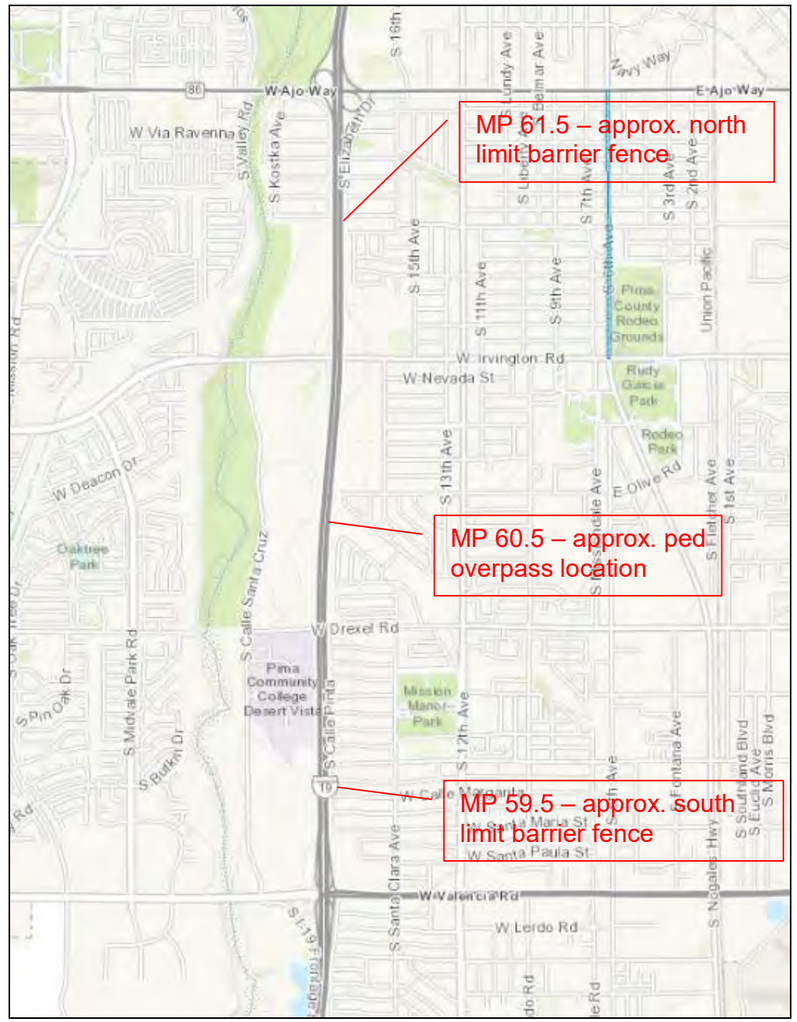
ATTACHMENTS
1) State Location Map X 2) Project Vicinity Map X 3) Project Scope of Work 4) Project Schedule 5) Itemized Cost Estimate 6) 15% Design Plan Sheets (as needed)

ADOT

ATTACHMENT 1 – LOCATION MAP



ATTACHMENT 2 – PROJECT VICINITY MAP



SCOPE OF WORK
(Provide a detailed breakdown of the project's scope of work using bullet format) · Construct pedestrian overpass · Construct 2.0 miles 8' barrier fencing, east side of I-19 from north end of existing noise wall near Valencia Blvd. to ½ mile south of Ajo Way · Construct 1.0 mile of 8' barrier fencing along commercial development west of I-19 between Irvington Rd and Drexel Rd .