Final Tier 1 Environmental Impact Statement and Preliminary Section 4(f) Evaluation

Appendix E2, Travel Forecasting Methods and Analysis Report

July 2021

U.S. Department of Transportation
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Travel Forecasting Methods and Analysis Report

FOR

I-11 Corridor Final Tier 1 EIS

Federal Project No.: 999-M(161)S
ADOT Project No.: 999 SW 0 M5180 01P

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Summary

This technical memorandum presents the travel forecasting methods and analysis used to evaluate the No Build Alternative, Recommended Alternative, and Preferred Alternative for the Interstate 11 Corridor Final Tier 1 Environmental Impact Statement. It includes descriptions of the Arizona Statewide Travel Demand Model (Arizona Model), forecasting processes using the 2040 Arizona Model, and the resultant evaluations of transportation performance for each alternative.

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Table of Contents

Attachments

Figures

Tables

Acronyms

ADOT	Arizona Department of Transportation
Arizona Model	Arizona Statewide Travel Demand Model
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
I	Interstate
IWCS	I-11 and Intermountain West Corridor Study
LOS	level of service
MAG	Maricopa Association of Governments
mph	miles per hour
MPO	metropolitan planning organization
NEPA	National Environmental Policy Act
PAG	Pima Association of Governments
PMT	Project Management Team
SCMPO	Sun Corridor Metropolitan Planning Organization
SR	State Route
TAZ	traffic analysis zone
US	United States
VMT	vehicle miles of travel

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1 INTRODUCTION

1.1 Overview

The Federal Highway Administration (FHWA) and Arizona Department of Transportation (ADOT) are conducting the environmental review process for the Interstate 11 (I-11) Corridor from Nogales to Wickenburg, Arizona. A Tier 1 Environmental Impact Statement (EIS) is being prepared as part of this process in accordance with the National Environmental Policy Act (NEPA) and other regulatory requirements. FHWA is the federal lead agency and ADOT is the local project sponsor under NEPA.

The Draft Tier 1 EIS analyzed three Build Corridor Alternatives—Purple, Green, and Orange—in addition to the No Build Alternative. The Draft Tier 1 EIS recommended an alternative for public feedback (the Recommended Alternative), which was a hybrid of mainly the Purple and Green Alternatives. FHWA and ADOT are completing a Final Tier 1 EIS, which identifies a Preferred Alternative that is different from the Recommended Alternative. The Recommended and Preferred Alternatives are shown on **Figure 1-1**.

1.2 Purpose of Memorandum

This technical memorandum presents the travel forecasting methods and analysis used to evaluate the I-11 Build Corridor Alternatives and the No Build Alternative for the Final Tier 1 EIS. It describes the Arizona Statewide Travel Demand Model (Arizona Model), its 2040 population and employment projections, and the transportation performance measures used to evaluate the end-to-end Build Corridor Alternatives.

The same 2040 socioeconomic projections were used to prepare traffic forecasts for the Draft Tier 1 EIS and Final Tier 1 EIS. This memorandum describes the differences between the 2040 Arizona Model socioeconomic projections and newer projections for Maricopa, Pima, and Pinal Counties.

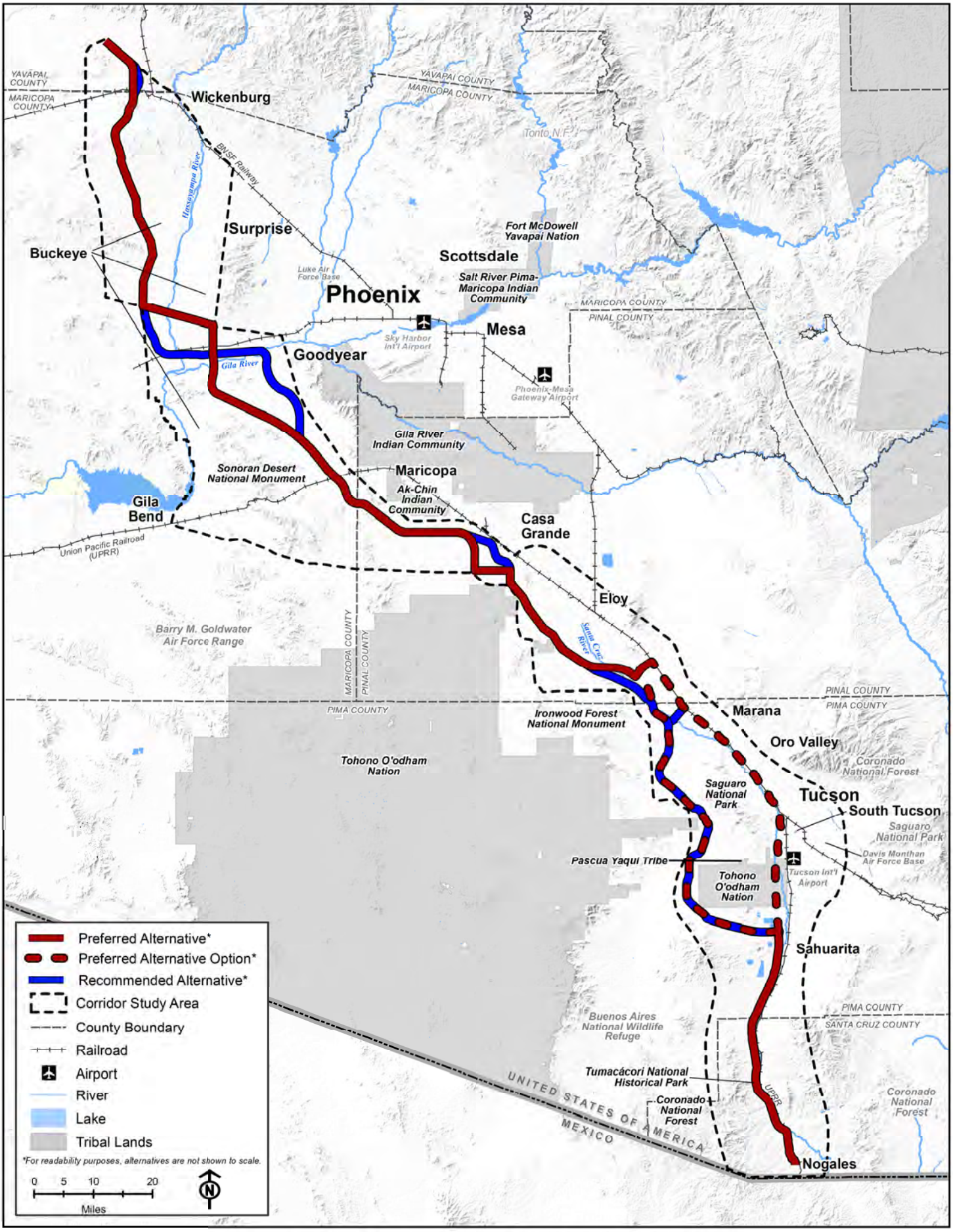

Figure 1-1. Recommended and Preferred Alternatives

2 ARIZONA STATEWIDE TRAVEL DEMAND MODEL

The 280-mile I-11 Corridor Study Area, from Nogales to Wickenburg, encompasses three of the most populous counties in Arizona: Maricopa, Pinal, and Pima Counties. The largest metropolitan areas of the state—Phoenix in Maricopa County and Tucson in Pima County—are also located in the Study Area. Early in this planning process, through discussions with ADOT, FHWA, and the rest of the I-11 Project Management Team (PMT)—including representatives from the three metropolitan planning organizations (MPOs) of the Maricopa Association of Governments (MAG), Pima Association of Governments (PAG), and Sun Corridor MPO (SCMPO)—transportation analysis models and approaches were assessed and recommended for application.

A key component of this assessment included identifying the appropriate travel demand modeling system to support the study. In particular, the selected modeling system was needed to support the study's purpose and need, evaluate and screen segment options during alternatives development, and support identification and evaluation of end-to-end Build Corridor Alternatives for the Tier 1 EIS. Key criteria used to determine the most appropriate travel demand modeling system included:

1. Is the modeling system already developed and available for application?
2. Does the modeling system represent agency-approved forecasting methods?
3. Does the modeling system provide full coverage of the Study Area?
4. Was the modeling system used to support the previous *I-11 and Intermountain West Corridor Study* (IWCS) (NDOT and ADOT 2014)?

The following travel demand modeling system options were reviewed and considered in this planning process, including:

- **Option 1 – Use regional travel demand models**. MAG and PAG both maintain regional travel models that represent travel demand for their regions. The MAG regional model also represents travel demand for Pinal County. The regional models were already developed and available for application and were considered approved forecasting methods. However, they did not cover the entire I-11 Corridor geographic area, although some elements of each modeling system were used to support the previous IWCS. These models would provide only partial representations of travel demand in the Study Area.

- **Option 2 – Use the Arizona Model**. The ADOT Travel Demand Modeling Group first developed its statewide model in 2008. The Arizona Model has been updated several times since. The Arizona Model was (1) already developed and readily available for use, (2) considered an approved forecasting method, (3) provided geographic coverage for the entire Study Area, and (4) was used to support the previous IWCS. In addition, ADOT regularly uses the Arizona Model to support various statewide planning studies, including the recently completed Arizona State Freight Plan and a series of ongoing regional corridor profile studies (ADOT 2017). The Arizona Model also provided geographic coverage of the

continental US, Mexico, and Canada, and forecast travel demand for short- and long-distance freight and passenger vehicles for the entire corridor and state.

In July 2016, based on the results of the above assessment, the I-11 PMT, working with MAG, PAG, and ADOT modeling staff, confirmed the use of the Arizona Model as the primary and preferred tool to support the study. MAG and PAG staff concurred with ADOT and the I-11 PMT that the statewide model would be the best tool for preparing forecasts for the 280 mile multi-county Study Area. It was also determined that ADOT would coordinate with MAG and PAG modeling staff to identify opportunities to use elements and processes from their regional modeling systems to enhance the results of the Arizona Model for application in the I-11 Corridor Study. More detailed Tier 2 environmental studies would likely use the regional models.

2.1 Model Overview

The Arizona Model was initially developed by ADOT as a trip-based model to estimate travel demand and the interaction of passenger and freight movements on the statewide transportation network. It was first developed in 2008 for ADOT's bqAZ (Building a Quality Arizona) Statewide Transportation Framework Study. In its current version as of December 2020, the Arizona Model has more than 6,000 traffic analysis zones (TAZs) containing detailed geographic-based information including socioeconomic (employment, population, number of households, other data) projections and road networks. The Arizona Model maintains the TAZ structure from the regional travel demand models used by the state's MPOs, including MAG and PAG. The Arizona Model is maintained by ADOT's Travel Demand Modeling Group, which produces existing analyses for 2015 and future forecasts to 2050. Both existing and future forecast travel demand are based on population and employment existing conditions and growth projections established by the Arizona State Demographer's Office (ADOT 2020c).

2.2 Travel Markets

The Arizona Model is a modeling system designed to estimate both short- and long-distance travel demand for passenger vehicles and commercial trucks. For short-distance travel, the Arizona Model is applied using a traditional four-step forecasting approach including (1) trip generation, (2) trip distribution, (3) mode choice, and (4) traffic assignment steps. Typically, short-distance trips are identified as less than 50 miles. However, since travel surveys show that some commuters will travel longer distances for work in the state, the Arizona Model allows up 120 miles for "super-commute" trips (ADOT 2011). Long-distance trips are considered to be more than 50 miles. The Arizona Model long-distance passenger vehicle trip estimates are based on the 2001–2002 National Household Travel Survey long-distance sample. Long-distance truck trips contained in the Arizona Model were estimated from the FHWA Freight Analysis Framework (ADOT 2011).

2.3 Population and Employment Projections

The population and employment projections in the current Arizona Model were developed in 2016 and have not been updated since the Draft Tier 1 EIS analysis. Newer population projections from PAG show scaled-back growth in Pima County. **Table 2-1** shows the Arizona Model population and employment projections from 2015 to 2040 by county for the Study Area. **Table 2-2** and **Table 2-3** show population and employment projections in the Arizona Model are

generally lower than more recent projections for Maricopa County, and higher than those projected for Pima and Pinal Counties.

Tier 2 studies will update the traffic analysis using regional travel demand models, which offer more frequently updated projections, include more detailed traffic analysis zones, and are better calibrated to local traffic behavior. These future studies would determine the number of lanes needed to accommodate travel demand forecasts.

Table 2-1. Population and Employment Growth, 2015 to 2040

	Population							
	County Totals				Within Corridor Study Area			
County	2015	2040	Growth	% Growth	2015	2040	Growth	% Growth
Santa Cruz	49,500	70,800	+21,300	43%	46,100	54,400	+8,300	18%
Pima	1,007,300	1,393,743	+335,800	33%	819,000	1,048,800	+229,800	28%
Pinal	369,100	916,341	+481,800	130%	50,200	101,200	+51,000	102%
Maricopa	4,110,600	6,202,435	+1,966,000	49%	74,500	342,400	+267,900	360%
Yavapai	218,500	316,900	+98,400	45%	400	700	+300	75%
Total	**5,755,000**	**8,658,300**	**+2,903,300**	**50%**	**990,200**	**1,547,500**	**+557,300**	**56%**
	Employment							
	County Totals				**Within Corridor Study Area**			
County	**2015**	**2040**	**Growth**	**% Growth**	**2015**	**2040**	**Growth**	**% Growth**
Santa Cruz	13,400	20,000	+6,600	49%	12,900	16,300	+3,400	26%
Pima	351,800	495,600	+143,800	41%	323,500	448,900	+125,400	39%
Pinal	54,000	294,000	+240,000	440%	13,000	48,500	+35,500	273%
Maricopa	1,732,600	2,777,800	+1,045,200	60%	11,000	49,000	+38,000	345%
Yavapai	57,200	87,100	+29,900	53%	20	60	+40	200%
Total	**2,209,000**	**3,674,500**	**+1,465,500**	**66%**	**360,420**	**562,760**	**+202,340**	**56%**

Source: Arizona Statewide Travel Demand Model, 2020.

Table 2-2. Comparison of 2040 Population Projections

	2040 Population Projections		
County	Draft Tier 1 EIS Data[a]	Updated Regional Data	Difference
Pima	1,393,743	1,209,498[b]	−184,245 (−13%)
Pinal	916,341	862,622[c]	−53,179 (−6%)
Maricopa	6,202,435	6,332,264[c]	129,829 (2%)

[a] ADOT, Arizona Statewide Travel Demand Model, projections dated June 2016.
[b] PAG, Regional Travel Demand Model, projections dated February 2020.
[c] MAG, Regional Travel Demand Model, projections dated October 2019.

Table 2-3. Comparison of 2040 Employment Projections

County	2040 Employment Projections		Difference
	Draft Tier 1 EIS Data[a]	Updated Regional Data	
Pima	495,569	504,496[b]	8,927 (2%)
Pinal	294,010	169,041[c]	−124,969 (−43%)
Maricopa	2,777,753	3,004,275[c]	226,522 (8%)

[a] ADOT, Arizona Statewide Travel Demand Model, projections dated June 2016.
[b] PAG, Regional Travel Demand Model, projections dated February 2020.
[c] MAG, Regional Travel Demand Model, projections dated October 2019.

2.4 Transportation Networks

The funded capacity improvements identified in the ADOT 2020–2024 Five-Year Transportation Facilities Construction Program (ADOT 2020a) for current freeways (for example, I-10, I-19, and I-17) were used as the basis to prepare the no build transportation networks for this study. These improvements represent the facilities planned to accommodate travel demand without the I-11 Corridor in place.

Within the Study Area, the No Build Alternative transportation network reflects existing conditions plus any capacity improvements programmed and funded for construction in the ADOT 2020–2024 Five-Year Transportation Facilities Construction Program. The No Build Alternative includes new capacity (additional lanes) on I-10 between Tucson and Casa Grande, and conversion of US Highway 93 (US 93) to a four-lane divided highway for a 3-mile segment through Wickenburg.

3 FINAL ENVIRONMENTAL IMPACT STATEMENT EVALUATION

This section presents the evaluation of each of the Final Tier 1 EIS Build Corridor Alternatives using the 2040 Arizona Model and includes a discussion of the transportation performance measures used to support the evaluations.

3.1 End-to-End Build Corridor Alternative Network Coding

The I-11 Final Tier 1 EIS Build Corridor Alternatives were evaluated as end-to-end alternatives. These end-to-end alternatives, including representations in the South, Central, and North Sections, were coded into the 2040 Arizona Model. For the build alternatives that follow portions of the existing State Route (SR) 85 corridor between Gila Bend and I-10, a new interstate facility was coded, leaving the current SR 85 coded as a local access facility. Alternatives that required new construction were coded as interstates connecting to either existing or planned future arterials.

3.1.1 Service Interchange Locations

The service interchange locations established in the Draft Tier 1 EIS were used for the Final Tier 1 EIS Build Corridor Alternatives. In circumstances where an end-to-end I-11 build alternative would co-locate with existing facilities such as I-19, I-10, or I-8, no new service interchanges were assumed and/or coded into the 2040 Arizona Model.

For an I-11 build alternative following a new corridor, future service interchange locations were identified and coded. These future interchange locations were coded to provide a connection to major arterials that either exist now or are planned in the future. Future service interchanges were spaced and coded for each alternative at least 2 miles apart.

3.1.2 System Interchange Locations

In locations where a proposed new Build Corridor Alternative intersected with an existing interstate facility such as I-19, I-10, or I-8, a new system interchange was identified and coded. These system interchanges would allow all directions of traffic to connect between the two facilities. Attachment A shows each of the end-to-end Build Corridor Alternative with existing and potential future system and service interchanges.

3.2 Comparison of Alternatives

Mobility measures for each of the three Build Corridor Alternatives are compared with the No Build Alternative to show differences in travel conditions between alternatives. These measures from the Arizona Model include:

- lane miles
- travel time

- vehicle miles of travel (VMT)
- average daily traffic
- level of service (LOS)

3.2.1 Lane Miles

Table 3-1 shows the additional lane miles required for each of the Build Alternatives compared with the No Build Alternative. The Recommended Alternative would require the most new lane miles.

Table 3-1. New Lane Miles for No Build and Build Alternatives

Corridor Alternative Section	No Build	Recommended Alternative	Preferred Alternative with West Option in Pima County	Preferred Alternative with East Option in Pima County
South Section (Nogales to Casa Grande)	0	364	368	219
Central Section (Casa Grande to Buckeye)	0	353	275	275
North Section (Buckeye to SR 71)	0	200	220	220
Total Alternative Length (miles)	0	276	276	267
Total New Lane Miles	**0**	**917**	**864**	**714**

3.2.2 Travel Time

The No Build Alternative offers many possible paths between Nogales and Wickenburg. **Table 3-2** shows northbound and southbound travel time and distance for several routes. The table shows that shorter paths through central Phoenix typically operate at slower speeds in miles per hour (mph) than longer routes outside of the urban area.

Table 3-2. Peak Period Travel Times from Nogales to Wickenburg in Afternoon, 2018 and 2040 (No Build Alternative)

Trips Between Nogales and Wickenburg[a]	Northbound			Southbound		
	Distance (miles)	Travel Time (minutes)[a]	Average Speed (mph)	Distance (miles)	Travel Time (minutes)[a]	Average Speed (mph)
2018						
I-19/I-10/I-17/ SR 74/US 60/US 93	244	230	64	244	225	65
I-19/I-10/ US 60/US 93	232	245	57	232	240	58
I-19/I-10/I-8/ SR 85/I-10/ SR 303L/US 60/ US 93	275	255	65	275	255	65

Trips Between Nogales and Wickenburg[a]	Northbound			Southbound		
	Distance (miles)	Travel Time (minutes)[a]	Average Speed (mph)	Distance (miles)	Travel Time (minutes)[a]	Average Speed (mph)
I-19/I-10/SR 101L/ US 60/US 93	238	230	62	238	235	61
I-19/I-10/SR 303L/ US 60/US 93	243	225	65	243	225	65
2040						
I-19/I-10/I-17/ SR 74/US 60/ US 93	248	331	45	246	347	43
I-19/I-10/US 60/ US 93	235	343	41	234	358	39
I-19/I-10/I-8/ SR 85/I-10/ SR 303L/US 60/ US 93	279	329	51	278	335	50
I-19/I-10/SR 202L/ I-10/SR 101L/ US 60/US 93	241	326	44	240	340	42
I-19/I-10/SR 202L/ I-10/SR 303L/ US 60/US 93	246	320	46	245	332	44
I-19/I-10/SR 101L/ US 60/US 93	242	342	44	240	355	41
I-19/I-10/SR 303L/ US 60/US 93	246	335	44	245	348	42

Source: Arizona Statewide Travel Demand Model, 2020.; Google Maps 2018.

[a] Travel times based on Google estimates for a 4 p.m. departure on March 14, 2018.

Table 3-3 shows the travel times along the shortest time path between cities in the I-11 travel market. This table shows that travel times in the Casa Grande – Wickenburg market will increase significantly as projected population and employment growth generates more intercity travel.

Table 3-3. Peak Period Travel Times for City Pairs in Afternoon, 2018 and 2040 (No Build Alternative)

City Pair	Northbound			Southbound		
	Distance (miles)	Travel Time (minutes)	Average Speed (mph)	Distance (miles)	Travel Time (minutes)	Average Speed (mph)
2018						
Nogales – Tucson	66	68	58	66	68	58
Tucson – Casa Grande	66	68	58	66	68	58
Casa Grande – Phoenix	50	60	50	50	58	52
Phoenix – Wickenburg	65	82	48	65	70	56

City Pair	Northbound			Southbound		
	Distance (miles)	Travel Time (minutes)	Average Speed (mph)	Distance (miles)	Travel Time (minutes)	Average Speed (mph)
Casa Grande – Wickenburg	114	125	55	114	115	59
2040						
Nogales – Tucson	66	68	60	66	70	56
Tucson – Casa Grande	66	83	48	66	77	51
Casa Grande – Phoenix	54	84	38	54	93	35
Phoenix – Wickenburg	67	120	34	67	130	31
Casa Grande – Wickenburg	141	170	50	141	185	46

Source: Google Maps 2018; Arizona Statewide Travel Demand Model, 2020.
Note: Travel times based on Google estimates for a 4 p.m. departure on March 14, 2018.

Table 3-4 shows 2040 afternoon peak period travel times from the Arizona Model between key city pairs in the I-11 corridor. The table also shows end-to-end travel times between Nogales and SR 71 near Wickenburg. All the I-11 Build Alternatives offer an improvement over the No Build Alternative. **Figure 3-1** shows the shortest travel time paths estimated by the Arizona Model for each alternative and city pair. City pair travel times were determined using centrally located origin and destination points for each city that are not on I-11, and include additional travel time to account for those origin and destination points.

Table 3-4. 2040 Travel Times in Minutes (Afternoon Peak Period)

Origin and Destination	2040 Travel Time (minutes)									
	No Build Alternative	Recommended Alternative			Preferred Alternative with West Option in Pima County			Preferred Alternative with East Option in Pima County		
	Mins.	Mins.	Change (Mins.)	% Change	Mins.	Change (Mins.)	% Change	Mins.	Change (Mins.)	% Change
Nogales to Tucson	65	65	0	0	65	0	0	63	–2	–3
Nogales to Casa Grande	142	122	–20	–14	123	–19	–13	133	–9	–6
Tucson to Casa Grande	83	82	–1	–1	82	–1	–1	77	–6	–7
Casa Grande to Buckeye	102	68	–34	–33	75	–27	–26	75	–27	–26
Buckeye to Wickenburg	79	68	–14	–9	70	–9	–11	70	–9	–11
End-to-End (Nogales to SR 71)	297	234	–63	–21	236	–61	–21	250	–47	–16

Source: Arizona Statewide Travel Demand Model, 2020.

3.2.3 Vehicle Miles of Travel

VMT estimates from the Arizona Model also show the differences between the Build Alternatives and the No Build Alternative. **Table 3-5** shows VMT for the No Build, Recommended, and Preferred Alternatives.

Table 3-5 shows the 2040 VMT estimates for passenger cars and trucks on all facilities in the Arizona Model highway network within the I-11 Corridor Study Area. The Recommended Alternative and both options of the Preferred Alternatives show a similar change in VMT compared to the No Build.

Table 3-5. 2040 Vehicle Miles Traveled – All Facility Types

	No Build	Recommended Alternative		Preferred Alternative with West Option in Pima County		Preferred Alternative with East Option in Pima County	
Section	VMT	VMT	% Change	VMT	% Change	VMT	% Change
Combined (Passenger Cars and Trucks)							
South (Nogales to Casa Grande)	30,088,800	30,264,600	1	30,038,400	–1	30,370,100	1
Central (Casa Grande to Buckeye)	6,190,200	8,325,800	34	7,980,500	29	7,955,100	29
North (Buckeye to Wickenburg)	2,478,100	2,611,300	3	2,612,800	5	2,606,300	5
End-to-End	**38,757,100**	**41,201,700**	**6**	**40,631,700**	**5**	**40,931,500**	**6**
Trucks							
South (Nogales to Casa Grande)	4,175,200	4,199,300	1	4,133,900	–1	4,219,000	1
Central (Casa Grande to Buckeye)	946,100	2,101,500	122	2,078,700	120	2,067,500	119
North (Buckeye to Wickenburg)	205,500	247,300	20	247,300	20	247,100	20
End-to-End	**5,326,200**	**6,548,100**	**23**	**6,459,900**	**21**	**6,533,600**	**23**

Source: Arizona Statewide Travel Demand Model, 2020.

3.2.4 Average Daily Traffic

Table 3-6 shows an average of 2018 weekday traffic and 2040 No Build Alternative weekday traffic forecasts for segments of existing highways. **Table 3-6** also shows a generalized LOS for these segments. Attachment B shows the 2018 average weekday traffic for existing highways. Attachment C shows the 2040 weekday traffic forecasts for existing highways.

Table 3-6. Average Weekday Traffic and Level of Service, 2018 and 2040 (No Build Alternative)

Facility	City Pair	Lanes	Average Weekday Traffic[a]	Level of Service
2018				
I-19	Nogales – Tucson	4	17,700–86,600	C or better to E
I-10	Tucson – Casa Grande[b,c]	4 to 8	45,000–167,100	C or better to E
I-8	Casa Grande – Gila Bend	4	6,300–10,400	C or better
SR 85	Gila Bend – I-10	4	11,800–20,600	C or better
2040				
I-19	Nogales – Tucson[c,d]	4 to 6	26,700–112,900	C or better to E [e]
I-10	Tucson – Casa Grande[b,c,d]	6 to 8	71,600–228,100	C or better to F
I-8	Casa Grande – Gila Bend[d]	4	7,500–25,900	C or better
SR 85	Gila Bend – I-10[d]	4	17,300–59,700	C or better

Source: ADOT 2017; Transportation Research Board 2016.

[a] 2018 average weekday traffic counts from ADOT Transportation Management System. Rounded to nearest thousand.

[b] This represents an average condition of 60 miles of I-10 between I-19 and I-8, which includes the Tucson central business district.

[c] The number of travel lanes varies across this segment.

[d] LOS varies across this segment.

[e] One additional travel lane in each direction between San Xavier Way and Ajo Road improves 2040 LOS.

Table 3-7 shows the average of 2040 average weekday traffic forecasts for segments of existing highways and the proposed I-11 Build Alternatives. This comparison shows how travel markets respond to new access created by each of the Build Alternatives.

Table 3-7. 2040 Average Daily Traffic Forecasts

Segment	2040 Average Weekday Traffic (Arizona Model)			
	No-Build	Recommended Alternative	Preferred Alternative with West Option in Pima County	Preferred Alternative with East Option in Pima County
Existing Highways				
US 93 west of SR 89	13,600	14,100	14,100	14,100
US 60 west of SR 74	61,100	55,000	55,000	55,000
I-10 west of SR 85	90,100	77,800	95,700	95,600
SR 85	20,800	24,600	25,500	25,500
I-8 east of SR 85	7,500	7,100	7,000	7,000
I-8 west of Trekell Road	21,300	43,900	43,500	43,900
I-10 west of Pinal Air Park	78,700	78,400	77,000	79,200
I-10 at St. Mary's Road	204,800	207,200	207,100	227,700
I-19 south of Ajo Way	112,900	112,800	112,800	127,100
I-19 south of Sahuarita Road	57,400	57,500	57,500	57,600

Segment	2040 Average Weekday Traffic (Arizona Model)			
	No-Build	Recommended Alternative	Preferred Alternative with West Option in Pima County	Preferred Alternative with East Option in Pima County
Proposed I-11				
I-11 south of US 60	–	8,500	8,600	8,000
I-11 south of I-10	–	38,900	54,000	54,000
I-11 south of SR 85	–	40,400	28,700	28,700
I-11 south of SR 238	–	27,900	20,000	20,000
I-11 south of I-8	–	10,100	4,800	4,300
I-11 south of Pinal Air Park	–	2,700	3,000	–
I-11 south of SR 86	–	500	500	–

Source: Arizona Statewide Travel Demand Model, 2020.

3.2.5 Level of Service

Figure 3-1 shows the 2040 generalized LOS for existing highways in the I-11 Corridor Study Area and key highways in urban Maricopa County for the No Build Alternative. **Figure 3-2**, **Figure 3-3**, and **Figure 3-4** show the 2040 generalized LOS for the I-11 Build Alternatives.

The number of lanes used in the Arizona Travel Demand Model was based on achieving the following defined LOS thresholds on I-11:

- Achieves LOS C or better on I-11 in in rural areas
- Achieves LOS D or better on I-11 in urban areas (Tucson)

Generally, four lanes were needed to meet the LOS threshold for new corridors. The Preferred Alternative with east option co-locates I-11 with I-10, and was assumed to require two to three additional lanes in each direction and improve traffic conditions on the co-located facility to LOS D or better. Tier 2 studies would evaluate other design concepts, such as elevated structures or elimination of frontage roads.

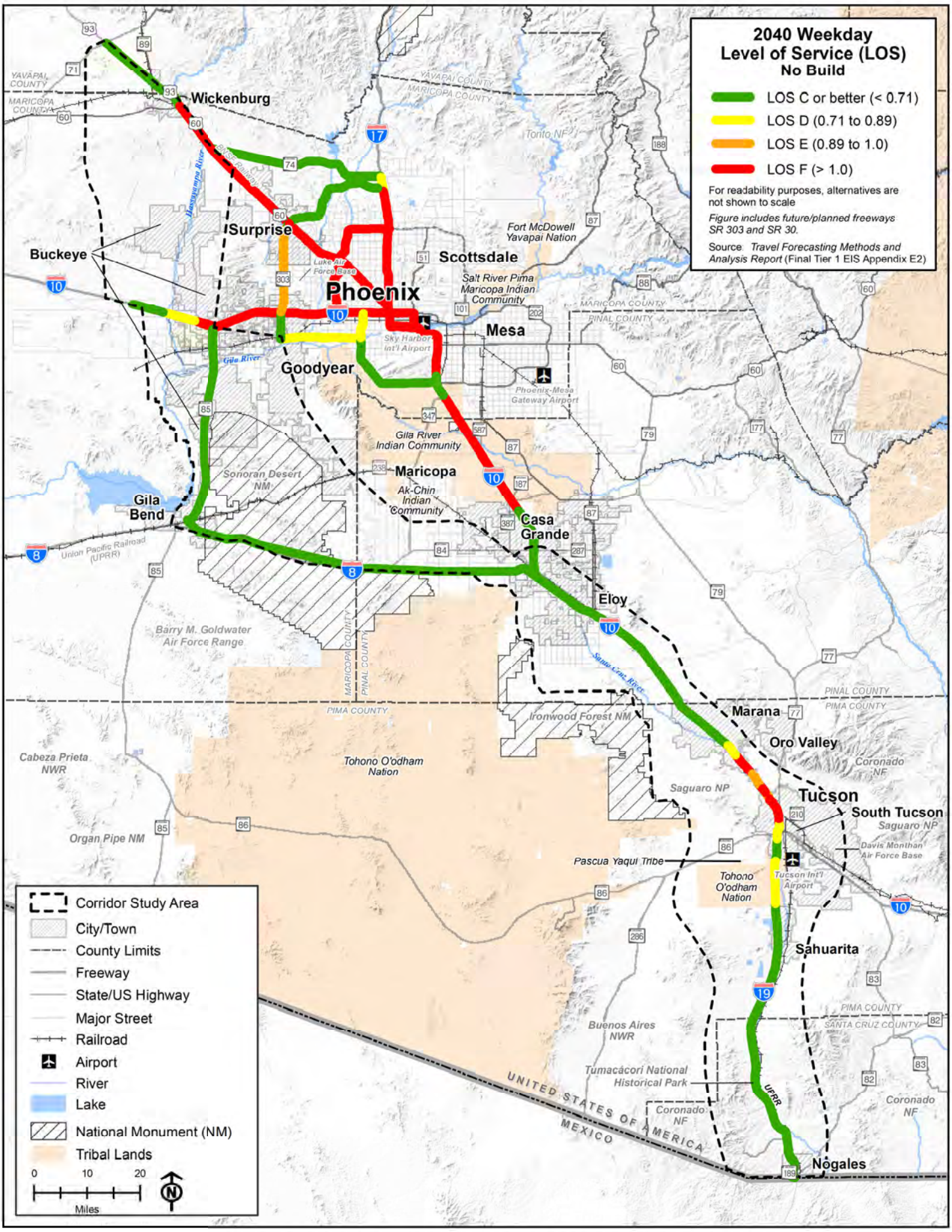

Figure 3-1. I-11 No Build Alternative 2040 Level of Service

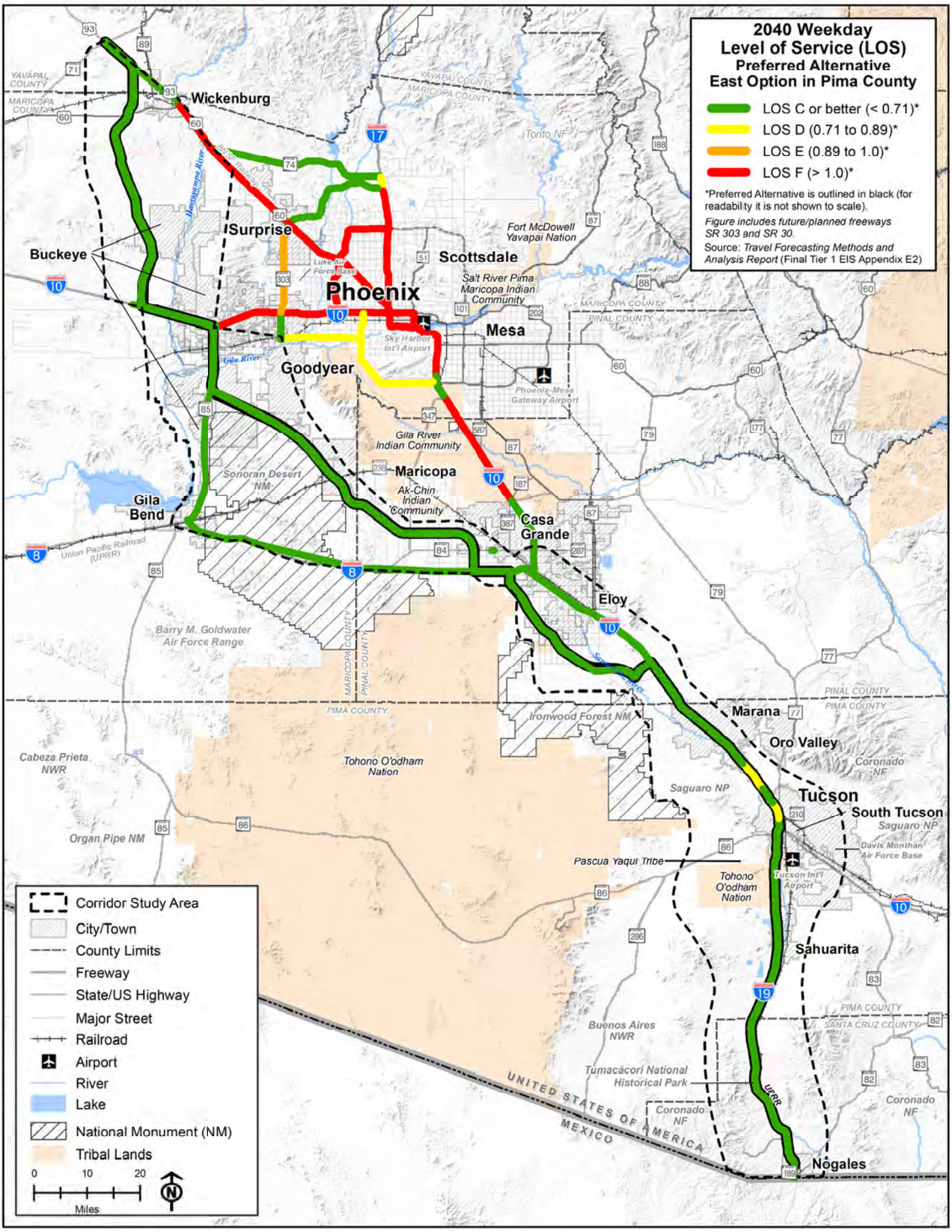

Figure 3-2. I-11 Preferred Alternative with East Option 2040 Level of Service

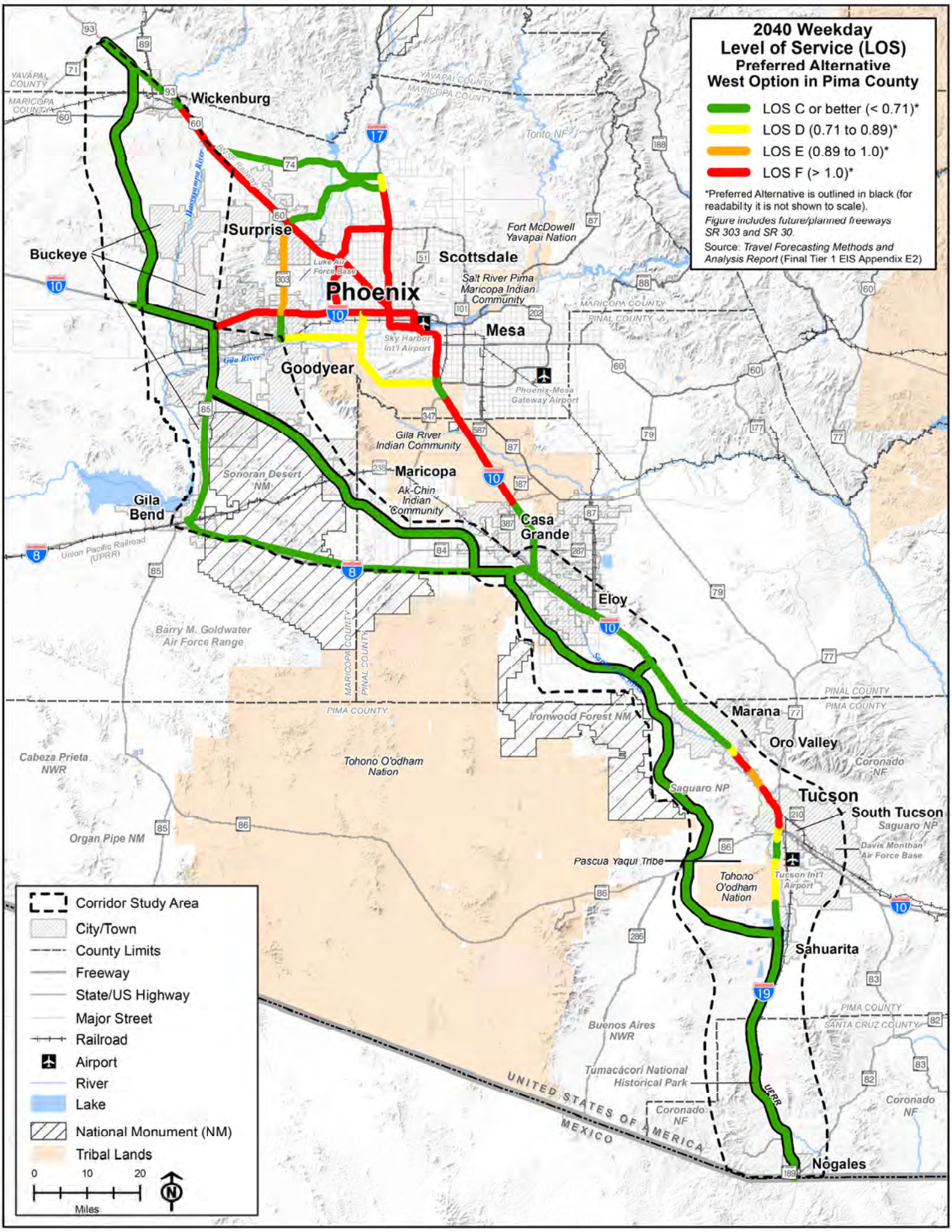

Figure 3-3. I-11 Preferred Alternative with West Option 2040 Level of Service

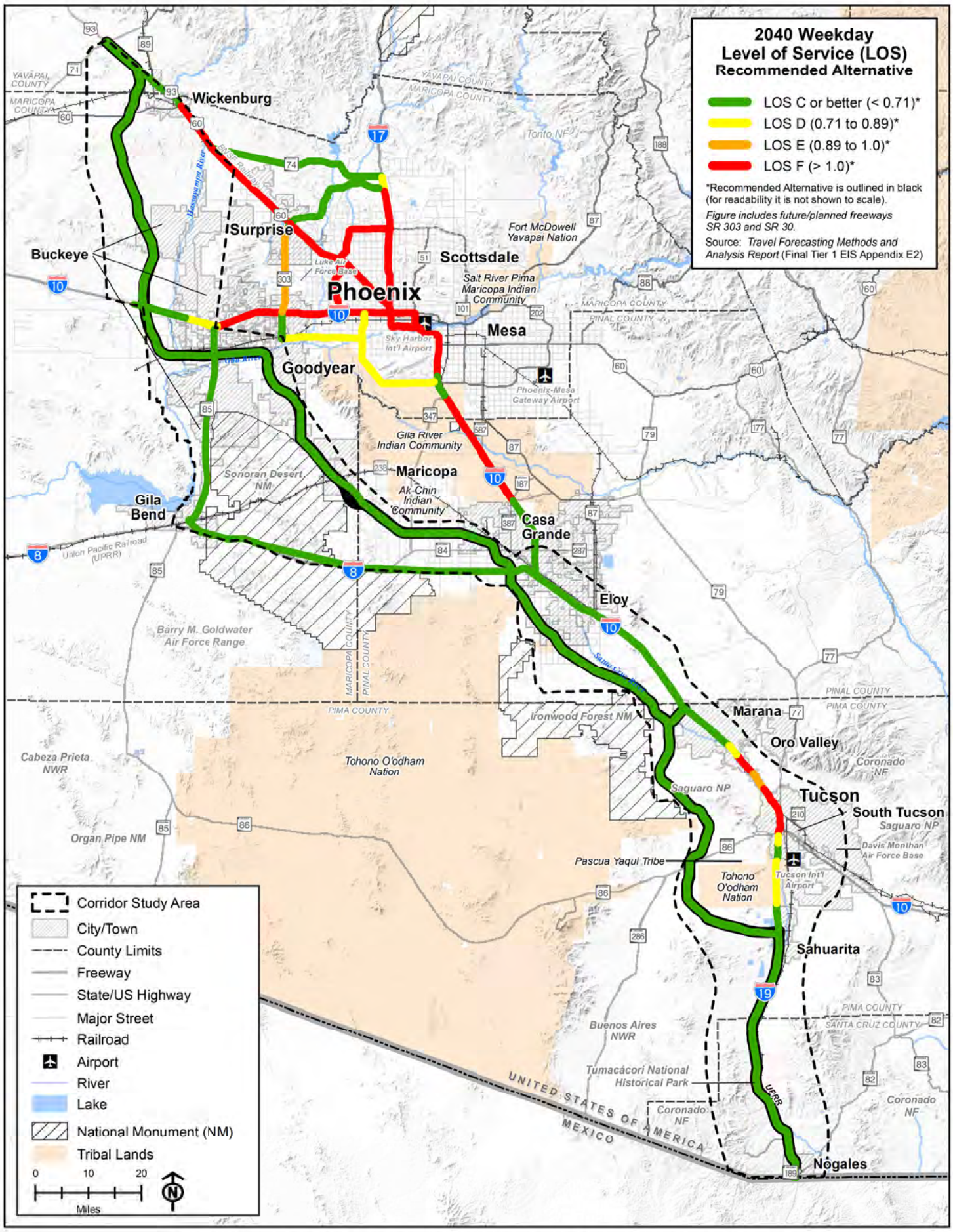

Figure 3-4. I-11 Recommended Alternative 2040 Level of Service

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ATTACHMENT A
Existing and Future Interchange Locations

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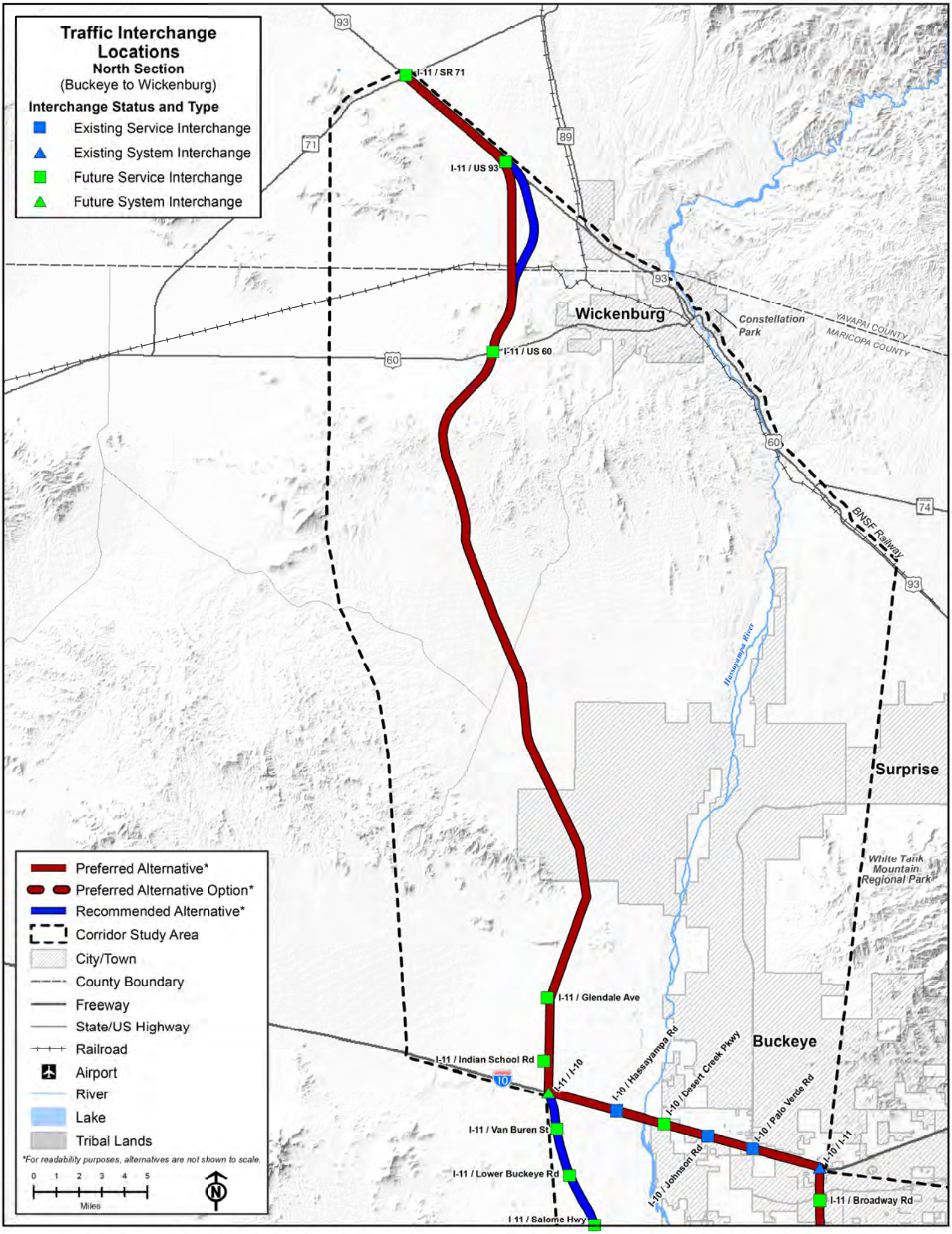

Figure A-1. Traffic Interchange Locations between Buckeye and Wickenburg

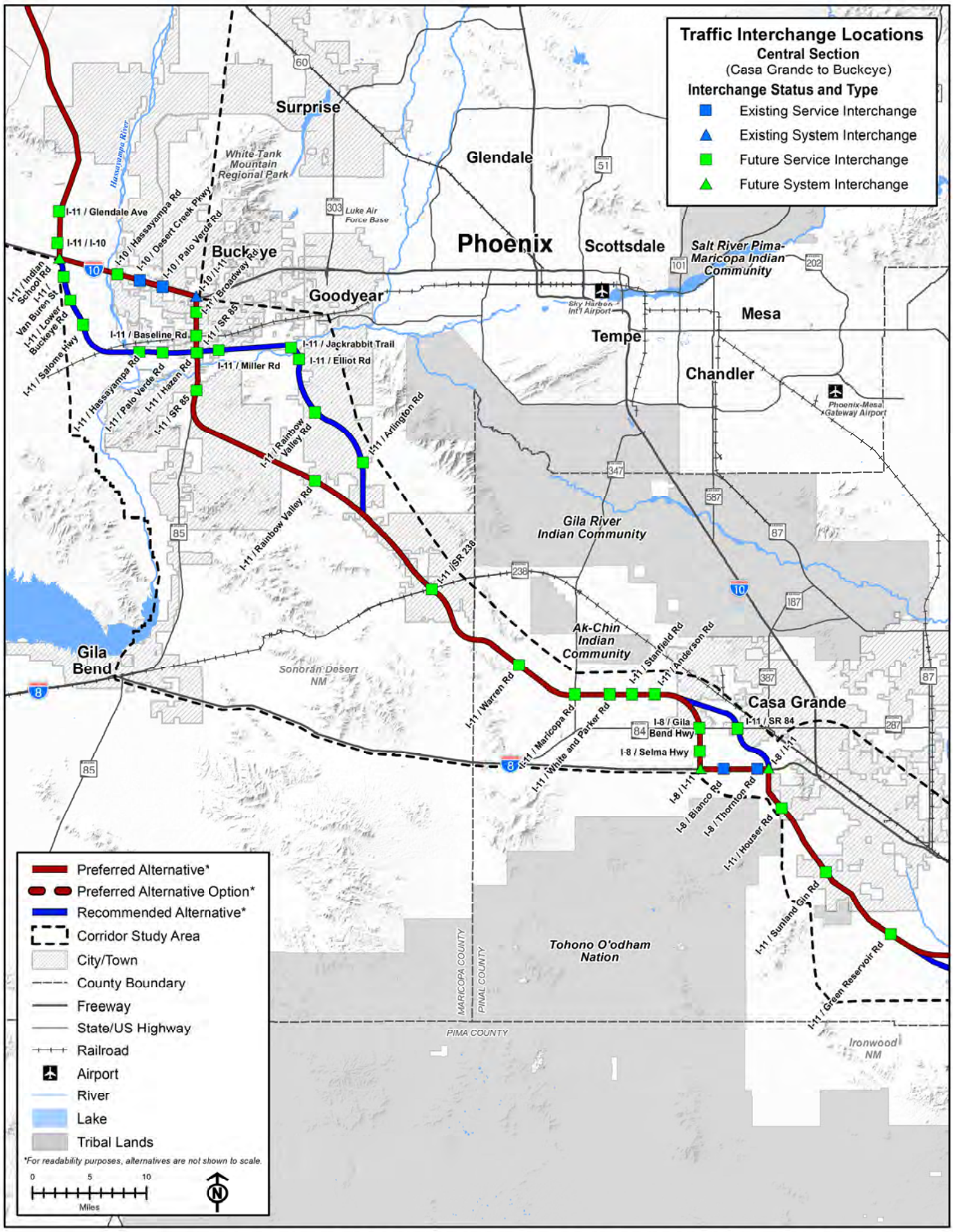

Figure A-2. Traffic Interchange Locations between Casa Grande and Buckeye

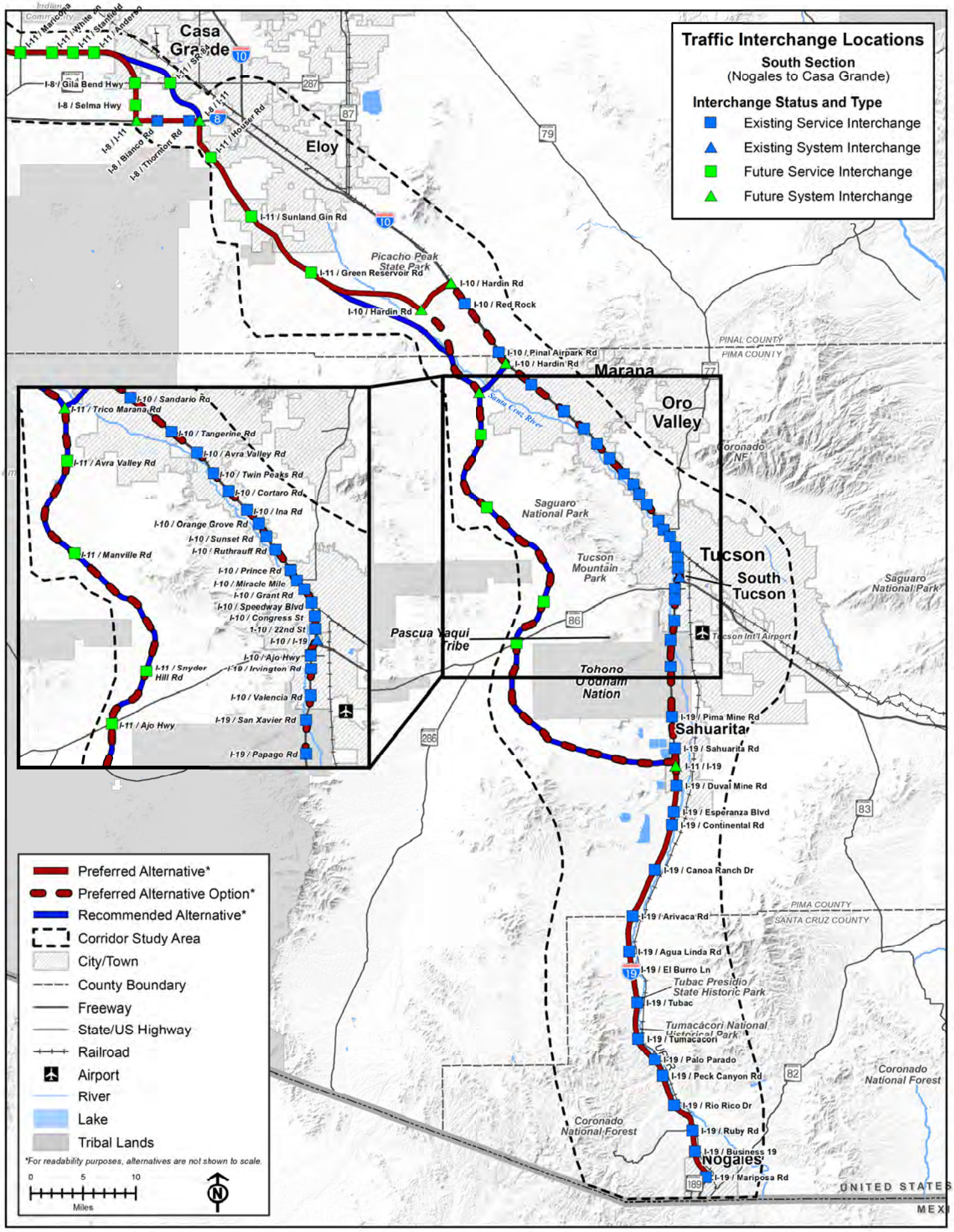

Figure A-3. Traffic Interchange Locations between Nogales and Casa Grande

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ATTACHMENT B
2018 Average Weekday Traffic

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Table B-1. 2018 Average Weekday Traffic

I-11 Alternative Option	From	To	2018		
			GP Lanes	Traffic Count	LOS
I-19 Santa Cruz County					
A	Mariposa Rd	Grand Ave	4	23,900	C or better
A	Grand Ave	Ruby Rd	4	32,500	C or better
A	Ruby Rd	Rio Rico Dr	4	29,400	C or better
A	Rio Rico Dr	Peck Canyon Rd	4	20,600	C or better
A	Peck Canyon Rd	Palo Parado Rd	4	20,200	C or better
A	Palo Parado Rd	Tumacácori-Carmen	4	18,600	C or better
A	Tumacácori-Carmen	Tubac	4	18,100	C or better
A	Tubac	Chavez Siding Rd	4	17,700	C or better
A	Chavez Siding Rd	Agua Linda Rd	4	19,900	C or better
A	Agua Linda Rd	Arivaca Rd	4	19,100	C or better
I-19 Pima County					
B, D	Arivaca Rd	Canoa Rd	4	23,500	C or better
B, D	Canoa Rd	Continental Rd	4	24,700	C or better
B, D	Continental Rd	Esperanza Blvd	4	30,000	C or better
B, D	Esperanza Blvd	Duval Mine Rd	4	36,900	C or better
B, D	Duval Mine Rd	Sahuarita Rd	4	40,600	C or better
B	Sahuarita Rd	Pima Mine Rd	4	39,200	C or better
B	Pima Mine Rd	Papago Rd	4	46,300	C or better
B	Papago Rd	San Xavier Rd	4	47,800	C or better
B	San Xavier Rd	Valencia Rd	4	45,700	C or better
B	Valencia Rd	Irvington Rd	4	68,800	D
B	Irvington Rd	Ajo Way	4	86,600	E
B	Ajo Way	I-10	6	80,200	C or better
I-10 Pima County					
B	I-19	Congress St	8	159,000	E
B	Congress St	Speedway Blvd	8	155,800	D
B	Speedway Blvd	Grant Rd	8	167,100	E
B	Grant Rd	Miracle Mile	8	147,100	D
B	Miracle Mile	Prince Rd	8	121,400	C or better
B	Prince Rd	Ruthrauff Rd	6	130,800	E
B	Ruthrauff Rd	Sunset Rd	6	115,600	D
B	Sunset Rd	Orange Grove Rd	6	116,200	D
B	Orange Grove Rd	Ina Rd	6	112,000	D
B	Ina Rd	Cortaro Rd	6	97,800	D
B	Cortaro Rd	Twin Peaks Rd	6	82,900	C or better

I-11 Alternative Option	From	To	2018		
			GP Lanes	Traffic Count	LOS
B	Twin Peaks Rd	Avra Valley Rd	6	67,500	C or better
B	Avra Valley Rd	Tangerine Rd	6	58,800	C or better
B	Tangerine Rd	Marana Rd	6	61,300	C or better
I-10 Pinal County					
B	Marana Rd	Pinal Air Park Rd	6	50,800	C or better
G	Pinal Air Park Rd	Red Rock	6	50,500	C or better
G	Red Rock	Picacho Peak Rd	6	50,500	C or better
G	Picacho Peak Rd	Picacho	6	50,500	C or better
G	Picacho	SR 87	6	49,400	C or better
G	SR 87	Sunshine Blvd	6	46,100	C or better
G	Sunshine Blvd	Toltec Rd	6	45,500	C or better
G	Toltec Rd	Sunland Gin Rd	6	45,300	C or better
G	Sunland Gin Rd	I-8	6	45,000	C or better
I-8 Pinal County					
G	I-10	Trekell Rd	4	10,400	C or better
G	Trekell Rd	Thornton Rd	4	7,900	C or better
G	Thornton Rd	Bianco Rd	4	8,200	C or better
G	Bianco Rd	Montgomery Rd	4	8,500	C or better
H	Montgomery Rd	Stanfield Rd	4	8,000	C or better
H	Stanfield Rd	SR 84	4	6,400	C or better
I-8 Maricopa County					
K	SR 84	Vekol Valley Rd	4	6,500	C or better
K	Vekol Valley Rd	Freeman Rd	4	6,700	C or better
K	Freeman Rd	Butterfield Trail	4	6,300	C or better
SR 85 Maricopa County					
K	Butterfield Trail	Fornes Rd	4	17,000	C or better
Q1	Fornes Rd	Lewis Prison Rd	4	11,800	C or better
Q2	Lewis Prison Rd	Buckeye Hills Dr	4	14,500	C or better
Q2	Buckeye Hills Dr	Narramore Rd	4	11,800	C or better
Q2	Narramore Rd	Hazen Rd	4	18,300	C or better
Q2	Hazen Rd	MC 85	4	20,600	C or better
Q2	MC 85	Baseline Rd	4	16,800	C or better
Q2	Baseline Rd	Broadway Rd	4	18,200	C or better
Q2	Broadway Rd	I-10	4	18,400	C or better
US 60 Maricopa County					
	SR 74	US 93	4	18,800	C or better

I-11 Alternative Option	From	To	2018		
			GP Lanes	Traffic Count	LOS
US 93 Maricopa County					
	US 60	Yavapai County Line	2	13,900	C or better
US 93 Yavapai County					
S,U,V	Maricopa County Line	SR 71	2	9,200	C or better
I-10 Maricopa County					
Q3	SR 85	Sun Valley Parkway	4	38,200	C or better
Q3	Sun Valley Parkway	Hassayampa Rd	4	27,900	C or better
Q3	Hassayampa Rd	Wintersburg Rd	4	24,300	C or better

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ATTACHMENT C
2040 Traffic Forecasts

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Table C-1. 2040 Traffic Forecasts

I-11 Alternative Option	From	To	2040 No Build			Preferred – West Option – 2040			Preferred – East Option -- 2040			Recommended – 2040		
			GP Lanes	Traffic Forecasts	2040 LOS	GP Lanes	Traffic Forecasts	2040 LOS	GP Lanes	Traffic Forecasts	2040 LOS	GP Lanes	Traffic Forecasts	2040 LOS
I-19 Santa Cruz County														
A	Mariposa Rd	Grand Ave	4	36,200	C or better	4	36,200	C or better	4	36,200	C or better	4	36,200	C or better
A	Grand Ave	Ruby Rd	4	48,600	C or better	4	48,600	C or better	4	48,600	C or better	4	48,600	C or better
A	Ruby Rd	Rio Rico Dr	4	44,600	C or better	4	44,600	C or better	4	44,600	C or better	4	44,600	C or better
A	Rio Rico Dr	Peck Canyon Rd	4	31,200	C or better	4	31,200	C or better	4	31,200	C or better	4	31,200	C or better
A	Peck Canyon Rd	Palo Parado Rd	4	30,500	C or better	4	30,500	C or better	4	30,500	C or better	4	30,500	C or better
A	Palo Parado Rd	Tumacácori-Carmen	4	28,100	C or better	4	28,100	C or better	4	28,100	C or better	4	28,100	C or better
A	Tumacácori-Carmen	Tubac	4	27,300	C or better	4	27,300	C or better	4	27,300	C or better	4	27,300	C or better
A	Tubac	Chavez Siding Rd	4	26,700	C or better	4	26,700	C or better	4	26,700	C or better	4	26,700	C or better
A	Chavez Siding Rd	Agua Linda Rd	4	30,000	C or better	4	30,000	C or better	4	30,000	C or better	4	30,000	C or better
A	Agua Linda Rd	Arivaca Rd	4	28,800	C or better	4	28,800	C or better	4	28,800	C or better	4	28,800	C or better
I-19 Pima County														
B, D	Arivaca Rd	Canoa Rd	4	35,200	C or better	4	35,100	C or better	4	35,200	C or better	4	35,100	C or better
B, D	Canoa Rd	Continental Rd	4	37,000	C or better	4	37,000	C or better	4	37,100	C or better	4	37,000	C or better
B, D	Continental Rd	Esperanza Blvd	4	43,500	C or better	4	43,500	C or better	4	43,600	C or better	4	43,500	C or better
B, D	Esperanza Blvd	Duval Mine Rd	4	54,100	C or better	4	54,100	C or better	4	54,200	C or better	4	54,100	C or better
B, D	Duval Mine Rd	Sahuarita Rd	4	57,400	C or better	4	57,500	C or better	4	57,600	C or better	4	57,500	C or better
B	Sahuarita Rd	Pima Mine Rd	4	54,100	C or better	4	53,900	C or better	4	54,400	C or better	4	53,900	C or better
B	Pima Mine Rd	Papago Rd	4	65,700	D	4	65,400	D	6	66,200	C or better	4	65,400	D
B	Papago Rd	San Xavier Rd	4	67,800	D	4	67,500	D	6	68,300	C or better	4	67,500	D
B	San Xavier Rd	Valencia Rd	6	63,700	C or better	6	63,500	C or better	6	65,400	C or better	6	63,500	C or better
B	Valencia Rd	Irvington Rd	6	92,500	C or better	6	92,400	C or better	8	104,100	C or better	6	92,400	C or better
B	Irvington Rd	Ajo Way	6	112,900	D	6	112,800	D	8	127,100	C or better	6	112,800	D
B	Ajo Way	I-10	6	102,900	D	6	102,600	D	10	115,900	C or better	6	102,600	D
I-10 Pima County														
B	I-19	Congress St	8	207,000	F	8	209,500	F	12	213,000	C or better	8	209,500	F
B	Congress St	Speedway Blvd	8	204,800	F	8	207,100	F	12	227,700	D	8	207,200	F
B	Speedway Blvd	Grant Rd	8	228,100	F	8	231,100	F	12	255,300	D	8	231,200	F
B	Grant Rd	Miracle Mile	8	205,400	F	8	208,300	F	12	230,200	D	8	208,300	F
B	Miracle Mile	Prince Rd	8	174,600	E	8	177,300	E	12	194,200	C or better	8	177,300	E
B	Prince Rd	Ruthrauff Rd	8	193,400	F	8	182,400	F	12	207,900	C or better	8	192,900	F
B	Ruthrauff Rd	Sunset Rd	8	166,800	E	8	172,600	E	10	184,200	D	8	172,600	E
B	Sunset Rd	Orange Grove Rd	8	161,000	E	8	165,900	E	10	177,100	D	8	165,900	E
B	Orange Grove Rd	Ina Rd	8	158,600	E	8	163,700	E	10	174,900	D	8	163,700	E
B	Ina Rd	Cortaro Rd	6	144,900	F	6	150,200	F	10	163,600	D	6	150,200	F
B	Cortaro Rd	Twin Peaks Rd	6	137,200	F	6	143,700	F	10	152,500	C or better	6	143,700	F

I-11 Alternative Option	From	To	2040 No Build			Preferred – West Option – 2040			Preferred – East Option -- 2040			Recommended – 2040		
			GP Lanes	Traffic Forecasts	2040 LOS	GP Lanes	Traffic Forecasts	2040 LOS	GP Lanes	Traffic Forecasts	2040 LOS	GP Lanes	Traffic Forecasts	2040 LOS
B	Twin Peaks Rd	Avra Valley Rd	6	104,600	D	6	108,500	D	8	110,300	C or better	6	108,600	D
B	Avra Valley Rd	Tangerine Rd	6	89,000	C or better	6	92,500	C or better	6	93,500	C or better	6	92,600	C or better
B	Tangerine Rd	Marana Rd	6	94,100	C or better	6	93,800	C or better	6	94,600	C or better	6	94,000	C or better
I-10 Pinal County														
B	Marana Rd	Pinal Air Park Rd	6	79,900	C or better	6	78,200	C or better	6	80,100	C or better	6	79,000	C or better
G	Pinal Air Park Rd	Red Rock	6	78,700	C or better	6	77,000	C or better	6	79,200	C or better	6	78,400	C or better
G	Red Rock	Picacho Peak Rd	6	80,100	C or better	6	78,300	C or better	6	80,300	C or better	6	79,500	C or better
G	Picacho Peak Rd	Picacho	6	80,100	C or better	6	78,900	C or better	6	80,000	C or better	6	79,500	C or better
G	Picacho	SR 87	6	76,400	C or better	6	77,800	C or better	6	78,200	C or better	6	77,800	C or better
G	SR 87	Sunshine Blvd	6	71,600	C or better	6	72,900	C or better	6	73,200	C or better	6	72,900	C or better
G	Sunshine Blvd	Toltec Rd	6	73,300	C or better	6	73,100	C or better	6	73,400	C or better	6	73,100	C or better
G	Toltec Rd	Sunland Gin Rd	6	76,100	C or better	6	75,200	C or better	6	75,700	C or better	6	75,300	C or better
G	Sunland Gin Rd	I-8	6	75,100	C or better	6	75,800	C or better	6	76,000	C or better	6	75,900	C or better
I-8 Pinal County														
G	I-10	Trekell Rd	4	25,900	C or better	4	49,000	C or better	4	49,600	C or better	4	49,500	C or better
G	Trekell Rd	Thornton Rd	4	21,300	C or better	4	43,500	C or better	4	43,900	C or better	4	43,900	C or better
G	Thornton Rd	Bianco Rd	4	24,600	C or better	4	47,800	C or better	4	47,700	C or better	4	18,400	C or better
G	Bianco Rd	Montgomery Rd	4	23,200	C or better	4	48,500	C or better	4	48,500	C or better	4	16,100	C or better
H	Montgomery Rd	Stanfield Rd	4	21,600	C or better	4	14,900	C or better	4	14,900	C or better	4	14,500	C or better
H	Stanfield Rd	SR 84	4	15,200	C or better	4	11,000	C or better	4	10,900	C or better	4	10,800	C or better
I-8 Maricopa County														
K	SR 84	Vekol Valley Rd	4	7,800	C or better	4	7,200	C or better	4	7,200	C or better	4	7,400	C or better
K	Vekol Valley Rd	Freeman Rd	4	8,000	C or better	4	7,400	C or better	4	7,400	C or better	4	7,600	C or better
K	Freeman Rd	Butterfield Trail	4	7,500	C or better	4	7,000	C or better	4	7,000	C or better	4	7,100	C or better
SR 85 Maricopa County														
K	Butterfield Trail	Fornes Rd	4	25,100	C or better	4	26,500	C or better	4	26,500	C or better	4	25,800	C or better
Q1	Fornes Rd	Lewis Prison Rd	4	17,300	C or better	4	18,700	C or better	4	18,700	C or better	4	18,200	C or better
Q2	Lewis Prison Rd	Buckeye Hills Dr	4	20,800	C or better	4	25,500	C or better	4	25,500	C or better	4	24,600	C or better
Q2	Buckeye Hills Dr	Narramore Rd	4	17,900	C or better	4	36,500	C or better	4	36,500	C or better	4	19,900	C or better
Q2	Narramore Rd	Hazen Rd	4	47,000	C or better	4	53,500	C or better	4	53,500	C or better	4	22,000	C or better
Q2	Hazen Rd	MC 85	4	56,200	C or better	4	60,300	C or better	4	60,300	C or better	4	20,600	C or better
Q2	MC 85	Baseline Rd	4	42,500	C or better	4	49,100	C or better	4	49,100	C or better	4	16,800	C or better
Q2	Baseline Rd	Broadway Rd	4	48,000	C or better	4	53,200	C or better	4	53,200	C or better	4	19,200	C or better
Q2	Broadway Rd	I-10	4	59,700	C or better	4	53,800	C or better	4	53,800	C or better	4	40,400	C or better
US 60 Maricopa County														
	SR 74	US 93	4	61,100	C or better	4	55,000	C or better	4	55,000	C or better	4	55,000	C or better

I-11 Alternative Option	From	To	2040 No Build			Preferred – West Option – 2040			Preferred – East Option -- 2040			Recommended – 2040		
			GP Lanes	Traffic Forecasts	2040 LOS	GP Lanes	Traffic Forecasts	2040 LOS	GP Lanes	Traffic Forecasts	2040 LOS	GP Lanes	Traffic Forecasts	2040 LOS
US 93 Maricopa County														
	US 60	Yavapai County Line	4	16,400	C or better	4	14,300	C or better	4	7,500	C or better	4	14,400	C or better
US 93 Yavapai County														
S,U,V	Maricopa County Line	SR 71	4	13,600	C or better	4	14,100	C or better	4	14,100	C or better	4	14,100	C or better
I-10 Maricopa County														
Q3	SR 85	Sun Valley Parkway	4	90,100	F	6	95,700	C or better	6	95,600	C or better	4	77,800	D
Q3	Sun Valley Parkway	Hassayampa Rd	4	65,300	D	6	70,000	C or better	6	71,600	C or better	4	55,300	C or better
Q3	Hassayampa Rd	Wintersburg Rd	4	51,100	C or better	6	57,100	C or better	6	57,100	C or better	4	48,900	C or better

Note: The No Build reflects the existing road cross section plus any capacity improvements identified in the ADOT 2020–2024 State Transportation Improvement Program.

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