Prepared for:

ADOT
ARIZONA DEPARTMENT OF TRANSPORTATION

205 South 17th Avenue
Phoenix, Arizona 85007

FHWA

RTA
Regional Transportation Authority

Feasibility Report Update

February 2015

Interstate 10: Junction Interstate 19 to State Route 83

Tucson – Benson Highway

State Route 210: Golf Links Road to I-10

Barraza – Aviation Parkway

Federal No.: 010-E(210)A
Project No.: 010 PM 260 H7825 01 L
Tucson District – Pima County

Prepared by:

JACOBS

101 North 1st Avenue, Suite 2600
Phoenix, Arizona 85003

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Expires 12/31/2015

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ADOT
Intermodal Transportation

MEMORANDUM

TO: Rod Lane, Tucson District, T100
Trent Kelso, Urban Project Management, EM01
Annette Riley, Assistant State Engineer, 611E

FROM: David Brauer, Urban Project Management, T100

CC: Paul O'Brien, Environmental Planning Group, EM02

DATE: February 23, 2015

RE: FEASIBILITY REPORT
010 PM 260 H7825 01L
I-10; JUNCTION I-19 TO SR 83 AND SR 210; GOLF LINKS ROAD TO I-10

This memorandum is prepared pursuant to Section 3.3 of the ADOT Action Plan for Federal-Aid Highway projects. The proposed major design features for this project are described in the attached Feasibility Report.

Your concurrence/approval on the proposed major design features is requested.

David G. Brauer, Project Manager, T100 — Date: 2-23-15

Concurrence:

Rod Lane, Tucson District, T100 — Date: 3-11-15

Trent Kelso, Urban Project Management, EM01 — Date: 3/13/15

Approval:

Annette Riley, Assistant State Engineer- Roadway, 611E — Date: 4/6/15

EXECUTIVE SUMMARY

1.1. Introduction

The Arizona Department of Transportation (ADOT) in cooperation with the Federal Highway Administration (FHWA) prepared a Feasibility Study to identify and evaluate alternatives for the improvement of I-10 from the Junction of I-19 to SR 83 and the extension of the Barraza-Aviation Parkway (SR 210) from Golf Links Road to I-10. This Feasibility Study presents the results of an investigation of alternative concepts for accomplishing improvements to both I-10 and SR 210.

Subsequent to the finalization of the Feasibility Report, an additional alternative for the extension of SR 210 from Golf Links Road to I-10 was identified for the improvement. This Feasibility Report Update includes the alternatives included in the previously approved report, and supplements the report with an additional alternative for accomplishing improvements to both I-10 and SR 210.

The study area is located in the ADOT Tucson District within the City of Tucson, the City of South Tucson and Pima County.

I-10 is a full access controlled interstate freeway. ADOT Project No. 010 PM 260 H7825 01L; Federal No. 010-E(210)A has not been programmed by ADOT. It is anticipated that Federal Aid Interstate funds will be used for the improvement of I-10.

The functional classification of SR 210 is Urban Other Freeway. SR 210 is a divided multi-lane urban highway that parallels I-10 and is located approximately 1.75 miles northeast of I-10.

The project study team, in cooperation with participating agencies, initiated a study of the feasibility of improving I-10 from the I-19 traffic interchange (TI) (MP 260.2) easterly through the SR 83 TI (MP 282.0) and extending SR 210 from its current easterly end at Golf Links Road to an interchange connection with I-10 at a location to be determined.

FHWA is serving as the lead federal agency and will continue to provide input and oversight for the alternatives identification and evaluation process.

During development of the Feasibility Report, improvement alternatives I, II and IIIc were identified and evaluated for the extension of SR 210 to several connection locations with I-10. The additional alternative included in the Feasibility Report Update is Alternative IV.

This **Feasibility Report Update** will evaluate and compare the four alternatives for the improvements for both I-10 and SR 210. The evaluation will include alternative configurations of I-10 for each of the SR 210 alternative alignments. The Study will also include I-10 mainline and interchange modifications from I-19 to SR 83. Improvements to I-10 and the extension of SR 210 to a connection with I-10 will accommodate design year 2040 traffic. In addition, the Pima Association of Governments (PAG) revised their Regional Transportation Plan reducing long-term population projections for the region. This update incorporates the resultant traffic projection changes for all of the alternatives including the no build alternative.

Following completion of the **Feasibility Report Update** and the **Environmental Overview (Phase I) Update** a **Design Concept Report** and **Environmental Assessment (Phase II)** will be initiated by ADOT in cooperation with the FHWA to further analyze and develop the alternatives that were identified in the Feasibility Study Update as being viable improvement alternatives to carry forward for further evaluation. The Design Concept Study will identify the alternative to be carried forward for final design and construction.

The following agencies and stakeholders have been involved in developing the study: FHWA, Pima Association of Governments (PAG), Pima County, City of Tucson, City of South Tucson, Davis-Monthan Air Force Base (DMAFB), US Customs & Border Protection, Tucson Airport Authority, Sun Tran, Arizona Game and Fish Department (AGFD), Arizona State Land Department (ASLD), the Regional Transportation Authority (RTA), and the Union Pacific Railroad (UPRR).

Purpose and Need

Increasing traffic volumes on I-10 in the vicinity of Tucson, Arizona have contributed to reduced operational effectiveness, particularly the segment of I-10 between I-19 and SR 83.

The traffic modeling accomplished for the combined I-10/SR 210 traffic analysis has demonstrated that north-south traffic demands through the project area are constrained by limitations on north-south arterial corridors. The number, type, and close proximity of access points to I-10 in this area compound the problem, contributing to an increase in local traffic using the Interstate Highway for short local trips.

In the future, increasing traffic volumes on this segment of I-10 originating from anticipated growth to the south and east of downtown Tucson, as well as growing demands on I-10 as an interstate facility, will lead to capacity and access restrictions on and along the interstate.

Poor operational performance for local, regional, and interstate traffic will result from operations in many portions of I-10 declining to level of service (LOS) F by 2040. The decline to LOS F will show the roadway is failing to function as intended with forced flow and extensive delays.

The purpose of the proposed improvement to I-10 and the extension of SR 210 to a direct connection with I-10 is to address deficiencies in the interstate highway system and provide motorists with an alternate route into Tucson's downtown business district. The improvements to I-10 and the extension of SR 210 will provide satisfactory service levels on both I-10 and SR 210 through the 2040 design year.

1.2. Traffic Data

An Initial Traffic Report was prepared that identified and evaluated the design year 2040 transportation needs for I-10 from I-19 east to SR 90 in Cochise County, and for the extension of SR 210 to connect with I-10.

The Pima Association of Governments (PAG) is in the process of finalizing the new 2045 Regional Transportation Plan (RTP). For this effort PAG reviewed and revised the forecasted regional growth. Due to the economic climate, PAG projected a more conservative growth with a significant reduction of population and employment in the PAG planning area. This has significantly impacted the study area travel demand and prompted a review of the recommendations made in the 2011 Initial Traffic Report.

The new 2045 PAG model socioeconomic data and Traffic Analysis Zones were not revised for this study. For this study it was assumed that the 2045 population will be in place by 2040 as a conservative assessment.

An Initial Traffic Report Addendum; I-10: Jct. Interstate 19 to SR 83/SR 210: Golf Links Road to I-10 has been prepared that utilizes the updated PAG data. The Initial Traffic Report Addendum identifies and evaluates the design year 2040 transportation needs for I-10 from I-19 east to SR 83, and for the extension of SR 210 to connect with I-10.

Roadway Network

System I and II roadway networks, developed for the 2011 Initial Traffic Report were used as the starting point for validating the recommended alternatives. Due to various environmental and design issues, System IIIc was eliminated and was replaced by System IV.

Traffic Forecast

The (2014) PAG Travel Demand Model for design year 2040 was used along with an external travel survey conducted by PAG in 2011 to develop future travel on I-10 and SR 210.

Future forecasted traffic volumes were generated using the 2040 socioeconomic data to identify the magnitude of the change in travel

demand between the old model assumptions used in the original traffic forecast and the assumptions used in the new model.

The No Build Scenario was used to create a benchmark against which the System Alternatives were compared.

Future forecasted traffic volumes were generated using the new 2040 socioeconomic data and future System I, II and IV roadway network alternatives. The roadway configurations needed to achieve acceptable levels of service for the alternatives.

Traffic Operational Analysis

The traffic operational analysis evaluates the peak hour traffic volumes obtained from the regional modeling efforts to refine and ensure that the improvement alternatives are operationally feasible. This iterative process includes roadway characteristics, traffic volumes, traffic control measures, and access spacing.

A traffic operational analysis was conducted using the VISSIM microsimulation model for the following scenarios.

1. Year 2010: Existing Conditions I-10 and SR 210.

   The existing roadway network within the study area was evaluated using traffic data collected in year 2010.

2. Year 2040: No-Build

   The existing roadway network within the study area was evaluated with the updated projected year 2040 traffic volumes. Under this scenario there were no proposed improvements made to either I-10 or SR 210.

3. Year 2040: System Alternative I. See **Figure 3.1 System Alternative I**.

   An improved roadway network was evaluated with the updated projected year 2040 traffic volumes. In the System Alternative I roadway improvement alternative, SR 210 is extended as a freeway along the Alvernon Way alignment to connect to I-10 at a system interchange.

4. Year 2040: System Alternative II. See **Figure 3.2 System Alternative II**.

   An improved roadway network was evaluated with the updated projected year 2040 traffic volumes. In the System Alternative II roadway improvement alternative, the freeway connection from I-10 to SR 210 begins just west of Valencia Road and continues parallel to the DMAFB before tying into the existing SR 210.

5. Year 2040: System Alternative IV. See **Figure 3.5 System Alternative IV**.

   An improved roadway network was evaluated with the updated projected year 2040 traffic volumes. The System Alternative IV roadway improvement alternative will extend SR 210 as a freeway along the Alvernon Way alignment and connect to I-10 with a system interchange. The improvement of I-10 will include the addition of Collector Distributor lanes both eastbound and westbound between the I-10/SR 210 System Interchange and Kolb Road.

Per ADOT Roadway Design Guidelines, for I-10 and SR 210 mainline and ramp roadways, and for intersections of ramps and crossroads, LOS D is acceptable for urban conditions. The section of I-10 between I-19 and SR 83 as well as SR 210 within the study area is considered urban in character for design year 2040.

Results of Operational Analysis

The operational analysis showed that System Alternative I, System Alternative II and System Alternative IV will operate with satisfactory service levels. However, additional iterations to modify traffic movements, primarily at traffic interchange (TI) ramps and crossroads, will be required for some traffic movements during the Phase II Design Concept Study.

1.3 Alternatives Considered

Improvements to I-10 and the extension of SR 210 to a connection with I-10 will be based primarily on developing the capacity to carry the projected 2040 design year traffic demand as identified via macro-level traffic modeling. This will require determining the minimum number of lanes in each direction needed for mainline I-10 with the SR 210 extension. Improvements will include improving existing conditions, such as; short weaving distances (especially regarding successive loop ramps), TIs spaced closer than the desirable one mile spacing, and short driver decision-making distances.

A two level analysis is used to identify alternatives to be carried forward to the Phase II Design Concept Study.

Level 1 examines alternatives for fatal flaws that render the alternative unusable. Alternatives that have no fatal flaws identified are then evaluated under Level 2.

Level 2 analysis includes:

- A determination of the traffic handling capability of each alternative, using design year traffic projections.
- Identification of impacts to surrounding area resulting from each alternative.
- A rough estimate of cost based on conceptual configuration of the roadway.
- Other factors as identified during the study process.

Level 1 Alternative Identification

The Level 1 process identifies alternative locations along I-10 for the connection of the SR 210 extension. Alternative alignments for the extension of SR 210 are then identified and both SR 210 and I-10 are evaluated to determine fatal flaws that may eliminate some of the connection points. The fatal flaws consist of factors that prohibit locating the SR 210 roadway in particular areas.

Only those alternatives that are feasible will be carried forward. Evaluation criteria include, but are not limited to:

- Support the major interchange of SR 210 with Alvernon Way/Golf Links Road.
- Avoid major impacts to DMAFB.
- Avoid major environmental, social and economic impacts identified along the alignment.
- Support the system interchange with I-10.
- Support local interchanges adjacent to the system interchange.

Six initial connection locations to I-10 were identified and evaluated using the criteria listed above.

System Alternative I

- I-10/SR 210 connection at Alvernon Way: There were no fatal flaws identified for the I-10/SR 210 connection at Alvernon Way. An alternative identified as **System Alternative I** will be carried forward for Level 2 analysis. See **Figure 3.1 System Alternative I**.

System Alternative II

- I-10/SR 210 connection west of Valencia Road: There were no fatal flaws identified for the I-10/SR 210 connection west of Valencia Road. An alternative identified as **System Alternative II** will be carried forward for Level 2 analysis. See **Figure 3.2 System Alternative II**.

System Alternatives III, IIIa & IIIb

- I-10/SR 210 connections east of Wilmot Road: Three alignment alternatives were investigated to connect SR 210 with I-10 east of Wilmot Road. See **Figure 3.3 System Alternative III, IIIa and IIIb**.
  - System Alternative III impacts the Thomas Jay Regional Park, the Craycroft Elementary School and the Lauffer Middle School. System Alternative III was eliminated from consideration.
  - Concerns with System Alternatives IIIa and IIIb:

System Alternatives IIIa and IIIb have the same horizontal alignment. The alignment of both alternatives impact DMAFB:
  - The alignment would pass within the restricted radius of a hazardous object pad that is located within DMAFB.
  - The alignments cross the corner of the runway Clear Zone, which is not allowed.
  - The alignments are within the Accident Potential Zone.
  - The alignments are located within Military Munitions Response Program areas.
- The possibility of realigning System Alternatives IIIa and/or IIIb was reviewed. However, no satisfactory alignment for these alternatives could be developed. System Alternatives IIIa and IIIb were eliminated from consideration.

System Alternative IIIc

- System Alternative IIIc would connect the extension of SR 210 to I-10 at Wilmot Road. This alternative was identified after it was determined that System Alternatives III, IIIa and IIIb were not acceptable. See **Figure 3.4 System Alternative IIIc**.

  System Alternative IIIc was eliminated because:
  - The estimated cost of System Alternative IIIc, not including the costs of right-of-way, utilities, hazardous material protection, or relocation, significantly higher than either System Alternative I or II.
  - System Alternative IIIc would require relocation of approximately 50 more residences than either System Alternative I or II.
  - There would be numerous conflicts with utilities located within local streets that would be crossed by System Alternative IIIc.
  - The vertical alignment would be depressed for much of the route including a portion under a major wash.
  - Right-of-way acquisition would be required from DMAFB.
  - The alignment of System Alternative IIIc passes near areas on DMAFB where explosive ordinance is removed from aircraft, creating a likely danger to users of the roadway if accidental explosions occurred.
  - The alignment of the roadway near DMAFB would need to be checked for unexploded ordinance.

System Alternative IV

- **System Alternative IV** is the extension of SR 210 south along the Alvernon Way alignment to I-10 and the addition of collector-distributor (CD) roadways adjacent to both the eastbound and westbound I-10 mainline roadway from Alvernon Way easterly through the Kolb Road TI.

  System Alternative IV will be carried forward for Level 2 analysis.

Other I-10/SR 210 Connection Locations:

- Craycroft Road: The I-10/SR 210 connection at Craycroft Road was eliminated because:
  - It bisected the community of Littletown and impacted both Lauffer Middle School and Craycroft Elementary School.
  - The system interchange ramps would conflict with the Valencia Road/I-10 TI, which would require the removal of the Valencia Road/I-10 TI ramps.
- Kolb Road and Rita Road: The I-10/SR 210 connections at both Kolb Road and Rita Road were eliminated because they shared the same alignment through the environmentally sensitive areas as the connection east of Wilmot Road identified above as System Alternative III.

Analysis of projected traffic on I-10 in the design year 2040 showed there would be only marginal improvements in I-10 traffic if the SR 210 connection with I-10 was extended to the east of Wilmot Road. This analysis reduces the value of alternative connections of SR 210 to I-10 east of Wilmot Road. See the Initial Traffic Report for further details.

Level 2 Alternative Analysis

The Level 2 further evaluates alternatives that were found to have no fatal flaws. Alternatives are developed to the extent that the traffic handling capability is identified and impacts to the adjacent properties are identified. The evaluation includes an estimate of cost based on the conceptual configuration. Other factors identified during the study process are also included in the evaluation of the alternatives.

System Alternative I

This alternative extends SR 210 southerly along the existing Alvernon Way alignment to I-10. See **Figure 3.1 System Alternative I**.

SR 210 between Golf Links Road and I-10 is a minimum of four lanes in each direction to accommodate both SR 210 through traffic and local traffic.

The SR 210/Alvernon Way/Golf Links TI provides all traffic movements except access to Contractors Way. Access to Contractors Way is provided from SR 210 via the Ajo Way TI.

The I-10/SR 210 system interchange lies on top of and incorporates the existing diamond TI at Alvernon Way and I-10.

System Alternative II

This alternative extends SR 210 southerly through the Alvernon Way/Golf Links TI, where it turns to the east along the southern edge of Davis-Monthan AFB, and then south along the Swan Road alignment to I-10. See **Figure 3.2 System Alternative II**.

SR 210 is a minimum of two lanes in each direction. The SR 210/Alvernon Way/Golf Links TI provides all traffic movements except access to Contractors Way. Access to Contractors Way is provided from SR 210 via a TI at Irvington Road.

Because of the proximity of the proposed system interchange to the existing diamond TI at Valencia Road, the westbound Valencia Road and Craycroft Road ramps will be incorporated into the system interchange to provide access to/from both I-10 and SR 210.

System Alternative IV

System Alternative IV is the extension of SR 210 south along the Alvernon Way alignment to I-10 and the addition of collector-distributor (CD) roadways adjacent to both the eastbound and westbound I-10 mainline roadway from Alvernon Way easterly through the Kolb Road TI. See **Figure 3.5 System Alternative IV.**

- A system interchange will provide access between SR 210 and the eastbound and westbound I-10 CD roadways.
- The eastbound CD roadway is a continuation of the southbound SR 210 roadway.
- A ramp will be provided to allow vehicles on eastbound I-10 to exit I-10 and enter the eastbound CD roadway.
- The westbound CD roadway will curve to the north approaching Alvernon Way and become the northbound SR 210 roadway.
- Traffic interchanges will provide access between the CD roadways and major cross streets at Valencia Road, Craycroft Road, Wilmot Road and Kolb Road within the limits of the CD roadways.

Modifications to Existing I-10

Modifications to existing I-10 from I-19 to SR 83 are required to provide an acceptable LOS for design year 2040. The modifications include improvements to both the I-10 mainline roadway and to the existing I-10 TIs within the project limits.

I-10 Traffic Interchanges (TI)

In urban conditions, TIs should nominally be one mile apart.
However, the location of some major cross-roads that intersect I-10 with TIs results in distances between TIs of less than one mile.

- Park Avenue TI is approximately 0.7 miles from both 6th Avenue TI and Kino Parkway TI.
- Craycroft Road TI is approximately 0.85 miles from the Valencia Road TI.
- Palo Verde Road TI is approximately 0.6 miles from the Alvernon Way TI.

Elimination of these TIs is not practical, as they provide needed access to local businesses and governmental services. Therefore, reconfiguration of TI ramps is needed to maintain access, yet maximize weaving distances and safety for the traveling public. The Palo Verde Road TI can be removed and a new TI at Country Club Road is needed and will be added. Country Club Road is located approximately 1.2 miles from Kino Boulevard TI and Alvernon Way TI.

All other TIs meet or exceed the minimum one mile spacing criteria.

Each of the existing TIs within the project limits was evaluated from a capacity and safety standpoint to determine needed improvements. The evaluation process involved:

- Using the projected 2040 peak hour traffic volumes and micro-modeling software to identify problem areas or movements that have unacceptable levels of service.
- Identifying solutions.
- Testing solutions by re-running the micro-model with the proposed solutions coded into the software.
- Repeating the iterative process until adequate solutions are produced.

A description of improvements for each existing and new TI is included in **Section 3.3** of this report. Improvements meet the capacity and operational requirements, but are not necessarily the final recommended solution. That is to be determined in the Phase II Design Concept Study.

Alternatives for Further Consideration

Three alternatives will be carried forward to the Phase II Design Concept Study for further consideration:

- I-10/SR 210 System Alternative I
- I-10/SR 210 System Alternative II
- I-10/SR 210 System Alternative IV

Section 3.3 identifies items that will require additional analysis during the Phase II Design Concept Study.

Evaluation Criteria

As a result of input from the Study Team, Performance Measures have been developed for evaluating the impact of alternative transportation improvements during the Phase II Design Concept Study. The Performance Measure Ranking percentages are as follows:

- 30% Transportation Performance
- 25% Financial/Economic Performance
- 15% Social Impact
- 15% Land Use/Economic Development Impacts
- 15% Environmental Impacts

1.4 Environmental Overview

The Environmental Overview is summarized in **Section 5** of this report. The entire Environmental Overview is in **Appendix H** of this report.

A Public Information Meeting was held October 6, 2011. The meeting is summarized in the Environmental Overview Summary.

1.5 Cost Estimates

The total estimated costs for System Alternative I and II are listed below. The costs exclude the cost of utilities and ROW. The amount of ROW to be acquired, in acres, is listed separately.

System Alternative I

I-10	$691,100,000
SR 210	$194,940,000
System Alternative I Total	$886,040,000
System Alternative I ROW –	196 acres

System Alternative II

I-10	$671,270,000
SR 210	$171,200,000
System Alternative II Total	$842,470,000
System Alternative II ROW – 337 acres	

System Alterative IV

I-10	$761,590,000
SR 210	$193,650,000
System Alternative IV Total	$955,240,000
System Alternative IV ROW	- 192 acres

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Registered Professional Engineer (Sanitary) CERTIFICATE NO. 13955 BRADFORD D. OLBERT Date Signed 2/11/16 ARIZONA, U.S.A.

Expires 12/31/2015

Registered Professional Engineer (Civil) CERTIFICATE NO. 24590 ROLAND C. COOK Date Signed 2/11/15 ARIZONA, U.S.A.

Expires 6/30/17

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APPENDICES

INTRODUCTION

1.1 Forward

The Arizona Department of Transportation (ADOT) in cooperation with the Federal Highway Administration (FHWA) prepared a Feasibility Study to identify and evaluate alternatives for the improvement of I-10 from the Junction of I-19 to SR 83 and the extension of the Barraza-Aviation Parkway (SR 210) from Golf Links Road to I-10. **Figure 1-1 Project Location Map** shows the location of the study area for both I-10 and SR 210 in the State of Arizona.

Subsequent to the finalization of the Feasibility Report, an additional alternative for the extension of SR 210 from Golf Links Road to I-10 was identified for the improvement. This Feasibility Report Update includes the alternatives included in the previously approved report, and supplements the report with an additional alternative for accomplishing improvements to both I-10 and SR 210.

The study area is located in the ADOT Tucson District within the City of Tucson, the City of South Tucson and Pima County.

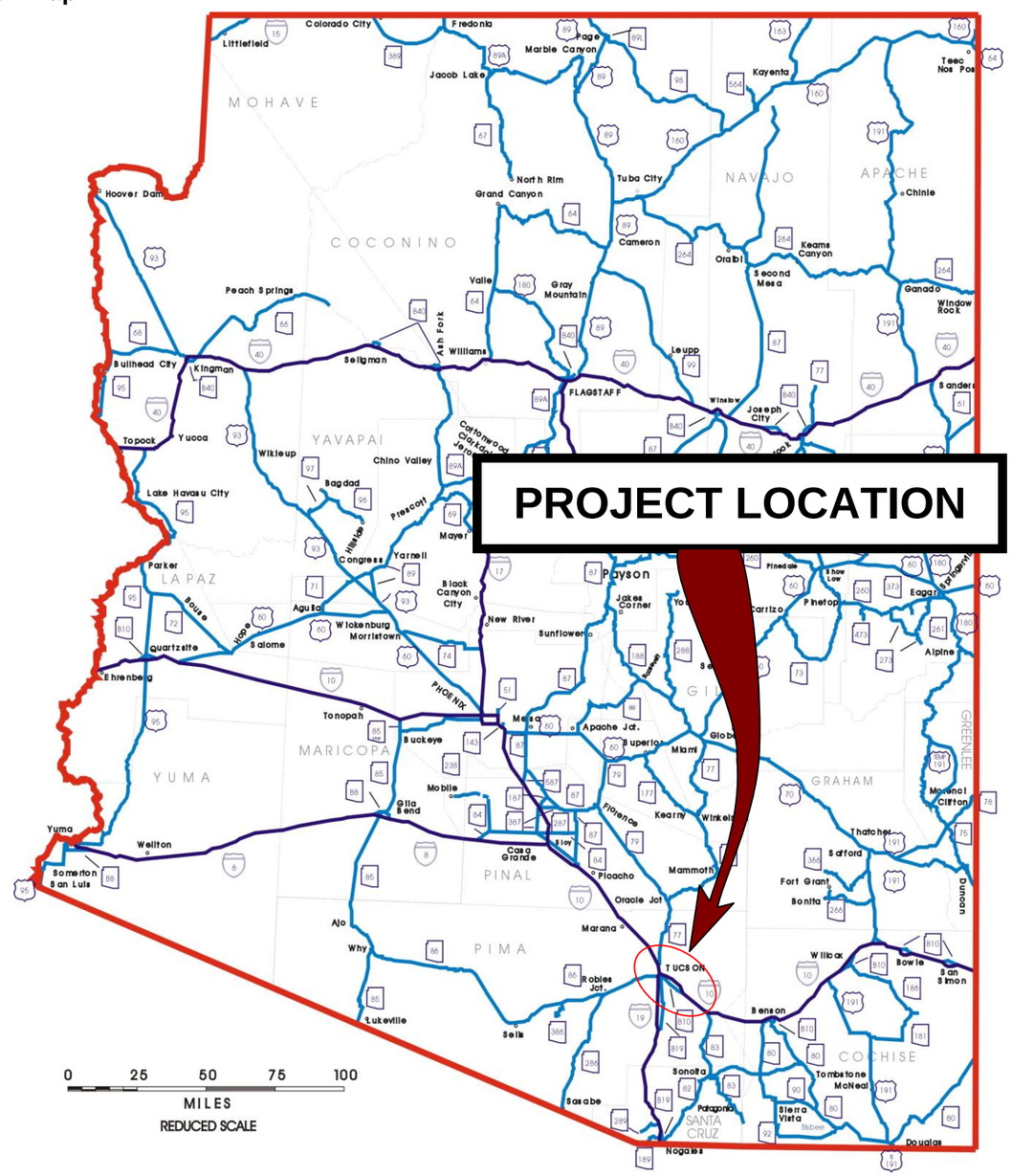
I-10 is a full access controlled interstate freeway. ADOT Project No. 010 PM 260 H7825 01L; Federal No. 010-E(210)A has not been programmed by ADOT. It is anticipated that Federal Aid Interstate funds will be used for the improvement of I-10.

The functional classification of SR 210 is Urban Other Freeway. SR 210 is a divided multi-lane urban highway that parallels I-10 and is located approximately 1.75 miles northeast of I-10. SR 210 begins at Broadway Boulevard and ends just past South Palo Verde Road. From Broadway Boulevard through the intersection of Country Club Road, SR 210 has three-lanes in each direction. The roadway then narrows and continues with two-lanes in each direction to the end of SR 210. However, the road continues east and connects to Golf Links Road.

FHWA is serving as the lead federal agency and will provide input and oversight for the alternatives identification and evaluation process.

Following completion of the Feasibility Report Update and Environmental Overview Update (Phase I) a Design Concept Study and Environmental Assessment (Phase II) will be initiated by ADOT in cooperation with the FHWA. Alternatives that were identified as being viable improvement alternatives will be further analyzed and developed. The Design Concept Study will identify the alternative to be carried forward for final design and construction.

Figure 1.1 Project Location Map



During Phase II the Design Concept Study will be extended on I-10 through the SR 90 interchange in Benson, AZ. The Environmental Assessment will end just beyond the I-10 /SR 83 interchange.

The following were involved in developing the study: FHWA, Pima Association of Governments (PAG), Pima County, Davis- Monthan Air Force Base (DMAFB), City of Tucson, City of South Tucson, US Customs & Border Protection (CBP), Tucson Airport Authority, Sun Tran, Arizona Game and Fish Department (AGFD), Arizona State Land Department (ASLD), the Regional Transportation Authority (RTA), and the Union Pacific Railroad (UPRR).

1.1.1 Project Objectives

The project study team, in cooperation with participating agencies, initiated a study of the feasibility of improving I-10 from the I-19 traffic interchange (TI) (MP 260.2) easterly through the SR 83 TI (MP 282.0) and extending SR 210 from its current easterly end at Golf Links Road to an interchange connection with I-10 at a location to be determined.

This **Feasibility Report Update** will identify the improvements for each of the highways. The updated report will identify and evaluate alternative alignments for extending SR 210 and connecting SR 210 to I-10 with a System Interchange. The evaluation will include alternative configurations of I-10 for each of the SR 210 alternative alignments. The Study will also include I-10 mainline and interchange modifications from I-19 to SR 83. Improvements to I-10 and the extension of SR 210 to a connection with I-10 will accommodate design year 2040 traffic.

1.1.2 Study Process for Update

The purpose of the I-10/SR 210 Feasibility Study is to develop and evaluate alternatives for improvement of I-10 between I-19 and SR 83 and for the extension of SR 210 to a connection with I-10 to meet future traffic demands for Design Year 2040. The Feasibility Study presents various alternatives for accomplishing the necessary improvements and evaluates each alternative with recommendations for alternatives to be retained and carried forward for further study.

During development of the Feasibility Report, improvement alternatives I, II and IIIc were identified and evaluated for the extension of SR 210 to several connection locations with I-10. The alternatives included incorporation of a system interchange where SR 210 would connect to I-10. Improvement of the I-10 mainline and existing interchanges from I-19 to SR 83 was included in the alternative evaluations. Traffic modeling of the alternatives was done for design year 2040 traffic projections to identify alternatives that would provide acceptable levels of service on both I-10 and SR 210.

The additional alternative included in the Feasibility Report Update is Alternative IV.

The Feasibility Report Update for I-10; Jct. I-19 to SR 83 & SR 210; Golf Links Road to I-10 was initiated with a Kickoff Meeting that included representatives from participating agencies. The meeting was held January 27, 2014 at the ADOT Tucson District Conference Room. See **Meeting Notes, Appendix H**.

Progress Meetings for the Feasibility Report Update were held beginning in June 2014 to inform team members and agencies of progress and to obtain input relative to ongoing tasks on both I-10 and SR 210. See **Meeting Notes, Appendix H**.

1.2 Purpose and Need for the Project

1.2.1 Purpose and Need for the Improvement of I-10

The Interstate Highway System was intended to relieve congestion, improve safety, and enhance the economy by facilitating the movement of people and goods throughout the nation. Increasing traffic volumes on I-10 in the vicinity of Tucson, Arizona have contributed to reduced operational effectiveness, particularly the segment of I-10 between I-19 and SR 83.

The traffic modeling accomplished for the combined I-10/SR 210 traffic analysis has demonstrated that north-south traffic demands through the project area are constrained by limitations on north-south arterial corridors. The UPRR switching yard located parallel to SR 210, north of I-10 prohibits any north-south arterials between Kino Parkway and Alvernon Way. The Davis-Monthan Air Force Base (AFB) prohibits any north-south arterials between Alvernon Way and Kolb Road. Traffic along I-10 concentrates at certain TIs where major north-south arterials exist.

The number, type, and close proximity of access points to I-10 in this area compound the problem, contributing to an increase in local traffic using the Interstate Highway for short local trips. Conflicting interaction between local and regional/interstate traffic has led to a reduction in the capacity of I-10 to accommodate through–travel. The numerous access points on I-10 present additional performance issues because they typically have their own operational limitations associated with location, proximity, design, and capacity. These limitations further slow travel on the I-10 mainline and lead to more conflict between local and regional traffic. The resulting combination of factors contributes to a growing degradation of the primary purpose and operational characteristics of I-10 as originally designed, and compromises the purposes of the overall roadway network in the study area.

Analysis of existing 2010 traffic shows that I-10 in the study area still operates at level of service (LOS) D or better in the AM and PM peak hours except for isolated areas where AM or PM peak hour LOS is less than LOS D, as discussed in **Section 2.3, Traffic Operational Analysis**, in this report.

In the future, increasing traffic volumes on this segment of I-10 originating from anticipated growth to the south and east of downtown Tucson, as well as growing demands on I-10 as an interstate facility, will lead to capacity and access restrictions on and along the interstate. Poor operational performance for local, regional, and interstate traffic will result from operations on this portion of I-10 declining to LOS D then to LOS F by 2040. The decline from LOS D to LOS F will show the roadway is failing to function as intended with forced flow and extensive delays. The combination of demand exceeding capacity and poor access along I-10 will restrict and compromise the primary functions of the roadway network in the study area.

The purpose of the proposed improvement to I-10 is to address deficiencies in the Interstate highway system through the study area and ultimately develop improvements that will provide satisfactory service levels on the Interstate highway through the 2040 design year.

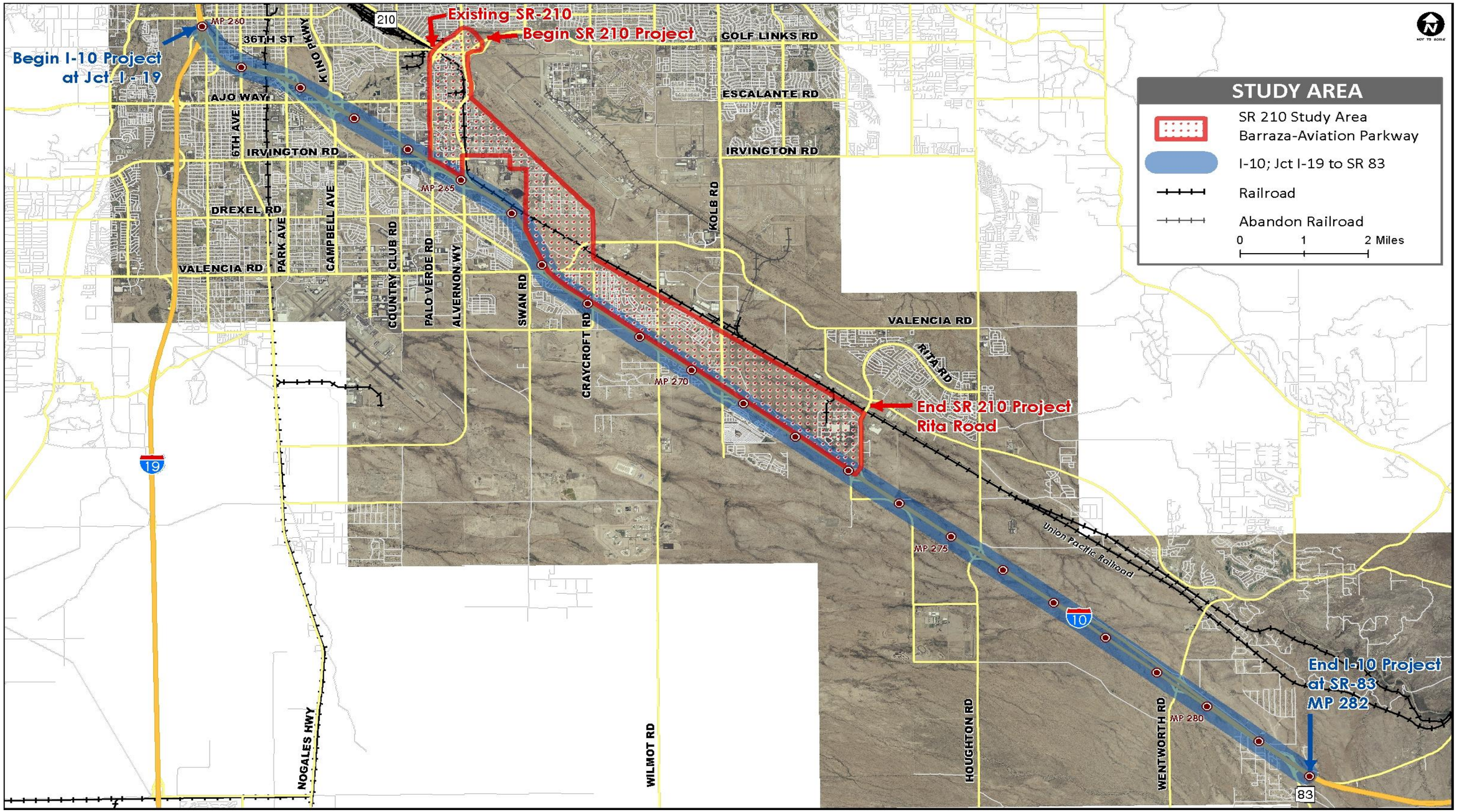
1.2.2 Purpose and Need for the Extension of SR 210 to a Connection with I-10

SR 210 in the City of Tucson, Arizona, was built as an urban highway subsequent to the construction of I-10. SR 210 is approximately 3.4-miles long and is oriented in a northwest to southeast direction, extending southeast from West Broadway Boulevard at North 1st Avenue, with intersections at Kino Parkway, East 22nd Street, South Country Club Road, East 34th Street, and South Palo Verde Road, before terminating at Alvernon Way / Golf Links Road.

Much of SR 210 was constructed adjacent to the Union Pacific Railroad (UPRR); they share a number of grade separations from the City's street network. This proximity to the railroad minimizes the number of cross streets and access points to SR 210, which is advantageous to the use of SR 210 as an urban parkway. However, the presence of the UPRR switch yard serves as a barrier to north-south city arterials, which has a negative effect on traffic that is destined to and from North Tucson. Much of the north-south traffic that is blocked by the UPRR remains on I-10 to access major north-south arterials to reach their destinations.

SR 210 is intended to provide motorists with an alternate route into Tucson's downtown business district from points east and south of downtown.

Figure 1.2 Vicinity Map



The use of SR 210 as a business spur is limited by the fact that motorists on westbound I-10 desiring to access downtown Tucson via SR 210 must currently use city arterials to get from I-10 to SR 210. The additional trips on the city arterials tend to exceed the capacity of the local roadway network, which causes motorists to stay on I-10. Commercial and commuter traffic heading into downtown Tucson also use I-10 and add to peak hour congestion, causing increased volume and stress to the operation of the interstate highway. As is, the limited capacity and limited access for local trips prevents the existing roadway network in the study area from functioning as primarily intended.

Since I-10 runs parallel to SR 210 approximately 1.75 miles south of SR 210, connecting SR 210 and I-10 would facilitate the intended use of SR 210 as a business spur. It would provide westbound local traffic with an attractive alternative to using I-10 for accessing downtown Tucson and would allow the interstate route to better serve through-traffic.

For SR 210 traffic to increase to a level nearer capacity, local traffic currently using I-10 would require improved access via an extension of SR 210 to the south and east, likely connecting to I-10 somewhere between the existing Alvernon Way TI and the Rita Road TI south of DMAFB. This connection would allow SR 210 to become a viable alternative to I-10 for local traffic to and from the business, university and cultural districts in the downtown Tucson area.

The purpose of extending SR 210 to an interchange with I-10 is to provide traffic originating east and south of downtown Tucson an alternative route to access the city center. Improved operational performance for local, regional, and interstate traffic would result from better utilization of SR 210 and improved operations on I-10.

1.3 Characteristics of the I-10 and SR 210 Corridors

1.3.1 Characteristics of the I-10 Corridor

The study area begins within the limits of the I-10/I-19 System Interchange at MP 260.2 and extends eastward approximately 22 miles to I-10 MP 282.0, east of the I-10/SR 83 TI. See **Figure 1-2 Vicinity Map**.

Property adjacent to I-10 is primarily industrial from I-19 east through Alvernon Way. East of Alvernon Way to approximately Rita Road, the adjacent property is a mixture of residential and commercial properties with areas that are undeveloped. From Rita Road through the end of the project at SR 83 the adjacent property is primarily undeveloped.

The Union Pacific Railroad approaches I-10 from the north along the east side of Alvernon Way. The railroad turns and continues southeast approximately 250-feet north of I-10 for a short distance. The railroad and I-10 then separate and continue south-east about three-quarters of a mile apart.

At the beginning of the project, I-10 turns from a north-south direction to an east-west direction as the corridor proceeds to the east. Just east of Park Avenue, I-10 turns to the southeast. From Park Avenue to the end of the project I-10 is oriented on a northwest to southeast diagonal that intersects the city street grid at approximately a 45-degree angle.

From the beginning of the project at I-19 to Kino Parkway, I-10 has three lanes eastbound and three lanes westbound with 10-foot inside and outside shoulders. From Kino Parkway to the end of the project just east of SR 83, I-10 has two eastbound lanes and two westbound lanes with 10-foot outside shoulders and 4-foot inside shoulders.

I-10 has a variable width median running through the project area. From the beginning of the project through 6th Avenue the median width is 32-feet, with a concrete barrier located in the center of the median. Through the horizontal curve east of 6th Avenue the median narrows to 26-feet. The 26-foot median continues to Park Avenue, where the median transitions to 60-feet wide and the concrete barrier ends. The 60-foot wide median continues to Kino Parkway, where the width of the median transitions to 84-feet wide. The 84-foot wide median continues to Valencia Road. The median width narrows to 68-feet wide through the horizontal curve on I-10 at Valencia Road. The 68-foot wide median continues through Houghton Road to approximately MP 277.4, where the eastbound and westbound roadways separate and continue on independent alignments to approximately MP 281.3, west of the SR 83 TI where the eastbound and westbound roadways come together and continue with an 88-foot median.

The existing cross-slope of the I-10 roadway in tangent sections as shown on as-built plans is:

Beginning of Project @ MP 260.2 to MP 267.5: roadway cross-slope is -0.01ft/ft from median to shoulder.

MP 267.5 to End of Project @ MP 282.0: roadway cross-slope is -0.015ft/ft from median to shoulder.

TIs are located at all of the major cross streets including from west to east: 6th Avenue, Park Avenue, Kino Parkway, Palo Verde Road, Alvernon Way, Valencia Road, Craycroft Road, Wilmot Road, Kolb Road, Rita Road, Houghton Road, Wentworth Road / Colossal Cave Road, and SR 83.

The Design Speed on I-10 through the project limits is 65 mph in accordance with the ADOT RDG for urban/fringe urban Controlled Access Highways.

The speed limit on I-10 is 55 mph from I-19 through the Kino Parkway TI where the speed limit increases to 65 mph through Kolb Road TI. The speed limit then increases to 75 mph easterly through the end of the Feasibility Study area.

Previous I-10 Projects

Based upon available data at ADOT Engineering Records, the following I-10 projects have been completed within the Study Area.

Table 1.1 Previous Projects Within the I-10 Study Area

Project No.	Begin MP	End MP	Const. Date	Description
UI-141(4)	259.8	261.2	1955	2-24' PCC + 10'AC
IR 10-5(54)	260	262.4	1989	I-19 – Park Ave. Remove & Replace Exist. EB, WB & Structures
NH 10-5(71)	260	262		I-19 – Park Ave. Landscape & Irrigation
ARRA 010-D(206)A	260.2	267.2		I-19 – Valencia Rd. FMS
I-10-5(32)	260.7	261.5	1965	6th Ave. TI Ramps, Vet OP & Fr. Rd.
F 002-4(1)	261.2	261.5	1958	Veterans OP and Approaches MBS
I-10-4-927	260.4	-	1976	Jct. I-19 TI Groove Ramps
IM 10-5(77)P	260.5	268.8	2001	Jct. I-19 – Craycroft Rd. Signing
I-10-5(16)	261.4	264	1964	Vet OP – Hughes Access Rd. GD
I-10-5(28)	261.4	268.3	1967	Vet OP – Valencia Rd. BC PCC
I-10 -5(42)	261.4	267.5	1983	Lighting & Safety
ACIR-10-5(58)	262	267	1988	Park Ave. – Valencia Rd. Pavement Rehab
I-10-5-910	262.4	-	1976	Ajo Way OP (EB) Bridge Repair
N-900-0-543	262.6, 268.1		1999	Kino & Craycroft TIs Minor Improvements
I-10-5(30)	262.7	263	1966	Campbell Rd TI GD/Str
I-10-5(17)	264	267.5	1965	Hughes Access Rd. – East GD
010 E NFA	264.1	264.9	2008	Palo Verde TI Construct TI Lighting
IR 10-5(55)	265	-	1984	Alvernon Way (Valencia-Irvington Rd) GD
IR 10-5(61)	265	265.4	1986	Alvernon Way OP
BP-IR-10-5(57) & BP-F 084-1(9)	267	-	1983	Kolb Rd.(I-10 – Valencia Rd.) New TI
I-10-5(56)	267.1	267.5	1986	I-10 @ Valencia Rd. New TI
I-10-5(5) & F 002-4(6)	267.5	272.8	1958	1-36' AC (EB)
I-10-5(12)	267.5	272.8	1958	GD/AC (WB)
IR-10-5(62)	267.5	272	1990	Valencia – Rita Rd. Remove, Recycle , AC Olay

Table 1.1 Previous Projects Within the I-10 Study Area

Project No.	Begin MP	End MP	Const. Date	Description
IR-I-10-5(40)	267.53	281.2	1978	Valencia Rd. – Mtn. View TI Resurface
IR-10-5(30)	268	-	1986	I-10 Access Ramps (Kino Blvd/Ajo Way) Mod. TI, GD/AC Pave
ARRA 010-E(203)A	272	276	2009	Rita Rd. – Houghton Rd. Mill & Replace ½" AR-ACFC
ACIR 10-5(66)	272	275.5	1992	Rita Rd. – Houghton Rd. Mill, Replace & ACFC
I-10-5(20)	272.9	281	1962	Rita Rd. – Mtn. View Rd. 1-38' AC (WB)
I-10-5(47)	275	296.2	1973	Houghton Rd. – Cochise C. L. Overlay
I-10-5(45)	275	281.2	1978	Houghton Rd. – Mtn. View Rd. Resurface
IM 10-5(74)	275.9	281.4	1994	Houghton Rd. – Mtn View Rd. Pavement Pres.
ARRA 010-E(205)A	276	281.4	2010	Houghton Rd. – Mtn. View TI Mill & Replace AC & AR-ACFC
I-10-5-916	277.9	-	2001	Wash Bridge #689 Scour Protection
IM 010-E(1)P	279.4	-	2000	Vail Rd. TI Minor TI Improvements
FI 18(19)	281	288.9	1955	Jct. SR 83 – Cienega Wash Construct 40' Bit Pavement
I-10-5(10)	281	290.6	1959	Mtn. View – Pantano (WB) GD/AC

Existing I-10 Right-of-Way

The existing right-of-way (ROW) width of I-10 varies through the length of the project. At each TI the right-of-way increases substantially, depending on the configuration of the TI. The ROW is also increased to accommodate frontage roads. The following ROW mainline widths provide a general overview of the ROW corridor. However, it will be necessary to refer directly to the ADOT ROW plans for detailed information.

- From the I-19 TI to the 6th Avenue TI – Mainline ROW width is 200-feet.
- From the Park Avenue TI to the Valencia Road TI – Mainline ROW width is 300-feet.
- From the Valencia Road TI to the Kolb Road TI – Mainline ROW width is 280-feet.
- From the Kolb Road TI to the Rita Road TI – Mainline ROW width varies from 300-feet to 400-feet.
- From the Rita Road TI through the Houghton Road TI to MP 277 - Mainline ROW width is 400-feet.
- At MP 277 the I-10 EB and WB roadways split into independent alignments. From MP 277 to MP 281 the ROW width of the I-10 mainline is:
  - EB I-10 – 94-feet south of the EB construction centerline.
  - WB I-10 – width varies with a 60-foot minimum north of the WB construction centerline.
  - The area between the EB and WB construction centerlines is included in the I-10 ROW.
- From the SR 83 TI to the end of the project at MP 282 the width of the I-10 mainline ROW is 362-feet.

Existing I-10 Structures

The following existing structures are located along I-10 within the study area:

Table 1.2 Existing I-10 Structures

Milepost	Structure No.	Structure Name	Spans/Str. Length	Br. Rdwy. Width
260.37	2599	12th Ave. Connector Br.	1/95	55.2'
260.55	2194	10th Avenue OP	4/310'	147.3'
260.99	2195	6th Ave. TI UP	2/209'	82'
261.41	2164	Frontage Road. UPRR OP WB	3/167'	40'
261.41	2196	Loop Road. UPRR PB EB FR	3/167'	40'
261.41	2197	Veterans UPRR OP	3/168'	125.8'
261.72	2162	Park Ave. TI OP EB	4/251'	72.5'
261.72	2163	Park Ave. TI OP WB	4/248'	72'
262.38	2012	Ramp K3 Over Ajo Way	2/176'	26'
262.44	1107	Ajo Way OP EB	4/261'	38'
262.44	1108	Ajo Way OP WB	4/261'	38'
262.53	1162	Kino Pkwy TI UP NB	7/504'	49'
262.53	1163	Kino Pkwy TI UP SB	6/461'	38'
262.82	1109	Diversion Channel Br EB	1/90'	64'
262.82	1110	Diversion Channel Br WB	1/90'	50'
263.82	1111	Country Club OP EB	3/150'	38'
263.82	1112	Country Club OP WB	3/150'	38'

Table 1.2 Existing I-10 Structures

Milepost	Structure No.	Structure Name	Spans/Str. Length	Br. Rdwy. Width
264.27	1217	Irvington Road. OP EB	4/261'	42'
264.27	1218	Irvington Road. OP WB	4/261'	42'
264.37	1219	Palo Verde TI OP EB	4/195'	42'
264.37	1220	Palo Verde TI OP WB	4/195'	42'
265.02	2018	Alvernon Way TI OP EB	2/215'	60'
265.02	2019	Alvernon Way TIOPWB	2/215'	60'
265.80	5555	Julian Wash RCB	6Brl/74'	-
266.00	1223	Drexel Road. OP EB	3/141'	38'
266.00	1224	Drexel Road. OP WB	3/141'	38'
267.10	1225	Valencia Road. TI OP EB	4/183'	38'
267.10	1226	Valencia Road. TI OP WB	4/183'	38'
267.65	1044	Earp Wash Trib Br EB	4/96'	48.8'
267.65	1045	Earp Wash Trib Br WB	4/96'	48.8'
267.65	1052	Earp Wash Trib Br FR Br	4/96'	24'
267.65	6814	Earp Trib RCB/EB FR	3Brl/32'	-
268.08	594	Craycroft TI OP EB	4/177'	38.2'
268.08	595	Craycroft TI OP WB	4/177'	38.2'
269.36	596	Wilmot Road TI OP EB	4/177'	38'
269.36	597	Wilmot Road. TI OP WB	4/177'	38'
270.58	1823	Kolb Road TI UP	2/280'	76.2'
273.14	711	Rita Road TI UP	4/234'	29.8'
275.49	713	Houghton Road TI UP	4/234'	29.8'
277.46	463	Wash Bridge EB	4/94'	36'
277.90	689	Wash Bridge WB	4/94'	37.8'
277.90	1020	Wash Bridge NFR	3/66'	24'
279.10	6515	RCBC NFR	2Brl/21'	-
279.37	744	Vail Road TI UP EB	3/160'	30'
279.37	745	Vail Road TI UP WB	3/160'	30'
281.68	1053	SR 83 (Mtn View) TI UP	4/330'	30'

1.3.2 Characteristics of the SR 210 Corridor

The study area begins at the east end of SR 210 near Golf Links Road and Alvernon Way. The north-west end of the Davis-Monthan AFB is located just east of the end of SR 210. Alignments to extend SR 210 south-east to connect with I-10 will be identified east from Alvernon Way. The northern limits of the study area will be the southern boundary of Davis-Monthan AFB. Alignments to extend SR 210 will have to turn to the south to avoid Davis-Monthan AFB.

Property through the study area for extending SR 210 is primarily industrial from Alvernon Way east to Craycroft Road. From Craycroft Road to the east the property is primarily residential with some undeveloped land. The Thomas Jay Regional Park is located to the east of Craycroft Road and south of the UPRR. The Pima Air Museum is located just east of Valencia Road and north of the UPRR.

Previous SR 210 Projects

Based upon available data at ADOT Engineering Records, the following project has been completed within the project limits.

Table 1.3 Previous Projects within the SR 210 Study Area

Project No.	Begin MP	End MP	Const. Date	Description
M-824-9-522	2.4	4.5	1995	Grade, Drain, Pave, Structures

Existing SR 210 Right-of-Way and Access Control

Existing Right-of Way (ROW) for SR 210 is shown on the ADOT Right of Way Plan for the Aviation Corridor Highway; Park Avenue – Palo Verde Road, SR 210; Project No. AZP-824-9-704. The northern ROW line and the southern ROW line and access control line is shown on this set of plans.

The north access control line is defined on the Results of Survey; Aviation Corridor Highway; 6th Avenue – Palo Verde Road; Project No. 210 PM 001 H0888 01R, Federal No. N 810-601-PM(1). Access control is broken at 22nd Street, 34th Street and Richie Boulevard.

The southern ROW and Access Control line is a common line with the northern UPRR Right-of-Way line.

East of Palo Verde Road all existing ROW is Tucson City Street Right-of-Way.

Existing SR 210 Structures

The following existing structures are located along SR 210 within the study area.

Table 1.4 Existing Structures - SR 210 Study Area

Roadway	Struct. No.	Structure Name	Spans/Str. Length	Br. Rdwy. Width
Golf Links Rd.	9815	Aviation Hwy. Ramp OP	3/250	72’
Alvernon Way	9809	Aviation Hwy. UP Br.	1/86	76’
Alvernon Way	9811	Alvernon NB FR. OP	3/146	100’
Alvernon Way	8733	Small Wash RCB	3/30	80

2 TRAFFIC AND CRASH DATA

2.1 Forward

I-10 is one of the major travel routes in the State of Arizona. It serves national, regional and local trips connecting large metropolitan areas to rural communities. The I-10 corridor from I-19 to SR 90 provides connectivity between the rural communities of Sierra Vista and Benson in Cochise County to the Tucson urban core in Pima County.

PAG is the agency responsible for the Tucson metropolitan area regional transportation planning. SouthEastern Arizona Governments Organization (SEAGO) is the counterpart for Cochise County.

PAG has identified the SR 210 extension from Golf Links Road to I-10 as a vital connection required to meet future mobility needs in the Tucson metro area.

PAG is in the process of finalizing the new 2045 Regional Transportation Plan (RTP). For this effort PAG reviewed and revised the forecasted regional growth. Due to the economic climate, PAG projected a more conservative growth with a significant reduction of population and employment in the PAG planning area. This has significantly impacted the study area travel demand and prompted a review of the recommendations made in the 2011 Initial Traffic Report.

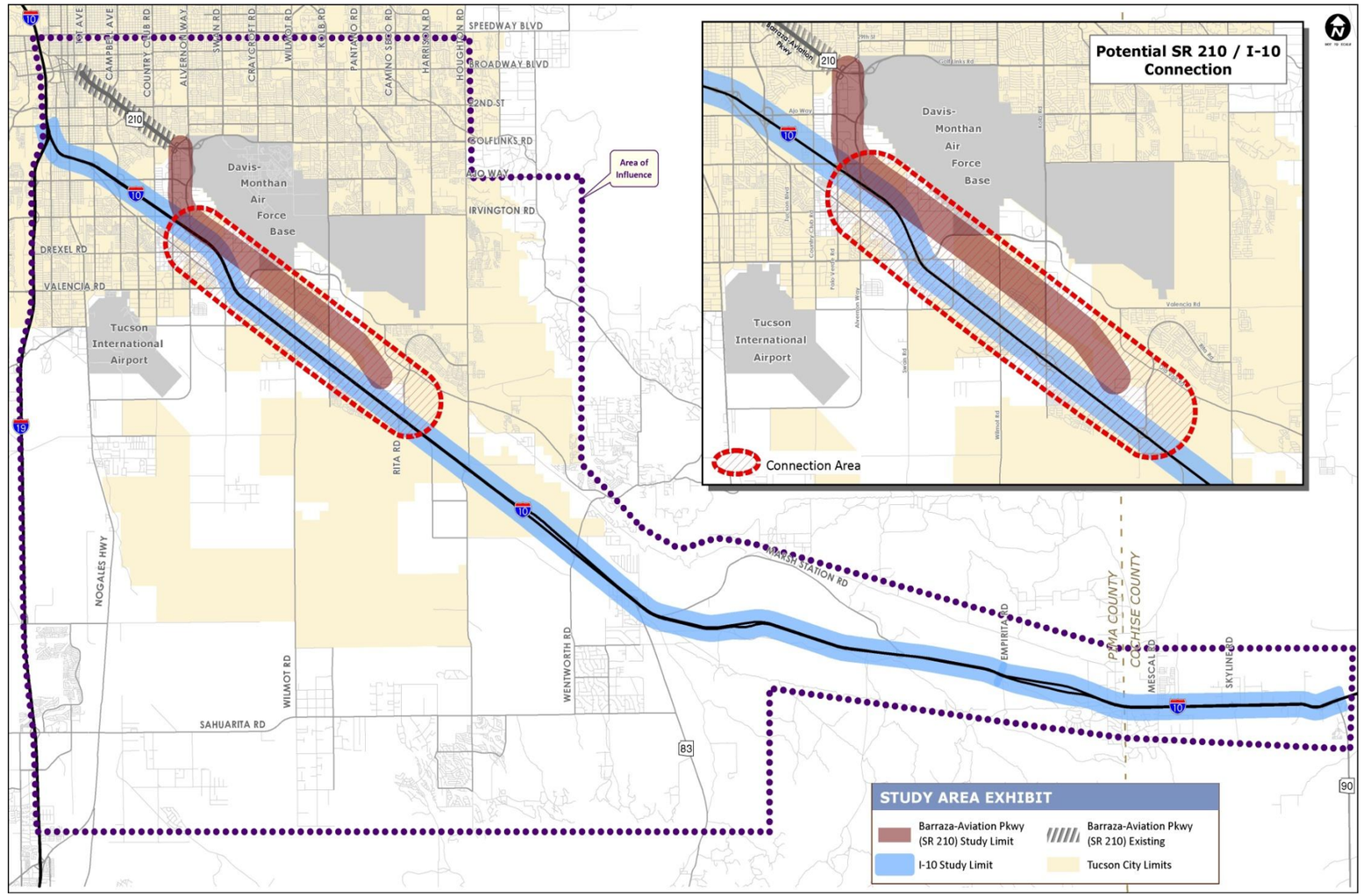
An Initial Traffic Report Addendum; I-10: Jct. Interstate 19 to SR 90/SR 210: Golf Links Road to I-10, has been prepared that identifies and evaluates the design year 2040 transportation needs for I-10 from I-19 east to SR 90 in Cochise County, and for the extension of SR 210 to connect with I-10. This Feasibility Report Update utilizes the Initial Traffic Report Addendum for the analysis of improvements to I-10 from I-19 to SR 83, and the extension of SR 210 to a connection with I-10.

2.1.2 Influence Area and Study Area

Travel patterns and transportation facilities operations are very much influenced by land use growth assumptions for a particular area. To identify what the future transportation needs might be, it is first necessary to understand the area growth trends. For this purpose we have established an influence area shown in **Figure 2.1, Influence Area and Study Area**. An influence area is the locale with the highest potential influence on the transportation facility by either daily use of the facility or by proximity to the facility. For this feasibility study update the influence area is bounded to the north by Broadway Road, to the south by Sahuarita Road, to the east by SR 83, and to the west by I-19.

The study area for both corridors includes the areas up to one mile on either of I-10 and the future SR-210 extension. In addition, the area from Palo Verde Road to Rita Road along I-10 was analyzed for potential termini of the SR-210 extension.

Figure 2.1 Influence Area and Study Area



2.2 Traffic Forecast

2.2.1 Technical Process and Assumptions

A regional travel demand model is a planning tool used to assess how transportation systems will perform based on the future land use and forecasted growth in the study area. The current transportation system is often used as the initial roadway system and new improvements are identified based on the future demand. Using the travel demand model as a planning tool, future transportation needs are assessed and potential roadway improvements are modeled and evaluated. The macro scale nature of this tool only provides a planning evaluation for the operation of roadway between intersections or interchanges. It provides an order of magnitude of the travel demand to help us identify the location, type and capacity of the improvements.

The 2014 PAG Travel Demand Model and the Northwest Cochise County Transportation Plan which forecasted travel demand has been utilized to identify future transportation deficiencies, reduced mobility and bottleneck locations in the study area.

2.2.2 PAG Travel Demand Model

The (2014) PAG Travel Demand Model, for the design year 2040, was obtained for the study at the end of February 2014. The model covers approximately 4,300 square miles in Pima County and includes the more populated urban areas of Tucson, Marana, Oro Valley and Green Valley. However for this study, the modeling efforts were focused in the area of influence. In 2011 PAG conducted an external travel survey to better understand the patterns of the traveling public in, out and through the PAG planning area. The survey results were used to calibrate the external travel component of the model. The new 2010 Census information and the American Community Survey data provided more accurate information about population distribution and current travel characteristics in the PAG region. These items together with new growth assumptions directly affect future travel on I-10 and SR 210.

2.2.3 Socioeconomic Data

Socioeconomic data in the PAG model consists of population, housing units, and employment and is compiled at the Traffic Analysis Zone (TAZ) level. Traffic Analysis Zones (TAZs) are geographic zonal units used to tabulate land use and employment data. Boundaries of the TAZs are defined based on similar land uses, physical barriers, and major streets in the transportation system. PAG revised the TAZ structure used in the 2011 Initial Traffic Report. Some large TAZs in the influence area were split to provide a better and more accurate access to the future roadways in the network. The **New Traffic Analysis Zone (TAZ) Structure** exhibit in **Appendix B, Traffic Modeling** presents the 2040 PAG model TAZs within the area of influence.

The new 2045 PAG model socioeconomic data and TAZs were not revised for this study. For this study we assumed that the 2045 population will be in place by 2040 as a conservative assessment. The socioeconomic data provided for this study in February 2014 was not final. The overall population and employment forecast will not change, but its allocation may change slightly. Future model traffic volumes are a result of the PAG 2040 population, housing units, and employment projections. **Table 2.1 2010 and 2040 Socioeconomic Summary** displays the socioeconomic data for years 2010 and 2040 for the influence area and for the entire PAG model area. By 2040 the PAG model area will have approximately 1.45 million people, a 31 percent increase from 2010 which correlates to a linear growth rate of 1.04 percent per year. By 2040, the area of influence is estimated to have a population of 612,243, an increase of 47 percent and a linear growth rate of 1.6 percent per year. Employment in the PAG region will double by 2040 from 307,249 to 613,575 in the PAG model area and from 156,482 to 294,231 in the influence area. The **New 2040 Population** and the **New 2040 Total Employment** exhibits in **Appendix B, Traffic Modeling** display the 2040 population density and employment density within the area of influence respectively. As the figures illustrate, the area of influence is planned for residential growth with some employment concentrated along I-10 and I-19. With the major employment located in the northwestern portion of the influence area, in the vicinity of downtown Tucson, residents will have to travel through the influence area to reach employment centers.

Table 2.1 2010 and 2040 Socioeconomic Summary

	2010		2040 RTP	
	Area of Influence	PAG Model Area	Area of Influence	PAG Model Area
Total Population	**416,990**	**1,109,157**	**612,243**	**1,455,443**
Population in Housing Units	398,755	1,082,064	596,445	1,431,551
Population in Group Quarters	18,213	27,043	15,798	23,892
Institutionalized Population	5,862	11,038		
Non-institutionalized Population	12,378	16,105		
Housing Units	**152,742**	**436,797**	**216,020**	**562,457**
Total Employees*	**156,482**	**307,249**	**294,231**	**613,575**
Retail	15,717	36,201	40,639	83,817
Whole Sale	5,243	8,336	9,509	16,488
Fire	7,791	16,986	17,516	39,474
Industrial	26,644	42,016	47,279	78,018
Service	74,365	159,001	149,636	351,555
Public Service	26,722	44,709	29,652	44,223
David Monthan Air Force Base	10,283	10,283	7,340	7,340

*Does not include the employment at David Monthan Air Force Base

2.2.4 Roadway Network

System I and II roadway networks, developed for the 2011 Initial Traffic Report were used as the starting point for validating the recommended alternatives. Due to various environmental and design issues, System IIIc was eliminated and was replaced by System IV. System IV introduces a collector distributor road on I-10 from the I-10/SR 210 interchange to Kolb Road to provide congestion relief to I-10 in that section of the proposed improvement.

2.2.5 Sensitivity Analysis

To verify if the improvements recommended in the 2011 Initial Traffic Report were still applicable, future forecasted traffic volumes were generated using the new 2040 socioeconomic data and System I and II roadway network alternatives. This step was also necessary in order to identify the magnitude of the change in travel demand between the old model assumptions and the new model assumptions. Based on the new traffic forecast, the recommended improvements for each system were reviewed.

Due to the decrease in population and employment, especially in the study area, the decrease in future travel demand was significant. This resulted in the reduction of one lane in each direction along I-10 from Alvernon Way to SR 90 from the configuration recommended in the 2011 Initial Traffic Report.

System I and II where revised to include one less lane along I-10 from Alvernon and SR 90. System IV was developed using the same assumptions. **Figure 2.3, 2040 Number of Lanes – System I, Figure 2.4, 2040 Number of Lanes – System II**, and **Figure 2.5, 2040 Number of Lanes – System IV** depict the revised System I, II and IV roadway number of lanes respectively.

2.2.6 No-Build Scenario

The No build scenario is often used to determine how future transportation systems operate without planned improvements on specific facilities. This will also help locate and quantify future travel needs and deficiencies. For this analysis, the 2040 revised roadway network was used, but the I-10 and SR 210 facilities were coded to current conditions. The primary purpose of the No-Build is to create a benchmark against which the System Alternatives will be compared.

2.2.7 Forecasted Traffic Volumes

Future forecasted traffic volumes were generated using the new 2040 socioeconomic data and future System I, II and IV roadway network alternatives. The traffic volumes were reviewed for reasonability and compared to other study results for consistency. In addition, the forecasted traffic volumes were used to evaluate the performance of the improvements based on the following measures: level-of-service (LOS), vehicle miles traveled (VMT), vehicle hours traveled (VHT) and screenline analysis.

2.2.8 Roadway Level of Service

Roadway segment level-of-service (LOS) is a qualitative measurement describing traffic conditions in terms of speed, travel time, freedom to maneuver, comfort, convenience, traffic interruptions, and safety. Six classifications, designated by the letters A through F, are used to define level-of-service. LOS A represents the best free flow conditions, whereas LOS F represents heavily congested flow with traffic demand exceeding highway capacity.

Roadway planning level capacities stratified by functional classification and area types were applied to each roadway segment in the study network. For regional planning purposes, unsatisfactory capacity of a roadway segment is typically defined as the forecasted annual average daily traffic (AADT) that results in LOS E-F in the urban environment and D-F in the rural environment. Typically these conditions are characterized by low travel speeds, between two points, and are reflective of speeds that are much below the posted speeds.

For this study, roadway configurations and capacity improvements were made until a planning level LOS E and LOS D were achieved in the urban and rural areas respectively for the majority of the roadways in the study area.

Figure 2.2 2040 LOS Depiction presents a visual representation of LOS with respect to traffic flow.

Figure 2.2 2040 LOS Depiction

A factor that affects traffic flow and ultimately LOS is a roadway's directional or per lane capacity. This capacity is a designation of how much traffic a roadway segment can carry, and is usually based on the road's functional classification as defined by U.S. Department of Transportation.

The daily volume to capacity ratio (v/c) was used to calculate the roadway segment LOS. **Table 2.2 V/C and LOS** shows the relationship between v/c, LOS and congestion used on all roadways in this study area.

Roadways with unsatisfactory levels of service, LOS E and F, are identified by orange and red lines on the roadway map. These unsatisfactory LOS levels are generally associated with the high traffic volume roads, such as I-10, I-19, Kino Parkway and Valencia Road. These v/c values were compared with v/c resulting from the alternative roadway networks identified in the study and used to determine the effectiveness of each alternative.

Table 2.2 V/C and LOS

V/C	LOS	Congestion
0.0 – 0.79	A-C	Low
0.8 – 0.89	D	Medium
0.90 – 0.99	E	High
<1.0	F	Severe

2.2.9 VMT and VHT

Vehicle miles traveled (VMT) and vehicle hours traveled (VHT) are frequently used to measure congestion. VMT refers to the number of miles that are traveled in a day, while VHT refers to the amount of time spent traveling in a day. Their ratio is often referred to as the "average network speed". Since the speed is an average for an entire roadway system, minor changes are significant. Regardless if VMT increases, VHT should decrease to confirm improved performance. This results in an increase in the average network speed and improved mobility.

Figure 2.3 2040 Number of Lanes – System I

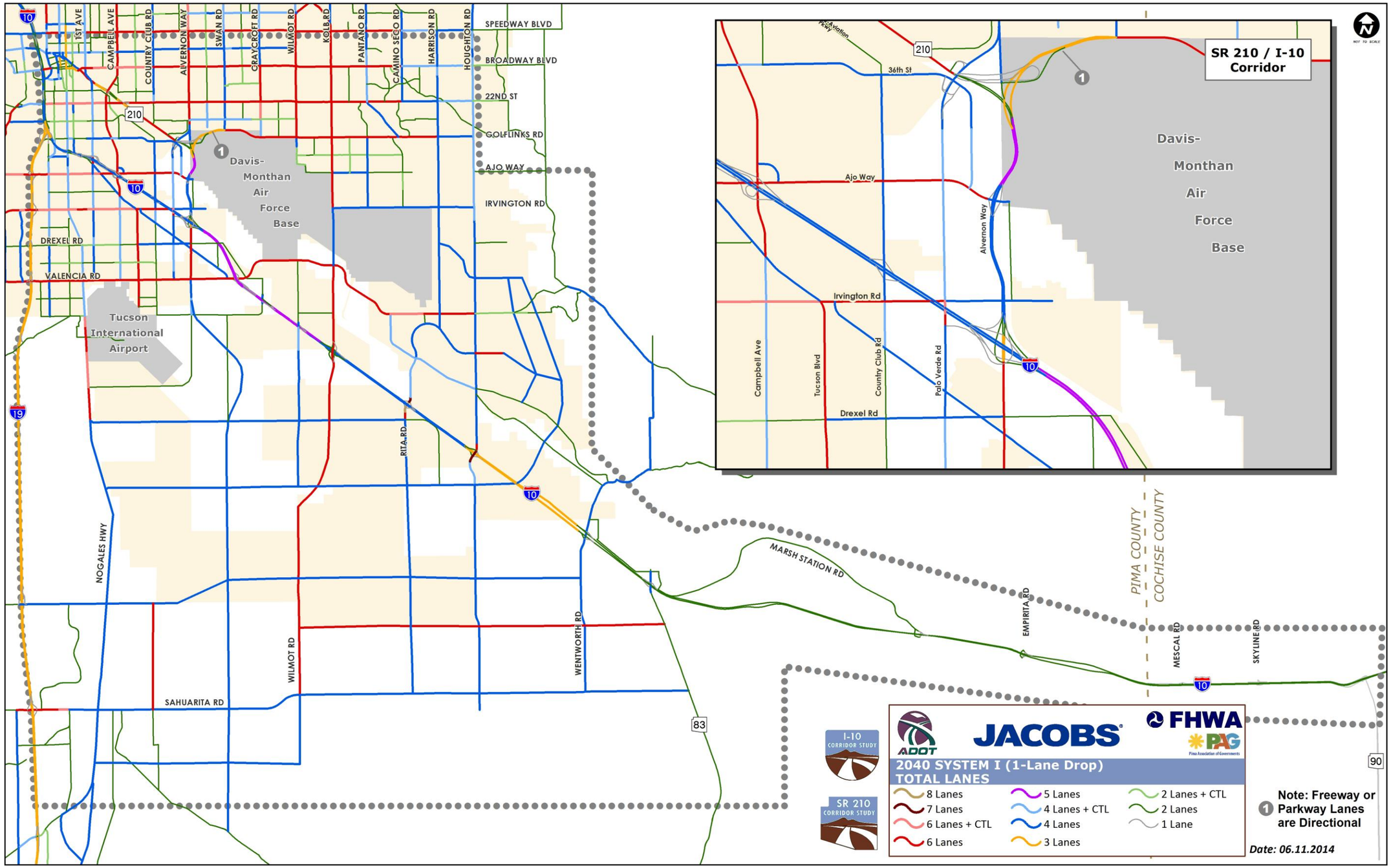


Figure 2.4 2040 Number of Lanes – System II

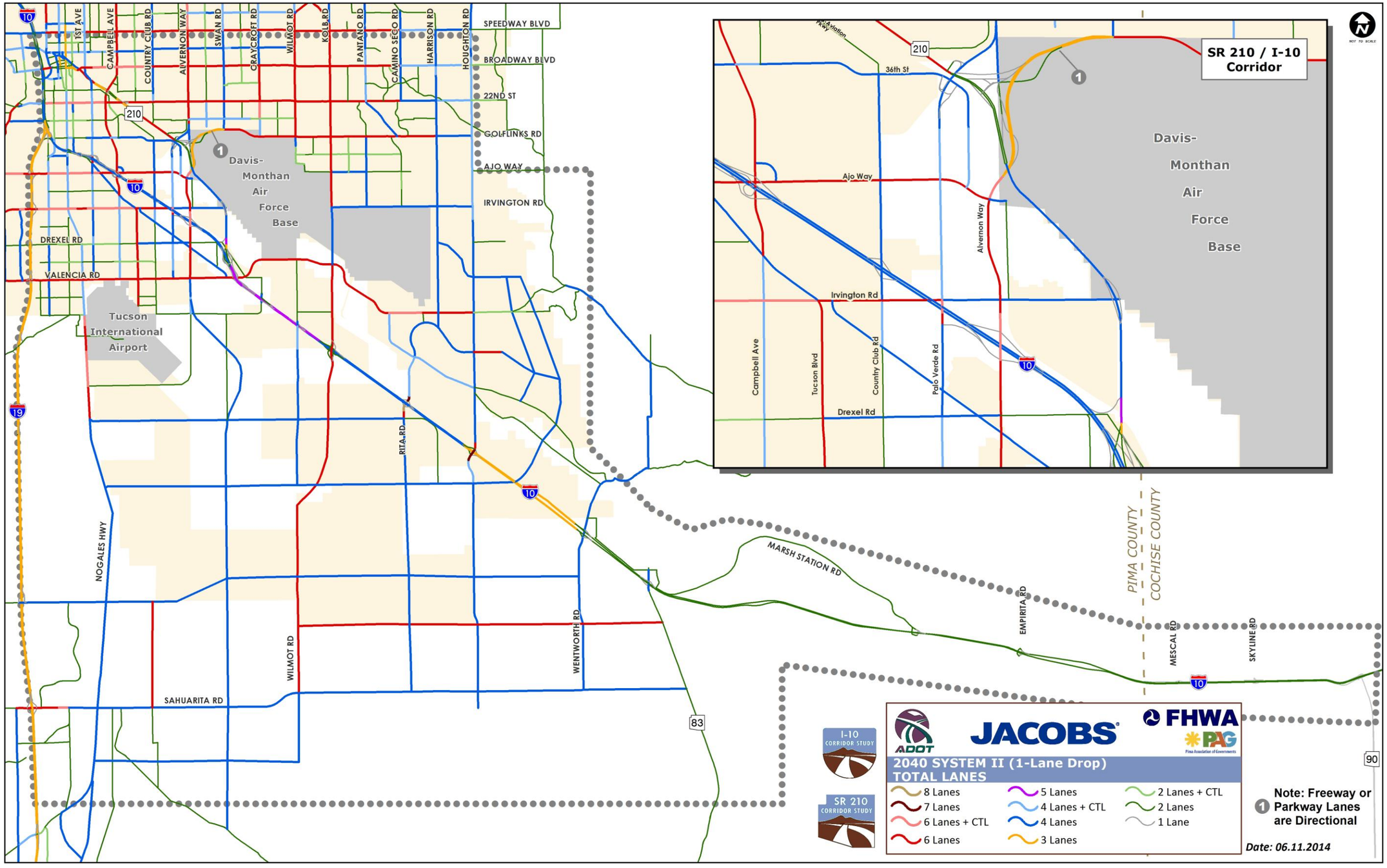
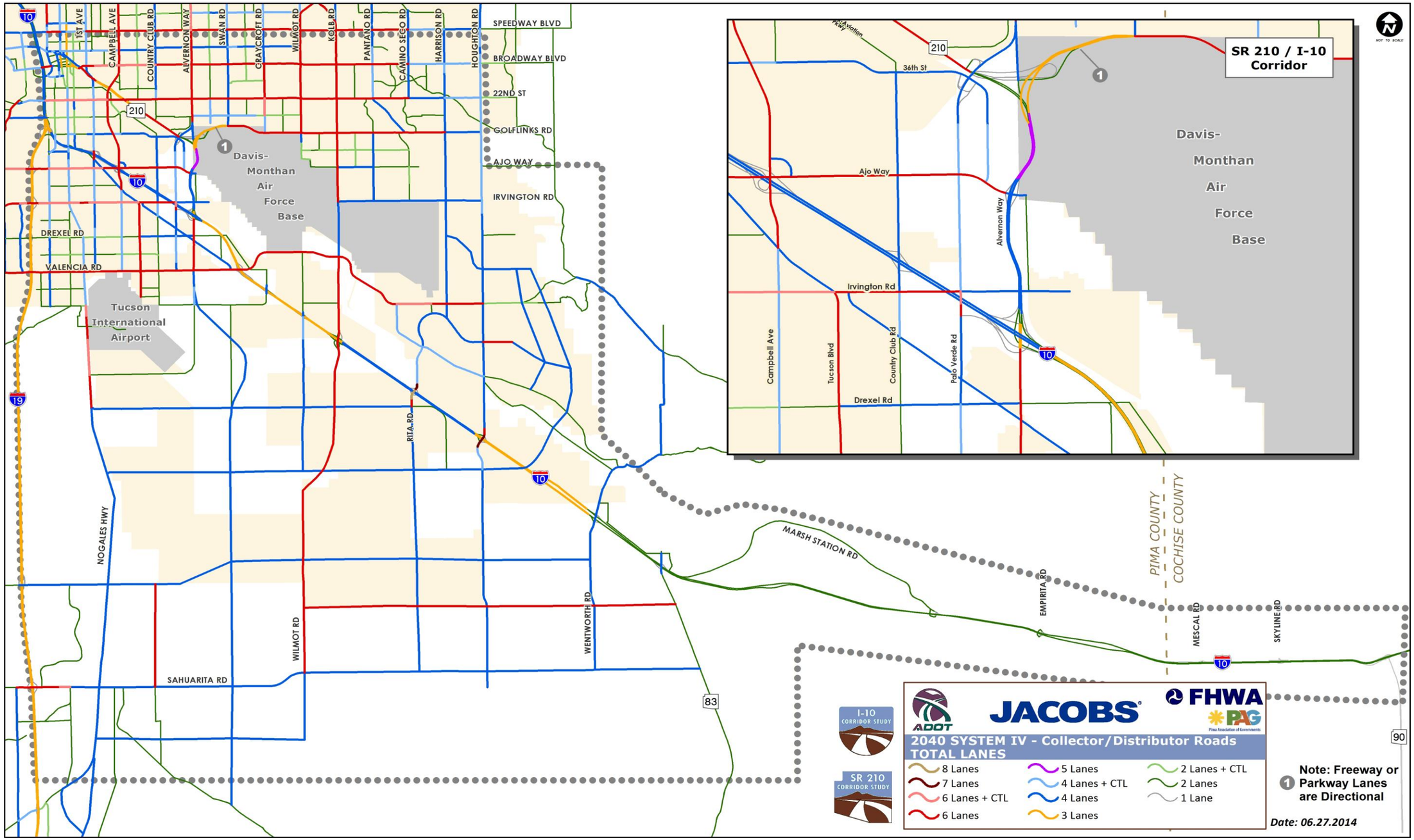


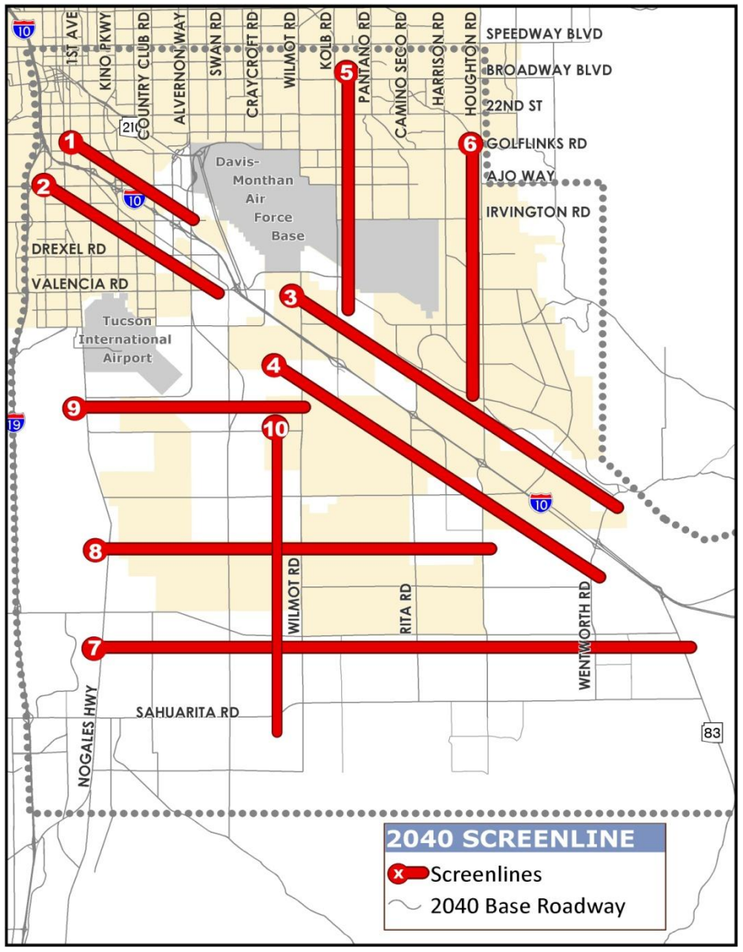
Figure 2.5 2040 Number of Lanes – System IV



2.2.10 Screenlines

In addition to reviewing the daily congestion levels and traffic volumes, a screen line analysis was conducted to evaluate the impacts of the improvements. Screenlines are imaginary lines that cross arterials at specific locations. Traffic volume results from the various system alternatives were compared at those locations. As presented in **Figure 2.6 Screenlines**, ten (10) screenlines were strategically placed throughout the area of influence to capture the distribution of traffic on the surrounding facilities for each scenario. The resulting volume for each screenline provides an indication of how the improvements on I-10 or SR 210 will affect the east-west or north-south thoroughfares in the influence area.

Figure 2.6 Screenlines



2.2.11 Turning Movement Module

A separate module, using TransCAD, was developed for the study to estimate turning movement volumes at specific intersection locations within the influence area. Turning movement volumes from the model were post processed based on traffic count data and utilized in the operational analysis of the facilities and intersections during Traffic Operational Analysis portion of the study described in **Section 2.3, Traffic Operational Analysis** of this report.

2.2.12 System Alternatives

Upon review of the alternative analysis results and stakeholder input, the three distinct system alternatives were finalized:

- System I comprised of interchange and mainline improvements along I-10 and SR 210 with a System Interchange at I-10 and Alvernon Way.
- System II comprised of interchange and mainline improvements along I-10 and SR 210 with a System Interchange at I-10 west of Valencia Road.
- System IV System comprised of interchange and mainline improvements along I-10 and SR 210 with a System Interchange at Alvernon Way and a collector distributor roadway from Alvernon Way to Kolb Road.

2.2.13 I-10 Summary of Findings

The **2040 System I Level Of Service,** the **2040 System II Level Of Service** and the **2040 System IV Level Of Service** exhibits in **Appendix B, Traffic Modeling** display the volumes and levels of congestion through the project area and **Table 2.3 Summary of Findings by System Alternatives – I-10** displays the level-of-service (LOS) summary of findings in tabular form. All system alternatives show definite improvements when compared to the No-Build scenario, especially on the segment between Kino Parkway and Rita Road. Systems I and II show LOS D between Alvernon Way and Rita Road, while System IV only shows LOS D between Kolb Road and Rita Road. This is to be expected due to the presence of the collector-distributor roadways in System IV.

Table 2.3 Summary of Findings by System Alternatives – I-10

Location	CONGESTION LEVELS I-10			
	2040 No Build	System I	System II	System IV
I-19 - 6th St				
6th St - Kino Pkwy				
Kino Pkwy - Country Club Rd				
Country Club Rd - Alvernon Way				
Alvernon Way - Valencia Rd				
Valencia Rd - Craycroft Rd				
Craycroft Rd - Wilmont Rd				
Wilmont Rd - Kolb Rd				
Kolb Rd - Rita Rd				
Rita Rd - Houghton Rd				
Houghton Rd - Wentworth Rd				
Wentworth Rd - SR 83				
SR 83 - Mescal Rd				
Mescal Rd - SR 90				
LOS	A - C	D	E	F

2.2.14 SR 210 Summary of Findings

All segments of SR 210 operate at a good LOS in the No-Build and all system alternatives. However, in System II the segment of SR 210 from Alvernon Way to Valencia displays LOS F. This is attributed to the facility type (parkway) planning level capacity used in this analysis, which is much lower than the freeway capacity. **Table 2.4 Summary of Findings by System Alternatives – SR 210** displays the summary of findings.

Table 2.4 Summary of Findings by System Alternative - SR 210

Location	CONGESTION LEVELS SR-210			
	2040 No Build	System I	System II	System IV
Broadway Blvd - Kino Pkwy				
Kino Pkwy - 22nd St				
22nd St - County Club Rd				
Country Club Rd - Alvernon Way				
Alvernon Way - I-10				
Alvernon Way - Valencia Rd				
LOS	A - C	D	E	F

2.2.15 System Alternatives Scenario Screenline Analysis

The screenline analysis, displayed in **Table 2.5 2040 System Alternatives Screenline Analysis** for the system alternatives, shows an overall decrease of traffic on arterials along I-10 between the No-Build and any of the system alternatives. The increased capacity on I-10 in the system alternatives provides the most relief to the arterials in screenlines 4, 5 and 6.

Table 2.5 2040 System Alternatives Screenline Analysis

Screenline	Year 2040 Volumes			
	No Build	System I	System II	System VI
1	199,915	223,040	172,041	219,256
2	205,652	199,972	200,954	201,171
3	173,706	171,147	172,467	175,289
4	160,366	172,584	173,004	168,220
5	173,942	169,195	167,527	166,475
6	112,879	106,832	106,064	106,017
7	86,202	86,403	86,841	85,691
8	149,759	152,287	152,709	152,062
9	110,224	107,909	107,338	107,245
10	85,458	79,504	79,927	79,531

2.2.16 System Alternatives Scenario Mobility Improvement Analysis

The VMT and VHT for all system alternatives shown in **Table 2.6 VMT and VHT System Alternatives I, II and IV** are very similar with System IV producing the best average speed, even if the difference between systems is very minor.

Table 2.6 VMT and VHT System Alternatives I, II and IV

ALTERNATIVES	VMT	VHT	Speed
No Build	13,735,531	366,293	37.50
System I	14,211,676	360,496	39.42
System II	14,211,677	360,564	39.42
System IV	14,232,675	360,314	39.50

2.3 Traffic Operational Analysis

A Traffic Operational Analysis was conducted to evaluate the effectiveness of the existing roadway and traffic conditions and to evaluate the improvement alternatives developed to handle future traffic volumes as projected by the 2040 PAG Travel Demand Model.

The study limits for the traffic operational analysis included I-10 from I-19 to SR 83, and SR 210 from 34th Street to Alvernon Way. The study area included freeway mainline, ramps, arterials, traffic interchange intersections, and intersections adjacent to the interchange that are directly affected by the interchange operations.

2.3.1 Methodology

The regional traffic modeling provided a macroscopic analysis of the potential improvement alternatives and provided information on the general number of lanes and general concept of the interchanges for future conditions. The traffic operational analysis evaluates the peak hour traffic volumes obtained from the regional modeling efforts, at a 'microscopic level', to refine and ensure that the improvement alternatives are operationally feasible. This is an iterative process and takes into account existing and future roadway characteristics, traffic volumes, traffic control measures, and access spacing.

The methodology involved in the operational analysis included the following:

- 'Spot Checks' were conducted on mainline freeway segments and merge/diverge areas, for the proposed improvement alternatives, per the Highway Capacity Manual (HCM) using the *Highway Capacity Software* (HCS).
- The optimal configuration and operation of the traffic interchange intersections and adjacent arterial intersections were evaluated using the *Synchro/Sim Traffic* software.
- The AM and PM peak-hour operations of the roadway network system within the study area were modeled using the *VISSIM* microsimulation software and included:
    - I-10: mainline, merge/weave areas, ramps, ramp junctions with cross streets, traffic interchange intersections and adjacent intersections directly impacted by the interchange operations.
    - SR 210 (Barraza-Aviation Parkway): arterial, signalized and unsignalized intersections, and ramps.

VISSIM is a microscopic time step and behavior based simulation model developed to model urban traffic and public transit operations. The program can analyze traffic and transit operations under constraints such as lane configuration, traffic composition, traffic signals, transit stops, etc. This makes it a useful tool for the evaluation of various alternatives based on transportation engineering and planning measures of effectiveness. The measures of effectiveness (MOE's) obtained from the VISSIM microsimulation model include delay, speed, volume/density, queues, etc. These are then translated into a level-of-service (LOS) description by facility type, based on the 2010 Highway Capacity Manual definitions. Level-of-service is a qualitative measure of the operational efficiency or effectiveness of a roadway. Six levels of service are defined and are designated by letters ranging from A through F, with LOS A representing the best range of operating conditions and LOS F representing the worst. The specific terms in which each level of service is defined vary with the type of facility involved. Per ADOT Roadway Design Guidelines, for mainline I-10 and SR 210, LOS D is the design criteria for urban conditions while LOS B is the design criteria for rural conditions.

2.3.2 Operational Analysis

A traffic operational analysis was conducted using the VISSIM microsimulation model for the following five scenarios:

1. Year 2010: Existing
   The existing roadway network within the study area was evaluated using traffic data collected in year 2010. The section of I-10 between I-19 and Houghton is considered urban in character, and the section of I-10 between Houghton and SR 83 is considered rural in character. SR 210 within the study area is considered urban in character.
2. Year 2040: No-Build
   The existing roadway network within the study area was evaluated with the projected year 2040 traffic volumes. Under this scenario there were no proposed improvements made to either I-10 or SR 210. The section of I-10 between I-19 and SR 83 as well as SR 210 within the study area are considered urban in character.
3. Year 2040: System I
   An improved roadway network (improvements to freeway/highway, ramps, and traffic interchange intersections) was evaluated with the projected year 2040 traffic volumes. In the System I roadway improvement alternative, SR 210 is extended as a freeway along the Alvernon Way alignment to connect to I-10 at a system interchange. The section of I-10 between I-19 and SR 83 as well as SR 210 within the study area are considered urban in character.
4. Year 2040: System II
   An improved roadway network (improvements to freeway/highway, ramps, and traffic interchange intersections) was evaluated with the projected year 2040 traffic volumes. In the System II roadway improvement alternative, the freeway connection from I-10 to SR 210 begins just west of Valencia Road and continues parallel to the Davis-Monthan Air Force Base (AFB) before tying into the existing SR 210. The section of I-10 between I-19 and SR 83 as well as SR 210 within the study area are considered urban in character.
5. Year 2040: System IV
   An improved roadway network (improvements to freeway/highway, ramps, and traffic interchange intersections) was evaluated with the projected year 2040 traffic volumes. In the System IV roadway improvement alternative, SR 210 is extended as a freeway along the Alvernon Way alignment to connect to I-10 at a system interchange. A collector-distributor roadway parallels I-10 in both directions between the I-10/SR 210 interchange and Kolb Road. The section of I-10 between I-19 and SR 83 as well as SR 210 within the study area are considered urban in character.

2.3.3 Results of Operational Analysis

The following figures summarize the results of the I-10 Mainline Operational Analysis:

Year 2010 – Existing Conditions

Mainline:

For more details, refer to **Figure 2.7: I-10 2010 Existing Conditions – Mainline Lanes & LOS Summary** on page 18.

- For the section of I-10 between I-19 and Houghton Road, the LOS is D or better in both the AM and PM peak hour.
- For the section of I-10 between Houghton Road and SR 83, the LOS is B or better in both the AM and PM peak hour, except:
  - I-10 EB between Houghton Road and Wentworth Road operates at LOS F in the PM peak hour due to the EB Off-ramp traffic backing up onto the mainline.

Ramps:

For more details, refer to **Table 2.7 I-10 Ramps LOS Summary** on page 23.

- For the section of I-10 between I-19 and Houghton Road, the LOS is D or better in both the AM and PM peak hour, except:
  - I-10 EB Off-ramp to Kino Parkway NB operates at LOS E in the AM peak hour due to queuing backups at the stop control.
  - I-10 EB Off-ramp to Rita Road operates at LOS F in the AM peak hour due to queuing backups at the stop control.
  - I-10 EB Off-ramp to Houghton Road operates at LOS F in the PM peak hour due to queuing backups at the stop control.
- For the section of I-10 between Houghton Road and SR 83, the LOS is B or better in both the AM and PM peak hour, except:

- I-10 EB Off-ramp to Wentworth Road operates at LOS F in the PM peak hour due to queuing backups at the stop control.
- I-10 WB On-ramp from Wentworth Road operates at LOS C in the AM peak hour.

Intersections:

For more details, refer to **Table 2.9 I-10 Intersection LOS Summary** on page 26; and **Table 2.10 SR 210 Intersection LOS Summary** on page 27.

- For the section of I-10 between I-19 and Houghton Road, all the intersections in the vicinity of the project operate at LOS D or better during the AM and PM peak hour, except:
  - I-10 WB ramp and Valencia Road operates at LOS E during the AM peak hour.
- For the section of I-10 between Houghton Road and SR 83, all the intersections in the vicinity of the project operate at LOS B or better during the AM and PM peak hour. except:
  - I-10 EB ramp and Wentworth Road operates at LOS C during the PM peak hour.
- For the section of SR 210 between Broadway Boulevard and Alvernon Way, all the intersections operate at LOS C or better during the AM and PM peak hour.

Year 2040 – No Build

Mainline:

For more details, please refer to **Figure 2.8: I-10 No-Build Alternative 2040 - Mainline Lanes & LOS Summary** on page 19.

- For the section of I-10 between I-19 and SR 83, the LOS is E or worse in both the AM and PM peak hour, except:
  - I-10 WB section between Rita Road and Houghton Road operates at LOS D in the PM peak hour.
  - I-10 WB section between Houghton Road and Wentworth Road operates at LOS C in both the AM and PM peak hour.
  - I-10 EB section between Wentworth Road and SR 83 operates at LOS A in the AM peak hour and LOS C in the PM peak hour.
  - I-10 WB section between Wentworth Road and SR 83 operates at LOS B in both the AM and PM peak hour.
  - I-10 EB section east of SR 83 operates at LOS A in both the AM and PM peak hour.
  - I-10 WB section east of SR 83 operates at LOS A in the AM peak hour and LOS B in the PM peak hour.

Ramps:

For more details, please refer to **Table 2.7 I-10 Ramps LOS Summary** on page 23.

- For the section of I-10 between I-19 and SR 83, the LOS is E or worse in both the AM and PM peak hour, except:
  - I-10 WB off-ramp to I-19 operates at LOS D in the AM peak hour and LOS B in the PM peak hour.
  - I-10 EB off-ramp to 6th Avenue operates at LOS C in the AM peak hour and LOS B in the PM peak hour.
  - I-10 WB on-ramp from 6th Avenue operates at LOS C in the AM peak hour and LOS D in the PM peak hour.
  - I-10 WB off-ramp to 6th Avenue operates at LOS B in both the AM and PM peak hour.
  - I-10 EB off-ramp to Park Avenue operates at LOS D in the AM peak hour.
  - I-10 WB on-ramp from northbound Park Avenue operates at LOS B in both the AM and PM peak hour.
  - I-10 WB off-ramp to Park Avenue operates at LOS D in the AM peak hour.
  - I-10 EB on-ramp from northbound Kino Parkway operates at LOS A in both the AM and PM peak hour.
  - I-10 WB on-ramp from Kino Parkway operates at LOS B in the AM peak hour and LOS D in the PM peak hour.
  - I-10 WB on-ramp from Ajo Way operates at LOS D in the AM peak hour and LOS C in the PM peak hour.
  - I-10 WB off-ramp to Ajo Way operates at LOS C in the PM peak hour.
  - I-10 WB on-ramp from Hotel Drive operates at LOS A in the AM peak hour and LOS B in the PM peak hour.
  - I-10 WB off-ramp from Hotel Drive operates at LOS C in the AM peak hour and LOS B in the PM peak hour.
  - I-10 EB off-ramp to Alvernon Way operates at LOS A in both the AM and PM peak hour.
  - I-10 WB off-ramp to Alvernon Way operates at LOS B in both the AM and PM peak hour.
  - I-10 WB on-ramp from Valencia Road operates at LOS C in both the AM and PM peak hours.
  - I-10 EB off-ramp to Craycroft Road operates at LOS C in the AM peak hour.
  - I-10 WB on-ramp from Craycroft Road operates at LOS C in the PM peak hour.
  - I-10 WB on-ramp from Wilmot Road operates at LOS C in both the AM and PM peak hour.
  - I-10 WB off-ramp to Wilmot Road operates at LOS C in the PM peak hour.
  - I-10 EB off-ramp to Kolb Road operates at LOS C in the PM peak hour.
  - I-10 WB on-ramp from Kolb Road operates at LOS A in both the AM and PM peak hour.
  - I-10 WB on-ramp from Rita Road operates at LOS C in the AM peak hour.
  - I-10 WB on-ramp from Houghton Road operates at LOS C in the PM peak hour.
  - I-10 WB on-ramp from Wentworth Road operates at LOS C in both the AM and PM peak hour.
  - I-10 EB on-ramp from Wentworth Road operates at LOS A in both the AM and PM peak hour.
  - I-10 WB off-ramp to Wentworth Road operates at LOS A in the AM peak hour and LOS B in the PM peak hour.
  - I-10 EB off-ramp to SR 83 operates at LOS A in the AM peak hour.
  - I-10 EB on-ramp from SR 83 operates at LOS A in both the AM and PM peak hour.
  - I-10 WB on-ramp from SR 83 operates and LOS C in the AM peak hour and LOS B in the PM peak hour.
  - I-10 WB off-ramp to SR 83 operates at LOS A in the AM peak hour.

Intersections:

For more details, please refer to **Table 2.9 I-10 Intersection LOS Summary** on page 26; and **Table 2.10 SR 210 Intersection LOS Summary** on page 27.

- For the section of I-10 between I-19 and SR 83, all the intersections in the vicinity of the project operate at LOS E or worse during the AM and PM peak hour, except:
  - Palo Verde Road and Irvington Road operates at LOS D in both the AM and PM peak hour.
  - Hotel Drive and Irvington Road operates at LOS D in both the AM and PM peak hour.
  - Alvernon Way and Irvington Road operates at LOS D in the AM peak hour.
  - I-10 EB ramp and Alvernon Way operates at LOS B in the AM peak hour.
- For the section of SR 210 between 34th Street and Alvernon Way, all the intersections operate at LOS E or worse during the AM and PM peak hour, except:
  - SR 210 and 34th Street operates at LOS A in both the AM and PM peak hour.
  - Palo Verde Road and the Frontage Road operates at LOS A in both the AM and PM peak hour.

- Palo Verde Road and 37th Street operates at LOS A in both the AM and PM peak hour.
- SR 210 and Alvernon Way operates at LOS C in both the AM and PM peak hour.

Year 2040 – System Alternative I Improvements

Mainline:

For more details, refer to **Figure 2.9 I-10 System Alternative I – 2040 Build - Mainline Lanes & LOS Summary** on page 20.

- For the section of I-10 between I-19 and SR 83, the LOS is C or better in both the AM and PM peak hour.

SR 210 Mainline:

For more details, please refer to **Figure 2.9: I-10 System I Alternative – 2040 Build - Mainline Lanes & LOS Summary** on page 20.

- For the section of SR 210 between 34th Street and the I-10/SR 210 system interchange, the LOS is D or better in both the AM and PM peak hour.

I-10 Ramps:

For more details, please refer to **Table 2.7 I-10 Ramps LOS Summary** on page 23.

- For the section of I-10 between I-19 and SR 83, the LOS is D or better in both the AM and PM peak hour.

SR 210-Ramps:

For more details, refer to **Table 2.8 SR 210 Ramps LOS Summary Table** on page 25.

- For the section of SR 210 between Golf Links Road and the I-10/SR 210 system interchange, the LOS is B or better in both the AM and PM peak hour.

Intersections:

For more details, refer to **Table 2.9 I-10 Intersection LOS Summary** on page 26; and **Table 2.10 SR 210 Intersection LOS Summary** on page 27.

- For the section of I-10 between I-19 and SR 83, all the intersections in the vicinity of the project operate at LOS C or better during the AM and PM peak hour.
- For the section of SR 210 between 34th Street and the I-10/SR 210 system interchange, all the intersections operate at LOS C or better during the AM and PM peak hour.

Year 2040 – System Alternative II Improvements

Mainline:

For more details, refer to **Figure 2.10 I-10 System Alternative II – 2040 Build - Mainline Lanes & LOS Summary** on page 21.

- For the section of I-10 between I-19 and SR 83, the LOS is C or better in both the AM and PM peak hour.

SR 210 Mainline:

For more details, please refer to Figure 2.10: "I-10 System II Alternative – 2040 Build - Mainline Lanes & LOS Summary" on page 21.

- For the section of SR 210 between 34th Street and the I-10/SR 210 system interchange, the LOS is C or better in both the AM and PM peak hour.

I-10 Ramps:

For more details, refer to **Table 2.7 I-10 Ramps LOS Summary** on page 23.

- For the section of I-10 between I-19 and SR 83, the LOS is D or better in both the AM and PM peak hour.

SR 210 Ramps:

For more details, refer to **Table 2.8 SR 210 Ramps LOS Summary** on page 25.

- For the section of SR 210 between Golf Links Road and the I-10/SR 210 system interchange, the LOS is C or better in both the AM and PM peak hour.

Intersections:

For more details, refer to **Table 2.9 I-10 Intersection LOS Summary** on page 26; and **Table 2.10 SR 210 Intersection (LOS) Summary** on page 27.

- For the section of I-10 between I-19 and SR 83, all the intersections in the vicinity of the project operate at LOS C or better during the AM and PM peak hour.
- For the section of SR 210 between 34th Street and Alvernon Way, all the intersections operate at LOS C or better during the AM and PM peak hour.

Year 2040 – System Alternative IV Improvements

Mainline:

For more details, please refer to **Figure 2.11: I-10 System IV Alternative – 2040 Build - Mainline Lanes & LOS Summary** on page 22.

- For the section of I-10 between I-19 and SR 83, the LOS is C or better in both the AM and PM peak hour.
- For the CD roadway between the I-10/SR 210 system interchange and Kolb Road, the LOS is C or better in both the AM and PM peak hour.

SR 210 Mainline:

For more details, please refer to **Figure 2.11: I-10 System IV Alternative – 2040 Build - Mainline Lanes & LOS Summary** on page 22.

- For the section of SR 210 between 34th Street and the I-10/SR 210 system interchange, the LOS is C or better in both the AM and PM peak hour.

I-10 Ramps:

For more details, please refer to **Table 2.7: I-10 Ramps LOS Summary** on page 23.

- For the section of I-10 between I-19 and SR 83, the LOS is D or better in both the AM and PM peak hour.

SR 210 Ramps:

For more details, please refer to **Table 2.8: SR 210 Ramps LOS Summary** on page 25.

- For the section of SR 210 between Golf Links Road and the I-10/SR 210 system interchange, the LOS is B or better in both the AM and PM peak hour.

Intersections:

For more details, please refer to **Table 2.9: I-10 Intersection LOS Summary** on page 26, and **Table 2.10 SR 210 Intersection LOS Summary** on page 27.

- For the section of I-10 between I-19 and SR 83, all the intersections in the vicinity of the project operate at LOS D or better during the AM and PM peak hour.
- For the section of SR 210 between 34th Street and the I-10/SR 210 system interchange all the intersections operate at LOS C or better during the AM and PM peak hour.

Figure 2.7 I-10 Existing Conditions 2010 – Mainline Lanes & LOS Summary

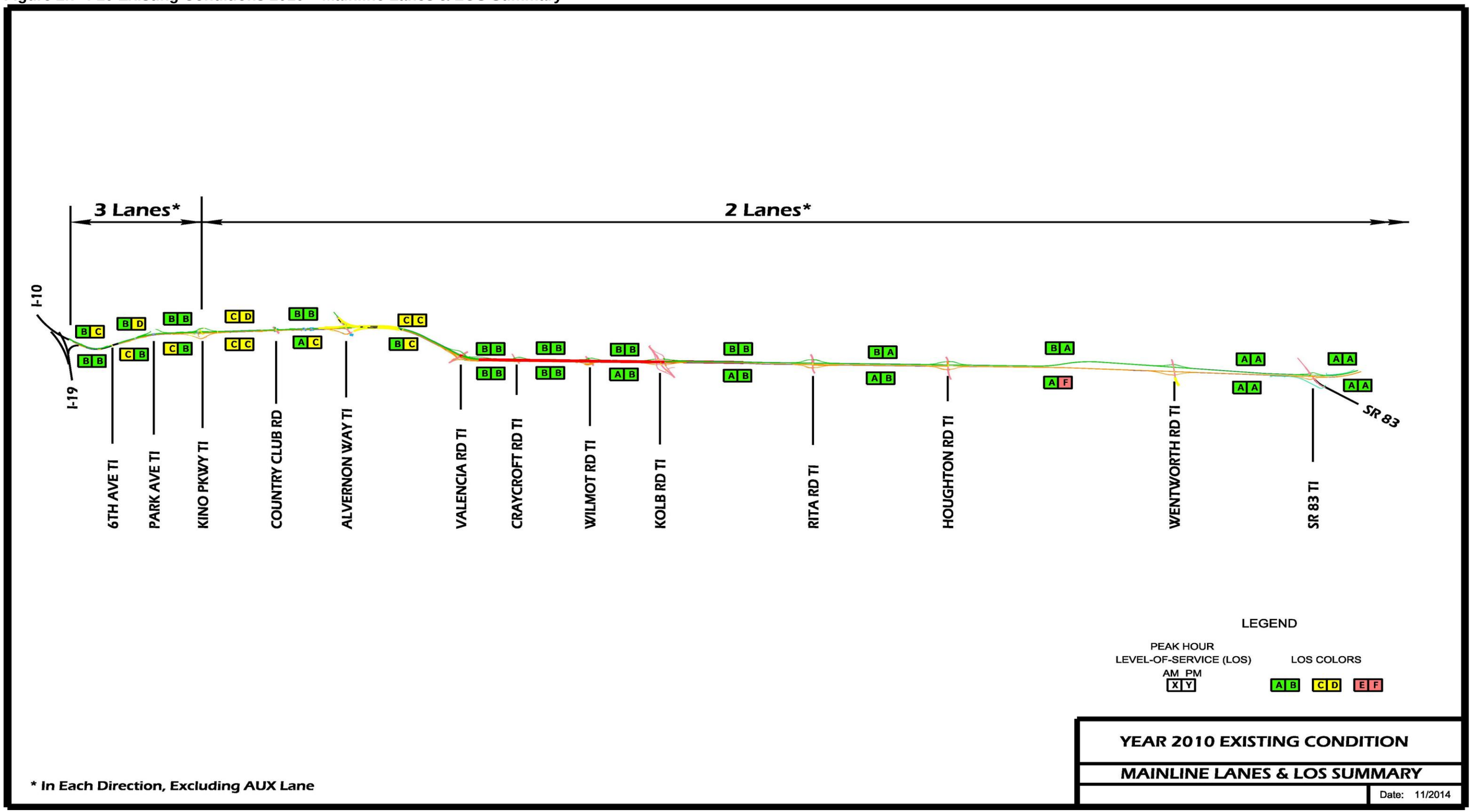


Figure 2.8 I-10 No-Build Alternative 2040 – Mainline Lanes & LOS Summary

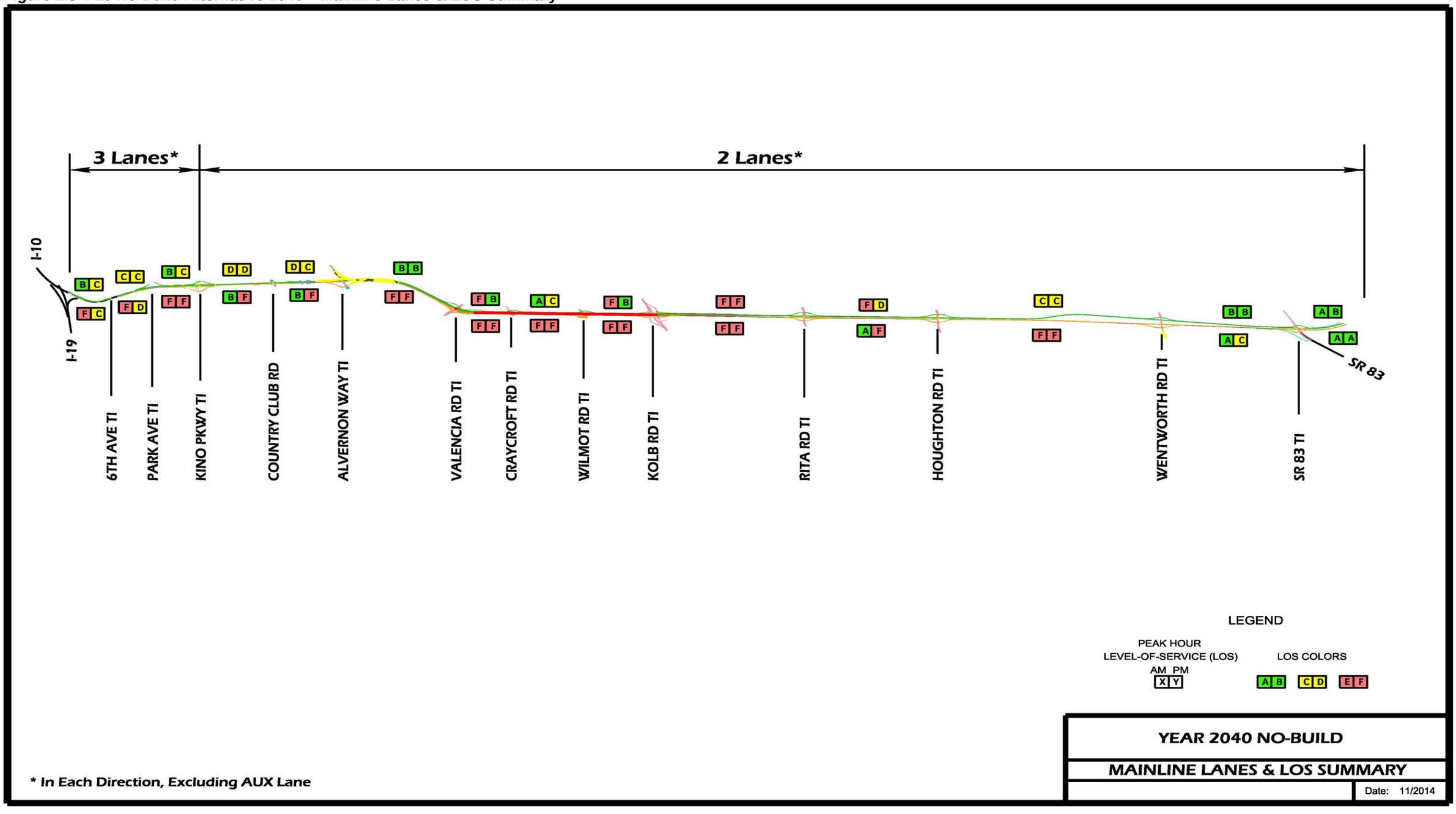


Figure 2.9 I-10 System Alternative I – 2040 Build – Mainline Lanes & LOS Summary

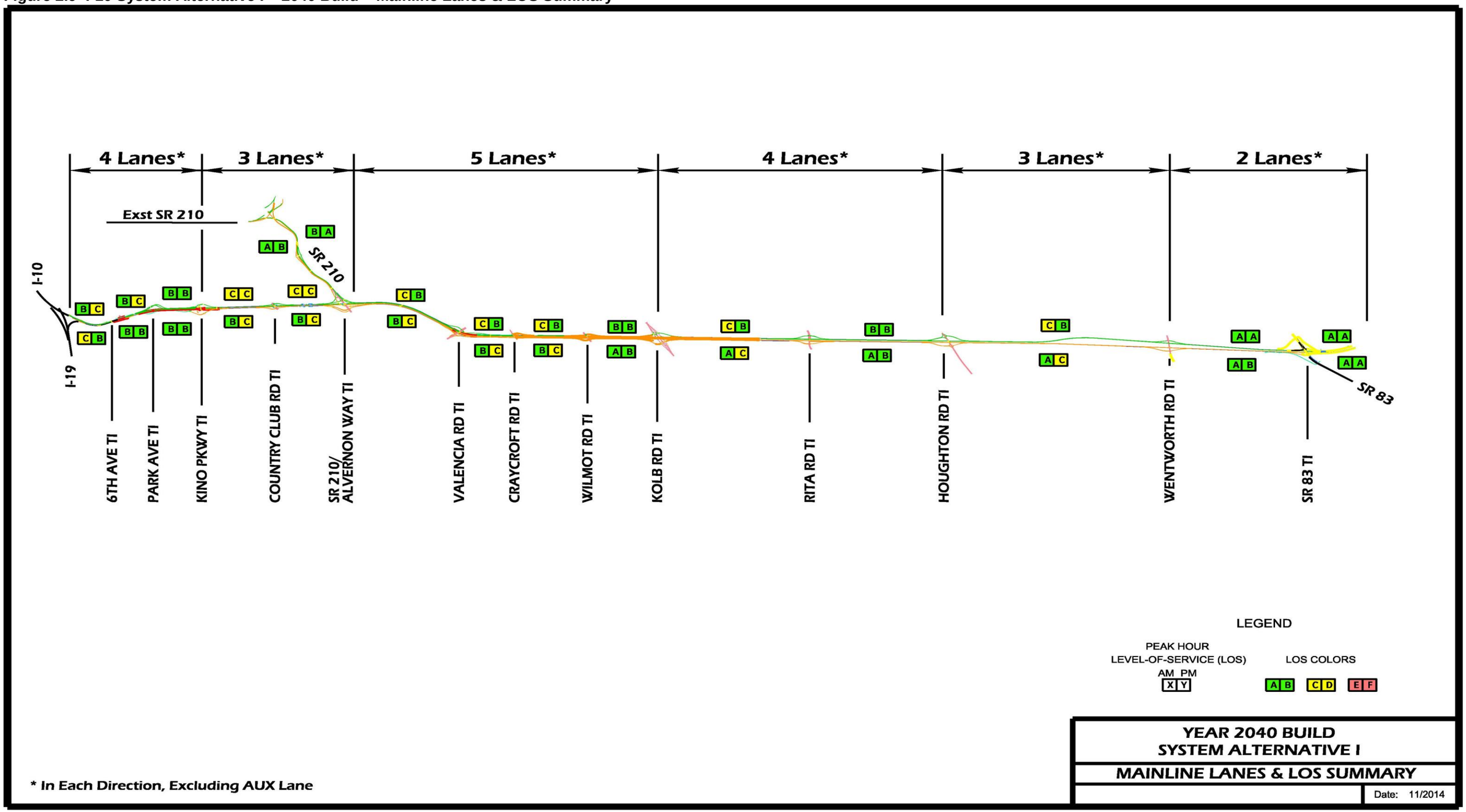


Figure 2.10 I-10 System Alternative II – 2040 Build – Mainline Lanes & LOS Summary

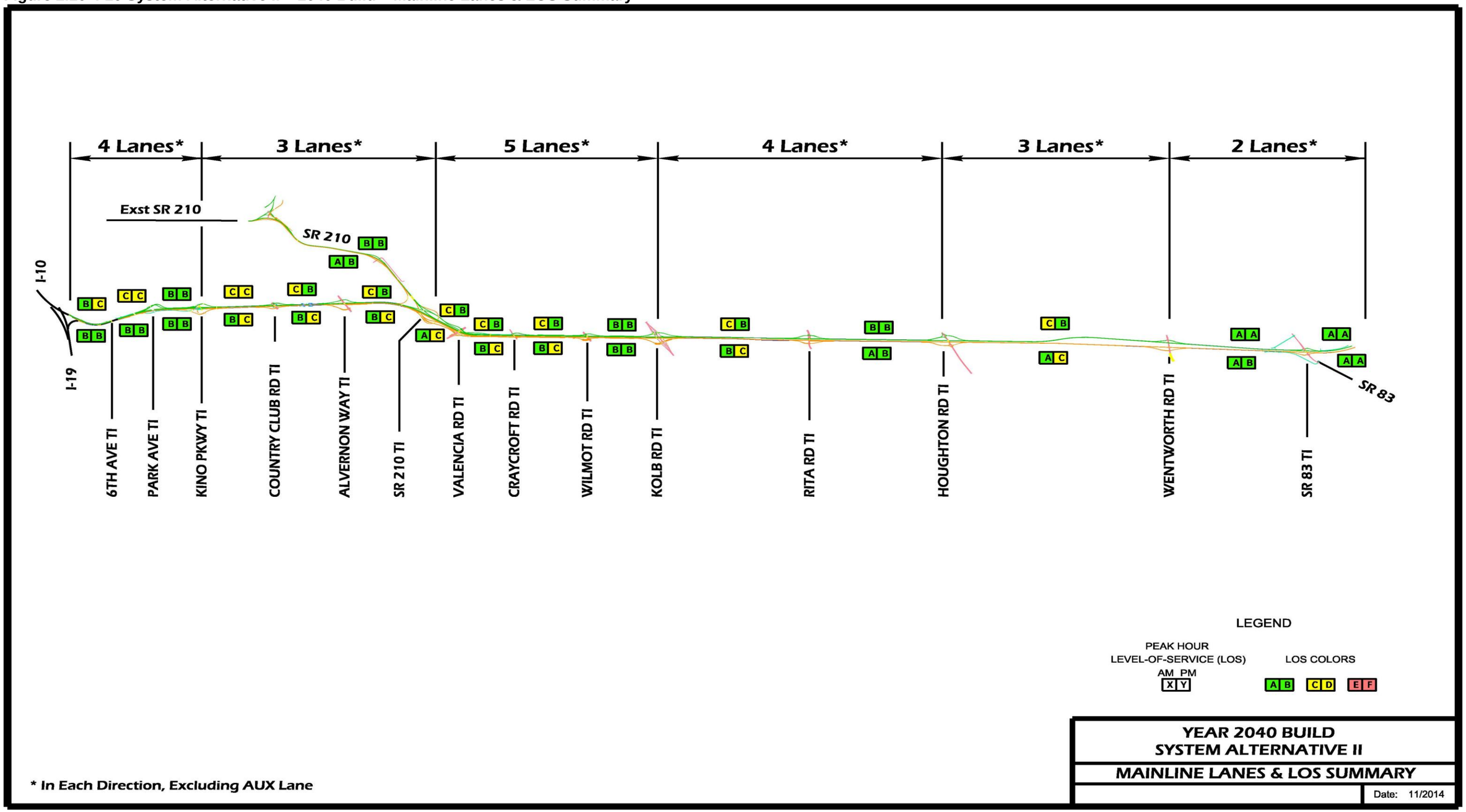


Figure 2.11 I-10 System Alternative IV – 2040 Build – Mainline Lanes & LOS Summary

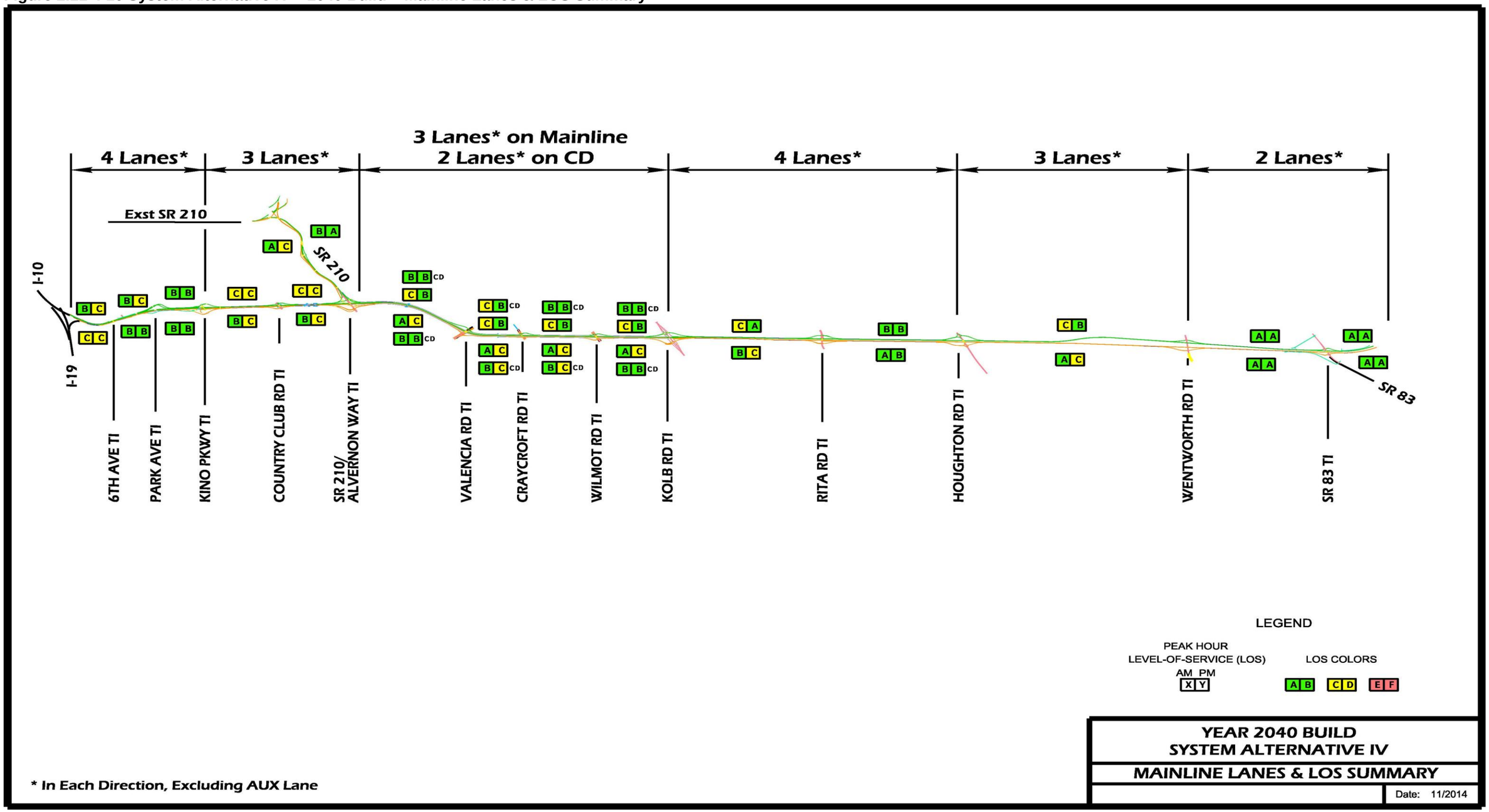


Table 2.7 I-10 Ramps LOS Summary Table

Traffic Interchange (TI)	Ramp Name	Operational Analysis Scenarios									
		2010 – Existing LOS		2040 – No Build LOS		2040 - System I LOS		2040 - System II LOS		2040 - System IV LOS	
		AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr
I-10 & I-19 System	I-10 WB to I-19 SB Ramp	A	C	D	F	C	C	C	D	C	C
	I-19 NB to I-10 EB Ramp	C	B	F	F	C	B	C	B	C	C
6th Ave.	WB Off-Ramp	A	A	B	B	B	B	B	A	B	B
	WB On-Ramp	A	B	C	D	B	B	B	B	B	B
	EB Off-Ramp	B	A	C	B	B	B	B	B	B	B
	EB On-Ramp	A	A	D	F	A	B	A	B	B	B
Park Ave.	WB Off-Ramp	A	A	D	E	B	B	C	B	B	C
	WB On-Ramp	A	B	C	D	B	C	B	D	B	C
	EB Off-Ramp	B	A	D	F	B	B	B	A	B	B
	EB On-Ramp	A	A	F	F	A	A	A	A	A	A
Kino Pkwy.	EB Off-Ramp to SB Kino Pkwy.	B	A	F	F	(2)	(2)	(2)	(2)	(2)	(2)
	EB Off-Ramp to NB Kino Pkwy.	E	A	F	F	(2)	(2)	(2)	(2)	(2)	(2)
	EB On-Ramp from SB Kino Pkwy.	A	A	F	F	B	C	B	C	B	C
	EB On-Ramp from NB Kino Pkwy.	A	A	A	A	(2)	(2)	(2)	(2)	(2)	(2)
	WB Off-Ramp	(1)	(1)	(1)	(1)	C	B	C	B	C	B
	WB On-Ramp	B	B	B	D	B	C	B	C	B	C
	EB Off-Ramp	(1)	(1)	(1)	(1)	B	B	B	B	B	B
	EB On-Ramp	(1)	(1)	(1)	(1)	A	A	B	D	A	A
Ajo Way	WB Off-Ramp	B	A	F	C	(2)	(2)	(2)	(2)	(2)	(2)
	WB On-Ramp	A	C	D	C	(2)	(2)	(2)	(2)	(2)	(2)
Country Club Rd.	WB Off-Ramp	(1)	(1)	(1)	(1)	B	B	B	B	C	B
	WB On-Ramp	(1)	(1)	(1)	(1)	C	D	C	D	B	C
	EB Off-Ramp	(1)	(1)	(1)	(1)	C	B	C	B	C	B
	EB On-Ramp	(1)	(1)	(1)	(1)	B	B	A	B	B	B
Palo Verde Rd.	EB Off-Ramp to SB Palo Verde Rd.	A	A	F	F	(2)	(2)	(2)	(2)	(2)	(2)
	EB Off-Ramp to NB Palo Verde Rd.	B	A	F	F	(2)	(2)	(2)	(2)	(2)	(2)
	EB On-Ramp from SB Palo Verde Rd.	A	D	F	F	(2)	(2)	(2)	(2)	(2)	(2)
	WB On-Ramp from SB Palo Verde Rd.	A	B	F	F	(2)	(2)	(2)	(2)	(2)	(2)
Irvington Rd.	WB Off-Ramp	A	A	C	B	(2)	(2)	(2)	(2)	(2)	(2)
	WB On-Ramp	B	D	A	B	(2)	(2)	(2)	(2)	(2)	(2)

(1) Currently not a ramp.

(2) Not a future ramp.

Table 2.7 (Continued) I-10 Ramps LOS Summary Table

Traffic Interchange (TI)	Ramp Name	Operational Analysis Scenarios									
		2010 – Existing LOS		2040 – No Build LOS		2040 - System I LOS		2040 - System II LOS		2040 - System IV LOS	
		AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr
Alvernon Way	WB Off-Ramp	B	A	B	B	A	A	B	A	A	A
	WB On-Ramp	(1)	(1)	(1)	(1)	A	C	C	C	A	C
	EB Off-Ramp	A	A	A	A	A	A	B	B	A	B
	EB On-Ramp	A	B	E	F	A	B	A	B	A	A
I-10 & SR 210 System	I-10 WB to SR 210 NB	(1)	(1)	(1)	(1)	B	B	C	B	B	A
	I-10 EB to SR 210 NB	(1)	(1)	(1)	(1)	A	A	A	A	B	A
	SR 210 SB to I-10 EB	(1)	(1)	(1)	(1)	A	B	A	B	A	B
	SR 210 SB to I-10 WB	(1)	(1)	(1)	(1)	A	A	A	A	A	A
Valencia Rd.	WB Off-Ramp	B	A	F	F	C	B	B	B	B	C
	WB On-Ramp	B	A	C	C	D	D	B	B	B	B
	EB Off-Ramp	A	B	F	F	C	D	A	B	B	B
	EB On-Ramp	A	A	F	F	B	C	B	C	B	C
Craycroft Rd	WB Off-Ramp	A	A	F	F	B	A	A	A	A	A
	WB On-Ramp	A	A	F	C	B	B	B	B	B	B
	EB Off-Ramp	A	A	C	F	A	B	A	B	A	B
	EB On-Ramp	A	A	F	F	A	B	A	B	A	B
Wilmot Rd	WB Off-Ramp	A	A	F	C	A	A	A	A	A	A
	WB On-Ramp	A	A	C	C	C	C	D	C	C	C
	EB Off-Ramp	A	A	F	F	B	C	B	C	B	C
	EB On-Ramp	A	A	E	E	A	A	A	A	A	B
Kolb Rd.	WB Off-Ramp	A	A	F	F	B	B	B	B	B	B
	WB On-Ramp	A	A	A	A	B	A	B	B	B	C
	EB Off-Ramp	A	A	F	C	A	B	A	B	B	C
	EB On-Ramp	A	A	F	F	A	A	A	A	B	C
Rita Rd.	WB Off-Ramp	A	A	F	F	B	B	B	B	B	B
	WB On-Ramp	A	B	C	F	C	B	C	B	C	B
	EB Off-Ramp	F	B	F	F	B	B	B	C	B	C
	EB On-Ramp	A	A	F	F	A	B	A	B	B	B
Houghton Rd.	WB Off-Ramp	A	A	F	F	B	A	B	A	B	B
	WB On-Ramp	B	A	F	C	C	C	C	C	C	C
	EB Off-Ramp	A	F	F	F	B	C	B	C	B	D
	EB On-Ramp	A	A	F	F	A	B	A	B	A	B
Wentworth Rd.	WB Off-Ramp	A	A	A	B	A	A	A	A	A	A
	WB On-Ramp	C	A	C	C	C	B	C	B	C	B
	EB Off-Ramp	A	F	F	F	A	B	A	B	A	B
	EB On-Ramp	A	A	A	A	A	A	A	A	A	A

(1) Currently not a ramp.

(2) Not a future ramp.

Table 2.7 (Continued) I-10 Ramps LOS Summary Table

Traffic Interchange (TI)	Ramp Name	Operational Analysis Scenarios									
		2010 – Existing LOS		2040 – No Build LOS		2040 - System I LOS		2040 - System II LOS		2040 - System IV LOS	
		AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr
SR 83	WB Off-Ramp	A	A	A	E	A	A	A	A	A	A
	WB On-Ramp	A	A	C	B	B	B	B	B	B	B
	EB Off-Ramp	A	A	A	F	A	B	A	B	A	B
	EB On-Ramp	A	A	A	A	A	A	A	A	A	A

Table 2.8 SR 210 Ramps LOS Summary Table

Traffic Interchange (TI)	Ramp Name	Operational Analysis Scenarios									
		2010 – Existing LOS		2040 – No Build LOS		2040 - System I LOS		2040 - System II LOS		2040 - System IV LOS	
		AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr
Ajo Way	NB Off-Ramp	(1)	(1)	(1)	(1)	A	A	(2)	(2)	A	A
	NB On-Ramp	(1)	(1)	(1)	(1)	B	B	(2)	(2)	B	B
	SB Off-Ramp	(1)	(1)	(1)	(1)	B	B	(2)	(2)	B	B
	SB On-Ramp	(1)	(1)	(1)	(1)	A	A	(2)	(2)	A	A
Golf Links Rd.	NB Off-Ramp	(1)	(1)	(1)	(1)	B	B	(2)	(2)	B	B
	SB On-Ramp	(1)	(1)	(1)	(1)	B	B	(2)	(2)	B	B
Alvernon Way	NB Off-Ramp	(1)	(1)	(1)	(1)	(2)	(2)	B	B	(2)	(2)
	SB On-Ramp	(1)	(1)	(1)	(1)	(2)	(2)	B	C	(2)	(2)

(1) Currently not a ramp.

(2) Not a future ramp.

Table 2.9 I-10 Intersection LOS Summary Table

Traffic Interchange (TI)	Intersection Name	Operational Analysis Scenarios									
		2010 – Existing LOS		2040 – No Build LOS		2040 - System I LOS		2040 - System II LOS		2040 - System IV LOS	
		AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr
6th Ave.	I-10 WB Ramps & 6th Ave.	B	B	F	F	B	C	B	C	B	C
	I-10 EB Ramps & 6th Ave.	A	B	F	F	B	B	B	B	B	B
Park Ave.	I-10 WB Ramps & Park Ave.	B	A	F	F	B	B	B	B	B	B
	I-10 EB Ramps & Park Ave.	A	A	E	F	B	C	C	B	B	C
Kino Pkwy.	Kino Pkwy. & Ajo Connector	C	B	F	F	C	C	B	C	C	D
	I-10 WB Ramps & Kino Pkwy.	(1)	(1)	(1)	(1)	B	C	C	C	C	C
	I-10 EB Ramps & Kino Pkwy.	(1)	(1)	(1)	(1)	B	B	B	B	B	B
	Ajo Connector & Ajo Way	D	C	F	F	B	B	B	B	B	B
Country Club Rd.	I-10 WB Ramps & Country Club Rd.	(1)	(1)	(1)	(1)	B	B	C	B	B	B
	I-10 EB Ramps & Country Club Rd.	(1)	(1)	(1)	(1)	B	B	B	B	B	B
Palo Verde Rd.	Palo Verde Rd & Irvington Rd.	C	C	D	D	C	C	C	C	C	C
	I-10 EB Ramp & Palo Verde Rd.	(1)	(1)	(1)	(1)	A	A	A	A	A	A
	Hotel Dr. & Irvington Rd.	B	C	D	D	(2)	(2)	(2)	(2)	(2)	(2)
Alvernon Way	I-10 WB Ramps & Alvernon Way	(1)	(1)	(1)	(1)	B	C	B	B	B	C
	I-10 EB Ramps & Alvernon Way	B	B	B	E	B	B	B	B	B	B
Valencia Rd.	I-10 EB Ramps & Valencia Rd.	B	C	F	F	B	C	C	C	B	C
	I -10 WB Ramps & Valencia Rd.	E	B	F	F	B	C	B	B	B	C
Craycroft Rd.	I-10 EB Ramps & Craycroft Rd.	A	A	F	F	B	C	B	B	B	B
	I-10 WB Ramps & Craycroft Rd.	A	A	F	F	B	B	C	C	B	B
Wilmot Rd.	I-10 WB Ramps & Wilmot Rd.	A	A	F	F	B	B	B	B	B	B
	I-10 EB Ramps & Wilmot Rd.	A	B	F	F	B	B	B	B	B	B
Kolb Rd.	I-10 WB Ramps & Kolb Rd.	A	A	F	F	B	B	B	B	B	B
	I-10 EB Ramps & Kolb Rd.	A	A	F	F	A	B	A	A	A	A
Rita Rd.	I-10 WB Ramps & Rita Rd.	A	A	F	F	C	C	B	A	C	C
	I-10 EB Ramps & Rita Rd.	C	A	F	F	C	C	A	A	C	C
Houghton Rd.	I-10 WB Ramps & Houghton Rd.	A	A	F	F	B	B	A	A	B	B
	I-10 EB Ramps & Houghton Rd.	A	D	F	F	B	B	B	B	B	C
Wentworth Rd.	I-10 WB Ramps & Wentworth Rd.	A	A	F	F	B	B	B	B	B	A
	I-10 EB Ramps & Wentworth Rd.	A	C	F	F	B	B	B	B	B	B
SR 83	I-10 WB Ramps & SR 83	A	A	F	F	A	B	A	A	A	A
	I-10 EB Ramps & SR 83	A	A	F	F	A	B	A	B	A	B
	SR 83 & Frontage Rd.	A	A	F	F	(2)	(2)	(2)	(2)	(2)	(2)

(1) Currently not an intersection.

(2) Not a future Intersection.

Table 2.10 SR 210 Intersection LOS Summary Table

Traffic Interchange (TI)	Intersection Name	Operational Analysis Scenarios									
		2010 – Existing LOS		2040 – No Build LOS		2040 - System I LOS		2040 - System II LOS		2040 - System IV LOS	
		AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr	AM Peak Hr	PM Peak Hr
Ajo Way	SR 210 SB Ramps & Ajo Way	(1)	(1)	(1)	(1)	B	C	(2)	(2)	B	C
	SR 210 NB Ramps & Ajo Way	(1)	(1)	(1)	(1)	B	B	(2)	(2)	B	B
N/A	SR 210 & Alvernon Way	C	B	C	C	B	B	C	C	B	B
N/A	Alvernon Way & 37th St.	(1)	(1)	(1)	(1)	C	C	B	B	B	B
N/A	Palo Verde Rd. & 37th St.	B	B	A	A	C	C	B	B	C	C
N/A	Palo Verde Rd. & Frontage Rd.	B	B	A	A	B	B	B	B	B	B
N/A	SR 210 & Richey Blvd.	B	B	F	F	C	A	B	A	A	B
N/A	SR 210 & 34th St.	A	A	A	A	B	B	B	A	B	B

(1) Currently not an intersection.

(2) Not a future Intersection.

2.4 Crash Data

Crash Analysis

The 5-year crash data for the period from January 2005 to December 2009 was obtained from ADOT Traffic Safety Section (TSS), for both I-10 and SR210 corridors, within the study area. Crash data will be updated during preparation of the Design Concept Study. Annual Average Daily Traffic (AADT) data for the years 2007-2009 was obtained from ADOT Multimodal Planning Division (MPD), and for the years 2005-2006 was obtained from ADOT Transportation Data Management System (TDMS).

Crash frequencies over the 5-year period were summarized by segment on both I-10 and SR 210 corridors within the study area. Crash rates for total crashes and fatal crashes per million vehicle miles traveled (MVMT) were calculated and summarized by segment and direction. Statewide crash rate averages by functional classification were obtained from ADOT.

The crash data was analyzed to identify operational issues and high crash areas along the I-10 and SR 210 corridors within the study area by comparing the crash rates to statewide averages. Further analysis of the crash data to determine specific causes and identify crash patterns that can be addressed in future designs will be conducted during the Phase II Design Concept Study.

Crash Summary

The crashes for the I-10 and SR 210 corridors for the 5-year period are summarized in **Table 2.7 Summary of Crashes 2005-2009** based on crash severity.

Table 2.11 Summary of Crashes 2005-2009

Location	Crash Severity			
	Fatal	Injury	Property Damage/ None or Possible Injury	Total
I-10 Mainline	18	159	936	1,113
SR 210 Mainline	3	45	122	170

I-10 Corridor: I-19 to SR 83

The total number of crashes for the I-10 study area was 1,113 which included 18 fatal crashes. The remaining crashes were either injury or non-injury crashes. On the I-10 corridor, the segment with the highest number of crashes was from Kino Parkway to Palo Verde Road with a total of 200 crashes for both directions.

Table 2.8 I-10 TIs 5-Year Crash Summary (2005-2009) summarizes the crashes for the mainline within a TI, ramps, frontage roads, and cross streets at each of the TIs on I-10 from I-19 to SR 83 for the 5-year period between 2005 and 2009.

Table 2.9 I-10 Mainline 5-Year Crash Summary (2005-2009) summarizes the crashes and the crash rates for I-10 from I-19 to SR 83 for the 5-year period between 2005 and 2009.

On the I-10 corridor, all of the mainline segments had crash rates lower than the statewide average for an Urban Principal Arterial – Interstate, as shown in **Table 2.9** except:

- The segment from MP 277.0 to MP 278.0 (between Houghton Road and Wentworth Road) has a crash rate 1.30 times higher than the state average in the westbound direction.
- The segment from MP 277.0 to Wentworth Road has a crash rate 1.23 times higher than the state average in the eastbound direction; and a crash rate 1.27 times higher than the state average in the westbound direction.
- The segment from Wentworth Road to SR-83 has a crash rate 1.17 times higher than the state average in the eastbound direction.

The I-10 roadway through all three of the above sections is within the independent roadway section west of SR 83, where the alignment is well within design limits. Most of the crashes were single vehicle, run off the road type crashes. There are no significant anomalies that would appear to cause the crashes. During the Phase II Design Concept Study, a more thorough analysis will be made.

SR 210 Corridor: Broadway Boulevard to Alvernon Way

The total number of crashes for the SR-210 study area was 170 which included 3 fatal crashes. The remaining crashes were either injury or non-injury crashes. On the SR-210 corridor, the segment with the highest number of crashes was from Broadway Boulevard to Kino Parkway with a total of 40 crashes for both directions. The next highest segment, which was from 22nd Street to Country Club Drive, had a total of 33 crashes in both directions.

Table 2.10 SR 210 Mainline 5-Year Crash Summary (2005-2009) summarizes the crashes and the crash rates for SR 210 from Broadway Boulevard to Alvernon Way for the 5-year period between 2005 and 2009.

Table 2.11 SR 210 Intersections 5-Year Crash Summary (2005-2009) summarizes the crashes for SR 210 at each of the intersections and TIs between Broadway Boulevard and Alvernon Way for the 5-year period between 2005 and 2009.

Crashes Involving Wildlife

Arizona Game and Fish Department had expressed a concern about the high frequency of crashes involving wildlife on the I-10 corridor. The 5-year crash data was analyzed in detail to sort crashes involving Wild Animal-Game/Non-Game/Pet. The wildlife related crashes were summarized by segment for the I-10 corridor between I-19 and SR 83.

The segment of I-10 between milepost 278 to SR 83 had the highest number of crashes involving wildlife, as shown in **Table 2.9**.

Table 2.12 I-10 TIs 5-Year Crash Summary (2005-2009)

TI		Number of Crashes											
										Totals			
Crossroad (3)	Exit No.	On Mainline, Within TI Area[1], Not Related to TI	On Mainline, Related to TI	On Ramps or Attached Frontage Road System, Not Related to TI Intersections	At or Related to a Primary TI Intersection	On Cross Street, Not Related to Primary TI Intersections	At or Related to a Detached Frontage Rd Intersection	On Detached Frontage Rd	Unknown	Ramp-Related (Mainline, On a Ramp, or At a TI Intersection)	TI-Related (Ramp-Related + Detached-Frontage-Related)	All Except Mainline	All
Segment 1													
6th Ave	261	58	2	11	85	5	N/A	N/A	0	98	98	101	161
Park Ave	262	39	1	7	22	18	N/A	N/A	1	30	30	48	88
Kino Pkwy	263	83	2	36	175	35	N/A	N/A	0	213	213	246	331
Palo Verde Rd	264	43	6	33	31	135	N/A	N/A	0	70	70	199	248
Alvernon Way	265	59	2	3	72	13	N/A	N/A	0	77	77	88	149
Segment 2													
Valencia Rd	267	53	0	24	51	3	N/A	N/A	0	75	75	78	131
Craycroft Rd	268	69	1	3	23	2	N/A	N/A	0	27	27	28	98
Wilmot Rd	269	54	0	7	**37**	0	N/A	N/A	0	44	44	44	98
Kolb Rd	270	46	1	6	49	1	0	2	0	56	58	58	105
Rita Rd	273	43	1	5	7	0	N/A	N/A	0	13	13	12	56
Houghton Rd	275	25	2	13	44	8	N/A	N/A	0	59	59	65	92
Segment 3													
Wentworth Rd	279	26	0	7	25	0	5	2	0	32	39	39	65
SR 83	281	18	1	7	3	0	2	8	2	11	21	22	41
AVERAGE Segment 1[2]		56.4	2.6	18.0	77.0	41.2	N/A	N/A	0.2	97.6	97.6	136.4	195.4
AVERAGE Segment 2[2]		48.3	0.8	9.7	35.2	2.3	0.0	2.0	0.0	45.7	46.0	47.5	96.7
AVERAGE Segment 3[2]		22.0	0.5	7.0	14.0	0.0	3.5	5.0	1.0	21.5	30.0	30.5	53.0
AVERAGE - All TIs		47.4	1.5	12.5	48.0	16.9	2.3	4.0	0.2	61.9	63.4	79.1	127.9
TOTAL - All TIs		616	19	162	624	220	7	12	3	805	824	1028	1663

Notes:

[1] TI Area is defined as the portion of the mainline between the first and last ramps associated with the TI; may be different for EB and WB

[2] Average per TI (Does not include TIs where category is not applicable - "N/A")

[3] I-10 Segments are divided as follows:

- Segment 1, I-10, 6th Avenue to Alvernon Way is urban in character
- Segment 2, I-10, from Alvernon Way to Houghton Road is urban fringe in character
- Segment 3, I-10, from Houghton Road to SR 83 is rural in character

Table 2.13 I-10 Mainline 5-Year Crash Summary (2005-2009)

Segment			EB						WB						Animal-Related Crashes					
			All Crash Types			Fatal Crashes			All Crash Types			Fatal Crashes			EB		WB		Both Directions	
Beginning TI[1] or MP (7)	Ending TI[1] or MP	Type of Facility[2]	Number of Crashes	Crash Rate *(Crashes per MVMT[3])*	Ratio to Statewide Average[4,6]	Number of Crashes	Fatal Crash Rate *(Fatal Crashes per 100 MVMT[3])*	Ratio to Statewide Average[4,6]	Number of Crashes	Crash Rate *(Crashes per MVMT[3])*	Ratio to Statewide Average[4,6]	Number of Crashes	Fatal Crash Rate *(Fatal Crashes per 100 MVMT[3])*	Ratio to Statewide Average[4,6]	Number of Crashes	Animal Type(s)	Number of Crashes	Animal Type(s)	Number of Crashes	Animal Type(s)
Segment 1																				
I-19[5]	6th Ave	Urban Principal Arterial - Interstate	32	0.506	0.40	0	0.000	0.00	7	0.137	0.11	0	0.000	0.00	0		0		0	
6th Ave	Park Ave	Urban Principal Arterial - Interstate	11	0.184	0.15	0	0.000	0.00	34	0.575	0.45	0	0.000	0.00	0		0		0	
Park Ave	Kino Pkwy	Urban Principal Arterial - Interstate	44	0.759	0.60	0	0.000	0.00	39	0.680	0.54	0	0.000	0.00	0		0		0	
Kino Pkwy	Palo Verde Rd	Urban Principal Arterial - Interstate	103	0.929	0.73	0	0.000	0.00	97	0.875	0.69	3	2.706	3.91	0		1	Pet	1	Pet
Palo Verde Rd	Alvernon Way	Urban Principal Arterial - Interstate	28	0.889	0.70	0	0.000	0.00	11	0.349	0.28	0	0.000	0.00	0		0		0	
Alvernon Way	Valencia Rd	Urban Principal Arterial - Interstate	53	0.463	0.37	1	0.874	1.26	61	0.524	0.41	0	0.000	0.00	1	Wild (Non-Game)	0		1	Wild (Non-Game)
Segment 2																				
Valencia Rd	Craycroft Rd	Urban Principal Arterial - Interstate	35	0.759	0.60	0	0.000	0.00	35	0.787	0.62	2	4.496	6.50	0		0		0	
Craycroft Rd	Wilmot Rd	Urban Principal Arterial - Interstate	37	0.617	0.49	1	1.667	2.41	33	0.546	0.43	0	0.000	0.00	1	Pet	0		1	Pet
Wilmot Rd	Kolb Rd	Urban Principal Arterial - Interstate	24	0.424	0.33	0	0.000	0.00	33	0.583	0.46	0	0.000	0.00	0		1	Wild (Game)	1	Wild (Game)
Kolb Rd	Rita Rd	Urban Principal Arterial - Interstate	33	0.282	0.22	2	1.709	2.47	57	0.481	0.38	3	2.533	3.66	0		1	Wild (Game)	1	Wild (Game)
Rita Rd	Houghton Rd	Urban Principal Arterial - Interstate	40	0.436	0.34	0	0.000	0.00	47	0.512	0.40	1	1.090	1.57	1	Wild (Non-Game)	1	Wild (Non-Game)	2	Wild (Non-Game)
Segment 3																				
Houghton Rd	MP 277.0	Rural Principal Arterial - Interstate	12	0.226	0.40	1	1.885	0.98	26	0.490	0.86	1	1.885	0.98	0		1	Wild (Game)	1	Wild (Game)
MP 277.0	MP 278.0	Rural Principal Arterial - Interstate	11	0.313	0.55	0	0.000	0.00	26	0.740	1.30	0	0.000	0.00	0		1	Pet	1	Pet
MP 278.0	Wentworth Rd	Rural Principal Arterial - Interstate	35	0.701	1.23	0	0.000	0.00	36	0.721	1.27	0	0.000	0.00	2	Wild (Game)	3	Wild (Game)	5	Wild (Game)
Wentworth Rd	SR 83	Rural Principal Arterial - Interstate	44	0.666	1.17	1	1.514	0.79	29	0.439	0.77	2	3.029	1.57	4	Wild (Game) - 3 Wild (Non-Game) - 1	1	Wild (Game)	5	Wild (Game) - 4 Wild (Non-Game) - 1
TOTAL Segment 1		Urban Principal Arterial - Interstate	271	0.619	0.49	1	0.002	0.00	249	0.584	0.46	3	0.007	0.01	1	Wild (Non-Game)	1	Pet	2	Pet - 1 Wild (Non-Game) - 1
TOTAL Segment 2		Urban Principal Arterial - Interstate	169	0.455	0.36	3	0.008	0.01	205	0.551	0.44	6	0.016	0.02	2	Pet - 1 Wild (Non-Game) - 1	3	Wild (Game) - 2 Wild (Non-Game) - 1	5	Pet - 1 Wild (Game) - 2 Wild (Non-Game) - 2
TOTAL Segment 3		Rural Principal Arterial - Interstate	102	0.500	0.88	2	0.010	0.01	117	0.573	1.01	3	0.015	0.01	6	Wild (Game) - 5 Wild (Non-Game) - 1	6	Pet - 1 Wild (Game) - 5	12	Pet - 1 Wild (Game) - 10 Wild (Non-Game) - 1
TOTAL - ALL SEGMENTS			542	0.535	-	6	0.006	-	571	0.570	-	12	0.012	-	9	Pet - 1 Wild (Game) - 5 Wild (Non-Game) - 3	10	Pet - 2 Wild (Game) - 7 Wild (Non-Game) - 1	19	Pet - 3 Wild (Game) - 12 Wild (Non-Game) - 4

Notes:

[1] From/to crossroad overpass or underpass, unless otherwise noted
[2] Facility Functional Classification used for Statewide Average comparison
[3] MVMT = Million Vehicle-Miles Traveled
[4] Statewide average crash rates based on 2003-2006 data provided by ADOT TSS in March 2011
- Statewide Average Crash Rates:
  - Urban Principal Arterial - Interstate (All Crash Types): 1.269 per MVMT
  - Rural Principal Arterial - Interstate (All Crash Types): 0.568 per MVMT
  - Urban Principal Arterial - Interstate (Fatal Crashes): 0.69 per 100 MVMT
  - Rural Principal Arterial - Interstate (Fatal Crashes): 1.92 per 100 MVMT

[5] From the eastmost ramp eastward (does not include the area within the TI)

[6] Ratio to Statewide Average - Legend
- X.XX < 1
- 1 <= X.XX < 1.50
- 1.50 <= X.XX < 2.00
- 2.00<= X.XX

[7] I-10 Segments are divided as follows:
- Segment 1, I-10, from 6th Avenue to Alvernon Way is urban in character
- Segment 2, I-10, from Alvernon Way to Houghton Road is urban fringe in character
- Segment 3, I-10, from Houghton Road to SR 83 is rural in character

Table 2.14 SR 210 Mainline 5-Year Crash Summary (2005-2009)

Segment			EB						WB					
			All Crash Types			Fatal Crashes			All Crash Types			Fatal Crashes		
Beginning Crossroad[1]	Ending Crossroad[1]	Type of Facility[2]	Number of Crashes	Crash Rate *(Crashes per MVMT[3])*	Ratio to Statewide Average[4,5]	Number of Crashes	Fatal Crash Rate *(Fatal Crashes per 100 MVMT[3])*	Ratio to Statewide Average[4,5]	Number of Crashes	Crash Rate *(Crashes per MVMT[3])*	Ratio to Statewide Average[4,5]	Number of Crashes	Fatal Crash Rate *(Fatal Crashes per 100 MVMT[3])*	Ratio to Statewide Average[4,5]
Broadway Blvd	Kino Pkwy	Urban Principal Arterial - Other	8	0.370	0.135	0	0.000	0.00	32	1.478	0.540	0	0.000	0.00
Kino Pkwy	22nd St	Urban Principal Arterial - Other	19	1.383	0.506	1	7.279	4.38	3	0.218	0.080	0	0.000	0.00
22nd St	Country Club Dr	Urban Principal Arterial - Other	25	1.079	0.395	0	0.000	0.00	8	0.345	0.126	0	0.000	0.00
Country Club Dr	34th St	Urban Principal Arterial - Other	4	0.288	0.105	0	0.000	0.00	19	1.368	0.500	0	0.000	0.00
34th St	Richey Blvd	Urban Principal Arterial - Other	1	0.161	0.059	0	0.000	0.00	9	1.449	0.530	0	0.000	0.00
Richey Blvd	Dodge Blvd	Urban Principal Arterial - Other	9	1.755	0.642	2	39.003	23.48	10	1.950	0.713	0	0.000	0.00
Dodge Blvd	Alvernon Way	Urban Principal Arterial - Other	2	0.308	0.112	0	0.000	0.00	8	1.231	0.450	0	0.000	0.00
Alvernon Way	End of SR 210	Urban Principal Arterial - Other	10	1.731	0.633	0	0.000	0.00	3	0.519	0.190	0	0.000	0.00
TOTAL			78	0.812	0.297	3	0.031	0.02	92	0.958	0.350	0	0.000	0.00

Notes:

[1]From/to crossroad overpass or underpass, unless otherwise noted
[2]Facility Functional Classification used for Statewide Average comparison
[3]MVMT = Million Vehicle-Miles Traveled
[4]Statewide average crash rates based on 2003-2006 data provided by ADOT TSS in March 2011
-- Statewide Average Crash Rates:
Urban Principal Arterial - Other (All Crash Types): 2.736 per MVMT
Urban Principal Arterial - Other (Fatal Crashes): 1.661 per 100 MVMT
[5]Ratio to Statewide Average - Legend
X.XX < 1
1 <= X.XX < 1.50
1.50 <= X.XX < 2.00
2.00<= X.XX

Table 2.15 SR 210 Intersections 5-Year Crash Summary (2005-2009)

Intersection	Number of Crashes										
Crossroad	On Mainline, Not Related to Crossroad	On Mainline, Related to Crossroad	On Mainline, Related to Ramps	On Crossroad, Not Related to TI	On Crossroad, Related to TI	On Crossroad, Related to Ramps	Totals				
							Not Intersection Related	Intersection Related	Ramp Related	Unknown	All
Broadway Blvd	4	37	2	0	29	0	4	66	2	2	74
Kino Pkwy	10	8	0	21	73	0	31	81	0	6	118
22nd St	10	54	2	14	9	0	24	63	2	2	91
Country Club Rd	14	85	0	0	4	0	14	89	0	1	104
34th St	8	26	0	4	0	0	12	26	0	0	38
Richey Blvd	13	24	0	0	16	0	13	40	0	0	53
Dodge Blvd	7	10	0	0	0	0	7	10	0	0	17
Alvernon Way	9	2	0	0	0	0	9	2	0	0	11
Golf Links Rd	9	2	0	0	0	0	9	2	0	0	11
AVERAGE	9.3	27.6	0.4	4.3	14.6	0.0	13.7	42.1	0.4	1.2	57.4
TOTAL	84	248	4	39	131	0	123	379	4	11	517

3 ALTERNATIVES CONSIDERED

3.1 Introduction

The primary objective of the Feasibility Report Update of improvements to I-10 and the extension of SR 210 is to identify and evaluate additional alternatives for the improvement of I-10 between the I-10/I-19 System Interchange and SR 83 to accommodate updated design year 2040 traffic at an acceptable level of service. Alternatives for the I-10 improvement include both the extension of SR 210 from Golf Links Road to a connection with I-10, and improvements to the I-10 mainline roadway and TIs, in accordance with AASHTO and ADOT RDG requirements. Improvements to I-10 through the I-10/I-19 TI and to the north and west of the TI are not addressed in this study.

The Traffic Report prepared as part of the studies for the improvement of I-10 analyzed three No-Build concepts including (1) no lane improvements to I-10 and no extension of SR 210 to intersect with I-10, (2) improving only I-10, and (3) only extending SR 210. The conclusion was that both improvement of I-10 and extension of SR 210 to a connection with I-10 are required to provide to provide improved mobility and an acceptable level of service on both highways for the 2040 design year. See **Section 2. Traffic and Crash Data** of this **Feasibility Report Update.**

Improvements to I-10 and the extension of SR 210 to a connection with I-10 will be based primarily on developing the capacity to carry the projected 2040 design year traffic demand as identified via macro-level traffic modeling. This will require determining the number of lanes in each direction needed for mainline I-10 with the SR 210 extension. Improvements will include improving existing conditions, such as; short weaving distances (especially regarding successive loop ramps), TIs spaced closer than the desirable one mile spacing, and short driver decision-making distances. This Feasibility Report Update will also include consideration of modified configurations of TIs and the mainline roadways.

Per ADOT Roadway Design Guidelines, LOS D is the design criteria in urban conditions for I-10 and SR 210 mainline and ramp roadways, and for ramp/crossroad intersections. LOS B is the design criteria for rural conditions. The sections of I-10 between I-19 and SR 83 as well as SR 210 within the study area are considered urban in character for design year 2040.

The alternative development and evaluation process for I-10 first determines projected traffic demand and identifies capacity problems under a 'No-Build' scenario. Revisions to existing conditions needed to accommodate the projected traffic demand at an adequate Level of Service will be identified.

The extension of SR 210 will be based primarily on alternative connection points with I-10 and the resulting alignments for the extension of SR 210. The process of alternative development starts with the identification of the alternative connection points. Then an alignment for the extension of SR 210 from Golf Links Road to the connection point for each alternative is developed and evaluated. Each alternative requires a major TI with Alvernon Way/Golf Links Road on the west end and a system interchange with I-10 on the east end. An alternative to incorporate collector-distributor roadways with the I-10 mainline roadways has been identified to separate traffic entering and exiting I-10 from I-10 mainline through traffic.

Pima County has advised that consideration should be given to extending half-mile minor arterial or major collector streets across I-10 between I-10 TIs. to improve the connectivity of neighborhoods across I-10 and relieve the traffic volume of arterial streets at TIs. This request was outside the current scope of work but could be explored in Phase II at appropriate locations.

3.2 Level 1 Alternative Identification

Alternatives for the extension of SR 210 are based on different connection points of SR 210 to I-10. The resultant alignments for the extension of SR 210 and the modifications to I-10 are then identified and evaluated. The Level 1 process identifies alternative locations along I-10 for the connection of the SR 210 extension. Alternatives alignments for the extension of SR 210 are then identified and evaluated to determine fatal flaws that may eliminate some of the connection points. The fatal flaws consist of factors that prohibit locating the SR 210 roadway in particular areas.

Only those alternatives that are feasible will be carried forward into the Level 2 Analysis. Evaluation criteria include, but are not limited to:

- Support the major interchange of SR 210 with Alvernon Way/Golf Links Road.
- Avoid major impacts to Davis-Monthan AFB.
- Avoid major environmental, social and economic impacts identified along the alignment.
- Support the system interchange with I-10.
- Support local interchanges adjacent to the system interchange.

Six initial connection locations to I-10 were identified and evaluated using the criteria listed above. A seventh alternative that modified the configuration of I-10 was also identified and evaluated.

System Alternative I

System Alternative I is the improvement of I-10 and the extension of SR 210 with the connection of SR 210 to I-10 at Alvernon Way. See **Figure 3.1 System Alternative I.**

- SR 210 would be extended south along the Alvernon Way alignment, to a system interchange with I-10.
  - A diamond interchange would be provided at the junction of SR 210 and Ajo Way.
  - SR 210 overpass structures would be provided at the intersection of E. Michigan St. and the intersection of E. Irvington Rd.
  - A system interchange would be integrated with the diamond interchange movements at the junction of Alvernon Way and I-10.
  - Additional ROW would be required for SR 210, the SR 210/Golf Links interchange, the SR 210/Ajo Way interchange and the I-10/SR 210 system interchange.
  - There are no apparent major environmental, social or economic impacts identified with the SR 210 extension to a connection with I-10 at Alvernon Way.

System Alternative II

System Alternative II is the improvement of I-10 and the extension of SR 210 with the connection of SR 210 to I-10 located approximately one-half mile west of the existing Valencia Road diamond interchange. See **Figure 3.2 System Alternative II.**

- SR 210 would be extended southerly through the Alvernon Way/Golf Links TI, where it turns to the east along the southern edge of DMAFB, and then south along the Swan Road alignment to a system interchange with I-10.
  - The alignment of the extension of SR 210 along DMAFB crosses a triangular corner of the DMAFB property near Irvington Road. A site identified as "IRP" by DMAFB is located within the triangular piece of property. During the Phase II Design Concept Study a determination will be made as to whether the IRP site must be avoided or what measures may be necessary to allow the SR 210 extension to pass through the site.

Figure 3.1 System Alternative I

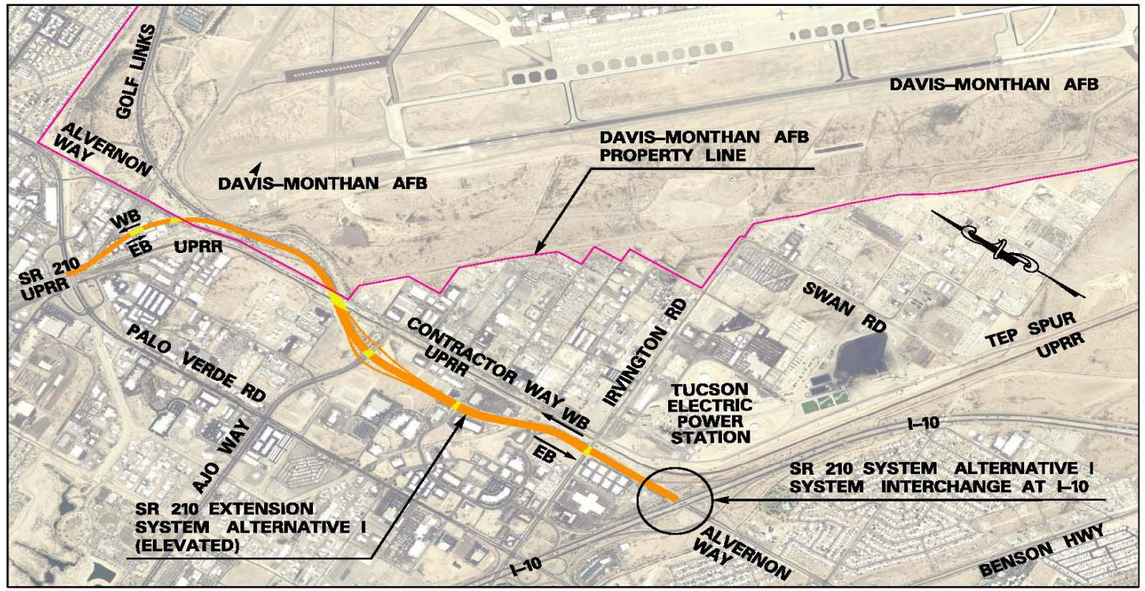


Figure 3.2 System Alternative II

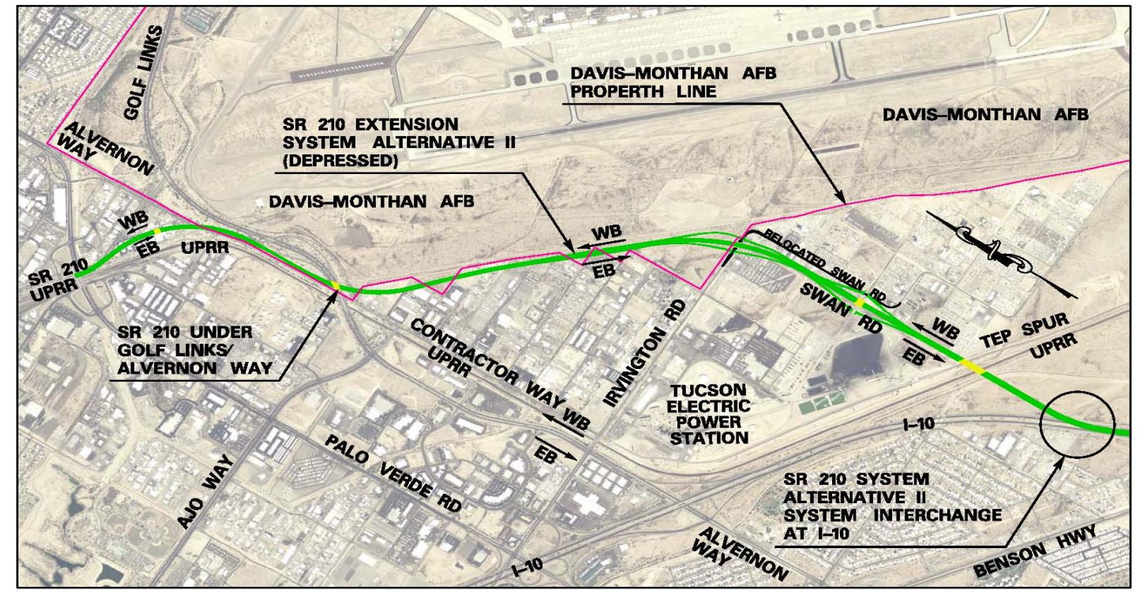


Figure 3.3 System Alternative III, IIIa and IIIb

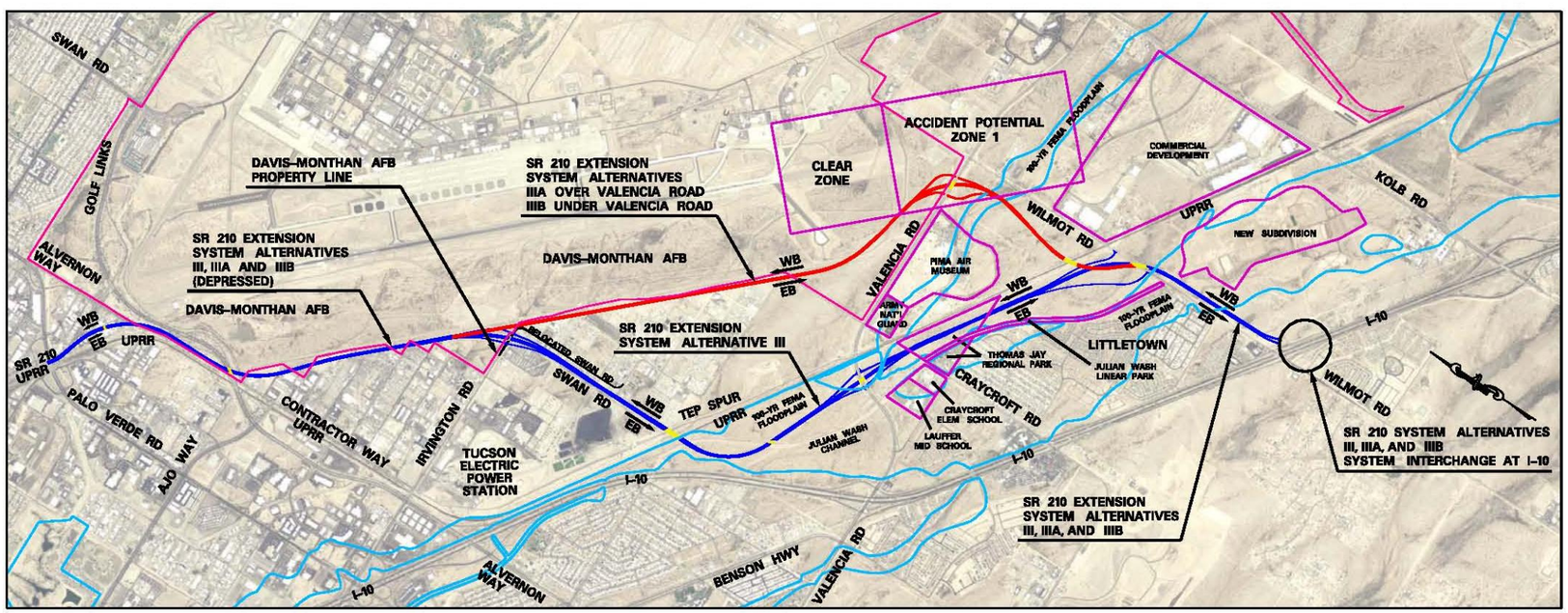


Figure 3.4 System Alternative IIIc

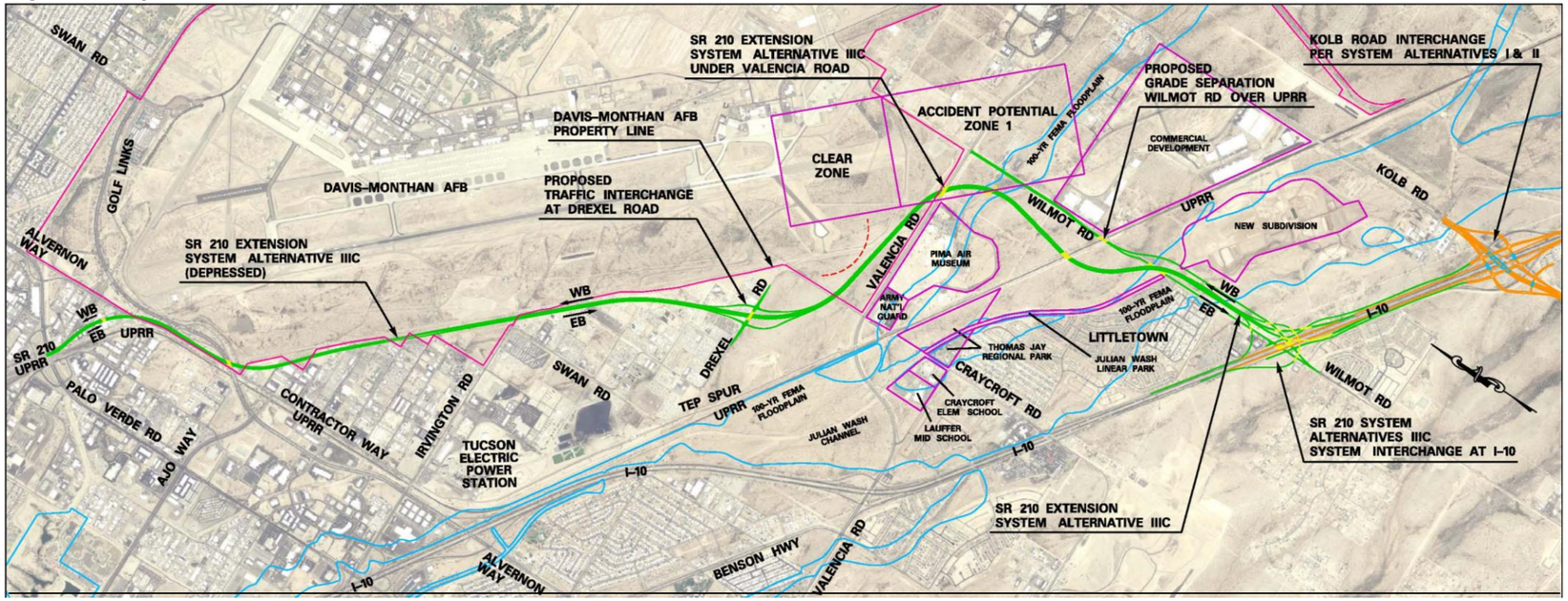
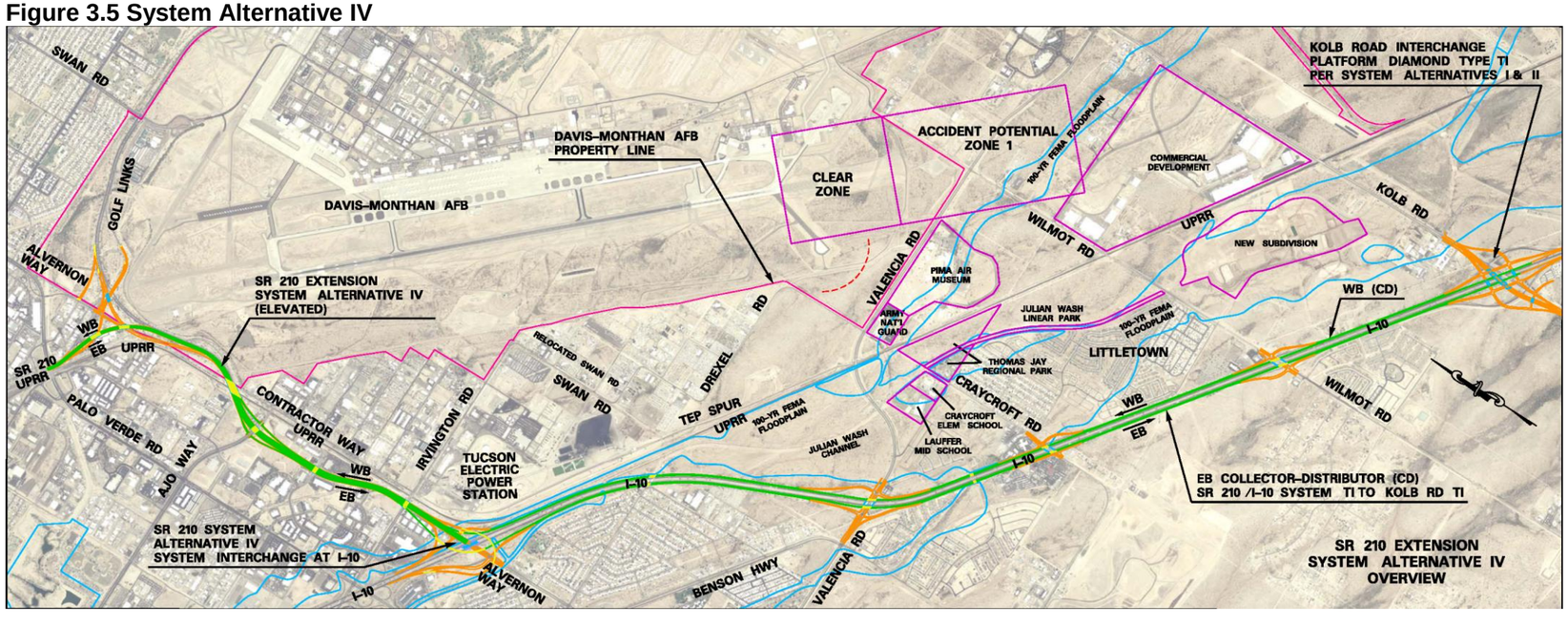


Figure 3.5 System Alternative IV



- The system interchange with I-10 would be located approximately one-half mile west of the existing Valencia Road diamond interchange.
- Irvington Road would be elevated over SR 210 and a diamond TI would be constructed for access to Irvington Road and Swan Road.
- The alignment of SR 210 would pass through business and industrial properties, and would be elevated over the UPRR.
- The SR 210 vertical alignment would be depressed for much of the route including a portion under a major wash located just south of Valencia Road.
- Additional ROW would be required for SR 210, the SR 210/Golf Links TI, the Irvington Road TI and the I-10/SR 210 system interchange.
- There are no apparent major environmental, social or economic impacts identified with the SR 210 extension to a connection with I-10 west of Valencia Road.

System Alternative III

System Alternative III is the improvement of I-10 and the extension of SR 210 to a connection of SR 210 to I-10 at Wilmot Road. See **Figure 3.3 System Alternative III, IIIa and IIIb** and **Figure 3.4 System Alternative IIIc.**

SR 210 would be extended southerly through the Alvernon Way/Golf Links TI, where it turns to the east along the southern edge of Davis-Monthan AFB, and then south along the Swan Road alignment across the UPRR tracks, similar to System Alternative II. However, after crossing the UPRR tracks, the alignment would parallel the UPRR to Wilmot Road. The alignment would cross over and parallel Wilmot Road on the east side to a connection with I-10.

- System Alternative III was eliminated because:
  - The horizontal alignment that parallels the UPRR passes through Thomas Jay Regional Park (a Section 4f issue). If the alignment is moved to the south to miss the Regional Park it would pass through Craycroft Elementary School and Lauffer Middle School, and would also pass through a residential development and conflict with the Julian Wash.
  - If Federal funding is used it would be necessary to obtain approval of a Section 4f environmental impact to the park. Since other alternatives to the extension of SR 210 have been identified that would not impact the park or other 4f properties, it would not be possible to obtain approval of using the park property. It is unlikely that construction of the extension of SR 210 without federal funding would be considered. In addition, it is unlikely the County would agree to use of the park property for highway right-of-way.

System Alternatives IIIa and IIIb

System Alternative IIIa and System Alternative IIIb are modifications of System Alternative III. They both include the improvement of I-10 and the extension of SR 210 to a connection of SR 210 to I-10 at Wilmot Road using a different alignment for SR 210 to bypass the environmental concerns associated with System Alternative III. System Alternative IIIa and IIIb use the same horizontal alignment, but different vertical alignments. System Alternative IIIa crosses over Valencia Road, while System Alternative IIIb crosses under Valencia Road. See **Figure 3.3 System Alternative III, System Alternative IIIa and System Alternative IIIb.**

- SR 210 would be extended southerly through the Alvernon Way/Golf Links TI and turn to the southeast along the southern edge of DMAFB. Just east of Craycroft Road the alignment would turn to the east to avoid the Pima Air Museum, and would then turn to the south, crossing Valencia Road east of the Pima Air Museum. It then crosses a FEMA 100-year floodplain, crosses over the UPRR, and continues south along the east side of Wilmot Road to a connection with I-10.
- System Alternative IIIa and IIIb were eliminated because:
  - The horizontal alignment turns into the DMAFB property near Craycroft Road, passing through a section of the base north of Valencia Road and through the existing security perimeter.
    - The alignment would pass within the restricted radius of a hazardous object pad that is located within the DMAFB area, to the north of Valencia Road and east of Craycroft Road. Location of the roadway within 1,250-ft. of the hazardous object pad is not permitted. The alignments of System Alternatives IIIa and IIIb are approximately 700-ft. from the hazardous object pad, which will not be allowed.
    - The alignments cross the southeast corner of the runway Clear Zone which is not allowed.
    - The alignments are within the Accident Potential Zone (APZ) area and Approach Departure Corridor. Passing through this area would probably require a high level of scrutiny and approval from the Air Force. Development within the APZ surface is limited in height. The vertical clearance climbs at a rate of 1-ft. per 20-ft. However, even if development is within the vertical limit, there is concern about security. Any development would have to be separated from the air base by physical barriers.
    - The alignments are located within Military Munitions Response Program (MMRP) areas. No construction is allowed in these areas until any MMRP issues are mitigated. This is a multi-year process.
  - The horizontal alignment would require utilizing maximum degrees of curvature and high superelevation rates for the roadway. If an interchange is provided at Valencia Road the ramps would be located on the curve having a delta angle of approximately 90 degrees. The horizontal alignment when combined with steep grades to go over or under Valencia Road presents engineering challenges and traffic operational problems. This is not a desirable approach for designing a new high speed limited access corridor and would not meet driver expectation.
  - The connection to I-10 would result in SR 210 functioning more like an arterial/collector roadway as outlined above for System Alternative III.

The possibility of realigning System Alternatives IIIa and/or IIIb to avoid the constraints with using DMAFB restricted areas was reviewed.

- Modifying the horizontal alignment to curve to the south to avoid the clearance radius for the hazardous object pad; then turn the alignment to the east between the clearance radius and Valencia Road was considered. It was determined that this alignment, along with the need for a traffic interchange at Valencia Road, would still be within the MMRP area and would require crossing a substantial area of the Pima Air Museum. This alignment was deemed to be unacceptable.
- Modifying the horizontal alignment to curve to the south prior to entering the restricted areas of DMAFB, and then continuing to the east on the north side of the UPRR right-of-way was reviewed. This alignment would take property from the Army National Guard located just north of the UPRR and would also take property from the Pima Air Museum. The alignment would require turning to the south and crossing Valencia Road and the UPRR to align the roadway with Wilmot Road. An interchange with Valencia Road would still be required. The vertical and horizontal alignment to accomplish this was determined to not be feasible.

System Alternative IIIc

System Alternative IIIc is a further modification of System Alternative III which was identified after it was determined that System Alternatives IIIa and IIIb were not acceptable and were eliminated from further consideration. System Alternative IIIc would include the improvement of I-10 and the extension of SR 210 to a connection of SR 210 to I-10 at Wilmot Road. See **Figure 3.4 System Alternative IIIc**.

- System Alternative IIIc would utilize a horizontal alignment for SR 210 that roughly parallels the south side of Davis-Monthan AFB from Alvernon Way to Swan Road. The alignment would then turn to the south and cross under Drexel Road. It would then turn back to the east past the Pima Air Museum and then turn to the south again and cross under Valencia Road. After crossing under a major wash just south of Valencia Road, the vertical alignment would climb to cross over the UPRR. The profile would stay elevated and cross over Wilmot Road and intersect I-10 with a system interchange.
- A new traffic interchange would be constructed at the crossing of SR 210 and Drexel Road. The local road system would provide access between SR 210 and Valencia Road via the traffic interchange at Drexel Road.
- Wilmot Road would be split into a couplet south of I-10 to facilitate turning movements at I-10 with a split diamond concept. The split diamond interchange would be integrated with the I-10 / SR 210 System Interchange.

  The Wilmot Road couplet would continue to the north of I-10 just beyond the 100-year FEMA Floodplain. The couplet roadways would merge into a two-direction roadway just south of the UPRR. Wilmot Road would be elevated and cross over the UPRR, eliminating the existing grade crossing.

System Alternative IIIc was developed in response to the Pima County Department of Transportation request for the extension of SR 210 that joins I-10 at or near Wilmot Road. System Alternative IIIc would avoid the Thomas Jay Regional Park, the Craycroft Elementary School and the Lauffer Middle School.

DMAFB reviewed the preliminary concept of System Alternative IIIc. Their review identified some concerns that would have to be overcome.

- System Alternative IIIc was eliminated because the cost of System Alternative IIIc will be substantially higher than either System Alternative I or II. Additional costs would include:
  - Additional construction and right-of-way costs because of the additional length of the corridor.
  - System Alternative IIIc would require relocation of approximately 50 more residences than either System Alternative I or II.
  - There would be numerous conflicts with utilities located within local streets that would be crossed by System Alternative IIIc.
  - Right-of-way acquisition would be required from DMAFB.
  - The alignment of System Alternative IIIc passes near areas on DMAFB where explosive ordinance is removed from aircraft, creating a likely danger to users of the roadway if accidental explosions occurred.
  - The alignment of the roadway near DMAFB would need to be checked for unexploded ordinance.
  - Other costs associated with impacting a longer, highly developed corridor.

System Alternative IV

Subsequent to the Approval of the Feasibility Report dated October 2012 by ADOT, an additional alternative, **System Alternative IV**, was identified for the improvement of I-10 and SR 210 within the project area.

System Alternative IV is the extension of SR 210 south along the Alvernon Way alignment to I-10 and the addition of collector-distributor (CD) roadways adjacent to both the eastbound and westbound I-10 mainline roadway from Alvernon Way easterly through the Kolb Road TI.

- A system interchange will provide access between SR 210 and the eastbound and westbound I-10 CD roadways. The system interchange will be integrated with the diamond interchange movements at the junction of Alvernon Way and I-10.
- The eastbound CD roadway is a continuation of the southbound SR 210 roadway.
- A ramp will be provided to allow vehicles on eastbound I-10 to exit I-10 and enter the eastbound CD roadway.
- The eastbound CD roadway will end with a taper into the eastbound I-10 mainline roadway at the Kolb Road TI.
- The westbound CD roadway will separate from the westbound I-10 mainline within the limits of the Kolb Road TI.
- The westbound CD roadway will curve to the north approaching Alvernon Way and become the northbound SR 210 roadway.
- A ramp will be provided to allow vehicles on the westbound CD roadway to exit the CD roadway and enter westbound I-10.
- The eastbound and westbound CD roadways will be separated from the eastbound and westbound I-10 mainline roadways by concrete barriers.
- Traffic interchanges will provide access between the CD roadways and major cross streets at Valencia Road, Craycroft Road, Wilmot Road and Kolb Road within the limits of the CD roadways.
- Additional right-of-way will be required for SR 210, the SR 210/Golf Links TI, the Ajo Way TI, and the I-10/SR 210 system interchange. Because of the additional width of the CD roadways along I-10, some additional right-of-way may be required along I-10.

Other I-10/SR 210 Connection Locations:

- The connection at Craycroft Road was eliminated because;
  - It bisected the community of Littletown and impacted both Lauffer Middle School and Craycroft Elementary School.
  - The system interchange ramps would conflict with the Valencia Road/I-10 TI, which would require the removal of the Valencia Road/I-10 TI ramps. Valencia Road is a major east-west arterial/parkway that requires full access with I-10.
- The connections at Kolb Road and Rita Road were eliminated because:
  - Alternatives that connect SR 210 with I-10 at Kolb Road and Rita Road share the alignment alternatives described above for System Alternative III east of Swan Road. Therefore, the SR 210 connections with I-10 at Kolb Road and Rita Road were eliminated.

Analysis of projected traffic on I-10 in the design year 2040 showed there would be only marginal improvements in I-10 traffic if the SR 210 connection with I-10 was extended to the east of Wilmot Road. This analysis reduces the value of alternative connections of SR 210 to I-10 east of Wilmot Road. See the Initial Traffic Report for further details.

3.3 Level 2 Alternative Analysis

The level 2 analysis includes:

- A determination of the traffic handling capability of each alternative, using design year traffic projections.
- Identification of impacts to surrounding areas resulting from each alternative.

- A rough estimate of cost based on conceptual configuration of the roadway.
- Other factors as identified during the study process.

3.3.1 System Alternative I

System Alternative I extends SR 210 southerly along the existing Alvernon Way alignment to I-10. See **Appendix C**. The extension is classified as an urban freeway and is elevated from north of the UPRR overpass to south of Irvington Road. Access to Ajo Way is provided via a diamond TI. SR 210 is grade-separated over Irvington Road.

The SR 210/Alvernon Way/Golf Links TI provides all traffic movements except access to Contractors Way. Access to Contractors Way is provided from SR 210 via the Ajo Way TI, then east on Ajo Way across the at-grade RR crossing just west of Contractors Way.

The horizontal layout of the SR 210 extension avoids conflicts with UPRR right-of-way. All new roadways are within or just west of the existing Golf Links/Alvernon Way roadways between Palo Verde Road and the UPRR overpass. All new elevated roadways are at approximately the same elevation as elevated Golf Links Road. Therefore, horizontal and vertical impacts to Davis-Monthan AFB are avoided.

SR 210 between Golf Links Road and I-10 is a minimum of four lanes in each direction to accommodate both SR 210 through traffic and local traffic to either Alvernon Way or Golf Links Road.

SR 210 mainline between Golf Links Road and the I-10/SR 210 system interchange at Alvernon Way will have LOS B or better, both AM and PM in 2040.

The SR 210 ramps between Golf Links Road and the I-10/SR 210 system interchange will have LOS B or better, both AM and PM in 2040.

The system interchange with I-10 lies on top of and incorporates the existing diamond TI at Alvernon Way and I-10.

- To complete the diamond TI, the westbound I-10 exit ramp to Palo Verde Road is eliminated and a new westbound entrance ramp from Alvernon Way is added.
- The major movements between I-10 and SR 210 (Ramps S-E, W-N, S-W, and E-N) are provided by directional ramps associated with the system interchange.
- The diamond TI ramps serve to provide access for the minor movements between I-10 and Alvernon Way (E-S and W-S).
- Directional Ramps S-E and W-N are a minimum of two lanes each to accommodate the heavy traffic volume demand between I-10 and SR 210.

I-10 will have four mainline lanes in each direction from I-19 easterly to Kino Parkway, three mainline lanes in each direction from Kino Parkway to the I-10/SR 210 system interchange at Alvernon Way, and five mainline lanes in each direction east of the I-10/SR 210 system interchange at Alvernon Way to Kolb Road. The need for five mainline lanes in each direction to the east of the I-10/SR 210 system Interchange reflects the additional traffic that enters I-10 via TI's with arterial roadways to the east, and then the reduction in traffic on I-10 due to traffic exiting at the SR I-10/SR 210 system interchange. East of Kolb Road the number of mainline I-10 lanes in each direction gradually reduces from four lanes to two lanes at Wentworth Road.

3.3.2 System Alternative II

This alternative extends SR 210 southerly through the Alvernon Way/Golf Links TI, where it turns to the east along the southern edge of Davis-Monthan AFB, and then south along the Swan Road alignment to I-10. See **Appendix D**. The system interchange with I-10 is located approximately one-half mile west of the existing Valencia Road diamond interchange.

The SR 210/Alvernon Way/Golf Links interchange provides all traffic movements except access to Contractor Way. Access to Contractor Way is provided from SR 210 via an interchange at Irvington Road, approximately one mile east of Contractor Way.

The horizontal alignment avoids conflicts with UPRR right-of-way in the Golf Links Road/Alvernon Way area. All new roadways are within or just west of the existing Golf Links/Alvernon Way roadways between Palo Verde Road and the UPRR overpass. All new elevated roadways are at approximately the same elevation as elevated Golf Links Road. Therefore, horizontal and vertical impacts to Davis-Monthan AFB are avoided.

SR 210 between Palo Verde Road and I-10 is a minimum of two lanes in each direction. SR 210 is grade-separated over both the Tucson Electric Power RR Spur and UPRR tracks.

Both WB and EB SR 210 west of Golf Links Road will have LOS C or better for both the AM and PM in 2040.

WB SR 210 mainline between Golf Links Road and the I-10/SR 210 system interchange west of Valencia Road will have LOS C or better, for the AM and LOS B or better for the PM in 2040. EB SR 210 will operate at LOS A during the AM peak hour and at LOS B or better during the PM peak hour.

The SR 210 ramps between Golf Links Road and the I-10/SR 210 system interchange will have LOS B or better for the AM and LOS C or better for the PM in 2040.

Because of the proximity of the proposed system interchange to the existing diamond TI at Valencia Road, the Valencia Road and Craycroft Road ramps will be incorporated into the system interchange to provide access to/from both I-10 and SR 210 from all ramps. See **Appendix D**. The major movements between I-10 and SR 210 (Ramps S-E, W-N, S-W, and E-N) are provided by directional ramps associated with the system interchange. Directional ramps S-E and W-N are a minimum of two lanes each to accommodate the heavy traffic volume demand between I-10 and SR 210.

I-10 will have four mainline lanes in each direction from I-19 easterly to Kino Parkway, three mainline lanes in each direction from Kino Parkway to the I-10/SR 210 system interchange *w*est of Valencia Road, four mainline lanes in each direction between the I-10/SR 210 system interchange and Valencia Road, and five mainline lanes in each direction east of Valencia Road to Kolb Road. The need for five mainline lanes in each direction to the east reflects the additional traffic that enters I-10 via TI's with arterial roadways to the east, and then the reduction in traffic on I-10 due to traffic exiting at the SR I-10/SR 210 System Interchange. East of Kolb Road the number of mainline I-10 lanes in each direction gradually reduces from four lanes to two lanes at Wentworth Road.

3.3.3 System Alternative IV

System Alternative IV extends SR 210 southerly along the existing Alvernon Way alignment to I-10 similar to System Alternative I. See **Appendix E**. The extension is classified as an urban freeway and is elevated from north of the UPRR overpass to south of Irvington Road. Access to Ajo Way is provided via a diamond TI. SR 210 is grade-separated over Irvington Road.

The SR 210/Alvernon Way/Golf Links TI provides all traffic movements except access to Contractors Way. Access to Contractors Way is provided from SR 210 via the Ajo Way TI, then east on Ajo Way across the at-grade RR crossing just west of Contractors Way.

The horizontal layout of the SR 210 extension avoids conflicts with UPRR right-of-way. All new roadways are within or just west of the existing Golf Links/Alvernon Way roadways between Palo Verde Road and the UPRR overpass. All new elevated roadways are at approximately the same elevation as elevated Golf Links Road. Therefore, horizontal and vertical impacts to Davis-Monthan AFB are avoided.

SR 210 between Golf Links Road and I-10 is a minimum of four lanes in each direction to accommodate both SR 210 through traffic and local traffic to either Alvernon Way or Golf Links Road.

SR 210 mainline between Golf Links Road and the I-10/SR 210 System interchange at Alvernon Way will have LOS B or better during the AM and LOS C or better during the PM in 2040.

The SR 210 ramps between Golf Links Road and the I-10/SR 210 System Interchange will have LOS B or better, both AM and PM in 2040. The System Interchange with I-10 lies on top of and incorporates the existing diamond TI at Alvernon Way and I-10.

- To complete the diamond TI, the westbound I-10 exit ramp to Palo Verde Road is eliminated and a new westbound entrance ramp from Alvernon Way is added.
- The major movements between I-10 and SR 210 (Ramps S-E, W-N, S-W, and E-N) are provided by directional ramps associated with the System Interchange.
- The diamond TI ramps serve to provide access for the minor movements between I-10 and Alvernon Way (E-S and W-S).
- Directional Ramps S-E and W-N are a minimum of two lanes each to accommodate the heavy traffic volume demand between I-10 and SR 210.

I-10 will have four mainline lanes in each direction from I-19 easterly to Kino Parkway and three mainline lanes in each direction from Kino Parkway to the I-10/SR 210 system interchange at Alvernon Way.

East of the I-10/SR 210 System Interchange CD roadways will be added adjacent to both the EB and WB I-10 mainline roadways. The CD roadways will begin as extensions of the SR 210 NB and SB roadways and will continue to the east, ending at the Kolb Road TI.

The EB and WB I-10 mainline roadways will have three lanes in each direction and the EB and WB I-10 CD roadways will have two lanes in each direction between the I-10/SR 210 System Interchange and Kolb Road. East of Kolb Road the number of mainline I-10 lanes in each direction gradually reduces from four lanes to two lanes at Wentworth Road. The LOS of both the mainline roadways and the CD roadways will be LOS C or better

The need for additional lanes in each direction to the east reflects the additional traffic that enters I-10 via TI's with arterial roadways to the east, and then the reduction in traffic on I-10 due to traffic exiting at the SR I-10/SR 210 System Interchange.

3.3.4 Modifications to Existing I-10

Modifications to existing I-10 from I-19 to SR 83 are required to provide an acceptable LOS for design year 2040. The modifications include improvements to both the I-10 mainline roadway and to the existing I-10 TIs within the project limits.

The modifications to existing I-10 will be similar for both System Alternative I and System Alternative II with the following exceptions:

- The number of mainline I-10 lanes will be different between the locations of the junction of I-10/SR 210 with System Alternative I and the junction of I-10/SR 210 with System Alternative II.
- The Alvernon Way TI and the Valencia Road TI will be different for System Alternative I than for System Alternative II.

The modifications to existing I-10 with System Alternative IV will be similar to the modifications to existing I-10 with System Alternative I and System Alternative II from I-19 to Alvernon Way and from Kolb Road to SR 83. From Alvernon Way to Kolb Road, Alternative IV will:

- Modify I-10 mainline roadways to incorporate CD roadways parallel to the eastbound and westbound I-10 mainline roadways.
- The Alvernon Way TI, the Valencia Rd. TI, the Craycroft Rd. TI, the Wilmot RD TI, and the Kolb Rd. TI will connect with the I-10 CD roadways.

Evaluation Process for Existing I-10 Mainline and TIs

Using the 2040 PAG Forecast Traffic Volumes for peak hour traffic volumes and 'Synchro' micro-modeling software, traffic capacity problems at TIs are identified wherever levels of service are low using the existing crossroad and ramp configurations. Solutions are then identified and tested by re-running the micro-model with the proposed solution coded into the software. This iterative process is repeated until an adequate solution is produced.

Since the 'Synchro' micro-modeling software is used at individual TIs, regional solutions are checked by combining the 'Synchro' solutions as a 2040 Build scenario and running it within the PAG Model.

Once the 2040 Build scenario is validated, the combined solution is presented to the project stakeholders. Stakeholder comments that impact the design solution are addressed by developing revised solutions and checking them through the micro-modeling process. The resulting combined solution is checked using VISSIM regional micro-modeling software. This identifies levels of service and numbers of lanes for mainline I-10, ramps, crossroads, and turn lanes.

All initial 'Synchro' micro-modeling runs and solutions involve a default of a standard diamond type TI. If micro-modeling indicates that a diamond type TI will not adequately function, other TI types are tested. **Section 3.3.5** describes each TI and required improvements.

I-10 Capacity

The results of traffic modeling indicate that in 2040 four lanes will be required in each direction on I-10 between the I-10/I-19 System Interchange and Kino Parkway and three lanes will be required in each direction on I-10 from Kino Parkway to the I-10/SR 210 System Interchange for all alternatives being considered. East of the I-10/SR 210 System Interchange, the number of lanes on I-10 vary to accommodate the traffic demand and range from six to two lanes in each direction. Auxiliary lanes are required between successive entrance and exit ramps.

The configuration of the I-10 mainline roadway varies with consideration of System Alternative IV which introduces CD roadways along the I-10 mainline from Alvernon Way to Kolb Road.

Because of the relatively close spacing between the alternative locations of the I-10/SR 210 System Interchange, traffic demand on I-10 is relatively the same for System Alternative I, System Alternative II and System Alternative IV. This means that traffic volumes and the number of mainline I-10 lanes both west and east of the SR 210 System Interchange are similar for System Alternative I, and System Alternative II. The traffic volumes for System Alternative IV are the same as for System Alternatives I and II; however, the configurations of the mainline roadways and ramp connections between the I-10 mainline and crossroads at traffic interchanges are different for System Alternative IV because of the introduction of the CD lanes.

I-10 mainline lanes will vary as follows:

- From the I-19 interchange easterly to the Kino Parkway interchange I-10 will have four mainline lanes in each direction.
- From the Kino Parkway interchange easterly to the I-10/SR 210 System Interchange I-10 will have three mainline lanes in each direction.
- Between the Alvernon Way interchange and the Valencia Road interchange I-10 will have the following number of mainline lanes in each direction for the alternatives under consideration:
  - System Alternative I: The I-10/SR 210 system interchange is at Alvernon Way. The I-10 mainline will have five lanes in each direction.
  - System Alternative II: The I-10/SR 210 system interchange is located approximately ½ mile west of the I-10/Valencia Road TI. The I-10 mainline will have three lanes in each direction between Alvernon Way and the I-10/SR 210 system interchange, and five lanes in each direction between the I-10/SR 210 system interchange and the Valencia Road TI.

  - System Alternative IV: Three mainline lanes plus two CD lanes in each direction.

- Between Valencia Road and Craycroft Road, I-10 System Alternative I will have five lanes in each direction, System Alternative II will have five mainline lanes in each direction and System Alternative IV will have will have three mainline lanes plus two CD lanes in each direction.
- Between Craycroft Road and Wilmot Road I-10 System Alternatives I and II will have five mainline lanes in each direction. System Alternative IV will have three mainline lanes plus two CD lanes in each direction.
- Between Wilmot Road and Kolb Road I-10 System Alternatives I and II will have four eastbound mainline lanes and five westbound mainline lanes. System Alternative IV will have three mainline lanes plus two CD lanes in each direction.
- Between Kolb Road and Houghton Road I-10 System Alternatives I, II and IV will have four mainline lanes in each direction.
- From Houghton Road to Colossal Cave Road/Wentworth Road I-10 System Alternatives I, II and IV will have three mainline lanes in each direction.
- From Colossal Cave Road/Wentworth Road easterly to the end of the project I-10 System Alternatives I, II and IV will have two lanes in each direction.

Auxiliary lanes will be required along both the eastbound and westbound I-10 roadways in addition to the mainline through lanes

I-10 will have LOS C or better in both directions through the limits of the project.

The western project limits of this study are at the I-10/I-19 System Interchange. Physical constrictions prevent I-10 widening north of the south ramps to/from 29th Street and potential widening solutions are not addressed in this study. The eastbound entrance ramp from 29th Street becomes the 4th eastbound general purpose lane on I-10. The 4th westbound general purpose lane on I-10 becomes a mandatory exit to 29th Street.

I-10 Right-of-Way

The areas adjacent to I-10 from I-19 to approximately 7,000-feet (1.3 miles) east of Kolb Road are developed with both commercial and residential development along I-10. The existing I-10 ROW corridor is quite narrow and there is very little unused ROW between the existing outer edges of the roadways and the ROW lines.

Input from Stakeholders indicated a desire to widen the existing roadways to the outside where feasible. However, preliminary layout of additional lanes for the I-10 mainline roadway and the reconfiguration of TI ramps indicates that within the limits discussed above from I-19 to approximately 7000-feet (1.3 miles) east of Kolb Road, it will be necessary to widen the I-10 mainline roadways into the median to the extent feasible to reduce the impact to adjacent properties that would occur if all widening is done to the outside of the existing roadways.

From the above location east of Kolb Road to the end of the project, just beyond the SR 83 TI there is little development adjacent to the existing I-10 ROW. Through this area widening I-10 to the outside of the existing roadways will be feasible.

Additional ROW will be required along I-10 where TIs and frontage roads are being modified.

I-10 Median

At the west end of the project, existing I-10 has a closed median with Portland Cement Concrete Pavement (PCCP) and a concrete median barrier located at median centerline. Through the horizontal curve over Park Avenue, the existing median changes from the closed median to an open median that separates the eastbound and westbound roadways. The open median continues throughout the remainder of the project, past the SR 83 TI.

Because of the need to minimize the impact on adjacent developed areas, it may be necessary to extend the closed median from Park Avenue east to approximately 7,000 feet (1.3 miles) east of Kolb Road at the end of an existing two-way frontage road along a developed area that restricts right-of-way. East of this location, widening of the I-10 mainline roadway to the outside appears to be feasible. A final determination of the location of the transition from a closed median to an open median should be made during the Phase II Design Concept Study.

I-10 TI Spacing

In urban conditions, TIs should nominally be one mile apart. This provides distance to develop adequate weaving distances associated with auxiliary lanes that normally occur between successive entrance and exit ramps. Since I-10 cuts angularly across the local street grid system with major arterials on one mile spacing, the distances between TIs are nominally more than one mile apart; typically 1.4 miles. However, the location of some existing TIs results in distances between TIs of less than one mile.

- Park Avenue TI is approximately 0.7 miles from both 6th Avenue TI and Kino Parkway TI.
- Craycroft Road TI is approximately 0.85 miles from the Valencia Road TI.
- Palo Verde Road TI is approximately 0.6 miles from the Alvernon Way TI.

Elimination of these TIs is not practical, as they provide needed access to local businesses and governmental services. Therefore, reconfiguration of TI ramps is needed to maintain access, yet maximize weaving distances and safety for the traveling public. The Palo Verde Road TI can be removed and a new TI at Country Club Road is needed and will be added. Country Club Road is located approximately 1.2 miles from Kino Boulevard TI and Alvernon Way TI. The ramps for the TIs at Park Avenue and Craycroft Road will be relocated to eliminate the weaving issues and improve safety for the traveling public. See **Section 3.3.5. I-10 TI Modifications** for the Park Avenue TI and Craycroft Road TI modifications concerning the ramps. All other TIs within the project limits meet or exceed the minimum one mile spacing criteria.

During the Phase II Design Concept Study, a Change of Access Report will be prepared that details traffic operations and addresses FHWA policy requirements for new or revised access points to the interstate system.

3.3.5 I-10 TI Modifications

Each of the existing TIs within the project limits was evaluated from a capacity and safety standpoint to determine needed improvements. The evaluation process involved:

- Using the projected 2040 peak hour traffic volumes and micro-modeling software to identify problem areas or movements that have unacceptable levels of service.
- Identifying solutions.
- Testing solutions by re-running the micro-model with the proposed solutions coded into the software.
- Repeating the iterative process until adequate solutions are produced.

Solutions typically involve enlarging the crossroads and ramp termini at the crossroads; providing additional through-lanes and turn-lanes to accommodate the higher traffic demand.

The existing TIs are typically diamond type TIs.

Where right-of-way is limited, tight diamond TIs are used. The tight diamond TIs can remain, subject to turning radius checks to be performed during the Phase II Design Concept Study.

- There are three partial cloverleaf TIs that will be modified to eliminate successive loop ramps. The successive loop ramps provide

inadequate weaving distances, limiting capacity and creating safety issues.

- There are several spread diamond TIs, mostly in the more rural sections east of Wilmot Road. Spread diamonds will be converted to standard diamond types to reduce right-of-way requirements unless there are reasons for retaining the spread configuration.

The existing TIs will be tested for capacity as diamond TIs with approximately 600 feet between the ramp termini, unless conditions dictate a different spacing. Where diamond TIs cannot provide the needed capacity, modifications will be made to develop the capacity. See **Appendix C** for plan views of the new and modified TIs.

A description of improvements for each existing and new TI is included below. Improvements meet the capacity and operational requirements, but are not necessarily the final recommended solution. That is to be determined in the Phase II Design Concept Study. Refer to **Appendix B** for projected traffic volumes on crossroads at each TI.

I-10/6th Avenue TI (MP 260.99)

The existing diamond type TI has four ramps that provide full access between I-10 and 6th Avenue. See plan sheets 1 and 2 of 2040 Improvements – System Alternatives I, II and IV in **Appendices C, D and E**.

- The eastbound entrance ramp from 6th Avenue is interrelated with the eastbound exit ramp from I-10 to Park Avenue via a weave on the frontage road.
- The existing westbound exit ramp from I-10 to 6th Avenue is interrelated with the entrance ramp from Park Avenue to I-10 via a short weave along mainline I-10.
- The 6th Avenue westbound exit ramp will be relocated to the east side of Park Avenue with grade separated crossings over the westbound exit ramp to Park Avenue and over Park Avenue.
- I-10 is fully depressed and passes under 6th Avenue.
- 6th Avenue across I-10 has two through lanes and single left turn lanes in each direction between the ramp termini. The City of South Tucson has advised that the outside pedestrian fencing on the 6th Avenue underpass bridge over I-10 has artistic enhancements that should be incorporated into any bridge widening or replacement.

Traffic modeling evaluations determined that the diamond TI at 6th Avenue functions adequately, but will need additional through and turn lanes on the crossroad. (Check updated Traffic Report).

Existing 6th Avenue has many signalized intersections and pedestrian crossings that are spaced relatively close together. The existing posted speed limit is 35 mph. The PAG Model cannot accurately depict these conditions, thus resulting in unrealistically higher volumes at the I-10/6th Avenue TI. Further evaluation of volumes and impacts upon improvements should be performed during the Phase II Design Concept Study. It is probable that the projected traffic volumes on 6th Avenue can be reduced, which would result in needing less improvement. This may also impact the need for 6th Avenue bridge replacement versus bridge widening.

The existing 'U-turn' ramp that connects the eastbound and westbound frontage roads provides access under I-10 in the vicinity of the UPRR crossing under I-10.

The vertical clearance under the I-10 bridge does not meet current design criteria. The need to retain this ramp should be determined during the Phase II Design Concept Study.

Ramp changes that are needed at the Park Avenue TI impact the 6th Avenue westbound exit ramp. Those changes are discussed under the following I-10/Park Avenue TI discussion.

I-10/Park Avenue TI (MP 261.72)

The existing partial cloverleaf TI has four ramps that provide full access between I-10 and Park Avenue. See plan sheet 2 of 2040 Improvements – System Alternatives I, II and IV in **Appendix C, D and E**.

- The weave along I-10 between the westbound loop entrance ramp and the exit ramp to 6th Avenue is too short.
- The eastbound exit ramp intersects Park Avenue approximately 600 feet south of I-10 with a signalized intersection, and becomes the west end of Benson Highway.
- Benson Highway crosses Park Avenue at a 45 degree skew angle. Therefore, left turns onto northbound Park Avenue are a sharp 135 degrees, which is not desirable.
- At I-10, Park Avenue has three through lanes and a single left turn lane in each direction. The outside northbound lane becomes the loop ramp. To the north, the curb line is continued for three lanes to the intersection with the westbound ramps, but the outside lane is striped for non-usage.

Modifications to the Park Avenue TI were identified and evaluated through the iterative process described previously.

- The loop ramp from Park Avenue to westbound I-10 will be replaced with a diamond entrance ramp from Park Avenue to westbound I-10. This converts the partial cloverleaf TI to a diamond type TI.
- The new westbound entrance ramp from Park Avenue results in an unacceptable length of weave between the entrance ramp and the existing exit ramp to 6th Avenue, necessitating moving the westbound exit ramp to 6th Avenue to the east of Park Avenue.
- The Park Avenue westbound exit ramp must be relocated to the east. To eliminate weaving with the westbound entrance ramp from Kino Parkway, the exit ramp to Park Avenue is relocated just inside the existing north right-of-way for I-10 to east of Kino Parkway and it 'braids' under Kino Parkway and the Kino entrance ramp to avoid weaving and improve safety.
- The eastbound exit ramp from I-10 to Park Avenue currently connects with the Benson Highway. That connection will remain and an additional connection will be extended to Park Avenue. This removes traffic from the skewed intersection with Benson Highway and improves traffic operations and safety.

Park Avenue will have 3-through lanes and single left-turn lanes in each direction. Existing Park Avenue has adequate width for this configuration.

Additional study will be required during the Phase II Design Concept Study to finalize the lane configurations.

I-10/Kino Parkway TI (MP 262.53)

Kino Parkway is one of four continuous major north-south arterials/parkways from south of I-10 into central and north Tucson that does not encounter a physical obstacle, such as the UPRR switching yard and Davis Monthan AFB. As such, the I-10/Kino Parkway TI is a major intermediate destination for traffic from the south and southeast part of the Tucson Metropolitan area to access downtown Tucson.

The existing partial cloverleaf TI provides access between I-10, Kino Parkway, and Ajo Way. See plan sheet 3 of 2040 Improvements – System Alternatives I, II and IV in **Appendix C, D and E**. Through traffic on all three roadways are grade-separated. The majority of access to and from I-10 is through TI ramps. The Ajo Way Connector between Kino Parkway and Ajo Way in the northeast quadrant provides access to and from westbound I-10 and Kino Parkway.

A diamond TI was evaluated through the iterative process described above.

- A direct connection for westbound I-10 traffic to Kino Parkway without using the Ajo Way Connector was used.
  - This new diamond ramp required the removal of the two existing ramps between westbound I-10 and Ajo Way.
  - The westbound access to and from Ajo Way is relocated to a new TI at Country Club Road.
- The eastbound I-10 exit loop ramp is removed and replaced with a new I-10 exit ramp west of Kino Parkway
  - The eastbound exit ramp is grade-separated over the new eastbound entrance ramp from Park Avenue.

  - The ramp terminus is located as far north as possible along Kino Parkway to increase the weave distance down to the left turn lanes onto Benson Highway.
- The southbound Kino Parkway to eastbound I-10 loop ramp was originally removed as a part of the effort to remove all loop ramps. However, the traffic simulations indicated that the heavy southbound left turn demand from Kino Parkway to eastbound I-10, along with the heavy northbound through traffic demand on Kino Parkway, causes the intersection of Kino Parkway and the I-10 eastbound entrance and exit ramps to fail.

  Therefore, a loop ramp is used to remove the southbound left-turn traffic from the ramp terminal intersection. The existing loop ramp will be modified to operate more safely. The loop ramp will merge with the diamond ramp. The ramp merge onto eastbound I-10 will be moved to the east to provide adequate length.

Kino Parkway will have three lanes in each direction Left turn lanes will be used for the northbound Kino Parkway to westbound I-10 movement.

Traffic modeling evaluations determined that the TI will function adequately as a diamond TI with the loop ramp. The modeling also indicates that both TI intersections operate at a satisfactory LOS for all conditions.

Additional study is needed during the Phase II Design Concept Study to finalize the TI configuration.

I-10/Country Club Road TI (MP 263.82)

A new diamond TI will be located at Country Club Road to replace the existing Palo Verde Road TI. See sheet 4 of 2040 Improvements – System Alternatives I, II and IV in **Appendix C, D and E**. Design criteria for skew angles of ramps at the crossroad will impact both the spacing between ramp termini and ramp alignments.

Traffic modeling evaluations determined that the diamond TI will function adequately, by providing three lanes and dual left turn lanes in each direction on the crossroad with external storage needed for the left turn lanes.

I-10/Palo Verde Road TI (MP 264.37)

The existing TI at the junction of I-10 and Palo Verde Road will be removed. See sheet 5 of 2040 Improvements – System Alternatives I, II and IV in **Appendix C, D and E**.

The proposed TI at I-10 and Country Club Road will provide access for traffic that currently uses the Palo Verde TI.

The existing eastbound frontage road on the south side of I-10 will remain. The intersection of the frontage road and Palo Verde Road will be modified to a "T" intersection to provide access from both northbound and southbound Palo Verde Road.

I-10/Alvernon Way TI (MP 265.02)

Alvernon Way is one of four continuous major north-south arterials/parkways from south of I-10 into central and north Tucson that does not encounter a physical obstacle, such as the UPRR switching yard and Davis Monthan AFB. The I-10/Alvernon Way TI is a major connector for traffic from the south and southeast part of the Tucson Metropolitan area to access central and downtown Tucson.

Alvernon Way is the location for two of the alternatives to connect SR 210 to I-10 (System Alternative I and System Alternative IV), covered in Section 3.3.1 and Section 3.3.3 of this report. If System Alternative I or System Alternative IV is selected, the Service TI discussed here would be integrated with a System Interchange as discussed for System Alternative I and System Alternative IV in the following subsections of this report.

If System Alternative II is selected, the I-10/Alvernon Way TI would be modified as discussed in the following paragraphs, but would not have to be integrated with a System Interchange.

The existing partial diamond TI has three ramps, but does not provide full access between I-10 and Alvernon Way. See sheet 6 of **Existing Conditions** in **Appendix A**. There is no existing westbound entrance ramp from Alvernon Way to westbound I-10.

The initial evaluation involved retaining the existing TI, with the following changes:

- The westbound entrance ramp would be added.
- The westbound exit ramp would be reconfigured to provide access to southbound Alvernon Way.
- The eastbound exit ramp will be reconfigured to improve the angle at the intersection with Alvernon Way.

Traffic modeling evaluations determined that the TI will function adequately as a diamond TI with three lanes in each direction plus left turn lanes on the crossroad. The modeling evaluations also indicate that both intersections will operate at LOS B, but external storage for left turns is needed. While existing curb locations do not support the external storage, there may be sufficient distance between the center bridge pier and the abutments to accommodate the additional lanes. Additional study is needed during the Phase II Design Concept Study to determine the final need for the external storage while providing an adequate LOS and to determine if the needed lanes will fit within the bridge opening.

I-10/SR 210 – System Alternative I Interchange (MP 265.02)

Under System Alternative I, SR 210 will be extended south along the Alvernon Way alignment to a System Interchange with I-10. Improvements to the existing diamond TI and crossroad, as listed above, will be performed. See sheets 5 and 6 of 2040 Improvements - System Alternative I in **Appendix C**.

Additional ROW will be required for the extension of SR 210.

The new system interchange will be integrated with and placed on top of the diamond service TI. The system interchange will include four new directional ramps.

Traffic modeling evaluations determined that the system interchange will function adequately, with the directional ramps serving I-10 to/from SR 210. Ramps S-E and W-N are major two-lane ramps. Ramp S-W and E-N are shown as one-lane ramps The diamond ramps will serve I-10 to Alvernon Way, especially to the south.

Portions of the new system interchange are within the existing Julian Wash floodplain and are adjacent to Los Ninos Elementary School and Los Ninos Park. Impacts to the floodplain, school and park should be studied in more detail during the Phase II Design Concept Study.

I-10/SR 210 – System Alternative II Interchange (MP 266.3)

Under System Alternative II, SR 210 will be extended to the east and will turn to the south, roughly along the Swan Road alignment, to intersect with I-10 west of the existing Valencia Road TI. See sheets 7 and 8 of 2040 Improvements – System Alternative II in **Appendix D**. The new system interchange will involve four new directional ramps and four minor ramps. Mainline SR 210 and Ramp S-W will cross over the UPRR and the Tucson Electric Power spur railroad tracks.

Additional ROW will be required for the extension of SR 210.

Traffic modeling evaluations determined that the system interchange will function adequately, with the directional ramps serving I-10 to/from SR 210. Ramps S-E and W-N are major two-lane ramps. Ramp S-W and E-N are shown as one-lane ramps The minor ramps provide full access from/to I-10 and SR 210 to/from Valencia Road and Craycroft Road.

The proximity of the I-10/SR 210 System Alternative II Interchange to Valencia Road will require ramps for the System Interchange to be integrated with ramps for the diamond interchange at Valencia Road as shown on sheets 7 and 8 of 2040 Improvements – System Alternative II in **Appendix D.**

A private development project, named Valencia Crossing Project, has been submitted to the City of Tucson. If the project is approved and implemented it would affect System Alternative II.

The majority of the system interchange is within the Julian Wash floodplain and will be on either high embankments or structures.

Further study regarding the proposed Valencia Crossing project and impacts to the Julian Wash floodplain will be needed during the Phase II Design Concept Study.

I-10/SR 210 – System Alternative IV Interchange (MP 265.02)

Under System Alternative IV, SR 210 will be extended south along the Alvernon Way alignment to a System Interchange with I-10. Improvements to the existing diamond TI and crossroad, as listed above, will be performed. See sheets 5 and 6 of 2040 Improvements - System Alternative IV in **Appendix E**.

Additional ROW will be required for the extension of SR 210.

The new system interchange will be integrated with and placed on top of the diamond service TI. The system interchange will include four new directional ramps.

Traffic modeling evaluations determined that the system interchange will function adequately, with the directional ramps serving I-10 to/from SR 210. Ramps S-E and W-N are major two-lane ramps that connect SR 210 and the I-10 CD roadways. Ramp S-W and E-N are shown as one-lane ramps. The diamond ramps will serve I-10 to Alvernon Way, especially to the south.

Portions of the new system interchange are within the existing Julian Wash floodplain and are adjacent to Los Ninos Elementary School and Los Ninos Park. Impacts to the floodplain, school and park should be studied in more detail during the Phase II Design Concept Study.

I-10/Valencia Road TI (MP 267.10)

The existing diamond TI has four ramps that provide full access between I-10 and Valencia Road. See sheet 8 of 2040 Improvements - System Interchange I in **Appendix C** and sheet 8 of 2040 Improvements – System Interchange IV in **Appendix E.**

As noted above the ramps for the I-10/Valencia Road TI will be integrated with the ramps for the I-10/SR 210 System Interchange II.

There are existing eastbound and westbound frontage roads between the Valencia Road and Craycroft Road TIs. There are no access driveways onto the eastbound frontage road. There are a few access driveways onto the westbound frontage road near Craycroft Road. The frontage roads will be removed. Further study may be required during the Phase II Design Concept Study to determine how best to provide access to adjacent properties. If properties would become landlocked by removing the frontage roads a decision will have to be made to provide alternative access or purchase access rights to the properties.

Traffic modeling evaluations determined that the existing diamond TI will function adequately by widening Valencia Road to provide three through lanes and dual left turn lanes in each direction. The increase in the width of Valencia Road will require the replacement of the existing I-10 bridges.

As discussed below, System Alternatives I, II and IV show the Craycroft Road eastbound exit ramp is relocated westerly to west of Valencia Road and crosses Valencia Road at grade and separates from the Valencia Road entrance ramp east of Valencia Road.. The Craycroft Road westbound entrance ramp is relocated westerly to just east of Valencia Road where it merges with the Valencia westbound exit ramp and continues across Valencia Road at grade and joins the Valencia Road westbound entrance ramp.

I-10/Craycroft Road TI (MP 268.08)

The existing tight diamond type TI has four ramps that provide full access between I-10 and Craycroft Road. See sheets 8 and 9 of 2040 Improvements – System Alternatives I, II and IV in **Appendix C, D and E**. There are commercial properties in three of the four quadrants of the TI, including the TTT truck stop in the northwest quadrant. The four-span I-10 overpass structures accommodate two lanes in each direction on the crossroad.

There are eastbound and westbound frontage roads between the Craycroft Road and Wilmot Road TIs. There are no access driveways onto the eastbound frontage road. There are a few access driveways onto the westbound frontage road near Wilmot Road. The frontage roads will be removed. Further study may be required during the Phase II Design Concept Study to determine how best to provide access to adjacent properties. It may be feasible to relocate these accesses to Wilmot Road. If properties would become landlocked by removing the frontage roads a decision will have to be made to provide alternative access or purchase access rights to the properties.

Due to the short distance between the Valencia Road and Craycroft Road TIs, back-to-back diamond TIs with auxiliary lanes will not function adequately, as the length of the auxiliary lanes will be too short. Therefore, the eastbound exit and westbound entrance ramps for Craycroft Road will be relocated westerly to just west of Valencia Road to provide for the Craycroft ramps to merge with the Valencia ramps and cross Valencia Road at grade.

Traffic modeling evaluations determined that the existing tight diamond TI functions adequately, by providing two lanes and single left turn lanes in each direction on Craycroft Road. The increase in crossroad width will require the replacement of the existing I-10 bridges. The westbound exit ramp will be realigned to improve the skew angle at the crossroad.

The conceptual improvements will retain the tight diamond configuration to minimize right-of-way acquisitions from the developed properties. However, this restricts the distance between the ramp terminals and limits left turn storage capacity. Further evaluation of truck turning radii, required left turn storage, and other elements is required during the Phase II Design Concept Study.

I-10/Wilmot Road TI (MP 269.36)

The existing tight diamond type TI has four ramps that provide full access between I-10 and Wilmot Road. See sheet 10 of 2040 Improvements – System Alternative I, II and IV in **Appendix C, D and E**. The four-span I-10 overpass structure only accommodates two lanes in each direction on the crossroad.

There are eastbound and westbound frontage roads between the Wilmot Road and Kolb Road TIs. There are no access driveways onto the eastbound frontage road. There are a few access driveways onto the westbound frontage road for utility facilities. It is intended to relocate these access points to the local street system and remove both the eastbound and westbound frontage roads. Further study may be required during the Phase II Design Concept Study to determine how best to provide access to adjacent properties.

Traffic modeling evaluations determined that the existing tight diamond TI functions adequately, by providing two lanes in each direction on Wilmot Road with a single left turn lane for the south to east movement and a double left turn lane for the north to west movement. The increase in crossroad width will require the replacement of the existing I-10 bridges. All ramps will be realigned to improve the skew angles at the crossroad.

The conceptual improvements will retain the TI in a tight configuration to minimize right-of-way acquisitions. However, this restricts the distance between the ramps and internal left turn storage. Further evaluation of truck turning radii, required left turn storage, and other elements is required during the Phase II Design Concept Study.

I-10/Kolb Road TI (MP 270.58)

The existing spread diamond type TI has four ramps that provide full access between I-10 and Kolb Road. See sheet 11 of 2040

Improvements – System Alternatives I, II and IV in **Appendix C, D and E**.

The I-10 CD roadways utilized in System Alternative IV terminate within the limits of the Kolb Road TI.

The PAG identified improvements to Kolb Road as a needed but unfunded improvement south of I-10. The improvement would extend Kolb Road to the south of I-10 and tie it into Wilmot Road. Kolb Road will then be identified as a Parkway and will be one of four continuous major north-south arterials/parkways from south of I-10 into central and north Tucson that does not encounter a physical obstacle, such as the UPRR switching yard and Davis Monthan AFB. The I-10/Kolb Road TI is a major connector for traffic from the southeast part of the Tucson Metropolitan area to access downtown Tucson via I-10 and north Tucson via Kolb Road. The major traffic movements at the TI are shown in **Appendix B.**

The combination of heavy through volumes on Kolb Road and heavy opposing turn volumes will create significant operational problems. Initial traffic modeling evaluations were performed with different types of TIs; diamond, single point urban (SPUI), and divergent diamond. None of these resolved the operational problems; particularly due to the projected heavy through volumes on Kolb Road. Finally, a diverging diamond TI with separate roadways for through traffic was developed and evaluated. It was determined that it functioned with a typical LOS of A. With this configuration, the Kolb Road mainline roadways are separated from the Kolb Road ramp connections. The ramp connections tie into a separate roadway that crosses I-10 and is centered between the northbound and southbound Kolb Road roadways. I-10 remains at ground level. The Kolb Road mainline roadways and the centered roadway that connects to the I-10 ramps are one level above I-10. The separated northbound and southbound mainline Kolb Road roadways carry only through traffic. Turning movements are restricted to the center roadway. Therefore, the turning movements do not interfere with the through movements. All ramps that connect to the center roadway are standard diamond type ramps.

East of Kolb Road, a two-way frontage road serves properties along the south side of I-10. The west end of the frontage road intersects Kolb Road approximately 300-ft. south of the existing ramp intersection. The frontage road parallels I-10 and ends approximately 7,000-ft. (1.3 miles) east of Kolb Road.

To retain the two-way frontage road and avoid new right-of-way, I-10 is shifted to the north. This also allows for the retention of the access point onto Kolb Road. However, due to the new interchange configuration, a new south connector is required to provide full access to/from the frontage road. The connector intersects with the center roadway, but passes under the northbound Kolb Road mainline roadway in a two-lane box structure. Additional access for the two-way frontage road could be established by the City of Tucson on the east end by extending Pantano Road north to the frontage road.

The ramp connector roadways and Kolb Road mainline roadways merge just south of IBM Road, a significant east-west arterial. Further evaluation is needed in the Phase II Design Concept Study to provide turning movements between Kolb Road and IBM Road.

I-10/Rita Road TI (MP 273.14)

The existing spread diamond TI has four ramps that provide full access between I-10 and Rita Road. See sheet 13 of 2040 Improvements – System Alternatives I, II and IV in **Appendix C, D and E**. The four-span bridge over I-10 has piers next to I-10 edges of pavement that are in conflict with I-10 widening (either closed or open median). Ramp geometry does not meet current design criteria. The TI will be revised to a standard diamond TI to improve geometrics. The ramps will be realigned to improve skew angles at the crossroad.

The increase in crossroad width along with the conflicts with existing bridge pier locations will require the replacement of the bridge over I-10.

Traffic modeling evaluations determined that the reconfigured diamond interchange functions adequately by providing three lanes and dual left turns in each direction on Rita Road.

I-10/Houghton Road TI (MP 275.49)

The existing spread diamond type interchange has four ramps that provide full access between I-10 and Houghton Road. See sheet 15 of 2040 Improvements – System Alternatives I, II and IV in **Appendix C, D and E**. The four-span bridge over I-10 has piers next to I-10 edges of pavement that are in conflict with I-10 widening (either closed or open median). Ramp geometry does not meet current design criteria.

Houghton Road is one of four continuous major north-south arterials/parkways from south of I-10 into central and north Tucson that does not encounter a physical obstacle, such as the UPRR switching yard and Davis Monthan AFB. The I-10/Houghton Road TI is a major connector for traffic from the southeast part of the Tucson Metropolitan area to access downtown Tucson via I-10 and east Tucson via Houghton Road. Recommended improvements at the interchange are:

- The interchange will be revised to a diverging diamond interchange to improve geometrics. The northbound and southbound through roadways will cross at the ramp terminals on both sides of I-10, thus reversing the direction of the through roadways within the limits of the TI. The ramps will be realigned to improve skew angles at the crossroad.
- The increase in crossroad width along with the conflicts with existing bridge pier locations will require the replacement of the bridge over I-10.

Traffic modeling evaluations determined that the diverging diamond interchange functions adequately by providing three lanes and dual left turns in each direction on Houghton Road.

Pima County has requested that Houghton Road be realigned to roughly follow the section line as shown in the plan sheets in **Appendix C, D and E**. This will be evaluated in the Phase II Design Concept Study.

I-10/ Colossal Cave / Wentworth Road TI (MP 279.37)

The existing spread diamond TI has four ramps that provide full access between I-10 and Colossal Cave/Wentworth Road. See sheet 18 of 2040 Improvements – System Alternatives I, II and IV in **Appendix C, D and E**. The TI is located where I-10 has an extra wide median, resulting in two bridges over I-10. Both of the three-span bridges have piers next to I-10 edges of pavement that are in conflict with I-10 widening. Ramp geometry does not meet current design criteria.

The TI will be revised to a standard diamond TI to improve geometrics. The wider crossroad width along with the pier issue will require the replacement of both bridges over I-10. The crossroad will be realigned to improve skew angles with the ramps.

Traffic modeling evaluations determined that the reconfigured diamond TI functions adequately by providing two lanes and left turns in each direction on Colossal Cave/Wentworth Road.

The frontage road along the north side of I-10 in the vicinity of the Colossal Cave/Wentworth Road will be reconstructed to align with the future local street network.

There are horizontal curves in the crossroad to the south that may impact the alignment of Colossal Cave/Wentworth Road. Horizontal alignment alternatives will be identified and evaluated during the Phase II Design Concept Study.

I-10/ SR 83 TI (MP 281.68)

The existing trumpet TI has four ramps that provide full access between I-10 and SR 83. See sheet 20 of 2040 Improvements – System Alternatives I, II and IV in **Appendix C, D and E**. The four-span bridge has piers next to I-10 edges of pavement that are in conflict with I-10 widening, especially for outside widening. Ramp geometry does not meet current design criteria. The connection of the existing two-way frontage road to the trumpet ramp does not meet current design criteria.

Indications from stakeholders are that future development north of I-10 will be occurring in the near future. The existing trumpet interchange does not provide for extending the crossroad to the north and using the existing connector to the frontage road is inappropriate. Therefore, the interchange will be revised to a standard diamond TI to provide access to the north and to improve ramp geometrics. Northbound SR 83 to westbound I-10 traffic will be converted from the free-flow trumpet ramp to a left turn onto a standard diamond ramp. The crossroad will be extended north of the TI; the extent to be determined during the Phase II Design Concept Study.

Traffic modeling evaluations determined that the reconfigured diamond TI functions adequately by providing two lanes and left turns in each direction on SR 83. The use of dual northbound left turns keeps northbound SR 83 traffic flowing at LOS B. To eliminate the dual left turns, a flyover ramp would be needed.

The existing two-way frontage road on the north side of I-10 on both the east and west side of SR 83 will be removed and relocated to align with the future local street network.

The existing two-way frontage road in the southwest quadrant will be shifted to provide proper offset from eastbound I-10. The frontage road will also be extended to tie into SR 83 opposite the Old SR 83 roadway to create a new intersection. Realignment of the frontage road will require new right-of-way.

3.4 Alternatives for Further Consideration

As discussed in **Section 3.2** of this Feasibility Report, it has been determined that System Alternatives III, IIIa, IIIb and IIIc are eliminated and will not be carried forward for further study.

System Alternative IV was identified to provide CD roadways between Alvernon Way and Kolb Road to improve access between I-10 and SR 210 and to extend the improved access between I-10 and the local street system easterly. System Alternative IV is described in **Section 3.2** of this report.

Therefore, to summarize:

Three alternatives will be carried forward to the Phase II Design Concept Study for further consideration:

- I-10/SR 210 System Alternative I
- I-10/SR 210 System Alternative II
- I-10/SR 210 System Alternative IV

Additional analysis of all alternatives being carried forward will be required during the Phase II Design Concept Study.

The weaving distance along I-10 between the I-19 ramps and 6th Avenue is short. Consideration may be given to eliminating the I-10 ramps to 29th Street and 22nd Street.

Consideration may be given to including underpasses or overpasses of I-10 at half-mile minor arterial or major collector streets in the transportation planning to improve north/south connectivity in addition to the connectivity provided at the traffic interchanges at one-mile major arterial streets.

3.4.1 Evaluation Criteria

As a result of input from the Study Team, Performance Measures have been developed for evaluating the impact of alternative transportation improvements during the Phase II Design Concept Study. The Performance Measure Ranking percentages are as follows:

- 30% Transportation Performance
- 25% Financial/Economic Performance
- 15% Social Impact
- 15% Land Use/Economic Development Impacts
- 15% Environmental Impacts

4 MAJOR DESIGN FEATURES

4.1 Introduction

This section describes the major design features used to develop and evaluate alternatives to meet current and future traffic needs and enhance safety and traffic operational features of I-10 and SR 210 including traffic interchanges and frontage roads.

The I-10/SR 210 improvement alternatives meet the design requirements in the ADOT Roadway Design Guidelines and the 2004 AASHTO Policy on Geometric Design of Highways and Streets. The improvements to I-10 satisfy requirements for interstate highways as contained in the AASHTO Policy on Design Standards Interstate System.

4.2 Major Design Features

4.2.1 Design Controls

The following design controls were used for both I-10 and SR 210 in the development of the alternatives:

- Design Year: 2040
- Design Speed
  - I-10 and SR 210 Mainline (Urban): 65 mph
  - I-10 and SR 210 Ramps – Service Interchange:
    - Main Body of Ramp: 50 mph
    - Parallel Exit Ramp: 60 mph
    - Parallel Entrance Ramp: 55 mph
    - Ramp at Crossroad: 35 mph
  - I-10 and SR 210 Ramps – System Interchange:
    - Main Body of Ramp: 55 mph
    - First Curve at Entrance: 55 mph
    - First Curve at Exit 65 mph
  - I-10 and SR 210 Ramps (At Crossroads): 35 mph
  - Crossroads through Interchange: 40 mph

    If the design speed of a crossroad outside the limits of an interchange is greater than 40 mph the higher design speed will be carried through the interchange.

  (Crossroads classified as Parkways may have 50 mph design speed.)
- Typical Sections:
  - I-10 Mainline, I-10 Collector-Distributor Roadway and SR 210 Mainline:

    Lane width: 12-feet

    Shoulder width:

    2 lanes in each direction:

    Outside shoulder: 10-feet

    Inside shoulder: 4-feet

    3 or more lanes in each direction:

    Outside shoulder: 12-feet*

    Inside shoulder: 12-feet *

    *Truck traffic DDHV is projected to exceed 250.
  - Number of Through Lanes – I-10:

    From I-19 to Kino Parkway:

    Eastbound: 4-lanes

    Westbound: 4-lanes

    From Kino Parkway to SR 210 connection to I-10:

    Eastbound: 3-lanes

    Westbound: 3-lanes

    From SR 210 connection to Valencia Road

    System Alternative I:

    Eastbound: 5-lanes

    Westbound: 5-lanes

    System Alternative II:

    Eastbound: 5-lanes

    Westbound: 5-lanes

    System Alternative IV:

    Eastbound: 3 mainline lanes + 2 CD lanes

    Westbound: 3 mainline lanes + 2 CD lanes

    From Valencia Road to Craycroft Road:

    System Alternative I:

    Eastbound: 5-lanes

    Westbound: 5-lanes

    System Alternative II:

    Eastbound: 5-lanes

    Westbound: 5-lanes

    System Alternative IV;

    Eastbound: 3 mainline lanes + 2 CD lanes

    Westbound: 3 mainline lanes +2 CD lanes

    From Craycroft Road to Wilmot Road:

    System Alternative I:

    Eastbound: 5-lanes

    Westbound: 5-lanes

    System Alternative II:

    Eastbound: 5-lanes

    Westbound: 5-lanes

    System Alternative IV:

    Eastbound: 3 mainline lanes + 2 CD lanes

    Westbound 3 mainline lanes + 2 CD lanes

    From Wilmot Road to Kolb Road:

    System Alternative I:

    Eastbound: 4-lanes

    Westbound 5-lanes

    System Alternative II:

    Eastbound: 4-lanes

    Westbound 5-lanes

    System Alternative IV:

    Eastbound: 3 mainline lanes + 2 CD lanes

    Westbound: 3 mainline lanes + 2 CD lanes

    From Kolb Road to Houghton Road

    Eastbound: 4-lanes

    Westbound: 4-lanes

    From Houghton Road to Colossal Cave/Wentworth Road

    Eastbound: 3-lanes

    Westbound: 3-lanes

    From Colossal Cave/Wentworth Road through SR 83:

    Eastbound: 2-lanes

    Westbound: 2-lanes
  - Through Lanes for SR 210 with System Alternative I and System Alternative IV:

    Through the main body of SR 210 with System Alternative I and System Alternative IV, the number of lanes will vary from 2-lanes in each direction to 4-lanes in each direction.

    (Note: Number of through lanes for SR 210 with System Alternatives I and IV includes lanes for both Alvernon Way local traffic and SR 210 traffic.)
  - Through Lanes for SR 210 with System Alternative II:

    Eastbound 2-lanes

    Westbound 2-lanes
  - Interchange Ramps (I-10 and SR 210):

All ramps shall be parallel type ramps. Two lane entrance ramps at service interchanges will have dual-lane metering of traffic onto the mainline.

1-Lane Directional Ramps:

Lane width: 12-feet

Left shoulder: 6-feet

Right shoulder: 10-feet

2-Lane Directional Ramps:

Lane width:	12-feet
Left shoulder:	4-feet
Right shoulder:	8-feet

1-Lane and 2-Lane Ramps:

Lane width:	12-feet
Left shoulder:	2-feet
Right shoulder:	8-feet

– Interchange Crossroads:
Crossroads will have raised curbs with 2-foot setback from the outside lane edge.

Crossroads will have raised medians with 2-foot setback to the median curb from the lane edge. Number of through lanes will vary per agreement with local agency having jurisdiction. Median width of crossroads within the ADOT R/W will be in accordance with RDG Chapter 500.

Lane width: 12-feet

- Slope Criteria:
  – I-10 and SR 210:
    Use ADOT RDG Figure 306.4B.
  – Interchange Ramps:
    Use ADOT RDG Figure 504.4A.

  Note: East of Houghton Road the character of the area becomes less urban, with large spacing between interchanges. During the DCR phase a determination will be made as to whether I-10 will be designed without curbs, using the rural configuration in accordance with the RDG.

- Roadway Cross-slope:
  – Roadway Cross-slope of tangent sections of new or reconstructed roadways shall be 0.02'/'

- Maximum Gradient (Urban):
  – I-10 and SR 210 Mainline: 3%
  – Interchange Ramps: Use ADOT RDG Section 504.1.
  – Interchange Crossroads adjacent to ramp termini: 3%

- Maximum Superelevation:
  – I-10 and SR 210 Mainline (RDG Section 202): 0.06 ft/ft
  – Interchange Ramps (RDG Section 504.3): 0.06 ft/ft
  (Ramp curves should not have spirals, per RDG Section 504.2)

- Maximum Degree of Curve:
  – I-10 and SR 210 Mainline (RDG Table 202.3B): 3° 27'
  – I-10 and SR 210 Interchange Ramps (RDG Table 202.3B)
  Circular curves will be used for ramp alignment.

Service Interchange:	
Main Body of Ramp:	6° 53'
Parallel Exit Ramp:	4° 18'
Parallel Entrance Ramp:	5° 24'
System Interchange:	
Body of Ramp:	5° 24'
First Curve at Entrance	5° 24'
First Curve at Exit	3° 27'

4.2.2 Access Control

I-10 is an Interstate Freeway with full control of access along the mainline roadways and through the full extent of all interchange ramps.

Existing SR 210 is a partial access controlled Parkway with access breaks at major signalized intersections.

The extension of SR 210 is an Urban Access Controlled Freeway with full control of access along the mainline roadways and through the full extent of all interchange ramps.

- The limits of access control managed by ADOT at interchange crossroads will be in accordance with Section 506 of the ADOT RDG.

- Access control along interchange crossroads beyond the requirements of Section 506 of the RDG will be implemented by agreements with the local agencies having jurisdiction over the crossroad. See **Appendix F; Access Control Strategies at Crossroads** for access control concepts at interchange crossroads.

4.2.3 Horizontal and Vertical Alignments

All elements of the I-10 and SR 210 improvements will comply with the ADOT RDG and the AASHTO guidelines.

The existing horizontal alignment of the I-10 eastbound and westbound mainlines will be retained when the improvements described herein are implemented. It may be necessary to modify the vertical alignment to accommodate vertical clearance requirements where new or widened structures are added, or where it is necessary to reconstruct the existing pavement. Additional through lanes will be added in some areas and traffic interchanges will be modified. The determination of vertical alignment of I-10 will be made during the Phase II Design Concept Study and an Analysis Report for retained portions of both the vertical and horizontal alignments will be prepared at that time.

4.2.4 Right-of-Way

The existing ROW for I-10, including ROW for TI ramps and for Frontage Roads will be used. It will be necessary to acquire additional ROW where interchanges and frontage roads are being extensively revised. The extent of new ROW will be defined during the Phase II Design Concept Study process.

ROW required for revisions to the existing ROW corridor will be in conformance with requirements of the ADOT RDG and AASHTO.

The minimum right-of-way width for the extension of SR 210 will be 10-feet beyond the catch line of the mainline or ramp roadway in accordance with Figure 306.4B of the ADOT RDG.

4.2.5 Drainage

Several major watercourse crossings exist within the study segment of I-10 and the extension of SR 210, and will be addressed during the Phase II Design Concept study.

1. Diversion Channel, EB (MP 262.82): single 85' span bridge.
2. Diversion Channel, WB (MP 262.82): single 85' span bridge.
3. Julian Wash (MP 265.80): 6 barrel, 74' total span Reinforced Concrete Box Culvert (RCBC).
4. Earp Wash Tributary, WB Frontage Road (MP 267.65): four 25' span bridge.
5. Earp Wash Tributary, EB (MP 267.65): four 25' span bridge.
6. Earp Wash Tributary, WB (MP 267.65): four 25' span bridge.
7. Earp Wash Tributary, EB Frontage Road (MP 267.65): three 10' span bridge.
8. Wash, EB (MP 277.46): four 25' span bridge.
9. Wash, WB (MP277.90): four 25' span bridge.
10. Wash, North Frontage Road (MP 277.90): three 22' span bridge.
11. Wash, North Frontage Road (MP 279.10): 2 barrel, 21' total span RCBC.
12. Julian Wash (FEMA Zone X) north of Valencia Road and south of the UPRR tracks.

Numerous smaller drainage crossing facilities existing along the study area will be addressed during the Phase II Design Concept Study.

Drainage investigation during the Phase II Design Concept Study will include the evaluation of existing roadway drainage systems and determinations as to whether the existing drainage facilities should be modified to accommodate the roadway improvements or should be replaced in their entirety.

4.2.6 Section 401 and 404 Permits

Impacts to floodplains, water quality, or the sole source aquifer would not be expected to have a major role in determining I-10 or SR 210 improvements.

Any widening of the I-10 mainline and new interchange ramps on the north side of I-10 between Kino Parkway and Craycroft Road may encroach on the 100-to-500-year Julian Wash floodplain. Drainage analysis during design would be needed to determine the degree of impacts. Primarily, impacts could be expected at Country Club Road (new TI), Alvernon Way (expanded TI under System Alternative I and System Alternative IV), and Swan Road (new TI under System Alternative II). A jurisdictional delineation should be conducted during final design to identify all Waters in the study area.

Julian Wash and several unnamed washes cross SR 210 in the study area and may be regulated by the Corps.

Section 404 of the Clean Water Act regulates the placement of fill or dredged material into Waters of the United States (Waters). The U. S. Army Corps of Engineers (Corps) has regulatory jurisdiction of Waters. A Section 401 Water Quality Certification, which is administered by the Arizona Department of Environmental Quality, is required for any action subject to Section 404; however, most projects that fall under a Nationwide Permit are conditionally certified under Section 401.

Coordination with the EPA during design would need to occur relative to sole source aquifer impacts. This study area is within the Upper Santa Cruz & Avra Basin Sole Source Aquifer designated area.

ADOT Environmental Planning Group shall apply for all permits required.

4.2.7 Floodplain Considerations

Research of known flood hazard areas or local flooding problem areas along or near existing I-10, and along or near the proposed extension of SR 210 within the study limits included review of the most recent Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMS), and discussions with City of Tucson and Pima County personnel.

Offsite drainage affecting the segment of I-10 from I-19 to SR 83 is characterized by washes flowing roughly parallel to I-10, from east-southeast towards the west-northwest. Inspection of FEMA FIRMS in the study area shows that several Special Flood Hazard Areas (SFHAS) exist adjacent to I-10 along this corridor to include the following locations:

1. East of Kino Parkway: Zone A, Tucson Diversion Channel crossing of I-1.0
2. West of Palo Verde Road, Zone A, unnamed flooding area south of I-10.
3. South of Valencia Road: Zone A, “1% Annual Chance Flood Discharge Contained in Culvert.”

Within the SR 210 study area there is one FEMA SFHA; Julian Wash (FEMA Zone X) south of Valencia Road and north of the UPRR tracks. Discussions with City of Tucson and Pinal County personnel revealed that they had no knowledge of additional local flooding problems within the I-10 and SR 210 extension study corridors.

4.2.8 Geology

The I-10 and SR 210 extension study corridors are located within the Basin and Range physiographic province, and are characterized as broad alluvial filled basins bounded by steeply dipping faults and fault-block mountains. The corridor within the limits of this project is within the Tucson Area (Upper Santa Cruz basin), which is a structural basin filled with alluvium and bounded by mountains.

The Upper Santa Cruz basin has a broad and gently sloping valley floor, generally trending north to northwest. Elevations in the basin range from about 2,490-feet in downtown Tucson to about 3,500-feet at the east edge of the basin near SR 83.

Geologic hazards along the I-10 study corridor include land subsidence and earth fissures, soil shrink and swell potential, floods and earthquakes.

- Land subsidence and earth fissures are associated with the draw-down of groundwater from the alluvial aquifers.
- Soil shrink and swell is a potential hazard in areas of the alluvial fan where sediment has been deposited from flood and mud flow events.
- Flood hazards may exist in low lying portions of the alignment near the stream channels. The I-10 alignment within the study area tends to parallel stream channels instead of crossing the channels. Flood hazards are therefore reduced to low lying portions of the alignment adjacent to the stream channels.
- Earthquake and seismic activity has been a low risk hazard in the Santa Cruz basin area. The Seismicity Map of the State of Arizona contains two events within 50 miles of the I-10/SR 210 study area. The intensity was such that damage to manmade structures would not be great.

Additional geotechnical information is available in the Materials Investigation Report for the I-10 Corridor Study, Junction I-19 to Pima/Cochise County Line prepared for ADOT.

4.2.9 Earthwork

Most of existing I-10 within the study area is constructed on earthwork embankments. Modifications to the I-10 mainline roadway, ramps and frontage roads will require importing fill material.

The extension of SR 210 under System Alternative I or System Alternative IV will be at-grade or above grade through the length of the extension to the connection with I-10. Borrow will be required.

The extension of SR 210 under System Alternative II will be below existing ground along the southern border of Davis Monthan AFB; then will climb above ground to cross over the UPRR. The earthwork balance is unknown at this time.

The extent of earthwork will be developed during the Design Concept Study.

4.2.10 Traffic Design

I-10

The existing service interchange at Palo Verde Road will be removed and replaced with a new service interchange at Country Club Road to improve spacing of traffic interchanges and improve connections to the local street system.

All other I-10 service interchanges within the project limits will be modified as described in Section 3, Alternatives Considered.

A system interchange will be developed at Alvernon Way if System Alternative I or System Alternative IV is selected.

A system interchange will be developed west of Valencia Road if System Alternative II is selected.

SR 210 Extension

The existing SR 210/Alvernon Way/Golf Links Road connection consists of a split interchange between Golf Links Road and Alvernon Way plus a diamond interchange between SR 210 and Alvernon Way.

- System Alternative I and System Alternative IV:
  System Alternative I and System Alternative IV will reconfigure the combined interchanges to extend SR 210 to a system interchange with I-10 at Alvernon Way. The interchange between SR 210 and Golf Links Road/Alvernon Way will be reconfigured with interchange connections with SR 210, Golf Links Road and Alvernon Way as shown in **Appendix C and E**.

  A diamond interchange will connect Ajo Way with extended SR 210.

- System Alternative II:
  System Alternative II will extend SR 210 east to a system interchange with I-10 approximately one-half mile west of Valencia Road.

The Alvernon Way/Golf Links Road interchange with SR 210 will be reconfigured as shown in **Appendix D**.

A diamond interchange will connect Irvington Road with extended SR 210.

During the Phase II Design Concept Study determinations will be made for interchanges along SR 210 between Golf Links Road and I-10.

4.2.11 Preliminary Pavement Design

Preliminary pavement design will be coordinated with the ADOT Pavement Design Section. Because of the age of the existing I-10 roadways, it may be necessary to reconstruct the pavement structure.

4.2.12 Transit

A report titled Transit Design Considerations for I-10 and State Route 210, dated July 2011, has been prepared (See **Appendix G**). The following future transit plans are identified in the report:

- The Regional Transportation Authority's (RTA) 20-year plan includes:
  - Express bus service between new park-and-ride lots at Wentworth Road (Old Vail Road) and Houghton Road, and downtown Tucson via I-10.
- PAG 2040 Regional Transit Plan (RTP) includes new express bus and Bus Rapid Transit (BRT) services that would operate along I-10 and across the corridor:
  - BRT along I-10 between Wentworth Road and downtown Tucson. Plans for this service are conceptual in nature.
  - BRT between southeast Tucson and downtown. This service could potentially use I-10 and SR 210.
  - New express bus services are proposed for the Kolb Road and Valencia Road corridors.
- PAG high capacity transit system plan includes both express bus and BRT on I-10.
  - Express bus along I-10 between the community of Vail, near Rita Road, and downtown Tucson. This service could also use SR 210.
  - BRT along I-10 between the community of Vail, near Rita Road and downtown Tucson. This service could also use SR 210.

Table 4.1 Utility and Railroad Contacts

Agency	Utility Type	Contact Name	Contact Information
American Telephone and Telegraph	Coaxial, Fiber	LSAC Group	800-241-3624
City of Tucson Water	Water, Reclaimed Water	Edward Lopez	520-837-2125 edward.lopez@tucsonaz.gov
City of Tucson Facilities Design & Maintenance	Electric, Gas, Sewer	Doug Alewelt	520-791-3141 doug.alewelt@tucsonaz.gov
City of Tucson Department of Transportation	Street Lights, Traffic Signals	Armando Bracamonte	520-791-3191 armando.bracamonte@tucsonaz.gov
City of Tucson Traffic Eng Irrigation	Irrigation	Kevin Kishbaugh	520-237-9561
City of Tucson Inet Fiber	Fiber	Jason Michaelson	520-791-3121
Cox Communications	Cable, TV, Fiber	Jeff Krause	520-867-7526 jeff.krause@cox.com
El Paso Natural Gas	Natural Gas	William Biggs	520-663-4260 william.biggs@elpaso.com
Kinder Morgan	Petroleum	Dale Ross or Pipeline Inquiry	520-514-1065 x 984
Level 3 Communications	Fiber	Carlos Muniz	602-322-2162 carlos.muniz@level3.com
MCI	Fiber	Joe Ryan	520-548-2939
Qwest Communications Network	Fiber/Coax	Alun Williams	520-458-5152 Alun.williams@qwest.com
Ray Water Company	Water	Rhonda Rosendaum	520-623-1332 raywaterco@gmail.com
Southwest Gas Company	Natural Gas	Kelly Fleenor	520-764-6107 kelly.fleenor@swgas.com
Sprint	Fiber	Colin Sword	602-417-0970 colin.sword@sprint.com
Time Warner (TW Telecom) / Xspedius Communications Co. LLC	Coaxial, Fiber	Abe Peña	520-618-4273 abraham.pena@twtelecom.com
Tucson Electric Power	Electric	Cynthia Garcia	520-918-8246 cgarcia@tep.com
Union Pacific Railroad	Railroad	Alex Popovici	Contact Robert Travis, ADOT Utilities and Railroad Engineering Liaison 520-712-6193
Vail Water	Water	John Boise	520-730-6045 jwboise@msn.com
Zapco Energy Tactics	Methane Gas	Phillip Priebe	815-671-3576

4.2.13 Utilities and Rail Facilities

Table 4.1 lists Utility and Railroad contacts.

- Union Pacific Railroad (UPRR):
  - I-10 crosses the UPRR Nogales Subdivision tracks at MP 268.12.
  - The UPRR is located to the east of Alvernon Way and approaches I-10 from the north and turns to the east just north of I-10. The I-10 right-of-way line is parallel to and 42-feet south of the UPRR right-of-way line from approximate MP 265.25 to MP 265.55. I-10 then turns to the southeast and separates from the UPRR by approximately three-quarters of a mile.
  - The extension of SR 210 with System Alternative I and System Alternative IV crosses over the UPRR south of the Alvernon/Golf Links Road TI.
  - The extension of SR 210 with System Alternative II crosses over the UPRR and the TEP Spur along the Swan Road alignment.

4.2.14 Design Exceptions

During the Phase II Design Concept Study an AASHTO Controlling Design Criteria Report will be prepared. An Analysis Report for any portions of the existing vertical and horizontal alignments that will be retained will be included in the AASHTO Controlling Design Criteria Report. At this time no design exceptions are anticipated for the I-10 or SR 210 improvements.

5 ENVIRONMENTAL OVERVIEW SUMMARY AND PUBLIC INVOLVEMENT

5.1 Introduction

The Environmental Overview (EO) has been updated to expand the analysis of one of the alternatives previously considered and to add a new alternative for consideration. The updated EO conducted in conjunction with preparation of the Feasibility Study Update is summarized in the following paragraphs. The complete EO is contained in **Appendix H**.

I-10 (Junction I-19 to SR 83)

The evaluation of the socioeconomic environment, physical and natural resources, cultural resources, and regulatory requirements conducted for I-10 indicates the proposed improvements from I-19 to SR 83 have no fatal flaws. The proposed improvements are located largely in or near the existing I-10 ROW. Impacts could occur with the TI connections to I-10 with SR 210; however, those impacts are moderate, with residential displacements unlikely, few business displacements, and limited impact on cultural resources. Natural or physical resource impacts would be expected with widening and TI reconfigurations in the rural segment of the corridor.

The loss of vegetation, widening of drainage structures, and general addition of more travel lanes could be expected to affect wildlife. A broad area from Houghton Road east beyond SR 83 has been identified by the USFWS, the AGFD, Pima County, and the City of Tucson as important to wildlife movement and/or conservation of plant and animal species. Project development in DCR/EA phase has an opportunity to work with the agencies to avoid or mitigate natural resource impacts.

Noise impacts typical to interstate widening or TI reconstruction appear to have mitigation options. The preparation of a noise report during the DCR/EA phase would identify specific areas affected. Changes in access or cross streets would require continued coordination with the local jurisdictions to minimize impacts.

SR 210 (Golf Links Road to I-10)

The evaluation of the socioeconomic environment, physical and natural resources, cultural resources, and regulatory requirements conducted for SR 210 indicates the extension from Golf Links Road to a connection with I-10 has some substantive environmental issues. The issues related to the System III, IIIa and IIIb alternatives (100 year floodplain impacts, close proximity to two public schools, potential environmental justice issue related to the community of Littletown, direct impact on a Section 4[f] resource and impacts related to DMAFB) resulted in dropping those alternatives from further consideration in this Feasibility Study.

Upon further analysis of operational, cost and environmental factors, System Alternative IIIc was eliminated.

The System IV alternative follows the same alignment as System I, and adds CD roadways adjacent to both eastbound and westbound I-10.

The issues related to the System I, II and IV alternatives, while notable with regard to economic impacts, would not be considered a fatal flaw resulting in a recommendation to not extend SR 210.

The greatest impacts to the SR 210 study corridor would be in the form of potential business displacements and changes in access for the System I, System II and System IV alternatives. A single residential parcel containing three homes in the midst of industrial zoning could be displaced by all three alternatives. System alternatives I and IV could require relocation of approximately 15 to 20 businesses and access changes to several others, while the System II alternative could require 30 to 40 business relocations and other access changes. Additionally the system II alternative may also encroach on DMAFB property. During the DCR/EA phase, additional evaluation would be needed to determine actual impacts, and input from the public/stakeholders should be considered in the development of design options to minimize impacts on businesses.

5.2 Coordination

The Feasibility Study and the EO for I-10 (Junction I-19 to State Route 83) and SR 210 (Golf Links Road to Eastern Terminus) were conducted in concert. Coordination with stakeholder agencies and team progress meetings were jointly held throughout the process.

Agency/Stakeholder Coordination

The project kickoff meeting was held on July 21, 2010, at the City of Tucson Fire Central Station. Participants included representatives from:

- FHWA
- ADOT
- PAG
- Pima County Department of Transportation
- Cochise County Highway and Flood Control Departments
- City of South Tucson

The need for further evaluation of System Alternative IIIc and the introduction of System Alternative IV resulted in beginning the Feasibility Study Update January 27, 2014.

Team meetings resumed in 2014 including the above mentioned participants plus the following participant agencies:

- City of Tucson
- Sun Tran
- DMAFB
- U.S. Customs and Border Protection
- UPRR

The meetings were chaired by the ADOT Project Manager and Jacobs Engineering Group Inc. Agenda items were varied for each meeting, with a focus on soliciting input from the stakeholders. Presentations to the stakeholders provided data and graphics depicting existing conditions, LOS, operational issues, traffic modeling/forecasts, alternatives development, and environmental resource issues. Early discussions included the potential to enlarge the SR 210 study corridor farther west. The corridor was shifted west to Palo Verde Road. Preliminary traffic analysis indicated that connection locations west of Alvernon Way would not generate substantive traffic relief on I-10; therefore, no alternatives using Palo Verde Road were developed.

Several stakeholder-focused discussions supplemented the monthly meetings, including:

- Sun Tran – August 22, 2010
- Utility Companies – September 27, 2010
- AGFD – November 11, 2010
- UPRR – March 9, 2011
- PAG – April 6, 2011, April 7, 2014, and October 15, 2014 (presentation to Transportation Planning Committee)
- DMAFB, PAG, and Pima County DOT – March 14, 2012 (Discussion of System IIIa, IIIb and IIIc alternatives)
- Pima County DOT – January 14 and 21, 2014 and July 30, 2014
- City of Tucson – March 6, 2014

All Feasibility Study materials were made available on the project website at www.jacobsaz.com.

Public Involvement

A Public Information Meeting was held October 6, 2011 at the Holiday Inn Hotel and Suites, 4550 S. Palo Verde Road, Tucson, AZ. The format of the meeting was an open house with an informational video. System Alternatives I, II were displayed for public view.

Approximately seventy people attended the meeting. The following public agencies were represented at the meeting: FHWA, ADOT, Pima County, PAG, RTA, DMAFB, City of Tucson. Two news stations covered the meeting: Fox News 11 and KVOA News 4.

6 COST ESTIMATES

Preliminary cost estimates based on conceptual plans have been prepared for System Alternative I, System Alternative II and System Alternative IV that will be carried into the Phase II Design Concept Study. The estimates are based on data available at the Feasibility Study level of development.

The estimate items and the basis for the estimated cost of each item for I-10 and SR 210 improvements are summarized below.

- **Mainline per Lane Mile – 6" AB + 10" PCCP + ½" AR-ACFC for 12' lanes + Striping (tape) and RPM. (Lane miles include travel lanes plus 12-ft. outside shoulders and 12-ft. median shoulders)**
- **Crossroad Urban (5 lanes) per Lin. Ft. – includes 5-lanes each direction, curb & gutter both sides, 6' sidewalk both sides, drainage**
- **Crossroad Urban (4 lanes) per Lin. Ft.** – includes 4-lanes each direction, curb & gutter both sides, 6'sidewalk both sides, drainage
- **Signalized Intersection per Each - includes** signals on 4 legs, signs, miscellaneous
- **Ramps and Frontage Roads per Lane per Lin. Ft. – includes curb & gutter or concrete half barrier on both sides**
- **Bridge per Sq. Ft. – estimated average cost**
- **PCCP Ramp Removal - Lump Sum - estimated cost based on approximate quantity of PCCP, AB, curb**
- **AC Ramp Removal – Lump Sum – estimated cost based on approximate quantity of AC and AB**
- **Bridge Removal – Lump Sum - estimated cost**
- **Retaining Wall per Sq. Ft. - estimated cost**
- **Borrow per Cu. Yd. – estimated cost**
- **Commercial Building Removal per Each - estimated cost**
- **Residential Building Removal per Each - estimated cost**
- **Pavement Drainage per Centerline Mile - based on estimated quantity of excavation, riprap, channel lining, pipe, catch basins, inlets, misc. items per mile**
- **Roadway Lighting per Centerline Mile – based on estimated cost per mile for similar project**
- **Roadway Signs per Centerline Mile - based on estimated cost per mile for similar project**
- **FMS per Centerline Mile - based on estimated cost per mile for similar project**
- **Landscaping per Centerline Mile – based on estimated cost per mile for similar project**
- **Enclosed Median per Centerline Mile - includes median embankment and Concrete Median Barrier**
- **Outside Curb & Gutter per Centerline Mile – based on estimated cost per mile for similar project**
- **Outside Concrete Barrier per Centerline Mile – based on estimated cost per mile for similar project**

Total Estimated Cost

The total estimated costs for System Alternative I, II and IV are listed below. The costs exclude the cost of utilities and ROW. The amount of ROW to be acquired, in acres, is listed separately.

System Alternative I

I-10	$691,100,000
SR 210	$194,940,000
System Alternative I Total	$886,040,000
System Alternative I ROW –	196 acres required

System Alternative II

I-10	$671,270,000
SR 210	$171,200,000
System Alternative II Total	$842,470,000
System Alternative II ROW –	337 acres required

System Alterative IV

I-10	$761,590,000
SR 210	$193,650,000
System Alternative IV Total	$955,240,000
System Alternative IV ROW	- 192 acres required

A more detailed breakdown of the costs associated with System Alternatives I, II and IV has been provided on the following pages.

Table 6.1 I-10/SR 210; System Alternative I (I-10 Improvements) Estimated Cost

Item Description	Unit	Quantity	Unit Price	Amount
Mainline	Lane Mile	276.9	$300,000	$83,065,341
Crossroad (5-lanes each direction)	Lin. Ft.	11,960	$1,000	$11,960,000
Crossroad (4-lanes each direction)	Lin. Ft.	11,160	$850	$9,486,000
Signalized Intersection	Each	31	$300,000	$9,300,000
Ramps and Frontage Roads	Lane Lin. Ft.	172,935	$150	$25,940,250
Bridge	Sq. Ft.	759,145	$90	$68,323,050
PCCP Ramp Removal	Lump Sum	1	$157,815	$157,815
AC Ramp Removal	Lump Sum	1	$630,800	$630,800
Bridge Removal	Lump Sum	1	$2,650,000	$2,650,000
Retaining Wall	Sq. Ft.	400,410	$60	$24,024,600
Borrow	Cu. Yd.	3,439,270	$10	$34,392,700
Commercial Building Removal	Each	3	$100,000	$300,000
Residential Building Removal	Each	10	$25,000	$250,000
Pavement Drainage	Centerline Mile	21.7	$1,530,000	$33,201,000
Roadway Lighting	Centerline Mile	21.7	$200,000	$4,340,000
Roadway Signs	Centerline Mile	21.7	$260,000	$5,642,000
FMS	Centerline Mile	21.7	$500,000	$10,850,000
Landscaping	Centerline Mile	21.7	$330,000	$7,161,000
Enclosed Median	Centerline Mile	1.6	$260,000	$416,000
Outside Curb & Gutter	Centerline Mile	14.2	$220,000	$3,124,000
Outside Concrete Barrier	Centerline Mile	6.8	$750,000	$5,100,000
SYSTEM I - I-10 SUBTOTAL			SUBTOTAL	$340,314,556
MISCELLANEOUS WORK (15%)	Lump Sum			$51,047,183
			SUBTOTAL	$391,361,739
DUST PALLIATIVE (1%)	Lump Sum			$3,913,617
FURNISH WATER (1%)	Lump Sum			$3,913,617
MAINTENANCE OF TRAFFIC (8%)	Lump Sum			$31,308,939
EROSION CONTROL AND POLLUTION PREVENTION (1%)	Lump Sum			$3,913,617
CONTRACTOR QUALITY CONTROL (2%)	Lump Sum			$7,827,235
CONSTRUCTION SURVEYING AND LAYOUT (1%)	Lump Sum			$3,913,617
			SUBTOTAL	$446,152,383
MOBILIZATION (10%)	Lump Sum			$44,615,238
			SUBTOTAL	$490,767,621
CONTINGENCY (5%)	Lump Sum			$24,538,381
CONSTRUCTION ENGINEERING (15%)	Lump Sum			$73,615,143
INDIRECT COST ALLOCATION (10.39%)	Lump Sum			$50,990,756
			SUBTOTAL	$639,911,901
OTHER COSTS				
ENGINEERING DESIGN (8%)	Lump Sum			$51,192,952
SYSTEM I – I-10 TOTAL				$691,100,000

Table 6.2 I-10/SR 210; System Alternative I (SR 210 Extension) Estimated Cost

Item Description	Unit	Quantity	Unit Price	Amount
Mainline	Lane Mile	23.3	$300,000	$6,990,909
Crossroad (5-lanes each direction)	Lin. Ft.	3,400	$1,000	$3,400,000
Signalized Intersection	Each	4	$300,000	$1,200,000
Ramps	Lane Lin. Ft.	57,670	$150	$8,650,500
Bridge	Sq. Ft.	261,250	$90	$23,512,500
AC Ramp Removal	Lump Sum	1	$139,285	$139,285
Bridge Removal	Lump Sum	1	$100,000	$100,000
Retaining Wall	Sq. Ft.	285,550	$60	$17,133,000
Borrow	Cu. Yd.	2,260,800	$10	$22,608,000
Commercial Building Removal	Each	41	$100,000	$4,100,000
Residential Building Removal	Each	5	$25,000	$125,000
Pavement Drainage	Centerline Mile	2.2	$1,530,000	$3,366,000
Roadway Lighting	Centerline Mile	2.2	$200,000	$440,000
Roadway Signs	Centerline Mile	2.2	$260,000	$572,000
FMS	Centerline Mile	2.2	$500,000	$1,100,000
Landscaping	Centerline Mile	2.2	$330,000	$726,000
Enclosed Median	Centerline Mile	2.2	$260,000	$572,000
Outside Curb & Gutter	Centerline Mile	1.7	$220,000	$379,167
Outside Concrete Barrier	Centerline Mile	1.2	$750,000	$876,420
SYSTEM I - SR 210 TOTAL				$95,990,781
MISCELLANEOUS WORK (15%)	Lump Sum			$14,398,617
			SUBTOTAL	$110,389,398
DUST PALLIATIVE (1%)	Lump Sum			$1,103,894
FURNISH WATER (1%)	Lump Sum			$1,103,894
MAINTENANCE OF TRAFFIC (8%)	Lump Sum			$8,831,152
EROSION CONTROL AND POLLUTION PREVENTION (1%)	Lump Sum			$1,103,894
CONTRACTOR QUALITY CONTROL (2%)	Lump Sum			$2,207,788
CONSTRUCTION SURVEYING AND LAYOUT (1%)	Lump Sum			$1,103,894
			SUBTOTAL	$125,843,914
MOBILIZATION (10%)	Lump Sum			$12,584,391
			SUBTOTAL	$138,428,306
CONTINGENCY (5%)	Lump Sum			$6,921,415
CONSTRUCTION ENGINEERING (15%)	Lump Sum			$20,764,246
INDIRECT COST ALLOCATION (10.39%)	Lump Sum			$14,382,701
			SUBTOTAL	$180,496,668
OTHER COSTS				
ENGINEERING DESIGN (8%)	Lump Sum			$14,439,733
SYSTEM I – SR210 TOTAL				$194,940,000

Table 6.3 I-10/SR 210; System Alternative II (I-10 Improvements) Estimated Cost

Item Description	Unit	Quantity	Unit Price	Amount
Mainline	Lane Mile	261.5	$300,000	$78,444,659
Crossroad (5-lanes each direction)	Lin. Ft.	14,635	$1,000	$14,635,000
Crossroad (4-lanes each direction)	Lin. Ft.	11,160	$850	$9,486,000
Signalized Intersection	Each	31	$300,000	$9,300,000
Ramps and Frontage Roads	Lane Lin. Ft.	197,635	$150	$29,645,250
Bridge	Sq. Ft.	756,450	$90	$68,080,500
PCCP Ramp Removal	Lump Sum	1	$157,815	$157,815
AC Ramp Removal	Lump Sum	1	$630,800	$630,800
Bridge Removal	Lump Sum	1	$2,650,000	$2,650,000
Retaining Wall	Sq. Ft.	249,460	$60	$14,967,600
Borrow	Cu. Yd.	3,216,570	$10	$32,165,700
Commercial Building Removal	Each	3	$100,000	$300,000
Residential Building Removal	Each	10	$25,000	$250,000
Pavement Drainage	Centerline Mile	21.7	$1,530,000	$33,201,000
Roadway Lighting	Centerline Mile	21.7	$200,000	$4,340,000
Roadway Signs	Centerline Mile	21.7	$260,000	$5,642,000
FMS	Centerline Mile	21.7	$500,000	$10,850,000
Landscaping	Centerline Mile	21.7	$330,000	$7,161,000
Enclosed Median	Centerline Mile	1.6	$260,000	$416,000
Outside Curb & Gutter	Centerline Mile	14.2	$220,000	$3,124,000
Outside Concrete Barrier	Centerline Mile	6.8	$750,000	$5,100,000
SYSTEM II - I-10 TOTAL				$330,547,324
MISCELLANEOUS WORK (15%)	Lump Sum			$49,582,099
			SUBTOTAL	$380,129,423
DUST PALLIATIVE (1%)	Lump Sum			$3,801,294
FURNISH WATER (1%)	Lump Sum			$3,801,294
MAINTENANCE OF TRAFFIC (8%)	Lump Sum			$30,410,354
EROSION CONTROL AND POLLUTION PREVENTION (1%)	Lump Sum			$3,801,294
CONTRACTOR QUALITY CONTROL (2%)	Lump Sum			$7,602,588
CONSTRUCTION SURVEYING AND LAYOUT (1%)	Lump Sum			$3,801,294
			SUBTOTAL	$433,347,542
MOBILIZATION (10%)	Lump Sum			$43,334,754
			SUBTOTAL	$476,682,296
CONTINGENCY (5%)	Lump Sum			$23,834,115
CONSTRUCTION ENGINEERING (15%)	Lump Sum			$71,502,344
INDIRECT COST ALLOCATION (10.39%)	Lump Sum			$49,527,291
			SUBTOTAL	$621,546,046
OTHER COSTS				
ENGINEERING DESIGN (8%)	Lump Sum			$49,723,684
SYSTEM II I-10 TOTAL				$671,270,000

Table 6.4 I-10/SR 210; System Alternative II (SR 210 Extension) Estimated Cost

Item Description	Unit	Quantity	Unit Price	Amount
Mainline	Lane Mile	29.6	$300,000	$8,884,659
Crossroad (5-lanes each direction)	Lin. Ft.	1,565	$1,000	$1,565,000
Signalized Intersection	Each	5	$300,000	$1,500,000
Ramps	Lane Lin. Ft.	41,630	$150	$6,244,500
Bridge	Sq. Ft.	169,150	$90	$15,223,500
AC Ramp Removal	Lump Sum	1	$138,300	$138,300
Bridge Removal	Lump Sum	1		$0
Retaining Wall	Sq. Ft.	52,300	$60	$3,138,000
Borrow	Cu. Yd.	2,900,800	$10	$29,008,000
Commercial Building Removal	Each	62	$100,000	$6,200,000
Residential Building Removal	Each	12	$25,000	$300,000
Pavement Drainage	Centerline Mile	3.5	$1,530,000	$5,355,000
Roadway Lighting	Centerline Mile	3.5	$200,000	$700,000
Roadway Signs	Centerline Mile	3.5	$260,000	$910,000
FMS	Centerline Mile	3.5	$500,000	$1,750,000
Landscaping	Centerline Mile	3.5	$330,000	$1,155,000
Enclosed Median	Centerline Mile	3.5	$260,000	$910,000
Outside Curb & Gutter	Centerline Mile	2.5	$220,000	$541,667
Outside Concrete Barrier	Centerline Mile	1.0	$750,000	$781,250
SYSTEM II - SR 210 TOTAL				$84,304,876
MISCELLANEOUS WORK (15%)	Lump Sum			$12,645,731
			SUBTOTAL	$96,950,607
DUST PALLIATIVE (1%)	Lump Sum			$969,506
FURNISH WATER (1%)	Lump Sum			$969,506
MAINTENANCE OF TRAFFIC (8%)	Lump Sum			$7,756,049
EROSION CONTROL AND POLLUTION PREVENTION (1%)	Lump Sum			$969,506
CONTRACTOR QUALITY CONTROL (2%)	Lump Sum			$1,939,012
CONSTRUCTION SURVEYING AND LAYOUT (1%)	Lump Sum			$969,506
			SUBTOTAL	$110,523,692
MOBILIZATION (10%)	Lump Sum			$11,052,369
			SUBTOTAL	$121,576,061
CONTINGENCY (5%)	Lump Sum			$6,078,803
CONSTRUCTION ENGINEERING (15%)	Lump Sum			$18,236,409
INDIRECT COST ALLOCATION (10.39%)	Lump Sum			$12,631,753
			SUBTOTAL	$158,523,026
OTHER COSTS				
ENGINEERING DESIGN (8%)	Lump Sum			$12,681,842
SYSTEM II – SR 210 TOTAL				$171,200,000

Table 6.5 I-10/SR 210; System Alternative IV (I-10 Improvements) Estimated Cost

Item Description	Unit	Quantity	Unit Price	Amount
Mainline	Lane Mile	298.7	$300,000	$89,608,366
Crossroad (5-lanes each direction)	Lin. Ft.	11,960	$1,000	$11,960,000
Crossroad (4-lanes each direction)	Lin. Ft.	11,160	$850	$9,486,000
Signalized Intersection	Each	31	$300,000	$9,300,000
Ramps and Frontage Roads	Lane Lin. Ft.	167,955	$150	$25,193,250
Bridge	Sq. Ft.	790,465	$90	$71,141,850
PCCP Ramp Removal	Lump Sum	1	$157,815	$157,815
AC Ramp Removal	Lump Sum	1	$630,800	$630,800
Bridge Removal	Lump Sum	1	$2,650,000	$2,650,000
Retaining Wall	Sq. Ft.	767,730	$60	$46,063,800
Borrow	Cu. Yd.	3,439,270	$10	$34,392,700
Commercial Building Removal	Each	3	$100,000	$300,000
Residential Building Removal	Each	10	$25,000	$250,000
Pavement Drainage	Centerline Mile	21.7	$1,530,000	$33,201,000
Roadway Lighting	Centerline Mile	21.7	$200,000	$4,340,000
Roadway Signs	Centerline Mile	21.7	$260,000	$5,642,000
FMS	Centerline Mile	21.7	$500,000	$10,850,000
Landscaping	Centerline Mile	21.7	$330,000	$7,161,000
Enclosed Median	Centerline Mile	17.2	$260,000	$4,472,000
Outside Curb & Gutter	Centerline Mile	14.2	$220,000	$3,124,000
Outside Concrete Barrier	Centerline Mile	6.8	$750,000	$5,100,000
SYSTEM I - I-10 SUBTOTAL			SUBTOTAL	$375,024,581
MISCELLANEOUS WORK (15%)	Lump Sum			$56,253,687
			SUBTOTAL	$431,278,269
DUST PALLIATIVE (1%)	Lump Sum			$4,312,783
FURNISH WATER (1%)	Lump Sum			$4,312,783
MAINTENANCE OF TRAFFIC (8%)	Lump Sum			$34,502,261
EROSION CONTROL AND POLLUTION PREVENTION (1%)	Lump Sum			$4,312,783
CONTRACTOR QUALITY CONTROL (2%)	Lump Sum			$8,625,565
CONSTRUCTION SURVEYING AND LAYOUT (1%)	Lump Sum			$4,312,783
			SUBTOTAL	$491,657,226
MOBILIZATION (10%)	Lump Sum			$49,165,723
			SUBTOTAL	$540,822,949
CONTINGENCY (5%)	Lump Sum			$27,041,147
CONSTRUCTION ENGINEERING (15%)	Lump Sum			$81,123,442
INDIRECT COST ALLOCATION (10.39%)	Lump Sum			$56,191,504
			SUBTOTAL	$705,179,043
OTHER COSTS				
ENGINEERING DESIGN (8%)	Lump Sum			$56,414,323
SYSTEM IV - I-10 TOTAL				$761,590,000

Table 6.6 I-10/SR 210; System Alternative IV (SR 210 Extension) Estimated Cost

Item Description	Unit	Quantity	Unit Price	Amount
Mainline	Lane Mile	23.3	$300,000	$6,990,909
Crossroad (5-lanes each direction)	Lin. Ft.	3,400	$1,000	$3,400,000
Signalized Intersection	Each	4	$300,000	$1,200,000
Ramps	Lane Lin. Ft.	53,440	$150	$8,016,000
Bridge	Sq. Ft.	261,250	$90	$23,512,500
AC Ramp Removal	Lump Sum	1	$139,285	$139,285
Bridge Removal	Lump Sum	1	$100,000	$100,000
Retaining Wall	Sq. Ft.	285,550	$60	$17,133,000
Borrow	Cu. Yd.	2,260,800	$10	$22,608,000
Commercial Building Removal	Each	41	$100,000	$4,100,000
Residential Building Removal	Each	5	$25,000	$125,000
Pavement Drainage	Centerline Mile	2.2	$1,530,000	$3,366,000
Roadway Lighting	Centerline Mile	2.2	$200,000	$440,000
Roadway Signs	Centerline Mile	2.2	$260,000	$572,000
FMS	Centerline Mile	2.2	$500,000	$1,100,000
Landscaping	Centerline Mile	2.2	$330,000	$726,000
Enclosed Median	Centerline Mile	2.2	$260,000	$572,000
Outside Curb & Gutter	Centerline Mile	1.7	$220,000	$379,167
Outside Concrete Barrier	Centerline Mile	1.2	$750,000	$876,420
SYSTEM I - SR 210 TOTAL				$95,356,281
MISCELLANEOUS WORK (15%)	Lump Sum			$14,303,442
			SUBTOTAL	$109,659,723
DUST PALLIATIVE (1%)	Lump Sum			$1,096,597
FURNISH WATER (1%)	Lump Sum			$1,096,597
MAINTENANCE OF TRAFFIC (8%)	Lump Sum			$8,772,778
EROSION CONTROL AND POLLUTION PREVENTION (1%)	Lump Sum			$1,096,597
CONTRACTOR QUALITY CONTROL (2%)	Lump Sum			$2,193,194
CONSTRUCTION SURVEYING AND LAYOUT (1%)	Lump Sum			$1,096,597
			SUBTOTAL	$125,012,085
MOBILIZATION (10%)	Lump Sum			$12,501,208
			SUBTOTAL	$137,513,293
CONTINGENCY (5%)	Lump Sum			$6,875,665
CONSTRUCTION ENGINEERING (15%)	Lump Sum			$20,626,994
INDIRECT COST ALLOCATION (10.39%)	Lump Sum			$14,287,631
			SUBTOTAL	$179,303,583
OTHER COSTS				
ENGINEERING DESIGN (8%)	Lump Sum			$14,344,287
SYSTEM IV - SR 210 TOTAL				$193,650,000