Feasibility Report
October 2012

Interstate 10: Junction Interstate 19 to State Route 83
Tucson – Benson Highway

State Route 210: Golf Links Road to I-10
Barraza – Aviation Parkway

Prepared by:
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Phoenix, Arizona 85003

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

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Prepared for:
ARIZONA DEPARTMENT
OF TRANSPORTATION
Intermodal Transportation Division
Roadway Engineering Group
Roadway Predesign Section

October 2012

Prepared by:
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Phoenix, Arizona 85003

Expires 12/31/2012

Expires 6/30/2014
ARIZONA DEPARTMENT OF TRANSPORTATION
OFFICE MEMO
INTERMODAL TRANSPORTATION DIVISION
January 24, 2013

TO: ROD LANE, TUCSON DISTRICT, TI10
ROBIN NAIMI, PROJECT MANAGER, TI10
ANNETTE RILEY, ASSISTANT STATE ENGINEER, #11E

FROM: BILLAH KHAN, ROADWAY PREDESIGN, #01E

SUBJECT: DESIGN MEMORANDUM
915 PM 360 H728 0EL
I-10, JUNCTION I-19 TO SR 83 AND SR 210, GOLF LINKS ROAD TO I-10
TUCSON-BENSON HIGHWAY / BARRAZA-AVIAITON PARKWAY
I-10

This memorandum is prepared pursuant to Section 3.2 of the ADOT Action Plan for Federal-Aid Highway projects. The proposed road/bridge features for this project are described in the attached Feasibility Report. Your concurrence/approval on the proposed major design features is requested.

[Signature]
REED HENRY, ROADWAY PRE DESIGN MANAGER, #01E

Concurrence: [Signature]
ROD LANE, DISTRICT ENGINEER, TUCSON DISTRICT, TI10
Date: 1-25-13

Concurrence: [Signature]
ROBIN NAIMI, PROJECT MANAGER, TI10
Date: 1/24/13

Approved: [Signature]
ANNETTE RILEY
ANNETTE RILEY, ASSISTANT STATE ENGINEER ROADWAY, #11E
Date: 3/18/13
EXECUTIVE SUMMARY

1.1. Introduction
The Arizona Department of Transportation (ADOT) in cooperation with the Federal Highway Administration (FHWA) is preparing 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.

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 provide input and oversight for the alternatives identification and evaluation process.

This Feasibility Study will identify the improvements for each of the highways. The Study 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.

Following completion of the Feasibility Study and the Environmental Overview (Phase I) 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 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.

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 extend just beyond the I-10/SR 83 interchange.

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-Montana 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 on this portion of I-10 declining from level of service (LOS) D 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 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 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 Study utilizes the Initial Traffic Report 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.

Regional Traffic Modeling
Capacity projects from the PAG reserve project list were added to the adopted 2040 RTP network to establish the 2040 Base Roadway Network for this study.

“No Build” scenarios are often used to determine how future transportation systems operate without planned improvements on specific facilities. To assess the impact of not improving I-10 and/or extending SR 210 to a connection with I-10 on the 2040 transportation system in the area of influence, three “No Build” scenarios were evaluated:

- No Build Option 1: 2040 Base Roadway Network with No SR 210 Extension and No I-10 Lane Improvements
- No Build Option 2: 2040 Base Roadway Network with SR-210 Extension, but no I-10 Lane Improvements
- No Build Option 3: 2040 Base Roadway Network with I-10 having 4-lanes in each direction from I-19 to Houghton Road and 2-lanes in each direction east of Houghton Road, but no SR 210 Extension.

Analysis of the “No Build” scenarios clearly shows that both the improvement to I-10 and the extension of SR 210 to a connection with I-10 are needed in 2040 to meet future travel demand. Individually they will not be able to provide an acceptable level of service in the area of influence, which is shown on Figure 2.1, 2040 RTP and Reserve Projects within the Area of Influence, page 8. Even together, as in the 2040 base roadway system, additional improvements are needed. These findings have been utilized to identify the corridor deficiencies and develop sets of improvements to improve mobility in the study area.

Traffic Operational Analysis
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 iterative process includes roadway characteristics, traffic volumes, traffic control measures, and access spacing.
A total of five roadway networks were developed for this study. Two roadway networks involved existing conditions and three were system alternatives proposed as potential solution. A traffic operational analysis was conducted using the VISSIM microsimulation model for four of the roadway networks. A third alternative was developed late into the study and was not analyzed using the VISSIM microsimulation. The five roadway networks are as follows:


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

   An improved roadway network was evaluated with the 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 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 III. See Figure 3.4 System Alternative III.

   A Traffic Operational Analysis for System Alternative IIIc will be performed as part of the Phase II Design Concept Study.

   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 both System Alternative I and System Alternative II 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.

   The operational analysis of System Alternative IIIc during the Phase II Design Concept Study will provide data for further analysis.

   **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 year 2040 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. 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. 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 extension to the east of Wilmot. An alternative identified as System Alternative II was 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 reallocating 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 connects 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.

The System Alternative IIIc roadway improvement alternative will 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 then turns to the south and crosses under Drexel Road. It turns back to the east past the Pima Air Museum and then turns to the south again and crosses under Valencia Road and intersects I-10 with a system interchange at Wilmot Road.

System Alternative IIIc 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 IIIc

The Level 2 Alternative Analysis for System Alternative IIIc will be included in the Phase II Design Concept Study. See Figure 3.4 System Alternative IIIc.

Modifications to Existing I-10

The results of traffic modeling indicate that I-10 between the I-10/I-19 System Interchange and the I-10/SR 210 System Interchange should be four lanes in each direction with auxiliary lanes between successive entrance and exit ramps. 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 three lanes in each direction as shown below.

- I-19 to I-10/SR 210 System Interchange: 4 lanes in each direction
- I-10/SR 210 System Interchange to Kolb Road: 6 lanes in each direction
- Kolb Road to Houghton Road: 5 lanes in each direction
- Houghton Road to Wentworth Road: 4 lanes in each direction
- Wentworth Road to SR 83: 3 lanes in each direction

I-10 Traffic Interchanges (TI)

In urban conditions, TIs should nominally be one mile apart. However, the location of some 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 3.2.4 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:
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

**1.3. Environmental Overview**

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

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

**1.4. Total Estimated Cost**

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**

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<th>Item</th>
<th>Cost</th>
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<tr>
<td>I-10</td>
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<tr>
<td>SR 210</td>
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<td>System Alternative I Total</td>
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System Alternative I ROW – 207 acres

**System Alternative II**

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<th>Item</th>
<th>Cost</th>
</tr>
</thead>
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<td>I-10</td>
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<td>SR 210</td>
<td>$165,630,000</td>
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<tr>
<td>System Alternative II Total</td>
<td>$866,740,000</td>
</tr>
</tbody>
</table>

System Alternative II ROW – 309 acres

**System Alternative IIIc**

The estimated cost and amount of ROW for System Alternative IIIc will be developed as part of the Phase II Design Concept Study.
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1. INTRODUCTION

1.1. Forward

The Arizona Department of Transportation (ADOT) in cooperation with the Federal Highway Administration (FHWA) is preparing 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. This Feasibility Study presents the results of an investigation of alternative concepts 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 Study and Environmental Overview (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.

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-
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 Study will identify the improvements for each of the highways. The Study 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

The Feasibility Study 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 July 21, 2010 at the City of Tucson Fire Central Station Training Room. See Meeting Notes, Appendix H.

Progress Meetings were held beginning in August 2010 to inform team members and agencies of progress and to obtain input relative to ongoing tasks on both I-10 and SR 210. Traffic/Design Focus Group meetings were held in November and December 2010 to reach decisions on the traffic modeling effort within the area of influence. See Meeting Notes, Appendix H.

Improvement alternatives 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 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. This 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.

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. North-south traffic through these areas uses I-10 to by-pass the north-south arterial restrictions.

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.

At the present time (2012), I-10 in the study area still operates at acceptable levels 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.

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 34 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 highway. 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 uses I-10 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.

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 roadway network in the study area from functioning as primarily intended.

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 F by 2040. The decline from LOS D to 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.
Figure 1.2 Vicinity Map

STUDY AREA
- SR 210 Study Area
- Barranza-Aviation Parkway
- I-10; Jct I-19 to SR 83
- Railroad
- Abandon Railroad

Legend:
- 0 1 2 Miles

Begin I-10 Project at Jct I-19
Existing SR 210 Project
Begin SR 210 Project
End SR 210 Project
Rita Road
End I-10 Project at SR 83
MP 282
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 I-10 to access the city center. Improved operational characteristics of the I-10 and SR 210 alternative route to access the city center would allow SR 210 to become a viable alternative route for traffic originating east and south of downtown Tucson and cultural districts in the downtown Tucson area.

DMAFB. This connection would allow SR 210 to become a viable alternative between the existing Alvernon Way TI and the Rita Road TI south of DMAFB. This 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 tracks 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 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 -0.0168 feet/ft from median to shoulder.
- MP 267.5 to End of Project @ MP 282.0: roadway cross-slope is -0.0152 feet/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>
<thead>
<tr>
<th>Project No.</th>
<th>Begin MP</th>
<th>End MP</th>
<th>Const. Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR-14(1)</td>
<td>259.8</td>
<td>261.2</td>
<td>1955</td>
<td>2-24&quot; RCC+10'AC</td>
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<tr>
<td>IR-10(5-54)</td>
<td>260</td>
<td>262.4</td>
<td>1989</td>
<td>1-19 – Park Ave. Remove &amp; Replace Ext. EB, WB &amp; Structures</td>
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<tr>
<td>NH-10(5-71)</td>
<td>260</td>
<td>262</td>
<td>1989</td>
<td>1-19 – Park Ave. Landscape &amp; Irrigation</td>
</tr>
<tr>
<td>ARRA 010- D(206A)</td>
<td>260.2</td>
<td>267.2</td>
<td>1965</td>
<td>6&quot; Ave. TI Ramps, Vet OP &amp; Fr. Rd.</td>
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<tr>
<td>I-10(5-32)</td>
<td>260.7</td>
<td>261.5</td>
<td>1999</td>
<td>Vet OP – Valencia Rd. BC PCC</td>
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<tr>
<td>F 002-4(1)</td>
<td>261.2</td>
<td>261.5</td>
<td>1998</td>
<td>6’ Ave. TI Ramps, Vet OP &amp; Fr. Rd.</td>
</tr>
<tr>
<td>I-10-4-927</td>
<td>260.4</td>
<td>267</td>
<td>2001</td>
<td>1-19 – Craycroft Rd. Signing</td>
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<tr>
<td>IM 10-5(77)P</td>
<td>260.5</td>
<td>268.8</td>
<td>2001</td>
<td>Vet OP – Houghton Rd. GD</td>
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<td>I-10-5(16)</td>
<td>261.4</td>
<td>264</td>
<td>1964</td>
<td>Vet OP – Houghton Rd. GD</td>
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<tr>
<td>I-10-5(28)</td>
<td>261.4</td>
<td>268.3</td>
<td>1967</td>
<td>Vet OP – Houghton Rd. BC PCC</td>
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<tr>
<td>I-10-5(42)</td>
<td>261.4</td>
<td>267.5</td>
<td>1983</td>
<td>Lighting &amp; Safety</td>
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<tr>
<td>ACIR-10-5(58)</td>
<td>262</td>
<td>267</td>
<td>1988</td>
<td>Park Ave. – Valencia Rd. Pavement Rehab</td>
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<tr>
<td>I-10-5-910</td>
<td>262.4</td>
<td>-</td>
<td>1976</td>
<td>6’ Ave. TI Roadway &amp; Approaches MBS</td>
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<tr>
<td>N-900-0-543</td>
<td>262.6</td>
<td>268.1</td>
<td>1965</td>
<td>1-19 – Kino South TI Improvements</td>
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<tr>
<td>I-10-5(30)</td>
<td>262.7</td>
<td>263</td>
<td>1966</td>
<td>6’ Ave. TI Roadway &amp; Approaches MBS</td>
</tr>
<tr>
<td>I-10-5(17)</td>
<td>264</td>
<td>267.5</td>
<td>1965</td>
<td>6’ Ave. TI Roadway &amp; Approaches MBS</td>
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<tr>
<td>010 E NFA</td>
<td>264.1</td>
<td>264.9</td>
<td>2008</td>
<td>Palo Verde TI Construct TI Lighting</td>
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<tr>
<td>IR-10-5(55)</td>
<td>265</td>
<td>-</td>
<td>1984</td>
<td>Ahwahnee Way (Valencia-Invilino Rd) GD</td>
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<tr>
<td>IR-10-5(61)</td>
<td>265</td>
<td>265.4</td>
<td>1986</td>
<td>Ahwahnee Way Way OP</td>
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<tr>
<td>I-10-5(56)</td>
<td>267.1</td>
<td>267.5</td>
<td>1986</td>
<td>1-10 @ Valencia Rd. New TI</td>
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<tr>
<td>I-10-5(51) &amp; F 002-4(0)</td>
<td>267.5</td>
<td>272.8</td>
<td>1958</td>
<td>1-16’ AC (EB)</td>
</tr>
<tr>
<td>I-10-5(12)</td>
<td>267.5</td>
<td>272.8</td>
<td>1958</td>
<td>1-16’ AC (EB)</td>
</tr>
<tr>
<td>IR-10-5(62)</td>
<td>267.5</td>
<td>272</td>
<td>1990</td>
<td>1-16’ AC (EB)</td>
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<td>IR-10-5(40)</td>
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<td>281.2</td>
<td>1978</td>
<td>1-16’ AC (EB)</td>
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<tr>
<td>IR-10-5(30)</td>
<td>268</td>
<td>-</td>
<td>1986</td>
<td>1-16’ Access Ramps (Kino Blv/Apo Road) Mod. TI, GD/AC Pave</td>
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<tr>
<td>ARRA 010- E(203A)</td>
<td>272</td>
<td>276</td>
<td>2009</td>
<td>Rita Rd. – Houghton Rd. Mill &amp; Replace ½ AR-ACFC</td>
</tr>
</tbody>
</table>

### Table 1.1 Previous Projects Within the I-10 Study Area
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 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.

Table 1.1 Previous Projects Within the I-10 Study Area

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Begin MP</th>
<th>End MP</th>
<th>Const. Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACIR 10-5(66)</td>
<td>272</td>
<td>275.5</td>
<td>1992</td>
<td>Rita Rd. – Houghton Rd. Mill, Replace &amp; ACFC</td>
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<tr>
<td>I-10-5(50)</td>
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<td>281</td>
<td>1962</td>
<td>Rita Rd. – Min. View Rd. 1st 38’ AC (WB)</td>
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<tr>
<td>I-10-5(47)</td>
<td>275</td>
<td>296.2</td>
<td>1973</td>
<td>Houghton Rd. – Cochise C. L. Overlay</td>
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<td>I-10-5(45)</td>
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<td>Houghton Rd. – Min. View Rd. Resurface</td>
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<tr>
<td>ARRA 010-E(205A)</td>
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<td>281.4</td>
<td>2010</td>
<td>Houghton Rd. – Min. View TI Mill &amp; Replace AC &amp; AR-ACFC</td>
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<tr>
<td>I-10-5-916</td>
<td>277.9</td>
<td>-</td>
<td>2001</td>
<td>Wash Bridge #68 Scour Protection</td>
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<tr>
<td>IM 010-E(1)P</td>
<td>279.4</td>
<td>-</td>
<td>2000</td>
<td>Vail Rd. TI Minor TI Improvements</td>
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<tr>
<td>FI 18(19)</td>
<td>281</td>
<td>288.9</td>
<td>1955</td>
<td>Jct. SR 83 – Cienega Wash Constr 40’ Bit Pave</td>
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<td>I-10-5(10)</td>
<td>281</td>
<td>290.6</td>
<td>1959</td>
<td>Min. View – Pantano (WB) GD/AC</td>
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Table 1.2 Existing I-10 Structures

<table>
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<tr>
<th>Milepost</th>
<th>Structure No.</th>
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<th>Spans/Str. Length</th>
<th>Br. Rdwy. Width</th>
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<td>60’</td>
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<td>2019</td>
<td>Alvernon Way TI OP WB</td>
<td>2/215’</td>
<td>60’</td>
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<tr>
<td>286.80</td>
<td>5555</td>
<td>Julian Wash RCB</td>
<td>6B/74’</td>
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<td>266.00</td>
<td>1223</td>
<td>Drexel Road OP EB</td>
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<td>38’</td>
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<td>266.00</td>
<td>1224</td>
<td>Drexel Road OP WB</td>
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<td>38’</td>
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<tr>
<td>267.10</td>
<td>1225</td>
<td>Valencia Road TI OP EB</td>
<td>4/183’</td>
<td>38’</td>
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<td>267.10</td>
<td>1226</td>
<td>Valencia Road TI OP WB</td>
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<tr>
<td>267.65</td>
<td>1044</td>
<td>Earp Wash Trib Br EB</td>
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<tr>
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<td>24’</td>
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<td>6814</td>
<td>Earp Trib RCB/EF Br</td>
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<td>268.08</td>
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<tr>
<td>268.08</td>
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<td>38’</td>
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<td>597</td>
<td>Willcox Road TI OP WB</td>
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<td>270.38</td>
<td>1823</td>
<td>Kolb Road TI UP</td>
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<td>273.14</td>
<td>711</td>
<td>Rita Road TI UP</td>
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<td>713</td>
<td>Houghton Road TI UP</td>
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<td>277.48</td>
<td>463</td>
<td>Wash Bridge EB</td>
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<td>Rincon Wash Bridge</td>
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<td>279.37</td>
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<td>Vail Road TI UP EB</td>
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<td>281.68</td>
<td>1053</td>
<td>SR 83 (Min View) TI UP</td>
<td>4/330’</td>
<td>30’</td>
</tr>
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</table>
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

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Begin MP</th>
<th>End MP</th>
<th>Const. Date</th>
<th>Description</th>
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<td>2.4</td>
<td>4.5</td>
<td>1995</td>
<td>Grade, Drain, Pave, Structures</td>
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</table>

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 0IR, 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

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Golf Links Rd.</td>
<td>9815</td>
<td>Aviation Hwy. Ramp OP</td>
<td>3/250</td>
<td>72'</td>
<td></td>
</tr>
<tr>
<td>Alvernon Way</td>
<td>9809</td>
<td>Aviation Hwy. UP Br.</td>
<td>1/86</td>
<td>76'</td>
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<tr>
<td>Alvernon Way</td>
<td>9811</td>
<td>Alvernon NB FR. OP</td>
<td>3/146</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Alvernon Way</td>
<td>8733</td>
<td>Small Wash RCB</td>
<td>3/30</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>
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 New Mexico provides connectivity between the rural communities in Cochise County to the Tucson urban core in Pima County.

Pima Association of Governments (PAG) is the agency responsible for the Tucson metropolitan area regional transportation planning.

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. The PAG 2040 Long Range Transportation Plan shows the SR 210 terminus with I-10 at Valencia Road; however this study has evaluated other locations for feasibility and improved mobility.

An Initial Traffic Report; I-10: Jct. Interstate 19 to SR 90/SR 210: Golf Links Road to I-10 (Initial Traffic Report) has been prepared that shows 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, 2040 RTP and Reserve Projects within the Area of Influence. 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 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.

2.1.1. Influence 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, 2040 RTP and Reserve Projects within the Area of Influence. 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 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.

2.1.2. Study Area

The study area for both corridors includes the areas up to one mile on either side 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.

Following is a summary of relevant Area Studies:

**PAG 2040 Regional Transportation Plan**

Pima Association of Governments (PAG) in July 2010 adopted their 2040 Regional Transportation Plan (RTP) which will serve as the guide for implementation of transportation projects and improvements throughout the PAG region. The PAG planning area is Pima County and encompasses the study area. There are no new freeway facilities in the 2040 RTP; however, the most notable improvements in the influence area are as follows:

- Widening I-10 East Corridor (I-19 to County Line) to 6 – 10 lanes and TI improvements.
- Obtaining right-of-way for the SR-210 Barraza - Aviation Extension (Palo Verde Road to I-10).

PAG identified additional needed, but not funded, transportation improvement projects that were not included in the adopted RTP shown in Figure 2.1, 2040 RTP and Reserve Projects within the Area of Influence. Since the RTP is fiscally constrained, PAG prepared a list of Reserve Projects that, if priorities change and funding is available, can be incorporated into the RTP thru an amendment process.

**Southeast Area Arterial Study**

A Major Streets and Routes plan was developed for the Southeast Area (area enclosed by I-19, I-10, SR 83, Santa Rita Experimental Range and Wildlife Area, and Coronado National Forest) that meets the future transportation needs at an arterial level. The study incorporated the projected growth within the area that includes regional activity centers, such as the Tucson International Airport and University of Arizona Technology Park, and several master-planned communities on the outskirts of the study area.

By 2040 total population and employment in the study area was estimated to be 254,570 and 105,580 respectively. By Build Out the estimated total population and employment will be 636,090 and 187,090 respectively.

Recommendations include:

- Full Access Controlled Roadways (Enhanced Parkways at 300-ft ROW) from I-19 to I-10:
  - System Interchange at I-19 near El Toro Road south of Sahuarita Road
  - System Interchange along I-10 at Kolb Road
- Corridor will follow the El Toro Road, Wilmot Road, and Kolb Road alignment
- Service Interchange at major roadways
- Full Access Controlled Roadways (Enhanced Parkways at 300-ft ROW) from Wilmot Road to I-10 following along the Andra Road alignment.
- Limited Access controlled roadways (Parkways at 150-ft ROW) along the following alignments:
  - Valencia Road
  - Old Nogales Highway
  - Alvernon Way/Swan Road
  - Houghton Road
  - Andra Road

2.2. Regional Traffic Modeling

2.2.1. Technical Process and Assumptions

Travel demand modeling is a tool to assess how future transportation systems will perform based on the land use and the forecasted growth in the model area. Model inputs include future population and employment; major activity centers; roadway characteristics such as number of lanes, speed, and functional classification.

A regional travel demand model is used to identify future transportation deficiencies and to develop corresponding improvements. Future roadway improvements can be modeled, evaluated, and assessed for their impact on the study roadways or surrounding facilities, such as arterials.

The forecasted traffic from a regional travel demand model is used to provide only planning level recommendations on a system wide level. The regional model output can also be used for the more detailed operational analysis conducted at the corridor level anytime during or after construction.

The PAG Travel Demand Model was obtained for the study. The model covers approximately 4,300 square miles and includes the more populated urban areas, such as Tucson, Marana, Oro Valley and Green Valley; however for this study the modeling efforts were focused within the area of influence. The PAG Travel Demand Model has two distinct input components: the socioeconomic data and the roadway network.
Figure 2.1 2040 RTP and Reserve Projects within the Area of Influence

2040 BASE ROADWAY EXHIBIT

- Level 1
- Level 2
- Regional Transportation Plan Roadway Network
- Tucson City Limits
- Reserve Projects
- Area of Influence

Date: 8.30.2010
Socioeconomic Data

Socioeconomic data in the PAG model consists of population, housing units, and employment which is compiled at the Traffic Analysis Zone (TAZ) level. Traffic Analysis Zones (TAZs) are geographic zonal units used to tabulate land use and trip generation data. Boundaries of the TAZs are defined based on similar land uses, physical barriers, and major streets in the transportation system.

The 2040 PAG model socioeconomic data and TAZs was not revised for the purpose of this study and includes the adopted 2040 population, housing units, and employment projections.

Roadway Network

The adopted 2040 PAG RTP roadway network was used as the starting point for developing the future base roadway network for the study. Listed below are several of the adopted 2040 RTP improvements within the area of influence:

- I-10 is an 8-lane facility from I-19 to Houghton Road
- New Facilities:
  - SR-210 Extension is an access controlled freeway from SR-210 to I-10.
  - Swan Road from Santa Rita Road to Valencia Road is a 4-lane parkway
  - Valencia Road from I-19 to Houghton Road is a 6-lane parkway
  - Harrison Road is a 4-lane Major Arterial from Irvington Road to Rita Road
  - New 4-lane Major Arterial that connects Pima Mine Road to Wentworth Road

The 2040 RTP Functional Classification Exhibit and the 2040 RTP Total Lanes Exhibit in Appendix B, Traffic Modeling, display the functional classification and number of lanes for the 2040 RTP network within the area of influence.

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. The turning movements were only generated for the 2040 horizon year. Turning movement volumes from the model were used as base data for the traffic operational analysis presented in Section 2.3 of this report.

2.2.2. Future Conditions

2040 Base Roadway Network

The adopted 2040 RTP roadway network is fiscally constrained; however, PAG identified needed but unfunded projects called “Reserve Projects”. These projects could be incorporated into the RTP if funding becomes available via an amendment. Due to the scarcity of infrastructures in the RTP and the aggressive growth in the area south of I-10 and east of I-19, the project team decided to include some of these projects in our study. Capacity projects from the PAG reserve project list were added to the adopted 2040 RTP network thus establishing the 2040 Base Roadway Network for this study, as shown in the 2040 Base Total Lanes Exhibit in Appendix B, Traffic Modeling. Capacity improvement projects were not limited to new roadway segments but also include lane and interchange improvements.

Results from this scenario were used as the benchmark against which all other alternatives were compared during the performance evaluation.

2040 Base Forecast Traffic Volumes

As illustrated in Figure 2.2, 2040 Base Daily Volumes and Level of Congestion, two portions of the I-10 corridor are severely congested, depicted in magenta; the first segment is from Alvernon Way to Kolb Road then from Houghton Road to SR-83.

The majority of the streets south of I-10 operate at high to severe levels of congestion, and portions of the Valencia Road and Mary Ann Cleveland will experience severe congestion levels.

Houghton Road through the area of influence operates at severe congestion levels at several locations, mostly from Sahuarita Road to Irvington Road.

Several I-10 TIs were identified as having either operational challenges or having severe congestion levels. Operational challenges at TIs, depicted in light blue, are located west of the SR-210 Extension intersection. Congested I-10 TIs, shown in light green, are located east of the SR-210 Extension intersection. Also, the area of the SR-210/Golf Links Road/and SR-210 Extension intersection have severely congested roadways and TIs.

2.2.3. No Build” Conditions

“No Build” scenarios are often used to determine how future transportation systems operate without planned improvements on specific facilities. To assess the impact of not improving I-10 and/or extending SR 210 on the 2040 transportation system in the area of influence, three “No Build” scenarios were evaluated:

- No Build Option 1: 2040 Base Roadway Network with No SR 210 Extension and No I-10 Lane Improvements
- No Build Option 2: 2040 Base Roadway Network with SR-210 Extension but no I-10 Lane Improvements
- No Build Option 3: 2040 Base Roadway Network with I-10 having 4-lanes in each direction from I-19 to Houghton Road and 2-lanes in each direction east of Houghton Road, but no SR 210 Extension

The 2040 Base Roadway Network was modified to reflect the three “No Build” scenarios. For reference we will be using SR 210 “No Build” to signify that the SR 210 Extension is not included and I-10 “No Build” to signify I-10 with existing lane configuration.

“No Build” Option 1 – 2040 Base with SR 210 “No Build” and I-10 “No Build”

The SR-210 Extension and the I-10 lane improvements were removed from the 2040 base roadway network in the area of influence. I-10 lane configuration reflects 2010 conditions. The I-10 corridor is severely impacted by the lack of lane improvements for the majority of the study area, thus distributing traffic to adjacent arterial streets and reducing the level of service of the roadways. The majority of streets located in the southern portion of the influence area are either highly or severely congested. The streets north of I-10 from Valencia Road to Wentworth Road are also experiencing high to severe levels of congestion. See Option 1 – 2040 Base with SR 210 “No Build” and I-10 “No Build” Daily Volumes and Level of Congestion in Appendix B, Traffic Modeling.

“No Build” Option 2 – 2040 Base with I-10 “No Build”

To determine the impact of the SR 210 Extension on surrounding facilities, the 2040 base roadway network was revised to remove the I-10 improvements in the area of influence. The SR-210 Extension is a 6-lane parkway extending from existing SR-210 at Golf Links Road to I-10 at Valencia Road (per RTP location).

Results show that the I-10 corridor is severely congested from Kino Parkway to Wentworth Road with the highest amount of traffic occurring between SR-210 Extension/Valencia Road to Rita Road. SR-210 Extension has moderate congestion and does alleviate some traffic on the I-10 corridor west of the I-10/SR 210 TI. The majority of roadways south of I-10 and west of I-19 operate at high to severe congestion levels. In order to avoid the congestion on I-10, traffic is distributed on the streets north of I-10, from Wentworth Road to Valencia Road, thus increasing the congestion on those roadways. Valencia Road and Mary Ann Cleveland Way are severely impacted. See Option 2 – 2040 Base with I-10 “No Build” Daily Volumes and Level of Congestion in Appendix B, Traffic Modeling.
Figure 2.2 2040 Base Daily Volumes and Level of Congestion
To assess the impact of the I-10 improvements on the influence area transportation system, the 2040 base roadway network was revised to delete the SR-210 Extension. I-10 is 4-lanes in each direction from I-19 to Houghton Road and 2-lanes in each direction east of Houghton Road.

Traffic on the I-10 corridor from I-19 to Houghton Road operates at a moderate congestion level with the exception of the segment from Alvernon Way to Kolb Road where the corridor is severely congested. Even with the increase of traffic on I-10, surrounding roadways still operate at high to severe congestion levels. The facilities most severely affected in the influence area are the roadways south of I-10 and portions of Mary Ann Cleveland Way north of I-10. See Option 3 – 2040 Base with SR 210 “No Build” Daily Volumes and Level of Congestion in Appendix B, Traffic Modeling.

Table 2.1 No Build Scenarios Summary of Findings summarizes the locations and degree of congestion for the various no build alternatives.

### Screenline Volumes: “No Build” Scenarios

In addition to reviewing the daily congestion levels and traffic volumes, a screen line analysis was conducted to evaluate the impacts of the improvements. Ten screenlines were strategically placed throughout the area of influence to capture the distribution of traffic on the surrounding facilities for each scenario. See Figure 2.3 2040 Screenlines. Screenlines are imaginary lines that cross arterials at specific locations. Traffic volume results from the various alternatives are then compared at those locations.

The inclusion of the SR-210 Extension does alleviate some of the traffic across screenlines 1 and 2. However, if I-10 is not improved to accommodate future travel demand, facilities crossing screenlines 5 and 6 increase significantly since the roadways provide an alternate route to downtown Tucson. In addition, the facilities in the southern portion of the area of influence are impacted, as depicted by the increase of the traffic crossing screenlines 3 and 4, if I-10 is not improved. With no I-10 improvements and no SR-210 Extension the influence area arterials overall carry more traffic than either of the other “No Build” scenarios.

### Vehicle Miles and Vehicle Hours Traveled

Vehicles traveled (VMT) and vehicle hours traveled (VHT) are frequently used to measure congestion. 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. Even if VMT increases, VHT should decrease to show improved performance. As a consequence the average network speed increases thus improving mobility. Table

2.2 No Build Scenarios VMT and VHT Comparison shows the comparison of the VMT and VHT for the various “No Build” alternatives. As shown, the I-10 improvement impact is greater than the SR 210 impact, when evaluated individually. However neither alone provides the congestion relief shown in the 2040 Base scenario.

All the analyses show that both facilities are needed in 2040 to meet future travel demand. Individually they will not be able to provide an acceptable level of service in the area of influence. Even together, as in the 2040 base roadway system, additional improvements are needed. These findings have been utilized to identify the corridor deficiencies and develop sets of improvements to increase mobility in the study area.
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 Broadway Boulevard to Alvernon Way including connections to Golf Links Road. The study area included freeway mainline, ramps, arterials, TI intersections, and intersections adjacent to the TI that are directly affected by the TI 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 TIs 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 AM and PM peak-hour operations of the roadway network system within the study area were modeled using the VISSIM microsimulation model and included:
  - I-10: mainline, merge/weave areas, ramps, ramp junctions with cross streets, TI intersections and adjacent intersections directly impacted by the TI operations.
  - SR 210 (Barraza-Aviation Parkway): arterial, signalized 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 (MOE). The 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 2000 Highway Capacity Manual definitions. Level of service is a qualitative measure of the operational efficiency or effectiveness of a roadway. Six (6) 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 I-10 and SR 210 mainline and ramp roadways, and for intersections of ramps and crossroads, LOS D is acceptable for urban conditions while LOS B is acceptable for rural conditions.

Operational Analysis

A traffic operational analysis was conducted using the VISSIM microsimulation model for four of the scenarios described below. A fifth scenario, System Alternative IIIC was developed late in the feasibility study process.

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. The section of I-10 between I-19 and Houghton Road, including the Houghton Road TI, is considered urban in character, and the section of I-10 between the Houghton Road TI and SR 83 is considered rural in character. SR 210 within the study area is considered urban in character.

2. Year 2040: Existing Conditions I-10 and SR 210

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 Houghton Road, including the Houghton Road TI, is considered urban in character, and the section of I-10 between the Houghton Road TI and SR 83 is considered rural in character. SR 210 within the study area is considered urban in character.

3. Year 2040: System Alternative I

An improved roadway network (improvements to freeway/highway, ramps, and TI intersections) was evaluated with the 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. The section of I-10 between I-19 and SR 83 and SR 210 within the study area are considered urban in character for design year 2040.

4. Year 2040: System Alternative II

An improved roadway network (improvements to freeway/highway, ramps, and TI intersections) was evaluated with the projected year 2040 traffic volumes. In the System Alternative II roadway improvement alternative, the freeway connection from existing SR 210 to I-10 begins at the end of existing SR 210, where SR 210 connects to Golf Links Road, and continues parallel to the Davis-Monthan Air Force Base (AFB). It turns to the south before tying into I-10 just west of Valencia 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.

5. Year 2040: System Alternative IIIC

A traffic operational analysis will be conducted for Alternative IIIC during the Phase II Design Concept Study.

2.3.2. Results of Operational Analysis

Year 2010 – Existing Conditions

Mainline: For more details, refer to Figure 2.4 I-10 2010 Existing Conditions – Mainline Lanes & LOS Summary on page 15.

- 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.

Ramps:

For more details, refer to Table 2.3 I-10 Ramps LOS Summary Table on page 19.

- 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.
  - I-10 EB Off-ramp to Rita Road operates at LOS F in the AM peak hour.
  - I-10 EB Off-ramp to Houghton Road operates at LOS F in the 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 Off-ramp to Wentworth Road operates at LOS F in the PM peak hour.
For more details, refer to Table 2.5 I-10 Intersection LOS Summary Table on page 22; and Table 2.6 SR 210 Intersection LOS Summary Table on page 23.

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 operate at LOS C or better during the AM and PM peak hour.

Year 2040 – Existing Conditions

Mainline:
For more details, refer to Figure 2.5 I-10 2040 Existing Conditions- Mainline Lanes & LOS Summary on page 16.

For the section of I-10 between I-19 and Houghton Road, the LOS is E or worse in both the AM and PM peak hour, except:
- I-10 WB section between Craycroft Road and Wilmot Road operates at LOS D in the AM peak hour.
- I-10 EB section between Rita Road and Houghton Road operates at LOS D in the AM peak hour.

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

Ramps:
For more details, refer to Table 2.3 I-10 Ramps LOS Summary Table on page 19.

For the section of I-10 between I-19 and Houghton Road, the LOS is E or worse in both the AM and PM peak hour.

For the section of I-10 between Houghton Road and SR 83, the LOS is E or worse in both the AM and PM peak hour, except:
- I-10 WB On-Ramp from Wentworth Road operates at LOS C in the AM peak hour.

For the section of I-10 between I-19 and Houghton Road, all the intersections operate at LOS E or worse during the AM and PM peak hour, except:
- I-10 WB Off-Ramp to SR 83 operates at LOS A in both the AM and PM peak hour.
- I-10 EB Off-Ramp to SR 83 operates at LOS B in the AM peak hour.
- I-10 EB Off-Ramp from SR 83 operates at LOS B in the PM peak hour.
- I-10 WB Off-Ramp from SR 83 operates at LOS A in both the AM and PM peak hour.
- I-10 EB On-Ramp from SR 83 operates at LOS C in the PM peak hour.
- I-10 EB On-Ramp from SR 83 operates at LOS A in both the AM and PM peak hour.

For more details, please refer to Table 2.5 I-10 Intersection LOS Summary Table on page 22; and Table 2.6 SR 210 Intersection LOS Summary Table on page 23.

For the section of I-10 between I-19 and Houghton Road, all the intersections in the vicinity of the project operate at LOS E or worse during the AM and PM peak hour.
- I-10 WB ramp and Park Avenue operates at LOS D in the PM peak hour.
- I-10 EB ramp and Park Avenue operates at LOS D in the AM peak hour.
- Kino Parkway and Ajo Way Connector operates at LOS B during the AM peak hour and LOS C during the PM peak hour.
- Ajo Way and Ajo Way Connector operates at LOS D during both the AM and PM peak hours.
- Irvington Road and Palo Verde Road operates at LOS D during both the AM peak hour and LOS C during the PM peak hour.
- I-10 WB ramp and Alvernon Way operates at LOS D during the AM peak hour and LOS B during the PM peak hour.
- Irvington Road and Ajo Way Connector operates at LOS D during both the AM and PM peak hours.
- Hotel Drive and Irvington Road operates at LOS D during the PM peak hour.
- I-10 WB ramp and Valencia Road operates at LOS C during both the AM and PM peak hour.
- I-10 WB ramp and Valencia Road operates at LOS C during both the AM and PM peak hour.
- I-10 EB ramp and Wilmot Road operates at LOS D during the PM peak hour.
- I-10 WB ramp and Craycroft Road operates at LOS C during the AM peak hour.

Ramps:
For more details, refer to Table 2.3 I-10 Ramps LOS Summary Table on page 19.

For the section of I-10 between I-19 and Houghton Road, all the intersections in the vicinity of the project operate at LOS C or worse during the AM and PM peak hour, except:
- I-10 WB On-Ramp from Wentworth Road operates at LOS B 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 SR 83 operates at LOS A in both the AM and PM peak hour.
- I-10 BW Off-Ramp to SR 83 operates at LOS B in both the AM and PM peak hour.
- I-10 WB Off-Ramp to SR 83 operates at LOS C in both the AM and PM peak hour.
- I-10 EB Off-Ramp from SR 83 operates at LOS B in the PM peak hour.
- I-10 EB Off-Ramp to SR 83 operates at LOS A in both the AM and PM peak hour.

For more details, please refer to Table 2.3 I-10 Ramps LOS Summary Table on page 19.

For the section of SR 210 between Broadway Boulevard and Alvernon Way, all the intersections operate at LOS E or worse during the AM and PM peak hour.
- SR 210 and Alvernon Way operates at LOS D during the AM peak hour.
- SR 210 and Alvernon Way operates at LOS C during both the AM and PM peak hours.
- SR 210 and Kino Parkway operates at LOS D during both the AM and PM peak hours.
- SR 210 and Country Club Road operates at LOS B during the AM peak hour.

Future Roadway/Interchange Configuration
The geometric configuration of the proposed roadway in design year 2040 complies with requirements of the ADOT RDG and the 2004 AASHTO Design Guidelines. However, during the Feasibility phase of development, the assumption was made that interchange ramps are single lane, and standard entrance and exit ramp configurations were used. During the Phase II Design Concept Study modifications will be made to the ramp configurations to comply with specific lane requirements in the ADOT RDG and to provide LOS D or better on all roadway segments.

Year 2040 – System Alternative I Improvements

Mainline:
For more details, refer to Figure 2.6 I-10 System Alternative I – 2040 Build - Mainline Lanes & LOS Summary on page 17.

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 hours.

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

I-10 Ramps:
For more details, please refer to Table 2.3 I-10 Ramps LOS Summary Table on page 19.
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, except:
- I-10 WB ramp to I-19 SB operates at LOS E in the PM peak hour.
- I-19 WB ramp to I-10 WB operates at LOS E in the AM peak hour and at LOS F in the PM peak hour.
- I-10 WB Off-ramp to Alvernon Way operates at LOS F during the PM peak hour.
- I-10 WB ramp to SR 210 NB operates at LOS E during the PM peak hour.
- I-10 EB On-ramp from Valencia Road operates at LOS D during the PM peak hour.
- I-10 WB Off-ramp to Craycroft Road operates at LOS F during the AM peak hour.
- I-10 WB On-ramp from Rita Road operates at LOS F during the AM peak hour.
- I-10 EB Off-ramp to Rita Road operates at LOS E during the PM peak hour.

The LOS values that are less than LOS D will be further adjusted during the Phase II Design Concept Study to improve them to LOS D or better.

**SR 210 Ramps:**
For more details, refer to **Table 2.4 SR 210 Ramps LOS Summary Table** on page 21.

- For the section of SR 210 between Golf Links Road and the I-10/SR 210 system interchange, the LOS is D or better in both the AM and PM peak hour, except:
  - NB On-ramp from Ajo Way operates at LOS E during both the AM and PM peak hour.

The LOS values that are less than LOS D will be further adjusted during the Phase II Design Concept Study to improve them to LOS D or better.

**Intersections:**
For more details, refer to **Table 2.5 I-10 Intersection LOS Summary Table** on page 20.

- 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, except:
  - I-10 WB section between the I-10/SR 210 system interchange and Valencia Road operates at LOS E in the AM peak hour.
  - During the Phase II Design Concept Study auxiliary lanes will be incorporated as required to improve the service level to LOS D or better.

**Year 2040 – System Alternative II Improvements**

**Mainline:**
For more details, refer to **Figure 2.7 I-10 Alternative System II – 2040 Build - Mainline Lanes & LOS Summary** on page 18.

- 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, except:
  - I-10 EB ramp to I-19 SB operates at LOS E in the PM peak hour.
  - I-10 WB ramp to I-19 SB operates at LOS E in the PM peak hour.
  - I-19 NB ramp to I-10 WB operates at LOS F in the AM peak hour.
  - SR 210 SB ramp to I-10 EB operates at LOS F during the PM peak hour.
  - SR 10 WB On-ramp from Alvernon Way operates at LOS F during the PM peak hour.

During the Phase II Design Concept Study auxiliary lanes will be incorporated as required to improve the service level to LOS D or better.

**SR 210 Mainline:**
For the section of SR 210 between Golf Links Road and the I-10/SR 210 system interchange, the LOS is D or better in both the AM and PM peak hour, except:
- SR 210 SB On-Ramp from Alvernon Way operates at LOS F during the PM peak hour.
- SR 210 EB Off-ramp to Valencia Road operates at LOS F during the PM peak hour.

The LOS values that are less than LOS D will be further adjusted during the Phase II Design Concept Study to improve them to LOS D or better.

**I-10 Ramps:**
For more details, refer to **Table 2.3 I-10 Ramps LOS Summary Table** on page 19.

- 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, except:
  - I-10 EB ramp to I-19 SB operates at LOS E in the PM peak hour.
  - I-10 WB ramp to I-19 SB operates at LOS E in the PM peak hour.
  - I-19 NB ramp to I-10 WB operates at LOS F in the AM peak hour.
  - SR 210 SB ramp to I-10 EB operates at LOS F during the PM peak hour.
  - I-10 EB On-ramp from Valencia Road operates at LOS F during the PM peak hour.
  - I-10 WB On-ramp from Wilmot Road operates at LOS E during the AM peak hour.
  - I-10 WB On-ramp from Rita Road operates at LOS E during the AM peak hour.

- I-10 EB Off-ramp to Rita Road operates at LOS E during the PM peak hour.

The LOS values that are less than LOS D will be further adjusted during the Phase II Design Concept Study to improve them to LOS D or better.

**Year 2040 – System Alternative Illc Improvements**

A Traffic Operational Analysis for System Alternative Illc improvements will be performed as part of the Phase II Design Concept Study.
Figure 2.5 I-10 No-Build Alternative 2040 – Mainline Lanes & LOS Summary

* In Each Direction
Figure 2.6  I-10 System Alternative I – 2040 Build – Mainline Lanes & LOS Summary

* In Each Direction

Legend:
- PEAK HOUR LEVEL-OF-SERVICE (LOS)
- AM, PM
- LOS COLORS

YEAR 2040 BUILD
SYSTEM ALTERNATIVE I
MAINLINE LANES & LOS SUMMARY

Date: 07/2011
Figure 2.7 I-10 System Alternative II – 2040 Build – Mainline Lanes & LOS Summary
## Table 2.3 I-10 Ramps LOS Summary Table

<table>
<thead>
<tr>
<th>Traffic Interchange (TI)</th>
<th>Ramp Name</th>
<th>Operational Analysis Scenarios</th>
<th>2010 – Existing Condition LOS</th>
<th>2040 – Existing Condition LOS</th>
<th>2040 – System I LOS</th>
<th>2040 – System II LOS</th>
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<td>PM Peak Hour</td>
<td>AM Peak Hour</td>
<td>PM Peak Hour</td>
<td>AM Peak Hour</td>
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<td>I-19 NB to I-10 EB Ramp</td>
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<td>B</td>
<td>F</td>
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<td>B</td>
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<td>F</td>
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<td>F</td>
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<td>F</td>
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</tbody>
</table>

(1) Currently not a ramp.
(2) Not a future ramp.
(3) The I-10 & I-19 System Interchange is outside the scope of this project. Only the connections between I-10 and the EB on-ramp and the WB exit ramp are included.
Additional study will be required during the Design Concept Study to improve the LOS and finalize the number of lanes on the ramps for System Alternative I and System Alternative II.

<table>
<thead>
<tr>
<th>Traffic Interchange (TI)</th>
<th>Ramp Name</th>
<th>2010 – Existing Condition LOS</th>
<th>2040 – Existing Condition LOS</th>
<th>Operational Analysis Scenarios</th>
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<td>(1)</td>
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<td>B</td>
<td>F</td>
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<td>F</td>
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(1) Currently not a ramp.
(2) Not a future ramp.
*
Additional study will be required during the Design Concept Study to improve the LOS and finalize the number of lanes on the ramps for System Alternative I and System Alternative II.
### Table 2.3 (Continued) I-10 Ramps LOS Summary Table

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(1) Currently not a ramp.
(2) Not a future ramp.
* Additional study will be required during the Design Concept Study to improve the LOS and finalize the number of lanes on the ramps for System Alternative I and System Alternative II.

### Table 2.4 SR 210 Ramps LOS Summary Table

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(1) Currently not a ramp.
(2) Not a future ramp.
* Additional study will be required during the Design Concept Study to improve the LOS and finalize the number of lanes on the ramps for System Alternative I and System Alternative II.
Table 2.5 I-10 Intersection LOS Summary Table

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<td>AM Peak Hour</td>
<td>PM Peak Hour</td>
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<td>I-10 EB Ramps &amp; Country Club Rd.</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td>Palo Verde Rd.</td>
<td>C</td>
<td>C</td>
<td>D</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>T-10 EB Ramp &amp; Palo Verde Rd.</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td>Hotel Dr. &amp; Irvington Rd.</td>
<td>B</td>
<td>C</td>
<td>E</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Valverno Way</td>
<td>B</td>
<td>B</td>
<td>D</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Valencia Rd.</td>
<td>B</td>
<td>B</td>
<td>D</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>T-10 EB Ramps &amp; Valencia Rd.</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>T-10 WB Ramps &amp; Valencia Rd.</td>
<td>E</td>
<td>B</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>Craycroft Rd.</td>
<td>I-10 WB Ramps &amp; Craycroft Rd.</td>
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<td>A</td>
<td>F</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>I-10 WB Ramps &amp; Craycroft Rd.</td>
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<td>A</td>
<td>C</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>I-10 WB Ramps &amp; Wilmot Rd.</td>
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<td>A</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>I-10 WB Ramps &amp; Wilmot Rd.</td>
<td>A</td>
<td>B</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>I-10 WB Ramps &amp; Kolb Rd.</td>
<td>A</td>
<td>A</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>I-10 EB Ramps &amp; Kolb Rd.</td>
<td>A</td>
<td>A</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>I-10 WB On-Ramp &amp; Kolb Rd.</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td>I-10 EB Off-Ramp &amp; Kolb Rd.</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td>I-10 EB Off-Ramp &amp; Kolb Rd.</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td>I-10 WB Off-Ramp &amp; Kolb Rd.</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td>Rita Rd.</td>
<td>A</td>
<td>A</td>
<td>F</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Houghton Rd.</td>
<td>A</td>
<td>A</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>Wentworth Rd.</td>
<td>A</td>
<td>A</td>
<td>F</td>
<td>F</td>
</tr>
</tbody>
</table>

(1) Currently not an intersection.
(2) Not a future Intersection.
<table>
<thead>
<tr>
<th>Traffic Interchange (TI)</th>
<th>Intersection Name</th>
<th>Operational Analysis Scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2010 – Existing Condition LOS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AM Peak Hour</td>
</tr>
<tr>
<td>Ajo Way</td>
<td>SR-210 SB Ramps &amp; Ajo Way</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td>SR-210 NB Ramps &amp; Ajo Way</td>
<td>(1)</td>
</tr>
<tr>
<td>N/A</td>
<td>SR-210 &amp; Alvernon Way</td>
<td>C</td>
</tr>
<tr>
<td>N/A</td>
<td>Alvernon Way &amp; 37th St.</td>
<td>(1)</td>
</tr>
<tr>
<td>N/A</td>
<td>Palo Verde Rd. &amp; 37th St.</td>
<td>B</td>
</tr>
<tr>
<td>N/A</td>
<td>Palo Verde Rd. &amp; Frontage Rd.</td>
<td>B</td>
</tr>
<tr>
<td>N/A</td>
<td>SR-210 &amp; Richey Blvd.</td>
<td>B</td>
</tr>
<tr>
<td>N/A</td>
<td>SR-210 &amp; 34th St.</td>
<td>A</td>
</tr>
<tr>
<td>N/A</td>
<td>SR-210 &amp; Country Club Rd.</td>
<td>B</td>
</tr>
<tr>
<td>N/A</td>
<td>SR-210 &amp; 22nd St.</td>
<td>A</td>
</tr>
<tr>
<td>N/A</td>
<td>SR-210 &amp; Kino Pkwy.</td>
<td>C</td>
</tr>
<tr>
<td>N/A</td>
<td>SR-210 &amp; Broadway Blvd.</td>
<td>B</td>
</tr>
<tr>
<td>N/A</td>
<td>SR-210 &amp; Connector</td>
<td>(1)</td>
</tr>
</tbody>
</table>

(1) Currently not an intersection.
(2) Not a future Intersection.
(3) For System Alternative I & II (Year 2040) analysis, SR-210 was not analyzed west of 34th Street.

* Additional study will be required during the Design Concept Study to improve the LOS and finalize the number of lanes on the ramps for System Alternative I and System Alternative II.
2.4. Crash Data

2.4.1. Crash Analysis

The most recent 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. 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 based on crash severity.

<table>
<thead>
<tr>
<th>Location</th>
<th>Crash Severity</th>
<th>2005-2009</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fatal</td>
<td>Injury</td>
</tr>
<tr>
<td>I-10 Mainline</td>
<td>18</td>
<td>159</td>
</tr>
<tr>
<td>SR 210 Mainline</td>
<td>3</td>
<td>45</td>
</tr>
</tbody>
</table>

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.

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

<table>
<thead>
<tr>
<th>Location</th>
<th>Fatality</th>
<th>Injury</th>
<th>Property Damage/None or Possible Injury</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-10 Mainline</td>
<td>18</td>
<td>159</td>
<td>836</td>
<td>1,113</td>
</tr>
</tbody>
</table>

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 segment from Wentworth Road to SR-83 has a crash rate 1.17 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.

Talk 2.10 SR 210 Mainline 5-Year Crash Summary (2005-2009)

<table>
<thead>
<tr>
<th>Location</th>
<th>Fatality</th>
<th>Injury</th>
<th>Property Damage/None or Possible Injury</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR 210 Mainline</td>
<td>3</td>
<td>45</td>
<td>122</td>
<td>170</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Crossroad (TI)</th>
<th>Exit No.</th>
<th>On Mainline, Within TI Area, Not Related to TI</th>
<th>On Mainline, Related to TI</th>
<th>On Ramps or Attached Frontage Road System, Not Related to TI Intersections</th>
<th>At or Related to a Primary TI Intersection</th>
<th>On Cross Street, Not Related to Primary TI Intersections</th>
<th>At or Related to a Detached Frontage Rd Intersection</th>
<th>On Detached Frontage Rd</th>
<th>Unknown</th>
<th>Ramp-Related (Mainline, On a Ramp, or At a TI Intersection)</th>
<th>TI-Related (Ramp-Related + Detached-Frontage-Related)</th>
<th>All Except Mainline</th>
<th>All</th>
<th>Number of Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Segment 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6th Ave</td>
<td>261</td>
<td>58</td>
<td>2</td>
<td>11</td>
<td>85</td>
<td>5</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
<td>98</td>
<td>98</td>
<td>101</td>
<td>161</td>
<td>616</td>
</tr>
<tr>
<td>Park Ave</td>
<td>262</td>
<td>35</td>
<td>1</td>
<td>7</td>
<td>22</td>
<td>18</td>
<td>N/A</td>
<td>N/A</td>
<td>1</td>
<td>30</td>
<td>30</td>
<td>48</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>Kino Pkwy</td>
<td>263</td>
<td>83</td>
<td>2</td>
<td>36</td>
<td>175</td>
<td>35</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
<td>213</td>
<td>213</td>
<td>246</td>
<td>331</td>
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</tr>
<tr>
<td>Palo Verde Rd</td>
<td>264</td>
<td>43</td>
<td>6</td>
<td>33</td>
<td>31</td>
<td>135</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
<td>70</td>
<td>70</td>
<td>199</td>
<td>248</td>
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<tr>
<td>Alvernon Way</td>
<td>265</td>
<td>59</td>
<td>2</td>
<td>3</td>
<td>72</td>
<td>13</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
<td>77</td>
<td>77</td>
<td>88</td>
<td>149</td>
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<td><strong>Segment 2</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valencia Rd</td>
<td>267</td>
<td>53</td>
<td>0</td>
<td>24</td>
<td>51</td>
<td>3</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
<td>75</td>
<td>75</td>
<td>78</td>
<td>131</td>
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<tr>
<td>Craycroft Rd</td>
<td>268</td>
<td>69</td>
<td>1</td>
<td>3</td>
<td>23</td>
<td>2</td>
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<td>N/A</td>
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<td>27</td>
<td>27</td>
<td>28</td>
<td>98</td>
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<td>Wilmot Rd</td>
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<td>7</td>
<td>37</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>98</td>
<td></td>
</tr>
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<td>Kolb Rd</td>
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<td>1</td>
<td>6</td>
<td>49</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>56</td>
<td>56</td>
<td>58</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>Rita Rd</td>
<td>273</td>
<td>43</td>
<td>1</td>
<td>5</td>
<td>7</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
<td>13</td>
<td>13</td>
<td>12</td>
<td>56</td>
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</tr>
<tr>
<td>Houghton Rd</td>
<td>275</td>
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<td>2</td>
<td>13</td>
<td>44</td>
<td>8</td>
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<td>N/A</td>
<td>0</td>
<td>59</td>
<td>59</td>
<td>65</td>
<td>92</td>
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<td><strong>Segment 3</strong></td>
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<td></td>
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</tr>
<tr>
<td>Wentworth Rd</td>
<td>279</td>
<td>26</td>
<td>0</td>
<td>7</td>
<td>25</td>
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<td>2</td>
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<td>32</td>
<td>39</td>
<td>39</td>
<td>65</td>
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<td>281</td>
<td>18</td>
<td>1</td>
<td>7</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>2</td>
<td>11</td>
<td>21</td>
<td>22</td>
<td>41</td>
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<tr>
<td><strong>AVERAGE Segment 1</strong></td>
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<td>2.6</td>
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<td>77.0</td>
<td>41.2</td>
<td>N/A</td>
<td>N/A</td>
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<td>97.6</td>
<td>97.6</td>
<td>136.4</td>
<td>195.4</td>
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<tr>
<td><strong>AVERAGE Segment 2</strong></td>
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<td>0.8</td>
<td>9.7</td>
<td>35.2</td>
<td>2.3</td>
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<td>N/A</td>
<td>2.0</td>
<td>0.0</td>
<td>45.7</td>
<td>46.0</td>
<td>47.5</td>
<td>96.7</td>
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</tr>
<tr>
<td><strong>AVERAGE Segment 3</strong></td>
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<td>7.9</td>
<td>14.0</td>
<td>0.0</td>
<td>3.5</td>
<td>5.0</td>
<td>1.0</td>
<td>21.5</td>
<td>21.5</td>
<td>30.0</td>
<td>30.5</td>
<td>53.0</td>
<td></td>
</tr>
<tr>
<td><strong>AVERAGE - All TIs</strong></td>
<td>47.4</td>
<td>1.5</td>
<td>12.5</td>
<td>48.0</td>
<td>16.9</td>
<td>2.3</td>
<td>4.0</td>
<td>0.2</td>
<td>61.9</td>
<td>63.4</td>
<td>79.1</td>
<td>127.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL - All TIs</strong></td>
<td>616</td>
<td>19</td>
<td>162</td>
<td>624</td>
<td>220</td>
<td>7</td>
<td>12</td>
<td>3</td>
<td>805</td>
<td>824</td>
<td>1028</td>
<td>1663</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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 2.9 I-10 Mainline 5-Year Crash Summary (2005-2009)

<table>
<thead>
<tr>
<th>Segment</th>
<th>Type of Facility</th>
<th>All Crash Types</th>
<th></th>
<th>Fatal Crashes</th>
<th>All Crash Types</th>
<th></th>
<th>Fatal Crashes</th>
<th>Animal-Related Crashes</th>
<th>Animal-Related Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Number of Crashes</td>
<td>Crash Rate (Crashes per MVMT)</td>
<td>Ratio to Statewide Average</td>
<td>Number of Crashes</td>
<td>Crash Rate (Crashes per MVMT)</td>
<td>Ratio to Statewide Average</td>
<td>Number of Crashes</td>
<td>Crash Rate (Crashes per 100 MVMT)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>271</td>
<td>0.619</td>
<td>0.49</td>
<td>1</td>
<td>0.002</td>
<td>0.00</td>
<td>249</td>
<td>0.584</td>
<td>0.46</td>
</tr>
<tr>
<td><strong>Segment 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-19</td>
<td>Urban Principal Arterial - Interstate</td>
<td>32</td>
<td>0.526</td>
<td>0.49</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5th Ave</td>
<td>Urban Principal Arterial - Interstate</td>
<td>11</td>
<td>0.182</td>
<td>0.15</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Park Ave</td>
<td>Urban Principal Arterial - Interstate</td>
<td>44</td>
<td>0.759</td>
<td>0.60</td>
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<td><strong>TOTAL - ALL SEGMENTS</strong></td>
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</tr>
</tbody>
</table>

**Notes:**
1. From/into crossroad 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
5. 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): 0.099 per 100 MVMT
   - Rural Principal Arterial - Interstate (Fatal Crashes): 1.02 per 100 MVMT

6. From the eastmost ramp eastward (does not include the area within the TI)
7. °Ratio to Statewide Average - Legend
   - I-XX < 1
   - 1.50 ≤ °I-XX < 2.00
   - °I-XX ≥ 2.00

8. 5-10 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 2.10 SR 210 Mainline 5-Year Crash Summary (2005-2009)

<table>
<thead>
<tr>
<th>Segment</th>
<th>Urban Principal Arterial - Other</th>
<th>Urban Principal Arterial - Other</th>
<th>Urban Principal Arterial - Other</th>
<th>Urban Principal Arterial - Other</th>
<th>Other (Fatal Crashes): 1.661 per 100 MVMT</th>
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</thead>
<tbody>
<tr>
<td>Broadway Blvd</td>
<td>2.00&lt;=</td>
<td>1.50 &lt;=</td>
<td>1.00</td>
<td>0.50</td>
<td>0.00</td>
</tr>
<tr>
<td>Kino Pkwy</td>
<td>1.50 &lt;=</td>
<td>1.00</td>
<td>0.50</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>22nd St</td>
<td>1.00</td>
<td>0.50</td>
<td>0.00</td>
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<tr>
<td>Country Club Dr</td>
<td>0.50</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>34th St</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Richey Blvd</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Dodge Blvd</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Alvernon Way</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Alvernon Way</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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</tr>
<tr>
<td><strong>TOTAL</strong></td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

### Notes:
1. From/to crossover 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
5. 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
6. Ratio to Statewide Average - Legend
   - X.XX < 1.50
   - 1.50 <= X.XXX < 2.00
   - 2.00 <= X.XX

### Table 2.11 SR 210 Intersections 5-Year Crash Summary (2005-2009)

<table>
<thead>
<tr>
<th>Intersection</th>
<th>On Mainline, Not Related to Crossroad</th>
<th>On Mainline, Related to Crossroad</th>
<th>On Crossroad, Not Related to Ramps</th>
<th>On Crossroad, Related to Ramps</th>
<th>Totals</th>
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<tr>
<td>Broadway Blvd</td>
<td>4</td>
<td>37</td>
<td>2</td>
<td>2</td>
<td>65</td>
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<tr>
<td>Kino Pkwy</td>
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<td>8</td>
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<td>21</td>
<td>31</td>
</tr>
<tr>
<td>22nd St</td>
<td>10</td>
<td>54</td>
<td>2</td>
<td>14</td>
<td>26</td>
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<td>Country Club Rd</td>
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<td>85</td>
<td>0</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>34th St</td>
<td>8</td>
<td>26</td>
<td>0</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Richey Blvd</td>
<td>13</td>
<td>24</td>
<td>0</td>
<td>16</td>
<td>33</td>
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<td>Dodge Blvd</td>
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<td>9</td>
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<td>0</td>
<td>0</td>
<td>2</td>
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<tr>
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<td>14.6</td>
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<td><strong>TOTAL</strong></td>
<td>84</td>
<td>248</td>
<td>4</td>
<td>39</td>
<td>131</td>
</tr>
</tbody>
</table>

### Notes:
- From/to crossover overpass or underpass, unless otherwise noted
- Facility Functional Classification used for Statewide Average comparison
- MVMT = Million Vehicle-Miles Traveled
- 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
- Ratio to Statewide Average - Legend
  - X.XX < 1.50
  - 1.50 <= X.XXX < 2.00
  - 2.00 <= X.XX
3. ALTERNATIVES CONSIDERED

3.1. Introduction

The primary objectives of the Feasibility Study of improvements to I-10 and the extension of SR 210 are to identify and evaluate alternatives for the improvement of I-10 between the I-10/I-19 System Interchange and SR 83 to accommodate 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 Initial Traffic Report prepared as part of the studies for the improvement of I-10 analyzed three No-Build concepts including improving only I-10, only extending SR 210, or both improving I-10 and extending SR 210 (See Section 2; Traffic and Crash Data in this report). The conclusion was that both improvement of I-10 and extension of SR 210 to a connection with I-10 are required to provide an acceptable level of service on both highways for the 2040 design year.

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.

Per ADOT Roadway Design Guidelines, LOS D is acceptable in urban conditions for I-10 and SR 210 mainline and ramp roadways, and for ramp/crossroad intersections. LOS B is acceptable 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 traffic demand and identifies capacity problems under a “No-Build” scenario. Revisions to existing conditions needed to accommodate the 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.

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 with the SR 210 extension to a connection with I-10.
- 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

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 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 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.
  - 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.
  - 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, Ilia and Ilb and Figure 3.4 System Alternative Ilc.
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 with 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 be an issue for 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 includes 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 will 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 then turns to the south and crosses under Drexel Road. It turns back to the east past the Pima Air Museum and then turns to the south again and crosses under Valencia Road. After crossing under a major wash just south of Valencia Road, the vertical alignment climbs to cross over the UPRR. The profile stays elevated and crosses over Wilmot Road and intersects I-10 with a system interchange.
  - A new traffic interchange will be constructed at the crossing of SR 210 and Drexel Road. The local road system will provide access between SR 210 and Valencia Road via the traffic interchange at Drexel Road.
  - Wilmot Road will 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 will be integrated with the SR 210/I-10 System Interchange.

The Wilmot Road couplet will continue to the north of I-10 just beyond the 100-year FEMA Floodplain. The couplet roadways will merge into a two-direction roadway just south of the UPRR. Wilmot
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.

### 3.3.1. System Alternative I

This alternative 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, 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 D 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 D or better, both AM and PM in 2040, except the NB On-ramp from Ajo Way to SR 210 will operate at LOS E, both AM and PM peak hour. The ramp with LOS E will be further modified during the Phase II Design Concept Study to provide LOS D or better.

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 west of the I-10/SR 210 System Interchange at Alvernon Way, and six mainline lanes in each direction east of the I-10/ SR 210 System Interchange at Alvernon Way. The need for six 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.

### 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 Contractors Way. Access to Contractors Way is provided from SR 210 via an interchange at Irvington Road, approximately one mile east of Contractors 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.

WB SR 210 mainline between Golf Links Road and the I-10/SR 210 System Interchange west of Valencia Road will have LOS D or better, for both AM and PM in 2040. EB SR 210 will operate at LOS B during the AM peak hour, but at LOS E during the PM peak hour. The EB section with LOS E will be further modified during the Phase II Design Concept Study to provide LOS D or better.
The SR 210 ramps between Golf Links Road and the I-10/SR 210 System Interchange will have LOS D or better, both AM and PM in 2040, except:

- The SR 210 Off-ramp to Valencia Road will operate at LOS F, during the PM peak hour.
- The SR 210 southbound On-ramp from Alvernon Way will operate at LOS F during the PM peak hour.

Both of the ramps with LOS F will be modified during the Phase II Design Concept Study to provide LOS D or better.

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 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 west of the I-10/SR 210 System Interchange west of Valencia Road, and six mainline lanes in each direction east of the I-10/SR 210 System Interchange west of Valencia Road. The need for six mainline lanes in each direction to the east reflects the additional traffic that enters I-10 via TI 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.

### 3.3.3. System Alternative Ilc

The Level 2 Analysis for System Alternative Ilc will be included in the Phase II, Design Concept Study. See Figure 3.4 System Alternative Ilc.

### 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 and System Alternative I and the junction of I-10 and System Alternative II.

### 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 crossing road 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. Stakesholder 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 3.3.4 describes each TI and required improvements.

### I-10 Capacity

The results of traffic modeling indicate that I-10 between the I-10/I-19 System Interchange and the I-10/SR 210 System Interchange should be four lanes in each direction with auxiliary lanes between successive entrance and exit ramps. 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 three lanes in each direction.

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 Alternative System I and Alternative System II.

This means that traffic volumes and the number of mainline I-10 lanes west of the SR 210 System Interchange are the same for both System Alternative I and System Alternative II. Likewise, traffic volumes and number of mainline I-10 lanes east of the SR 210 System Interchange are the same for both System Alternative I and System Alternative II. Only the section of I-10 between the most western and the most eastern of the I-10/SR 210 System alternative connections to I-10 will change.

Mainline I-10 will be four lanes in each direction from I-19 to the I-10/SR 210 System Interchange and six lanes in each direction from the I-10/SR 210 System Interchange to Kolb Road as shown below.

- I-10 to I-10/SR 210 System Interchange: 4 lanes in each direction
- I-10/SR 210 System Interchange to Kolb Road: 6 lanes in each direction
- Kolb Road to Houghton Road: 5 lanes in each direction
- Houghton Road to Wentworth Road: 4 lanes in each direction
- Wentworth Road to SR 83: 3 lanes in each direction

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 7,000-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.

### 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 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 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 sheet 1 and 2 of 2040 Improvements – System Alternatives I and II in **Appendix C and D**.

- The eastbound entrance ramp from 6th Avenue is interconnected with the eastbound exit ramp from I-10 to Park Avenue via a weave on the frontage road.
- The westbound exit ramp from I-10 to 6th Avenue is interconnected with the loop 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. 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 sheet 2 of 2040 Improvements – System Alternatives I and II in **Appendix C and D**.
The weaves 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 a 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 “bumps” 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 sheet 3 of 2040 Improvements – System Alternatives I and II in Appendix C and D. 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 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 and II in Appendix C and D. 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 and II in Appendix C and D. 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.

One of the alternative locations for the connection of SR 210 to I-10 is at Alvernon Way (System Alternative I), covered in Section 3.3.1 of this report. If System Alternative I is selected, the Service TI discussed here would be integrated with a System Interchange as discussed for the System Alternative I interchange in the following subsection of this report.

The existing partial diamond TI has three ramps, but does not provide full access between I-10 and Alvernon Way. See sheets 5 and 6 of 2040 Improvements – System Alternatives I and II in Appendix C and D. The westbound entrance ramp that would provide access from Alvernon Way to westbound I-10 is not provided.
The initial evaluation involved retaining the existing TI with the following changes:

- The westbound entrance ramp will be added.
- The westbound exit ramp will 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 turn lanes on the crossroad. The modeling evaluations also indicate that both intersections will operate at LOS B, but external storage for left turn lanes on the crossroad...

The new 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. See Future Roadway Interchange Configurations, page 13 of this report. The minor ramps provide full access from/to I-10 and SR 210 to/from Valencia Road and Craycroft Road.

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 majorities of the system interchange are 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 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.

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. See Future Roadway Interchange Configurations, page 13 of this report. 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.

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. See Future Roadway Interchange Configurations, page 13 of this report. The minor ramps provide full access from/to I-10 and SR 210 to/from Valencia Road and Craycroft Road.

The westbound entrance ramp is relocated westerly to just north of Valencia Road and is grade-separated over the westbound Valencia entrance ramp. The Craycroft Road westbound entrance ramp is relocated westerly to just north of Valencia Road and is grade-separated over the westbound Valencia exit 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 and II in Appendix C and D.

There are commercial properties in three of the four quadrants of the TI, including the TTI truck stop to the northwest quadrant. The four-lane I-10 overpass structures only accommodate two lanes in each direction on the crossroad.

Eastbound and westbound frontage roads connect between Craycroft Road and Wilmot Road. There are no access driveways onto the westbound frontage road near Wilmot Road. It may be feasible to relocate these accesses to Wilmot Road to avoid retaining the frontage road and avoid the need for additional right-of-way due to the need to provide proper offset between mainline I-10 and the frontage road. During the Phase II Design Concept Study a check of whether undeveloped properties have access to the frontage roads is needed. If properties would become landlocked by removing the frontage roads a decision will have to be made to either move them and widen the right-of-way or eliminate them and 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 north of Valencia Road to provide for the Craycroft ramps to “blend” over the Valencia ramps.

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 avoid 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.
The existing spread 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 and II in Appendix C and D. The four-span I-10 overpass structures only accommodate two lanes in each direction on the crossroad.

Eastbound and westbound frontage roads connect between Wilmot Road and Kolb Road. 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 the frontage road. This will avoid the need for additional right-of-way due to the need to provide proper offset between mainline I-10 and the frontage road. During the Phase II Design Concept Study a check of whether undeveloped properties have access to the frontage roads is needed. If properties would become landlocked by removing the frontage roads a decision will have to be made to either move them and widen the right-of-way or eliminate them and purchase access rights to the properties.

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 Wilmot Road. 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 avoid 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.

The existing spread diamond TI has four ramps that provide full access between I-10 and Kolb Road. See sheet 11 of 2040 Improvements – System Alternatives I and II in Appendix C and D.

Kolb 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/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 created 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 heavy through volumes on Kolb Road. Finally, a platform diamond TI was evaluated and it was determined that it functioned with a typical LOS of A. With this configuration, I-10 remains at ground level and Kolb Road is two levels above I-10. Both carry only through traffic. Turning movements are restricted to roadways in the middle level, which is the „platform”. Therefore, the turning movements do not interfere with the through movements. All ramps that connect to the „platform” 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 two platform ramps, but passes under Kolb Road 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 Voyager Road east to the Pantano Road alignment and then extending Pantano Road north to the frontage road.

The platform ramp to NB Kolb Road merges with Kolb Road only a few hundred feet south of IBM Road, a significant east-west arterial. Further evaluation is needed in the Phase II Design Concept Study to increase this distance and to optimize platform roadway geometry.

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.

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 and II in Appendix C and D. 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 standard diamond interchange 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 Houghton Road.

Pima County has requested that Houghton Road be realigned to roughly follow the section line. This will be evaluated in the Phase II Design Concept Study.

The existing spread diamond TI has four ramps that provide full access between I-10 and Wentworth Road. See sheet 18 of 1-10 2040 Improvements - Systems I and II in Appendix C and D. 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 Wentworth Road.

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

34. Alternatives for Further Consideration

During review of the Initial Feasibility Study, Pima County stated that the County has recently embarked on a regional planning effort related to economic development and the transportation infrastructure necessary to support that development in the southeast area of the Tucson region. These studies envision Wilmot Road south of I-10 and extending north of I-10 along the southern boundary of DMAFB as becoming a major transportation corridor in the region.

The County requested that Alternative III, Alternative IIIa and Alternative IIIb, which include connection of SR 210 to I-10 at Wilmot Road, be carried into the Phase II Design Concept Study where they will be analyzed in more detail considering the County’s transportation planning.

The Pima Association of Governments (PAG) also reviewed the Initial Feasibility Study and commented that the Pima County concerns are consistent with the PAG’s adopted southeast Area Arterial Study which identified the Wilmot Road corridor south of I-10 as a critical need for north-south traffic movement in the area as well as the likely location of a limited access freeway facility that links to I-19. PAG further commented that not including Wilmot Road in the ADOT study as a feasible alternative could prejudice future study and implementation of this critical corridor.

DMAFB submitted comments as a result of their review of the Initial Feasibility Study. A meeting with DMAFB was held, which included representatives of Pima County, PAG and the City of Tucson. DMAFB advised of constraints that would adversely affect System Alternatives IIIa and IIIb.

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

In response to the expressed desire of the Pima County Department of Transportation for an alternative for the extension of SR 210 that joined I-10 at or near Wilmot Road, System Alternative IIIc was identified, and is described in Section 3.2 of this Feasibility 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 IIIc

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

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
  - 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

- **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 where SR 210 connects to I-10:
    - Eastbound: 4-lanes
    - Westbound: 4-lanes
  - From SR 210 connection to Kolb Road:
    - Eastbound: 6-lanes
    - Westbound: 6-lanes
  - From Kolb Road to Houghton Road:
    - Eastbound: 5-lanes
    - Westbound: 5-lanes
  - From Houghton Road to Wentworth Road:
    - Eastbound: 4-lanes
    - Westbound: 4-lanes
  - From Wentworth Road through SR 83:
    - Eastbound: 3-lanes
    - Westbound: 3-lanes

- **Through Lanes for SR 210 with System Alternative I:**
  - Through the main body of SR 210 with System Alternative I, the number of lanes will vary from 4-lanes in each direction to 5-lanes in each direction.
  - (Note: Number of through lanes for SR 210 with System Alternative I 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: See Future Roadway Interchange Configurations, page 13 of this report.
- **Lanewidth:** 12-feet
- **Left shoulder:** 6-feet
- **Right shoulder:** 10-feet

2-Lane Directional Ramps:
- **Lanewidth:** 12-feet
- **Left shoulder:** 4-feet
- **Right shoulder:** 8-feet

1-Lane and 2-Lane Ramps:
- **Lanewidth:** 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.
  - **Lanewidth:** 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%
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 E: Access Management - 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 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.

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).
7. Earp Wash Tributary, EB Frontage Road (MP 267.65): three 10’ 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 I), and Swan Road (new TI under System 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:
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 drawdown 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 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 is selected.

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

A system interchange will be developed at Wilmot Road if System Alternatives IIIc 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: System Alternative I 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.

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.

- System Alternative IIIc: System Alternatives IIIc will extend SR 210 east to a system interchange with I-10 at Wilmot Road. The conceptual configuration of the Wilmot Road TI is a system interchange between I-10 and SR 210 with a split diamond interchange for traffic movement between I-10 and Wilmot Road. Further study will be done to develop the interchange configuration during the Phase II Design Concept Study. The Alvernon Way/Golf Links Road interchange with SR 210 will be reconfigured similar to the reconfiguration for System Alternative II.

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

4.2.13. Utilities and Rail Facilities

Table 4.1 lists Utility and Railroad contacts (see next page).

- 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 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.
  - The extension of SR 210 with System Alternatives IIIa, IIIb or IIIc crosses over the UPRR and the TEP Spur west of the Wilmot 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.

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<tr>
<td>American Telephone and Telegraph</td>
<td>Coaxial, Fiber</td>
<td>LSAC Group</td>
<td>800-241-3624</td>
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<td>City of Tucson Water</td>
<td>Water, Reclaimed</td>
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<td>520-837-2125</td>
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<td>City of Tucson Facilities Design &amp; Maintenance</td>
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<tr>
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<td>City of Tucson Traffic Eng Irrigation</td>
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<td>City of Tucson Inet Fiber</td>
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<td>Cox Communications</td>
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<tr>
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<tr>
<td>Union Pacific Railroad</td>
<td>Railroad</td>
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<td>Contact Robert Travis, ADOT Utilities and Railroad Engineering Liaison 520-712-6193</td>
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<tr>
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<td>815-671-3576</td>
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II and IIIc alternatives, while notable with regard to economic impacts, consideration in this Feasibility Study. The issues related to the system I, 4[f] resource) resulted in dropping that alternative from further proximity to two public schools, potential environmental justice issue displacements unlikely, few business displacements, and limited impact with I-10 has some substantive environmental issues. The issues related 44 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 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.

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 and System II alternatives, and potential residential displacements and changes in access for the System IIIc alternative. A single residential parcel containing three homes in the midst of industrial zoning could be displaced by all three alternatives. System I alternative could require relocation of approximately 15 to 20 businesses and access changes to several others, while the System II and IIIc alternatives could both require 30 to 40 business relocations and other access changes. Additionally the system II and IIIc alternatives may also encroach on DMAFB property, and the System IIIc alternative could impact four residential subdivisions north and south of the I-10/Wilmot Road TI. 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.

5.2.1. 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

Subsequent team meetings were generally held on a monthly basis at the ADOT Tucson District Office, with a videoconference link to ADOT Phoenix Administration. The videoconference link provided for optional participation in the meetings. Throughout the course of the meetings, additional stakeholder participants included:

- ASLD
- AGFD
- 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 analyze 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
- DMAFB, PAG, and Pima County DOT – March 14, 2012 (Discussion of System IIIa, IIIb and IIIc alternatives)

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

5.2.2. 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.

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 both System Alternative I and System Alternative II 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 preliminary cost estimate for System Alternative IIIc will be developed during the Phase II Design Concept Study.

The estimate items and the basis for the estimated cost of each item 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 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**
- **Embankment 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 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 $710,240,000
- SR 210 $185,220,000
- System Alternative I Total $895,460,000
- System Alternative I ROW – 207 acres required

**System Alternative II**

- I-10 $701,110,000
- SR 210 $165,630,000
- System Alternative II Total $866,740,000
- System Alternative II ROW – 309 acres required

**System Alternative IIIc**

The estimated cost and amount ROW for System Alternative IIIc will be developed as part of the Phase II Design Concept Study. A more detailed breakdown of the costs associated with System Alternatives I and II has been provided on the following pages.
### Table 6.1 I-10/SR 210; System Alternative I (I-10 Improvements) Estimated Cost

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Concrete Barrier</td>
<td>Centerline Mile</td>
<td>14.2</td>
<td>$220,000</td>
<td>$3,124,000</td>
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<tr>
<td>Outside Curb &amp; Gutter</td>
<td>Centerline Mile</td>
<td>6.6</td>
<td>$750,000</td>
<td>$5,100,000</td>
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<tr>
<td>Outside Concrete Barrier</td>
<td>Centerline Mile</td>
<td>6.6</td>
<td>$750,000</td>
<td>$5,100,000</td>
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<tr>
<td>System I - I-10 Subtotal</td>
<td>SUBTOTAL</td>
<td></td>
<td></td>
<td>$364,264,285</td>
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<tr>
<td>Miscellaneous Work (15%)</td>
<td>Lump Sum</td>
<td></td>
<td></td>
<td>$54,639,643</td>
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<tr>
<td>Dust Palliative (1%)</td>
<td>Lump Sum</td>
<td></td>
<td></td>
<td>$4,189,039</td>
</tr>
<tr>
<td>Furnish Water (1%)</td>
<td>Lump Sum</td>
<td></td>
<td></td>
<td>$4,189,039</td>
</tr>
<tr>
<td>Maintenance of Traffic (6%)</td>
<td>Lump Sum</td>
<td></td>
<td></td>
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<tr>
<td>Erosion Control and Pollution Prevention (1%)</td>
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<td>$4,189,039</td>
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<td>Contractor Quality Control (2%)</td>
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<td></td>
<td></td>
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<tr>
<td>Construction Surveying and Layout (1%)</td>
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</tr>
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<td>Mobilization (10%)</td>
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<td>Subtotal</td>
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<td>Construction Engineering (15%)</td>
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<td>Indirect Cost Allocation (5.19%)</td>
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<td>Other Costs</td>
<td>Lump Sum</td>
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<td>Subtotal</td>
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### Table 6.2 I-10/SR 210; System Alternative I (SR 210 Extension) Estimated Cost

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<th>Unit</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>Outside Concrete Barrier</td>
<td>Centerline Mile</td>
<td>1.2</td>
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<td>$9,300,000</td>
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<tr>
<td>Outside Curb &amp; Gutter</td>
<td>Centerline Mile</td>
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<td>$9,300,000</td>
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<td>System I - SR 210 Total</td>
<td>SUBTOTAL</td>
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<td></td>
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<td>Miscellaneous Work (15%)</td>
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<tr>
<td>Dust Palliative (1%)</td>
<td>Lump Sum</td>
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<td></td>
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<tr>
<td>Furnish Water (1%)</td>
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<td></td>
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</tr>
<tr>
<td>Maintenance of Traffic (6%)</td>
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<td>Erosion Control and Pollution Prevention (1%)</td>
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<td>Contractor Quality Control (2%)</td>
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<td>Construction Surveying and Layout (1%)</td>
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<td></td>
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<td>Contingency (5%)</td>
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<td>Construction Engineering (15%)</td>
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<td>Indirect Cost Allocation (5.19%)</td>
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<td>Other Costs</td>
<td>Lump Sum</td>
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<td>$13,720,237</td>
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<tr>
<td>System I - SR 210 Total</td>
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<td>$185,220,000</td>
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### Table 6.3: I-10/SR 210; System Alternative II (I-10 Improvements) Estimated Cost

<table>
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<th>Item Description</th>
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<th>Unit Price</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Mainline</td>
<td>Lane Mile</td>
<td>281.5</td>
<td>$300,000</td>
<td>$84,440,284</td>
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<tr>
<td>Crossroad (5-lanes each direction)</td>
<td>Lin. Ft.</td>
<td>14,415</td>
<td>$1,000</td>
<td>$14,415</td>
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<tr>
<td>Crossroad (4-lanes each direction)</td>
<td>Lin. Ft.</td>
<td>11,160</td>
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<tr>
<td>Signalized Intersection</td>
<td>Each</td>
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<tr>
<td>Ramps</td>
<td>Lane Lin. Ft.</td>
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<tr>
<td>Bridge</td>
<td>Sq. Ft.</td>
<td>979,295</td>
<td>$90</td>
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<tr>
<td>PCCP Ramp Removal</td>
<td>Lump Sum</td>
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<td>$157,815</td>
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<td>AC Ramp Removal</td>
<td>Lump Sum</td>
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<td>$630,800</td>
<td>$630,800</td>
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<tr>
<td>Retaining Wall</td>
<td>Sq. Ft.</td>
<td>280,370</td>
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<tr>
<td>Borrow</td>
<td>Cu. Yd.</td>
<td>3,216,570</td>
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<td>Commercial Building Removal</td>
<td>Each</td>
<td>9</td>
<td>$100,000</td>
<td>$900,000</td>
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<tr>
<td>Residential Building Removal</td>
<td>Each</td>
<td>10</td>
<td>$25,000</td>
<td>$250,000</td>
</tr>
<tr>
<td>Pavement Drainage</td>
<td>Centerline Mile</td>
<td>21.7</td>
<td>$1,530,000</td>
<td>$33,201,000</td>
</tr>
<tr>
<td>Roadway Lighting</td>
<td>Centerline Mile</td>
<td>21.7</td>
<td>$200,000</td>
<td>$4,340,000</td>
</tr>
<tr>
<td>Roadway Signs</td>
<td>Centerline Mile</td>
<td>21.7</td>
<td>$260,000</td>
<td>$5,642,000</td>
</tr>
<tr>
<td>FMS</td>
<td>Centerline Mile</td>
<td>21.7</td>
<td>$500,000</td>
<td>$10,850,000</td>
</tr>
<tr>
<td>Landscaping</td>
<td>Centerline Mile</td>
<td>21.7</td>
<td>$330,000</td>
<td>$7,161,000</td>
</tr>
<tr>
<td>Enclosed Median</td>
<td>Centerline Mile</td>
<td>10.4</td>
<td>$260,000</td>
<td>$2,704,000</td>
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<tr>
<td>Outside Curb &amp; Gutter</td>
<td>Centerline Mile</td>
<td>14.2</td>
<td>$320,000</td>
<td>$4,304,000</td>
</tr>
<tr>
<td>Outside Concrete Barrier</td>
<td>Centerline Mile</td>
<td>6.8</td>
<td>$750,000</td>
<td>$5,100,000</td>
</tr>
<tr>
<td><strong>SYSTEM II - I-10 TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>$359,563,349</td>
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<tr>
<td><strong>MISCELLANEOUS WORK (15%)</strong></td>
<td>Lump Sum</td>
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<td>$95,037,502</td>
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<tr>
<td><strong>DUST PALLIATIVE (1%)</strong></td>
<td>Lump Sum</td>
<td></td>
<td></td>
<td>$4,135,209</td>
</tr>
<tr>
<td><strong>FURNISH WATER (1%)</strong></td>
<td>Lump Sum</td>
<td></td>
<td></td>
<td>$4,135,209</td>
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<tr>
<td>MAINTENANCE OF TRAFFIC (8%)</td>
<td>Lump Sum</td>
<td></td>
<td></td>
<td>$3,081,668</td>
</tr>
<tr>
<td><strong>EROSION CONTROL AND POLLUTION PREVENTION (1%)</strong></td>
<td>Lump Sum</td>
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<td></td>
<td>$4,135,209</td>
</tr>
<tr>
<td><strong>CONTRACTOR QUALITY CONTROL (2%)</strong></td>
<td>Lump Sum</td>
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<td></td>
<td>$8,270,417</td>
</tr>
<tr>
<td><strong>CONSTRUCTION SURVEYING AND LAYOUT (1%)</strong></td>
<td>Lump Sum</td>
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<td></td>
<td>$4,135,209</td>
</tr>
<tr>
<td><strong>MOBILIZATION (10%)</strong></td>
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<td>Lump Sum</td>
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<tr>
<td><strong>CONSTRUCTION ENGINEERING (15%)</strong></td>
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<td><strong>INDIRECT COST ALLOCATION (5.19%)</strong></td>
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<tr>
<td><strong>OTHER COSTS</strong></td>
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<tr>
<td><strong>SYSTEM II - I-10 TOTAL</strong></td>
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<td></td>
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<td>$701,110,000</td>
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### Table 6.4: I-10/SR 210; System Alternative II (SR 210 Extension) Estimate

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<th>Item Description</th>
<th>Unit Description</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainline</td>
<td>Lane Mile</td>
<td>29.8</td>
<td>$300,000</td>
<td>$88,440,284</td>
</tr>
<tr>
<td>Crossroad (5-lanes each direction)</td>
<td>Lin. Ft.</td>
<td>1,156</td>
<td>$1,000</td>
<td>$1,156,000</td>
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<tr>
<td>Signalized Intersection</td>
<td>Each</td>
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<td>$1,500,000</td>
</tr>
<tr>
<td>Ramps</td>
<td>Lane Lin. Ft.</td>
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<td>Bridge</td>
<td>Sq. Ft.</td>
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<td>Lump Sum</td>
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<td>$138,300</td>
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<tr>
<td>Retaining Wall</td>
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<td>Borrow</td>
<td>Cu. Yd.</td>
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<td>Commercial Building Removal</td>
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<td>Roadway Drainage</td>
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<td>Pavement Drainage</td>
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<td>$1,530,000</td>
<td>$5,355,000</td>
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<tr>
<td>Roadway Lighting</td>
<td>Centerline Mile</td>
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<td>$200,000</td>
<td>$700,000</td>
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<tr>
<td>Roadway Signs</td>
<td>Centerline Mile</td>
<td>3.5</td>
<td>$200,000</td>
<td>$910,000</td>
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<tr>
<td>FMS</td>
<td>Centerline Mile</td>
<td>3.5</td>
<td>$500,000</td>
<td>$1,575,000</td>
</tr>
<tr>
<td>Landscaping</td>
<td>Centerline Mile</td>
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<td>$330,000</td>
<td>$1,155,000</td>
</tr>
<tr>
<td>Enclosed Median</td>
<td>Centerline Mile</td>
<td>3.5</td>
<td>$260,000</td>
<td>$910,000</td>
</tr>
<tr>
<td>Outside Curb &amp; Gutter</td>
<td>Centerline Mile</td>
<td>2.5</td>
<td>$220,000</td>
<td>$541,668</td>
</tr>
<tr>
<td>Outside Concrete Barrier</td>
<td>Centerline Mile</td>
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<td>$750,000</td>
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<td><strong>SYSTEM II - SR 210 TOTAL</strong></td>
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<td>$84,945,876</td>
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<tr>
<td><strong>MISCELLANEOUS WORK (15%)</strong></td>
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<tr>
<td><strong>DUST PALLIATIVE (1%)</strong></td>
<td>Lump Sum</td>
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<tr>
<td><strong>FURNISH WATER (1%)</strong></td>
<td>Lump Sum</td>
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<tr>
<td><strong>MOBILIZATION PER TRAFFIC (8%)</strong></td>
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<td><strong>EROSION CONTROL AND POLLUTION PREVENTION (1%)</strong></td>
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<td><strong>CONTRACTOR QUALITY CONTROL (2%)</strong></td>
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<td><strong>CONSTRUCTION SURVEYING AND LAYOUT (1%)</strong></td>
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<td><strong>MOBILIZATION (10%)</strong></td>
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<td><strong>CONTINGENCY (5%)</strong></td>
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<td><strong>CONSTRUCTION ENGINEERING (15%)</strong></td>
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<tr>
<td><strong>INDIRECT COST ALLOCATION (5.19%)</strong></td>
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