FINAL DESIGN CONCEPT REPORT
(Volume 1 of 2)

I-19 San Xavier Road to I-10

Project No. 019 PM 057 H5105 01L
Federal Aid Reference Number: 019-A (014)
ADOT Contract No. 04-34

August 23, 2012

Prepared For the
Arizona Department of Transportation
Tucson District – Pima County

PREPARED BY:

AECOM

1860 East River Road, Suite 300
Tucson, Arizona 85718

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ARIZONA DEPARTMENT OF TRANSPORTATION
OFFICE MEMO
INTERMODAL TRANSPORTATION DIVISION
January 27, 2012

TO: ROBIN RAINE, STATEWIDE PROJECT MANAGEMENT
TODD EMERY, TUCSON DISTRICT ENGINEER
ASSISTANT STATE ENGINEER – ROADWAY ENGINEERING GROUP

FROM: PAUL O'BRIEN, PREDESIGN SECTION

SUBJECT: FINAL DESIGN CONCEPT REPORT
I-19 SAN XAVIER ROAD TO I-10
019 PM 057 H5105 01L

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

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

Paul O'Brien 1/27/12
PAUL O'BRIEN, ROADWAY PREDESIGN, 605E

Concurrence: Robin Raine 2/8/12
ROBIN RAINE, STATEWIDE PROJECT MANAGEMENT Date

Concurrence: 2/20/12
TODD EMERY, TUCSON DISTRICT ENGINEER Date

Approved: Barry Crockett 2/22/12
ROADWAY ENGINEERING GROUP Date
Barry Crockett, Acting Roadway Group Mgr

CC: Environmental Planning Group, EM02
Roadway Design, 615E

ARIZONA DEPARTMENT OF TRANSPORTATION
Intermodal Transportation Division
Statewide Project Management

Arizona Governor's Award for Quality 2001 Award Recipient

PROJECT DETERMINATION FORM

Fiscal Year	Project Number (TRACS #)	County & District	Project Location and Highway
2012	019 PM 057 H5105 01L	Pima County Tucson District	San Xavier Road - I-10

0 indicates project not programmed

Description
Roadway improvements to include widening, interchange reconstruction, new interchanges and associated drainage, and traffic improvements. Phase I is programmed for design and construction.

Existing Program Yes	Existing Program No	Program Year	Estimated Cost
✓		2014	$86,000,000

Operating Partnership Category:

A	B	N	X	U	NA
		✓			

Reports Required:	Yes	No
Location and Design Concept Report	✓	
Design Concept Report	✓	

Class I	Class II	Class III
		✓

Public Hearing
In the Highway Development process, at least one public hearing or the opportunity for a hearing will be offered for any project that:

- [✓] requires a significant amount of new right-of-way;
- [ ] substantially changes the layout or function of connecting roadway or the facility being improved;
- [ ] has a significant adverse impact on abutting real property;
- [ ] otherwise has a significant social, economic, environmental or other effect;
- [ ] is controversial on environmental grounds;
- [ ] or has significant floodplain encroachment;
- [ ] none of the above conditions apply.

Recommends:

Yes	No		Yes	No	
✓		Public Forum		✓	Offer a separate Location/Design Hearings
	✓	Offer a combined Location/Design Hearing		✓	Hold a Design Public Hearing

Robin Raine 1/24/12
Robin Raine, Project Manager, SPMG, T100 Date

2/20/12
Todd Emery, Tucson District Engineer, T100 Date

Comments:
Practical construction phasing & TC may vary from what is shown in this Document. ALSO I-19 SB Retain project for VALENCIA Off Ramps May be needed.

Concur:

Vincent Li, Assistant State Engineer, SPMG, 614E Date

Thor Anderson, Manager, Environmental Planning Group, 619E Date

Approved:

Mary Viparina, Assistant State Engineer, Roadway Engineering Group, 611E Date

Jean Nehme, State Bridge Engineer, Bridge Group, 613E Date

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List of Acronyms and Abbreviations

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway Transportation Officials
AB	Aggregate Base
AC	Asphalt Concrete
ACB	Asphalt Concrete Base
ACFC	Asphalt Concrete Friction Course
ADA	Americans with Disabilities Act
ADOT	Arizona Department of Transportation
ASLD	Arizona State Land Department
BFE	Base Flood Elevation
CD	Collector Distributor
CCTV	Closed Circuit Television
DCR	Design Concept Report
DDI	Diverging Diamond Interchange
DMS	Dynamic Message Signs
EA	Environmental Assessment
EB	Eastbound
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Maps
FMS	Freeway Management System
HCM	Highway Capacity Manual
HCS	Highway Capacity Software
HOV	High Occupancy Vehicle
I-19	Interstate 19
I-10	Interstate 10
ITS	Intelligent Transportation System
LOS	Level of Service
LRFD	Load and Resistance Factor Design
MOE	Measures of Effectiveness
MP	Milepost
MPH	Miles Per Hour
MUTCD	Manual on Uniform Traffic Control Devices
NB	Northbound
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
OP	Overpass
PAG	Pima Association of Governments
PCC	Pima Community College
PCCP	Portland Cement Concrete Pavement
PCPHPL	Passenger Cars per Hour per Lane
PCRWRD	Pima County Regional Wastewater Reclamation Department
PHF	Peak Hour Factor
PDO	Property Damage Only
RCBC	Reinforced Concrete Box Culvert
RDG	Roadway Design Guidelines
RTP	Regional Transportation Plan
SAHRA	Semi-Arid Hydrology and Riparian Area
SB	Southbound
SPUI	Single Point Urban Interchange
SR 86	State Route 86
SWPPP	Stormwater Pollution Prevention Plan
TEP	Tucson Electric Power
TOC	Traffic Operations Center
TI	Traffic Interchange
TSMS	Tucson Stormwater Management Study
UP	Underpass
vpd	Vehicle per Day
vph	Vehicle per Hour
WAPA	Western Area Power Administration
WB	Westbound

EXECUTIVE SUMMARY

This Design Concept Report describes the development and evaluation of capacity improvement alternatives along Interstate 19 (I-19) from Milepost (MP) 56.3 south of San Xavier Road to Interstate 10 (I-10) (MP 63.0) to meet the Year 2030 traffic demand. This project is located in the Arizona Department of Transportation's (ADOT's) Tucson District, within Pima County, in southern Arizona. The project lies within the City of Tucson and the San Xavier District of the Tohono O'Odham Nation.

The primary objective of this study is to develop a Recommended Alternative for the I-19 corridor, in accordance with the approved regional and local transportation plans, that optimizes traffic operations within the corridor to meet the Year 2030 traffic demand. The Recommended Alternative will address the Projects Purpose and Need, and will address the stakeholders request for additional modifications to the 2003 Corridor Study Recommended Alternative. The following documents have been/will be developed in support of this study:

- Traffic Report
- Drainage Report
- Geotechnical Report
- Environmental Assessment (EA)
- Change of Access Report
- Bridge Selection Report
- AASHTO Report
- Design Concept Plans

Background

ADOT completed the *I-19 Corridor Study, I-10 to Pima/Santa Cruz County Line* in October 2003. The study recommended improvements for the I-19 corridor to meet the anticipated 2030 projected transportation demands.

ADOT also completed the I-19 *Project Assessment, San Xavier Road – Ajo Way (SR 86)* in August 2003. The study recommended interim improvements to the I-19 mainline.

The original scope of this project was to prepare a Design Concept Report (DCR) for I-19, from San Xavier Road to Ajo Way, for interim improvements identified in the 2003 Project Assessment. In November of 2005, the Federal Highway Administration (FHWA) recommended that ADOT prepare a DCR for the ultimate improvements identified in the 2003 Corridor Study.

During project development, it became clear that to meet future traffic demands and provide regional continuity, the limits of the project needed to be extended to, but not include, the I-19/I-10 system Traffic Interchange (TI). Additionally, FHWA, and the Tohono O'Odham Nation requested modifications to the *2003 Corridor Study Recommended Alternative*. Therefore, a new design alternative was created consisting of the 2003 Corridor Study Recommended Alternative with modifications at the San Xavier Road TI, Los Reales Road TI, and the I-19/I-10 system TI.

Need for the Project

I-19 is a major corridor for intrastate and international commerce between Mexico and the United States. As the population in the Tucson metropolitan area continues to grow, traffic volumes are anticipated to increase. Over time, the increase in traffic volumes will result in degraded traffic operations along I-19 for regional and intrastate travelers, and along the important CANAMEX Trade Corridor, a congressionally designated high-priority corridor (Pima Association of Governments - 2006). If the I-19 corridor is not improved, by the year 2030, the Level of Service (LOS) is anticipated to reach unacceptable levels.

In addition to capacity improvements, existing roadway design elements such as vertical clearance, ramp widths, and acceleration/deceleration lengths do not meet current American Association of State Highway Transportation Officials (AASHTO) design criteria. The pedestrian bridge over I-19, near Michigan Street does not meet current AASHTO and Americans with Disabilities Act (ADA) requirements. New access points are needed to accommodate planned development and anticipated growth. Lastly, existing pavement and cross-drainage facilities in the project area do not meet current standards.

The purpose of the proposed improvements is to:

- Accommodate travel demand along the project corridor through the design year 2030 by increasing capacity and providing a Level of Service (LOS) that meets ADOT criteria for traffic operations (LOS D or better).
- Maintain an adequate LOS so that I-19 meets operational criteria as part of the CANAMEX Trade Corridor, a congressionally designated high-priority corridor.
- Meet the future access needs for planned development and anticipated population growth.
- Maintain pedestrian access across I-19 near Michigan Street.
- Improve roadway geometry to meet current AASHTO, ADA, and ADOT standards.
- Improve drainage on I-19 to meet current AASHTO and ADOT standards

Design Concept Alternatives

This report evaluated the following three design concept alternatives:

- **No-Action Alternative -** This alternative includes the addition of one northbound and one southbound lane along I-19 from Valencia Road to I-10. Roadway improvements for this alternative are illustrated in Figure EX-1.
- **Alternative #1:** Represents the 2003 Corridor Study Recommended Alternative. Roadway improvements for this alternative are illustrated in Figure EX-2.
- **Alternative #2:** Represents the 2003 Corridor Study Recommended Alternative with modifications at the San Xavier Road TI, Los Reales Road TI, and the I-19/I-10 system TI. The roadway improvements for this alternative are illustrated in Figure EX-3.

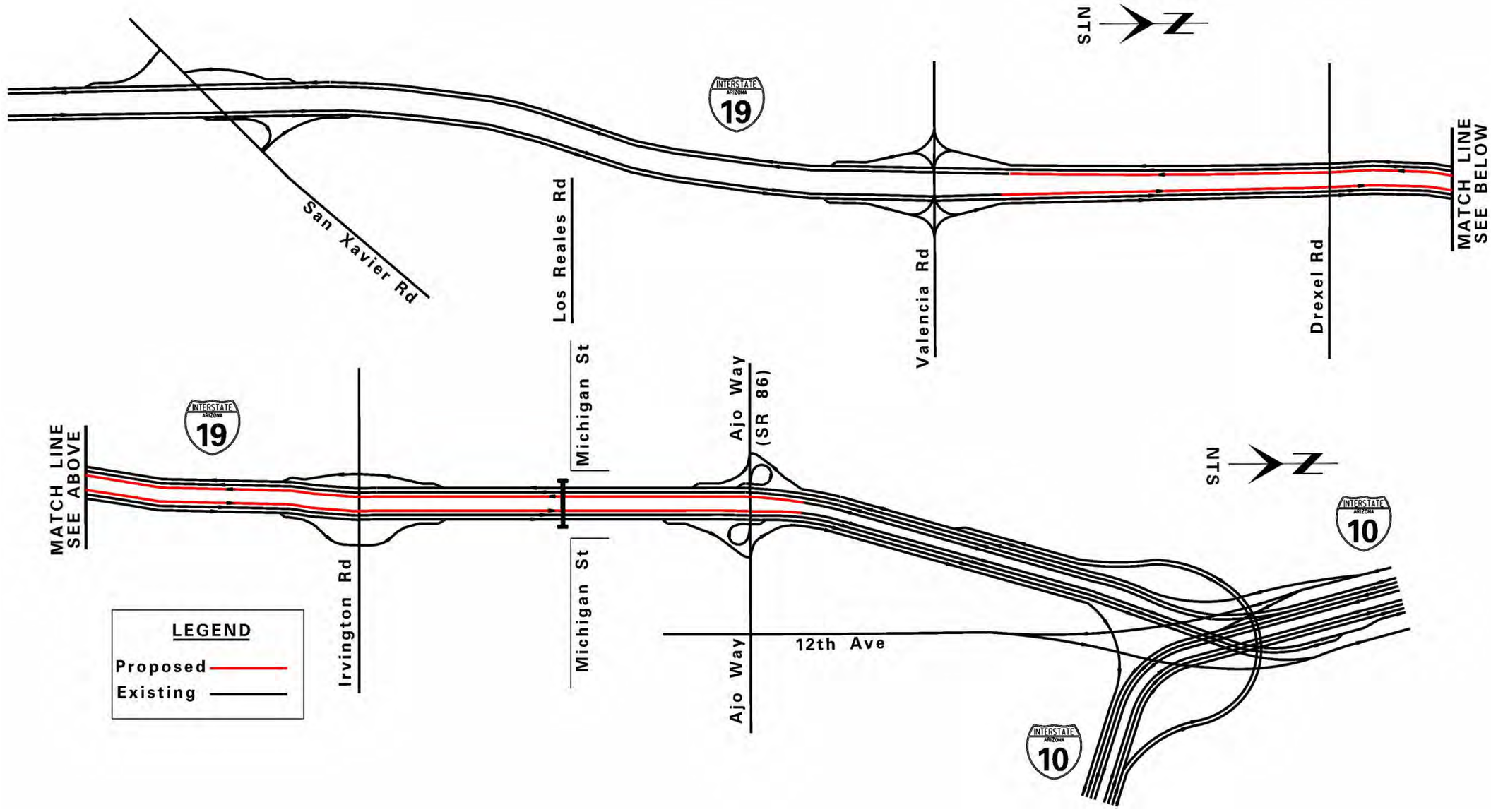


Figure EX-1: No-Action Alternative

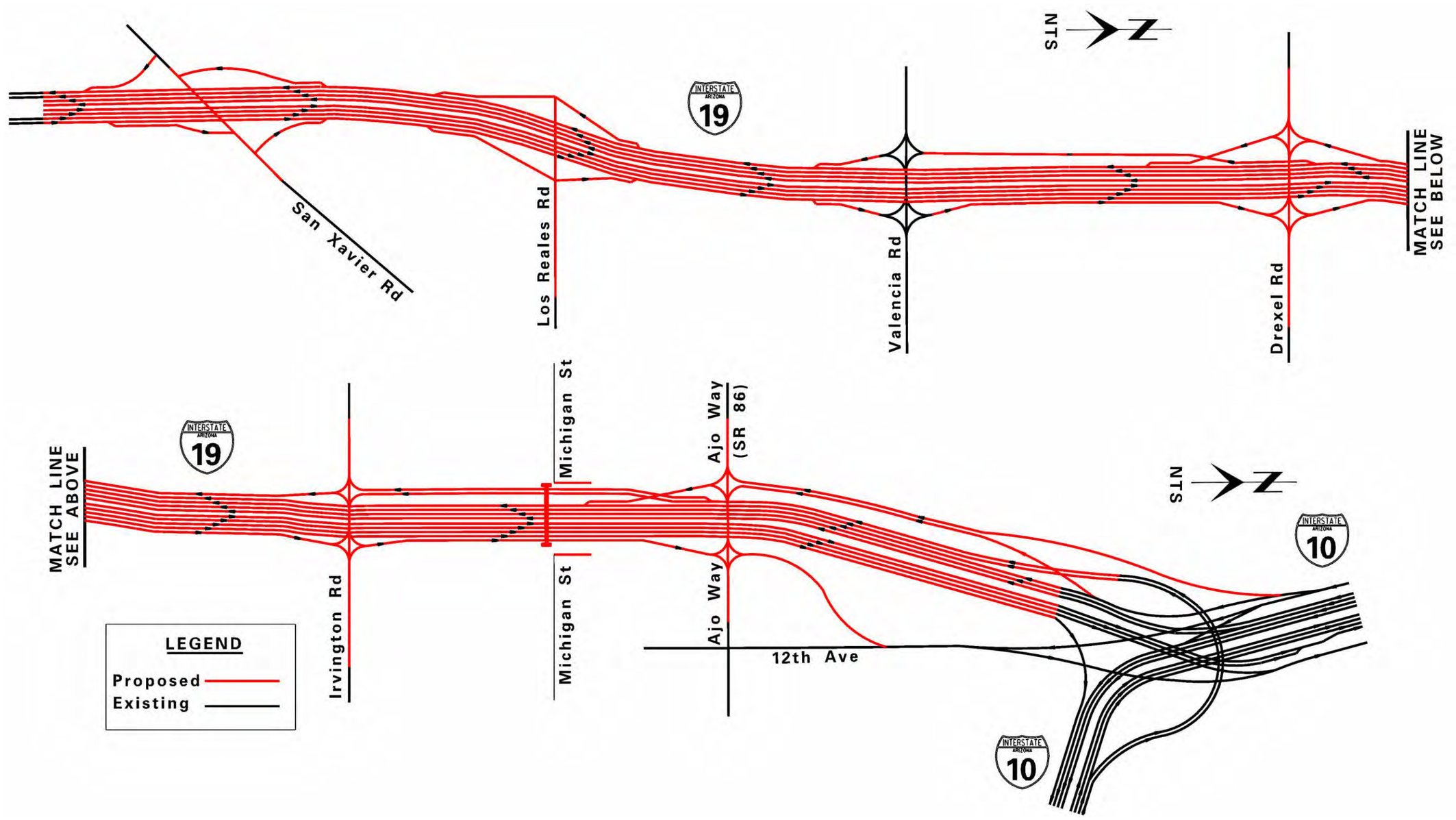


Figure EX-2: Alternative #1

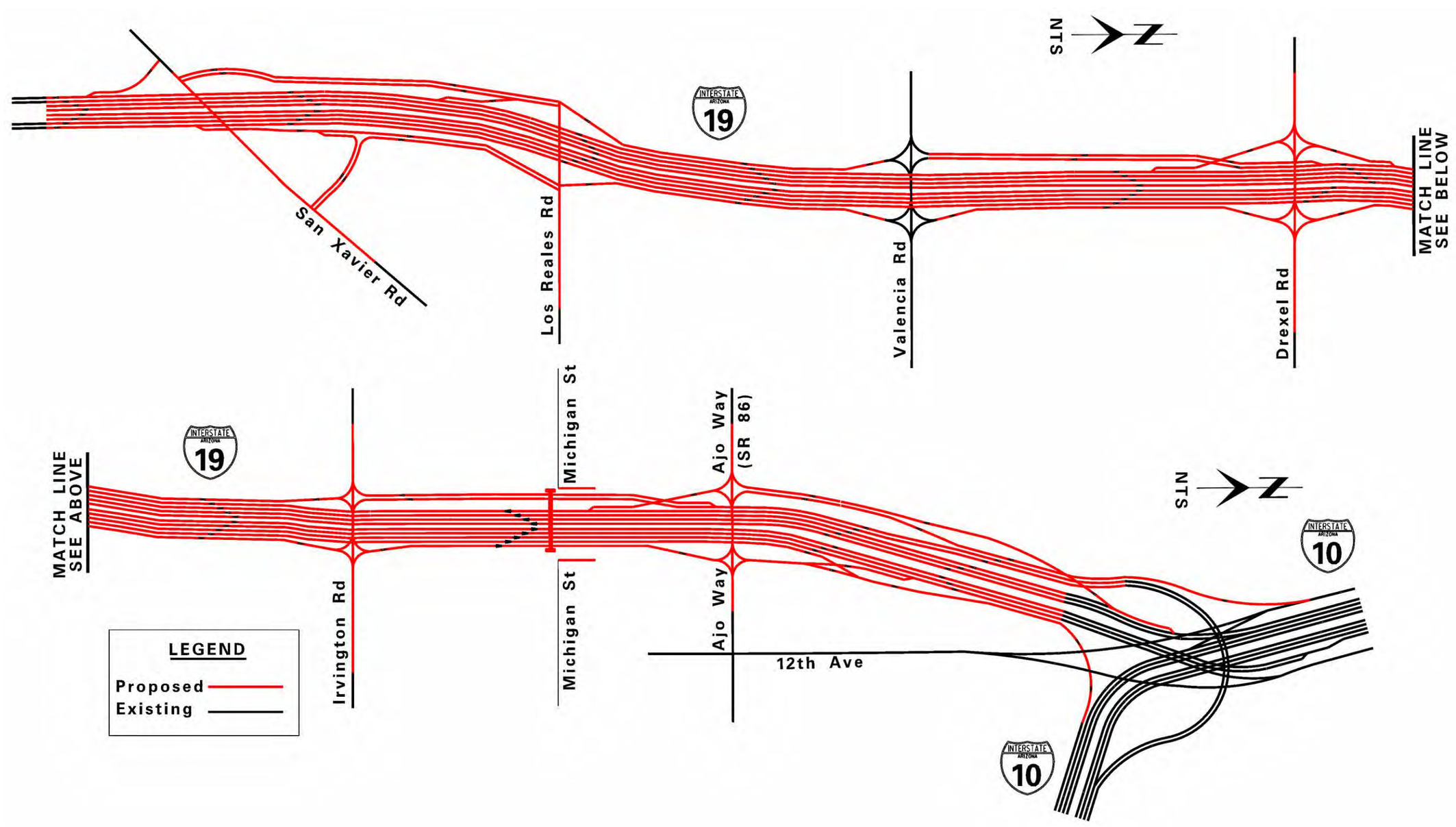


Figure EX-3: Alternative #2

A recommended alternative was selected based on several factors including design criteria, traffic operational characteristics, environmental impacts, right-of-way impacts, local access opportunities, constructability, project cost, and agency input. Based on the evaluation, Alternative #2 was selected as the Recommended Alternative for this Design Concept Report for the following main reasons:

- Existing features that do not meet current design standards will be reconstructed.
- Traffic operations and safety will be improved.
- Environmental impacts will be minimized.
- The public and key stakeholders prefer this alternative.

Major Features of the Recommended Alternative

The Recommended Alternative includes the following key roadway improvements:

- Reconstructing I-19 to four lanes in each direction between San Xavier Road and I-10.
- Constructing a modified split diamond interchange between San Xavier Road and Los Reales Road connected by Collector-Distributor (CD) roads. The existing modified diamond interchange at San Xavier Road will be reconstructed to a modified half-diamond interchange. A new modified half-diamond interchange will be constructed at Los Reales Road. CD roads will be constructed to connect the two modified half-diamond interchanges.
- Constructing a new Single Point Urban Interchange (SPUI) at Drexel Road.
- Reconstructing the existing diamond TI at Irvington Road to a SPUI.
- Reconstructing the existing partial clover leaf TI at Ajo Way to a SPUI.
- Providing CD roads between Ajo Way and I-10. Providing ramp connections between Ajo Way and the CD roads and between the CD roads and the I-19/I-10 system TI.
- Reconstructing the existing ramps in the northbound direction between Ajo Way and I-10 as braided ramps.
- Reconstructing the existing ramps in the southbound direction between I-10 and Ajo Way, and between Ajo Way and Irvington Road as braided ramps
- Reconstructing the existing southbound I-19 off-ramp at Valencia Road to accommodate the new braided ramps between Valencia Road and Drexel Road.
- Providing auxiliary lanes for northbound I-19 between Los Reales Road and Valencia Road, Valencia Road and Drexel Road, Drexel Road and Irvington Road, Irvington Road and Ajo Way, and Ajo Way and I-10.
- Providing auxiliary lanes for southbound I-19 between I-10 and Ajo Way, Irvington Road and Drexel Road, and Valencia Road and Los Reales Road.
- Reconstructing Ajo Way as a 6-lane divided roadway and Drexel Road as a 4-lane divided roadway.

Two lane ramps will be required at the westbound I-10 to southbound I-19 flyover on-ramp, the southbound I-19 off-ramp at Irvington Road and the southbound I-19 off-ramp at Valencia Road. Ramp metering will be required at the northbound I-19 on-ramp at Ajo Way.

Other improvements include a new pedestrian bridge over I-19 near Michigan Street, retaining walls, sound barriers, signing and pavement markings, drainage facilities, and freeway lighting. Intelligent Transportation System (ITS) infrastructure including ramp metering will be included as needed.

Approximately 74 acres of new right-of-way will be required to complete the Recommended Alternative

Coordination with concurrent construction projects will be required. Coordination will also be required with the utility companies within the project limits including Western Area Power Administration (WAPA), Tucson Electric Power (TEP), Southwest Gas (SW Gas), El Paso Natural Gas (El Paso Gas), Cox Cable Tucson (Cox), Tucson Water, Pima County Regional Wastewater Reclamation Department (PCRWRD), and Century Link (formerly Qwest Communications).

An EA is being developed in conjunction with this study. The EA includes a list of mitigation measures to be implemented as part of the project to avoid, reduce, or otherwise mitigate environmental impacts associated with the project.

Public Involvement

To ensure that the community had ample opportunity to provide comments and be involved in developing and evaluating the alternatives, this study has included an extensive public involvement process with public meetings, project newsletters, and a project website.

The agency stakeholders for this study included ADOT, FHWA, City of Tucson, City of South Tucson, Pima Association of Governments (PAG), Pima County, Tohono O'Odham Nation, Pima Community College, and the Pascua Yaqui Nation. Three agency scoping meetings were held on January 25, 2005, March 15, 2007, and March 31, 2009 at the Valencia Library Large Meeting Room. Ongoing coordination efforts with agency stakeholders continued throughout the study to supplement input received during the agency and public scoping meetings.

There were a total of four public scoping meetings held for this study. Three were held at the Valencia Library Large Meeting Room on January 25, 2005, March 15, 2007 and March 31, 2009, and one was held at the Pueblo Senior Center on June 15, 2011. During these meetings, the team presented the proposed roadway improvements for the corridor and solicited input from the public on the project scope and any issues, concerns, or comments.

Implementation Plan & Itemized Estimate of Project Costs

The proposed Implementation Plan for the Recommended Alternative includes a logical sequence of construction phasing that will systematically build the ultimate I-19 Corridor improvements over time as future traffic demands warrant and funding becomes available. A detailed implementation plan has been documented in this report which includes a phased approach for adding capacity to the corridor. Figure EX-4 illustrates the implementation plan for the I-19 corridor. The plan is divided into seven major construction phases as follows:

- Phase I – Reconstruct the Ajo Way TI (MP 61.90) including the Santa Cruz River bridge on Ajo Way and the Michigan Street pedestrian bridge. Additionally, this phase includes the reconstruction of portions of the I-19 mainline in the immediate area of the Ajo Way TI and the construction of the southbound I-19 braided off-ramp to Irvington Road. The estimated cost of this phase is approximately $89.8 million.

- Phase II – Reconstruct the Irvington Road TI (MP 60.95). The estimated cost of this phase is approximately $48.4 million.
- Phase III – Reconstruct the existing mainline to three lanes in each direction from Valencia Road to I-10 (MP 58.82 – MP 62.3). The estimated cost of this phase is approximately $86.3 million.
- Phase IV – Reconstruct the existing mainline to three lanes in each direction from San Xavier Road to Valencia Road (MP 56.3 – MP 58.82). The estimated cost of this phase is approximately $66.4 million.
- Phase V – Construct the Drexel Road TI (MP 59.90) and the southbound I-19 braided off-ramp to Valencia Road (if the Drexel Road bridge over the Santa Cruz River is completed, the order of this phase should be reevaluated). The estimated cost of this phase is approximately $45.2 million.
- Phase VI – Construct the fourth outer lane in each direction of I-19 and any auxiliary lanes from Valencia Road to I-10 (MP 58.82 – MP 62.3), including the braided ramps between Ajo Way and I-19/I-10 system TI. The estimated cost of this phase is approximately $92.2 million.
- Phase VII – Reconstruct the San Xavier Road TI (MP 56.95) and construct Los Reales Road TI (MP 58.90) including the CD roads between San Xavier Road and Los Reales Road. Additionally, construct the fourth outer lane in each direction of I-19 and any auxiliary lanes from San Xavier Road to Valencia Road (MP 56.3 – MP 58.82). The estimated cost of this phase is approximately $56.9 million.

The overall estimate of construction cost for the Recommended Alternative is approximately $485.1 million. The estimated cost for the Recommended Alternative includes approximately $399.3 million for construction, $31.9 million for design, $21.4 million for right-of-way/drainage easements, $28.5 million for utility design and relocations, and $4.0 million in environmental mitigations. Table EX-1 provides a detailed breakdown of the itemized estimate of project cost. The total cost in this phased approach includes some interim improvements (needed for maintaining traffic) that are built in one phase, but will be replaced in a future phase.

Table EX-1: Summary of Estimated Cost ($1,000)

Phase	Construction Cost	Design Cost	ROW & Drainage Easements	Utility Design and Relocations	Environmental Mitigation	Total Cost
Phase I	$75,252	$6,020	$2,381	$5,352	$753	$89,757
Phase II	$41,690	$3,335	$-	$2,961	$417	$48,403
Phase III	$67,565	$5,405	$7,856	$4,838	$676	$86,340
Phase IV	$53,363	$4,269	$4,450	$3,788	$534	$66,404
Phase V	$38,916	$3,113	$-	$2,748	$389	$45,166
Phase VI	$76,185	$6,095	$3,629	$5,483	$762	$92,154
Phase VII	$46,330	$3,706	$3,076	$3,335	$463	$56,911
Total	$399,300	$31,944	$21,392	$28,505	$3,993	$485,134

Current program funding identified in the ADOT 5-Year Transportation Facilities Construction Program (2012-2016) includes a total of $96.4 million. Table EX-2 provides details of the total current funding available for this project. The amount programmed in Fiscal Years 2012 and 2014 will be dedicated for completion of Phase I improvements (construction of the Ajo Way TI) with construction occurring in Fiscal Year 2014. The remaining phases will be built over a long period of time as future traffic demands warrant and funding becomes available. Additional funding sources will be required to implement the remaining phases of this project.

Table EX-2: Funding Availability ($1,000)

Phase	Type of Work	Funds	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
I	Design *	NH	$10,000	-	-	-	-
I	Construction *	NH	-	-	$86,385	-	-
TOTAL			**$10,000**	**-**	**$86,385**	**-**	**-**

* Some of the funding available for Design and Construction will be used for right-of-way and drainage easement acquisitions, utility relocations, and environmental mitigations.

Traffic Control

During construction of the I-19 mainline, traffic flow is expected to be maintained in both directions. All travel lanes on I-19 will remain open to traffic to the maximum extent possible.

During the construction of new structures, or the widening of the existing structures, one 12 ft lane in each direction with 2 ft of shy distance to the barrier will be provided along I-19. A minimum of one 12 ft lane in each direction with 2 ft of shy distance to the barrier will be provided along Ajo Way, Irvington Road, Drexel Road, and San Xavier Road. Temporary pavement and lane shifts will be required throughout the construction period to maintain traffic on the crossroads. Construction phasing will be assessed further in the Bridge Selection Report.

Existing ramps at the I-19/I-10 system TI will remain open to traffic during construction, with the exception of temporary night and weekend closures. Temporary pavement and lane shifts will also be required throughout the construction period to retain all ramp connections between I-19 and the crossroads.

Pedestrian traffic will be maintained at all times. The existing pedestrian bridge will remain in service until the new bridge is completed and ready to be used.

Temporary concrete barrier will be placed adjacent to the existing freeway outside shoulders. All grading, drainage, pavement widening, local lanes construction, bridge widening, retaining wall demolition and construction, sign structure foundations, and other items will be protected by temporary concrete barrier.

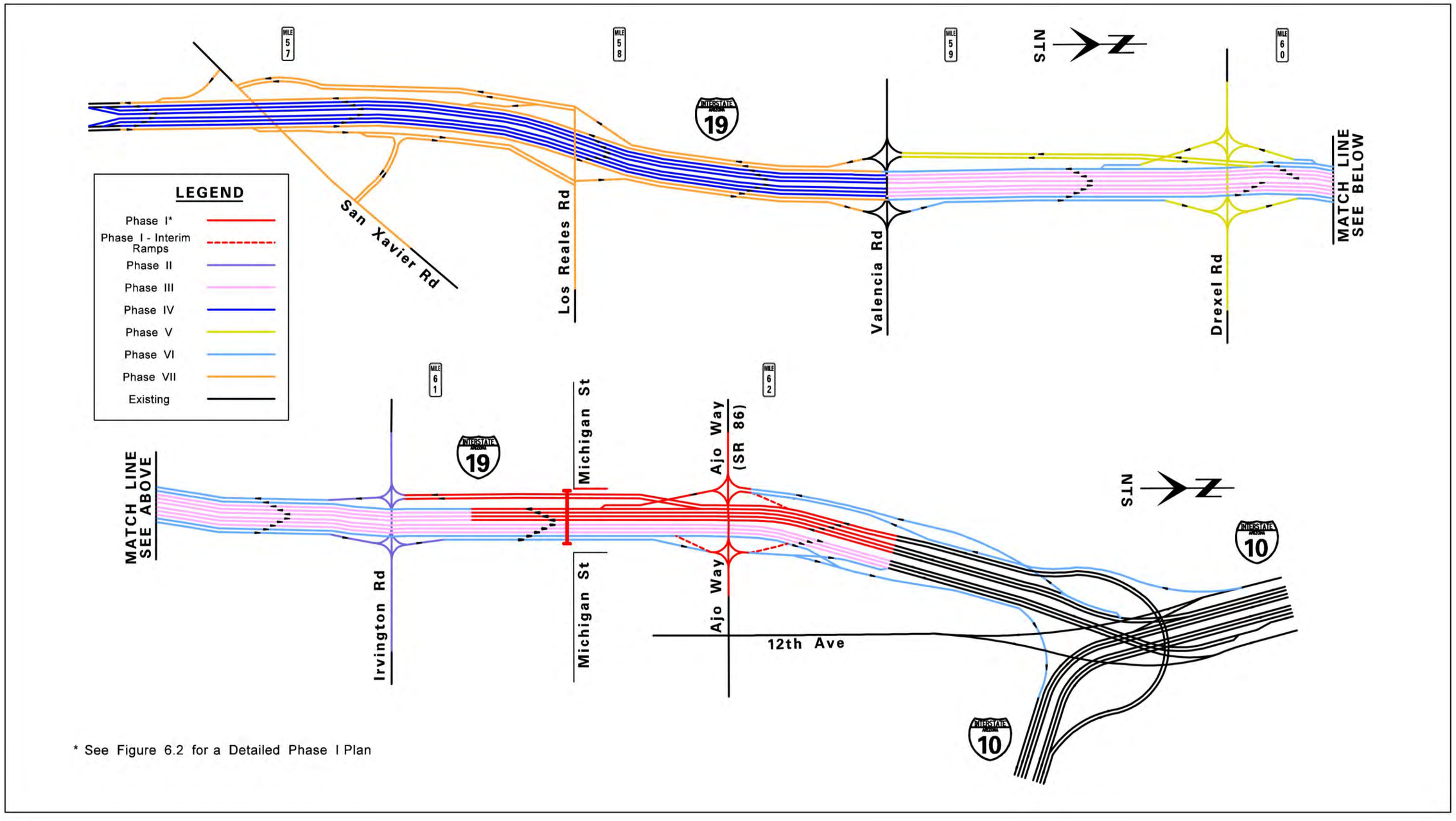


Figure EX-4: Recommended Alternative: Implementation Plan

Environmental Mitigation Measures

The following mitigation measures were presented in the Draft EA and are listed here in their final version. ADOT will implement these mitigation measures by incorporating them into the project construction documents. These mitigation measures supersede any of those identified in the Draft EA. The following mitigation measures and commitments are not subject to modification without prior written approval from FHWA.

Arizona Department of Transportation Design responsibilities are:

- During final design, ADOT will coordinate with the City of Tucson and commercial property owners to determine a final design that meets the purpose and need of the project but that minimizes impacts to commercial properties. (Refer to Environmental Assessment page 13.)
- During final design, appropriate mitigation measures, including testing and data recovery plans, will be developed and implemented by the Arizona Department of Transportation Environmental Planning Group Historic Preservation Team, in consultation with the State Historic Preservation Office and other consulting parties, for those National Register of Historic Places-eligible properties and cultural resources that require testing to determine eligibility that cannot be avoided. A memorandum of agreement will be executed for this project that stipulates a process for review of all cultural resources documentation generated from any future archaeological investigations. Construction activities will not occur in areas requiring testing and data recovery until cultural resources investigations are complete. (Refer to Environmental Assessment page 52.)
- During final design, the Project Manager will contact the Arizona Department of Transportation Noise Coordinator (602-712-7767) to arrange for qualified personnel to review and update the noise analysis. (Refer to Environmental Assessment page 74.)
- During final design, if noise abatement measures are recommended, the Arizona Department of Transportation will meet with each property owner whose site meets the criteria for abatement by the Arizona Department of Transportation Noise Abatement Policy, and an agreement will be reached with the property owners on whether a noise barrier wall is wanted. (Refer to Environmental Assessment page 22).
- The Arizona Department of Transportation will prepare and submit an application to the United States Army Corps of Engineers for a Clean Water Act Section 404 permit for the project. No work will occur within jurisdictional Waters of the United States until the appropriate Clean Water Act Section 401 Water Quality Certification and Section 404 permits are obtained. (Refer to Environmental Assessment page 78.)
- The City of Tucson Planning and Development Services (520-791-5550), the City of Tucson Department of Transportation Stormwater Management Section (520-791-4251), and the Pima County floodplain administrator (520-243-1800) will be provided an opportunity to review and comment on the design plans. (Refer to Environmental Assessment page 82.)
- All disturbed soils that will not be landscaped or otherwise permanently stabilized by construction will be seeded using species native to the project vicinity. (Refer to Environmental Assessment page 86.)
- During final design, if more than five years have elapsed between approval of the biological report and final design, the Arizona Department of Transportation Biologist will reevaluate the status of the Endangered Species Act listed species and initiate consultation with the United States Fish and Wildlife Service, if necessary. (Refer to Environmental Assessment page 88.)
- During final design, the Arizona Department of Transportation Project Manager will coordinate with the Arizona Department of Transportation Hazardous Materials Coordinator (602-712-7767) to complete testing for asbestos and lead-based paint within the project limits and, if necessary, recommend remediation measures. (Refer to Environmental Assessment page 89.)
- The Arizona Department of Transportation Project Manager will contact the Arizona Department of Transportation Hazardous Materials Coordinator (602-712-7767) 30 calendar days prior to bid advertisement to determine the need for additional site assessment. (Refer to Environmental Assessment page 89.)

Arizona Department of Transportation Roadside Development Section Responsibilities

- Protected native plants within the project limits will be impacted by this project; therefore, the Arizona Department of Transportation Roadside Development Section will determine if Arizona Department of Agriculture notification is needed. If notification is needed, the Arizona Department of Transportation Roadside Development Section will send the notification at least 60 calendar days prior to the start of construction. (Refer to Environmental Assessment page 86.)

Arizona Department of Transportation Tucson District Responsibilities

- Construction activities will not occur in areas requiring testing and data recovery until cultural resources investigations are complete. (Refer to Environmental Assessment page 52.)
- No work will occur within jurisdictional waters of the United States until the appropriate Clean Water Act Section 401 Water Quality Certification and Section 404 permit are obtained. (Refer to Environmental Assessment page 79.)
- The Engineer will submit the contractor's Arizona Pollutant Discharge Elimination System Notice of Intent and the Notice of Termination to the Environmental Coordinator. (Refer to Environmental Assessment page 83.)
- The Engineer will submit the National Pollutant Discharge Elimination System Notice of Intent and the Notice of Termination to the Environmental Protection Agency only after the District has reviewed and approved the Stormwater Pollution Prevention Plan. (Refer to Environmental Assessment page 83.)
- The Engineer will review the National Emissions Standards for Hazardous Air Pollutants notification received from the contractor. The contractor shall not start work associated with Arizona Department of Transportation structures until 10 working days have passed since the submittal of the National Emissions Standards for Hazardous Air Pollutants notification to the regulatory agencies. (Refer to Environmental Assessment page 89.)

Contractor Responsibilities

- The contractor shall coordinate with the Superintendent of the Tucson Unified School District (520-225-6000), Sunnyside Unified School District (520-545-2000), Pima Community College (520-206-4500), and San Xavier Mission School (520-294-0628) a minimum of 14 calendar days prior to traffic-disrupting activities to allow for coordination of school bus routes during construction. (Refer to Environmental Assessment page 37.)
- The contractor shall coordinate with the City of Tucson Fire Department (520-791-4512), the City of South Tucson Fire Department (520-792-2424), Tohono O'odham Nation Fire Department (520-383-8276), Tohono O'odham Nation Police Department (520-383-3275), and the Pima County Sheriff's Department (520-351-4600) a minimum of 14 calendar days prior to construction activities to inform them of the construction schedule. (Refer to Environmental Assessment page 39.)
- Construction activities shall not occur in areas requiring testing and data recovery until cultural resources investigations are complete. (Refer to EA page 52.)
- The contractor shall contact the Arizona Department of Transportation Historic Preservation Team (602-712-7767) at least 10 business days prior to the start of ground-disturbing activities to arrange for a qualified archaeologist to flag avoidance areas. (Refer to Environmental Assessment page 52.)
- The contractor shall avoid all flagged and/or otherwise designated sensitive resource avoidance areas within or adjacent to the project area. (Refer to Environmental Assessment page 52.)
- The contractor, in association with the District, shall submit the Arizona Pollution Discharge Elimination System Notice of Intent and the Notice of Termination to the Arizona Department of Environmental Quality only after the District has reviewed and approved the Stormwater Pollution Prevention Plan. (Refer to Environmental Assessment page 83.)
- The contractor, in association with the District, shall submit the National Pollution Discharge Elimination System Notice of Intent and the Notice of Termination to the Environmental Protection Agency only after the District has reviewed and approved the Stormwater Pollution Prevention Plan. (Refer to Environmental Assessment page 83.)
- All disturbed soils that will not be landscaped or otherwise permanently stabilized by construction shall be seeded using species native to the project vicinity. (Refer to Environmental Assessment page 86.)
- To prevent the introduction of invasive species, all earth-moving and hauling equipment shall be washed at the contractor's storage facility prior to entering the construction site. (Refer to Environmental Assessment page 86.)
- To prevent invasive species seeds from leaving the site, the contractor shall inspect all construction equipment and remove all attached plant/vegetation and soil/mud debris prior to leaving the construction site. (Refer to Environmental Assessment page 86.)
- The contractor shall complete a National Emissions Standards for Hazardous Air Pollutants notification for work associated with the Arizona Department of Transportation structures and submit to the Engineer for review. After Engineer approval, the notification shall be submitted to the Arizona Department of Transportation Hazardous Materials Coordinator (602-712-7767) for a five (5) working day review and approval. Upon approval by the Arizona Department of Transportation Hazardous Materials Coordinator, the contractor shall file the notification with Arizona Department of Environmental Quality and the Pima County Air Quality Department at least 10 working days prior to demolition/renovation associated with the Arizona Department of Transportation structures (Arizona Department of Transportation 2004a). (Refer to Environmental Assessment page 89.)
- The contractor shall not start work associated with the demolition/renovation of structures until 10 working days have passed since the submittal of the National Emissions Standards for Hazardous Air Pollutants notification to the regulatory agencies. (Refer to Environmental Assessment page 89.)

Standard Specifications Included as Mitigation Measures

- Traffic control will be in accordance with the United States Department of Transportation's most current Manual on Uniform Traffic Control Devices for Streets and Highways, and the Arizona Supplement to the Manual on Uniform Traffic Control Devices, including any revisions or additions, and/or associated provisions in the project plans, as determined by the Arizona Department of Transportation Traffic Design Section during design. (Refer to Environmental Assessment page 38.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 701 Maintenance and Protection of Traffic, Subsection 3.01 General (2008), "The contractor shall provide for the adequate protection of all vehicular and pedestrian traffic and workers through any portion of the work where construction operations interfere with, obstruct, or create a hazard to the movement of traffic." Further, "At the pre-construction conference, the contractor shall provide the Engineer with the name of the contractor's employee who is responsible for implementing, monitoring and altering, as necessary, the traffic control plan. The Engineer will then advise the local law enforcement agency having jurisdiction, or the names of the contractor's representative and a representative of the Department who will act in a similar capacity." (Refer to Environmental Assessment page 39.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 107 Legal Relations and Responsibility to Public, Subsection 05 Archaeological Features (2008), "When archaeological, historical, or paleontological features are encountered or discovered during any activity related to the construction of the project, the contractor shall stop work immediately at that location and shall take all reasonable steps to secure the preservation of those resources and notify the Engineer. The Engineer would direct how to protect the features. The contractor shall not resume work until it is so directed by the Engineer." The Arizona Department of Transportation Engineer will, in turn, notify the Arizona Department of Transportation Environmental Planning Group Historic Preservation Team (602-712-7767) to evaluate the significance of the resources. (Refer to Environmental Assessment page 52.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 107 Legal Relations and Responsibility to Public,

Section 104 Scope of Work, Subsection 08 Prevention of Air and Noise Pollution (2008), "The contractor shall control, reduce, remove or prevent air pollution in all its forms, including air contaminants, in the performance of the contractor's work. The contractor shall comply with applicable requirements of Arizona Revised Statutes Section 49-401 et seq. (Air Quality) and with the Arizona Administrative Code, Title 18, Chapter 2 (Air Pollution Control)." (Refer to Environmental Assessment page 64.)

- Fugitive dust generated from construction activities will be controlled in accordance with Department Standard Specifications for Road and Bridge Construction, Section 104.08 (2008), special provisions, and local rules or ordinances, including Maricopa County Air Pollution Control Regulation Rule 310 (Fugitive Dust) and Arizona Administrative Code, Title 18, Chapter 2 (Air Pollution Control) and Pima County Code Title 17 - Air Quality Control, Pima County Department of Environmental Quality Fugitive Dust Activity Permit. (Refer to Environmental Assessment page 64.)
- The contractor shall be required to meet the noise abatement requirements of Section 104.08, Prevention of Air and Noise Pollution, of Department Standard Specifications for Road and Bridge Construction (2008) during the roadway construction. If blasting is required for construction of the improvements, the contractor shall adhere to Section 107.10, Use of Explosives of Department's Standard Specifications for Road and Bridge Construction (2008). (Refer to Environmental Assessment page 74.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 104 Scope of Work, Subsection 08 Prevention of Air and Noise Pollution (2008), "The contractor shall comply with all local sound control and noise level rules, regulations and ordinances which apply to any work performed pursuant to the contract. Each internal combustion engine used for any purpose on the work or related to the work shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated during construction without its muffler being in good working condition." (Refer to Environmental Assessment page 74.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 104 Scope of Work, Subsection 09 Prevention of Landscape Defacement; Protection of Streams, Lakes, and Reservoirs (2008), "The contractor shall give special attention to the effect of its operations upon the landscape and shall take special care to maintain natural surroundings undamaged." (Refer to Environmental Assessment page 77.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 104 Scope of Work, Subsection 09 Prevention of Landscape Defacement; Protection of Streams, Lakes, and Reservoirs (2008), "The contractor shall take sufficient precautions, considering various conditions, to prevent pollution of streams, lakes, and reservoirs with fuels, oils, bitumens, calcium chloride, fresh Portland cement, fresh Portland cement concrete, raw sewage, muddy water, chemicals or other harmful materials. None of these materials shall be discharged into any channels leading to such streams, lakes or reservoirs." (Refer to Environmental Assessment page 83.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 810, Erosion Control and Pollution Prevention, Subsection 1.02, Other-Pollutants Controls (2008), "The work shall include implementing controls to eliminate the discharge of pollutants, such as fuels, lubricants, bitumens, dust palliatives, raw sewage, wash water, and other harmful materials; into storm and other off-site waters. The work shall include the implementation of spill prevention and material management controls and practices to prevent the release or wash off of pollutants. These controls and practices shall be specified in the Stormwater Pollution Prevention Plan and shall include storage procedures for chemicals and construction materials, disposal and cleanup procedures, the contractor's plan for handling of potential pollutants, and other pollution prevention measures as required." (Refer to Environmental Assessment page 83.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 107 Legal Relations and Responsibility to Public, Subsection 07 Sanitary, Health, and Safety Provisions (2008), "During construction operations, should material be encountered which the contractor believes to be hazardous or contaminated, the contractor shall immediately do the following: (1) stop work and remove workers within the contaminated areas, (2) barricade the area and provide traffic controls, and (3) notify the Engineer." The Arizona Department of Transportation Engineer will arrange for proper assessment, treatment, or disposal of those materials. Such locations will be investigated and proper action implemented prior to the continuation of work in that location. (Refer to Environmental Assessment page 89.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 1001 Material Sources, Subsection 2 General (2008), any material sources required for this project outside of the project area shall be examined for environmental effects, by the contractor, prior to use, through a separate environmental analysis. (Refer to Environmental Assessment page 90.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 107, Legal Relations and Responsibility to Public, Subsection 11, Protection and Restoration of Property and Landscape (2008), "Materials removed during construction operations such as trees, stumps, building materials, irrigation and drainage structures, broken concrete, and other similar materials shall not be dumped on either private or public property unless the contractor has obtained written permission from the owner or public agency with jurisdiction over the land. Written permission would not be required, however, when materials are disposed of at an operating, public dumping ground." Excess waste material and construction debris will be disposed of at sites supplied by the contractor, at a municipal landfill approved under Title D of the Resources Conservation and Recovery Act, at a construction debris landfill approved under Article 3 of the Arizona Revised Statutes 49-241 (Aquifer Protection Permit) administered by Arizona Department of Environmental Quality, at an inert landfill or at another approved site. (Refer to Environmental Assessment page 90.)

1.0 INTRODUCTION

1.1 Foreword

This Design Concept Report (DCR) describes the development and evaluation of capacity improvement alternatives along Interstate 19 (I-19) from Milepost (MP) 56.3 south of San Xavier Road to Interstate 10 (I-10) (MP 63.0) to meet the Year 2030 traffic demand. This project is located in the Arizona Department of Transportation's (ADOT's) Tucson District, within Pima County, in southern Arizona. The project lies within the City of Tucson and the San Xavier District of the Tohono O'Odham Nation. The study location and vicinity maps are shown in Figures 1-1 and 1-2, respectively.

ADOT completed *the I-19 Corridor Study, I-10 to Pima/Santa Cruz County Line* in October 2003. The study recommended improvements for the I-19 corridor to meet the ultimate 2030 projected transportation demands.

ADOT also completed the I-19 Project Assessment, San Xavier Road – Ajo Way (SR 86) in August 2003. The study recommended interim improvements to the I-19 mainline. The project assessment recommended the following lane configurations with all widening occurring in the median:

- Northbound: Three lanes from San Xavier Road to Valencia Road, with the San Xavier Road on-ramp adding the third lane. Four lanes from Valencia Road to Ajo Way, with the Valencia Road on-ramp adding the fourth lane. The fourth lane will exit at Ajo Way as an exit only lane, and three lanes will continue to the I-19/I-10 system interchange.
- Southbound: Three lanes from the I-19/I-10 system interchange to Ajo Way. Four lanes from Ajo Way to Valencia Road, with the Ajo Way on-ramp adding the fourth lane. The fourth lane will exit at Valencia Road as an exit only lane and three lanes will continue to San Xavier Road. The third lane will be dropped at the exit at San Xavier Road.

In 2004, ADOT contracted with AECOM to develop a DCR and Environmental Assessment (EA) for the interim improvements identified in the 2003 Project Assessment. In November of 2005, the Federal Highway Administration (FHWA) recommended that ADOT complete the DCR for the ultimate improvements identified in the 2003 Corridor Study to meet the Year 2030 traffic demand. AECOM was also to verify that the proposed improvements operate at an acceptable Level of Service (LOS) based on updated traffic projections.

During the project development, it became clear that to meet future traffic demands and provide regional continuity, the limits of the project were extended to, but not including, the I-19/I-10 system Traffic Interchange (TI). Additionally, FHWA and the Tohono O'Odham Nation requested modifications to the *2003 Corridor Study Recommended Alternative*. Therefore, a new design alternative was created consisting of the 2003 Corridor Study Recommended Alternative with modifications at the San Xavier Road TI, the Los Reales Road TI, and the I-19/I-10 system TI. Additional traffic analyses were performed to confirm that these modifications resulted in an acceptable LOS.

This DCR describes the development and evaluation of the I-19 corridor design concept alternatives to meet the Year 2030 traffic demand. Alternatives were evaluated and a Recommended Alternative was selected based on several factors including; evaluation of design criteria, traffic operational characteristics, environmental impacts, right-of-way impacts, local access opportunities, constructability, project cost, and agency input.

The following documents have been/will be developed in support of this DCR, and information gathered during that effort will be incorporated into this DCR:

- Traffic Report
- Drainage Report
- Geotechnical Report
- Environmental Assessment (EA)
- Change of Access Report
- Bridge Selection Reports
- Design Concept Plans

Public agencies that have been involved with this project include ADOT, FHWA, Pima Association of Governments (PAG), City of Tucson, Pima County, and the Tohono O'Odham Nation.

1.2 Need for the Project

I-19 is a major corridor for intrastate traffic and international commerce between Mexico and the US. In addition to its regional and international importance, I-19 is increasingly used by commuters within Tucson and outlying suburban areas. As the population in the Tucson metropolitan area continues to grow, traffic volumes are anticipated to increase. Over time, the increase in traffic volumes will result in degraded traffic operations along I-19 for regional and intrastate travelers, and CANAMEX truck traffic (PAG 2006).

1.2.1 Traffic Volumes

According to traffic counts conducted in 2001, I-19 carried an average of nearly 47,350 vehicles per day (vpd) within the project limits. The heaviest volume (64,200 vpd) occurred on the segment between Ajo Way and I-10, and the lowest volume (28,500 vpd) occurred on the segment between San Xavier and Valencia Roads. The Annual Average Daily Traffic (AADT) is predicted to increase by 150 percent along the project corridor between 2000 and 2030 (Table 1-1)

Table 1-1: Projected Traffic Growth along I-19 Mainline

Segment	AADT (vpd)	
	2001	2030 (No-Action)
I-10 to Ajo Way	64,200	131,600
Ajo Way to Irvington Road	56,300	127,200
Irvington to Valencia Road	40,400	112,500
Valencia Road to San Xavier Road	28,500	101,150
Entire project corridor	47,350	118,113

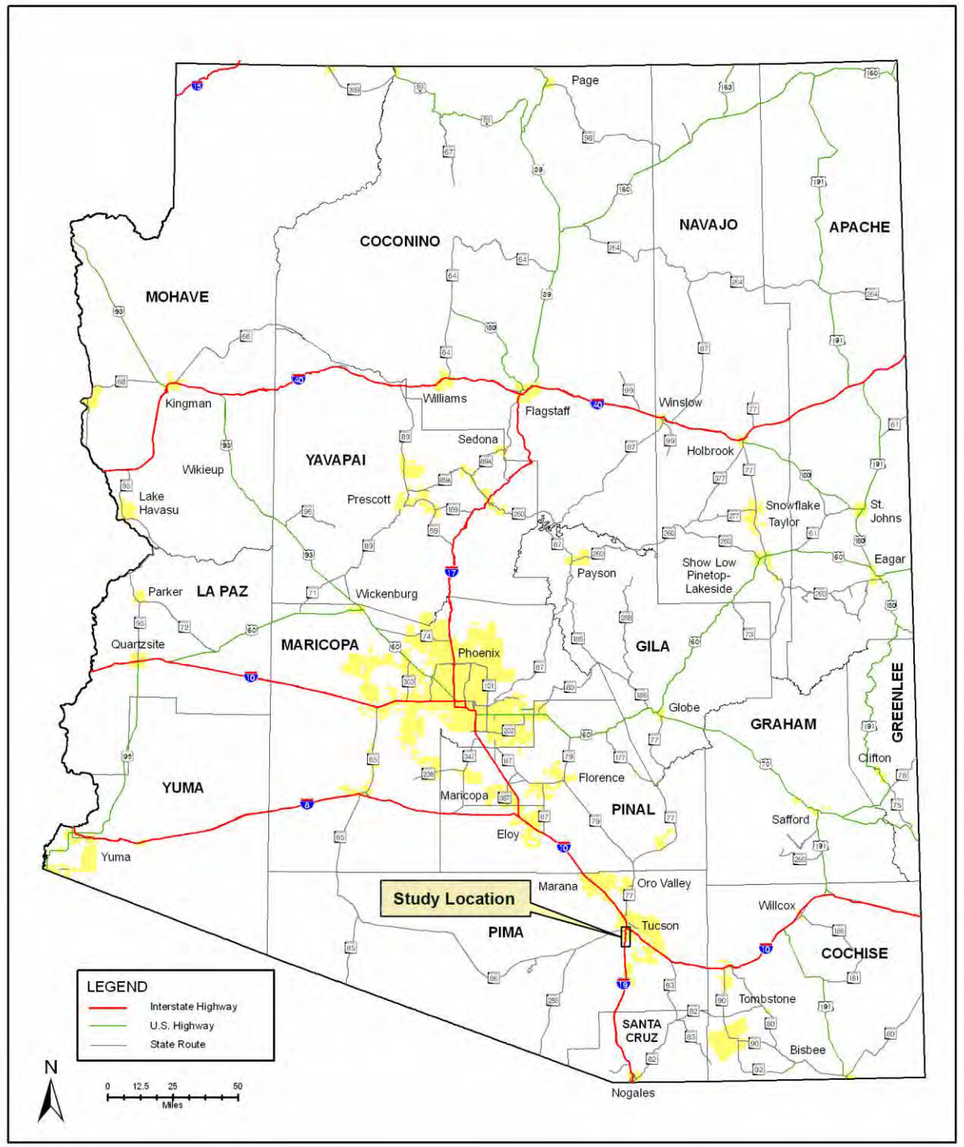


Figure 1-1: Location Map

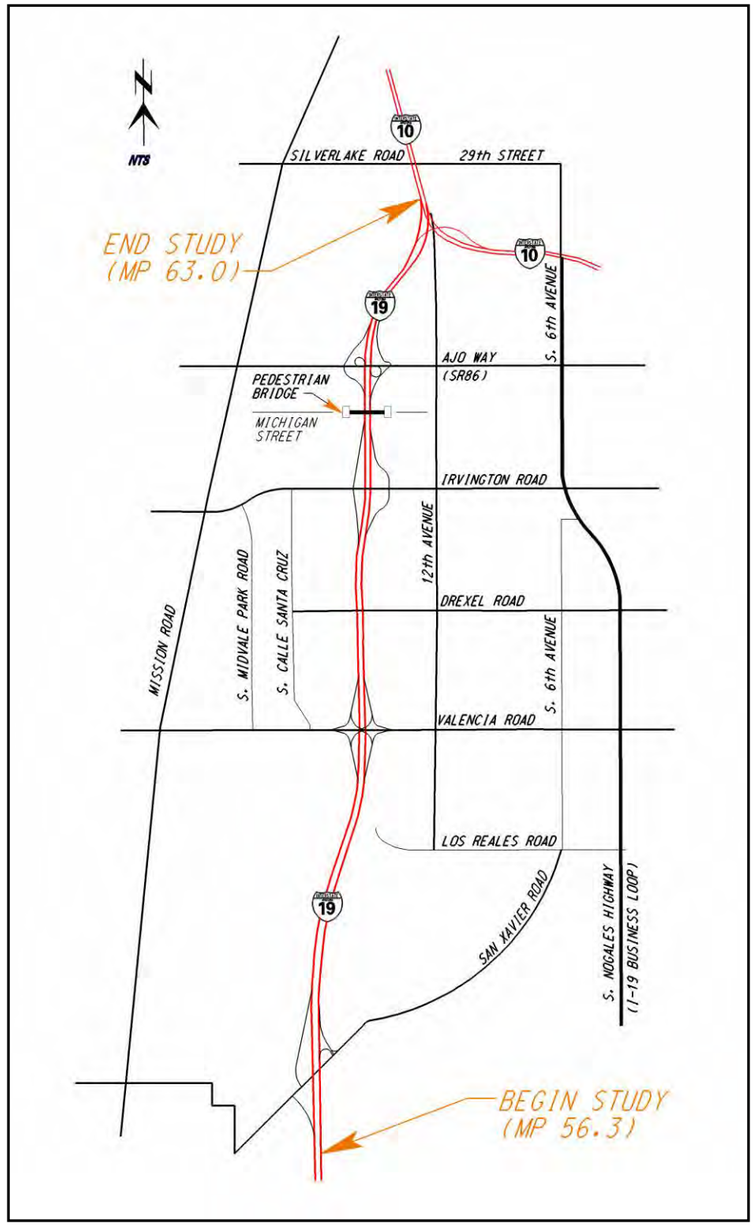


Figure 1-2: Vicinity Map

Population trends were examined for the Tucson metropolitan area and for Pima County to determine future traffic demand (Table 1-2). Between 2000 and 2030, the population in Pima County is expected to increase by approximately 79 percent and the Tucson Metropolitan area by approximately 65 percent. This population growth is expected to result in a greater traffic volume.

Table 1-2: Projected Population Growth

Place	Year 2000	Year 2030	Percent Change
Pima County	843,746	1,506,106	79%
Tucson metropolitan area	486,699	800,900	65%
Tohono O'Odham Nation (within Pima County)	9,545	10,075	6%

Source: PAG: TAZ 2000 and TAZ2030.

1.2.2 Level of Service (LOS)

LOS is a qualitative measure referring to the degree of congestion or delay experienced by motorists. The categories range from "A", which signifies little to no congestion or free flow conditions, to "F", which signifies severe congestion. Factors influencing freeway LOS include number of lanes, terrain, presence of trucks, access control, lane changes, merging, and weaving movements (Highway Capacity Manual [Transportation Research Board] 2000). ADOT's criteria for traffic operations for I-19 indicate that the roadway should be operating to accommodate traffic at a LOS D or better.

Table 1-3 illustrates the LOS analysis summary for the Year 2001 volumes and the Year 2030 projected volumes. In 2001, all segments of I-19 in the project corridor were operating at a LOS C or better. Without improvements, the I-19 corridor between San Xavier Road and Ajo Way is expected to operate at LOS E and LOS F by the Year 2030.

Table 1-3: 2001 and 2030 No-Action Alternative LOS

	I-19 Northbound		I-19 Southbound	
Segment	2001	No-Action (2030)	2001	No-Action (2030)
I-10 to Ajo Way	A	F	B	F
Ajo Way to Irvington Road	B	F	C	F
Irvington Road to Valencia Road	A	E	A	F
Valencia Road to San Xavier Road	A	F	A	F

In the Year 2030, traffic speeds on I-19 are estimated to be less than 40 mph during the morning and evening peak traffic periods. Traffic in the morning peak period is characterized by heavy congestion at all project area TIs, with vehicles backing up onto the on and off ramps due to insufficient capacity on the TIs and mainline. The evening peak traffic period is characterized by heavy congestion on the mainline due to vehicles weaving while trying to exit the interstate and the close proximity of the traffic interchanges. This condition is anticipated to degrade traffic operations in the year 2030 at the I-19/I-10 system TI.

According to the Highway Capacity Manual, at LOS D, a four-lane facility can accommodate up to 68,300 vpd; a six-lane facility can accommodate up to 106,500 vpd; and an eight-lane facility can accommodate up to 144,800 vpd.

1.2.3 CANAMEX Trade Corridor

The I-19 corridor was adopted as the initial segment of the CANAMEX Trade Corridor. The objective of this important trade corridor is to provide for the seamless and efficient transportation of goods, services, people, and information between Canada, United States, and Mexico. Without improvements, the I-19 corridor between San Xavier Road and I-10 would operate at LOS E or LOS F by 2030, which would compromise the efficiency of the CANAMEX Trade Corridor.

1.2.4 Current Roadway Standards

Interstate Highways are designed in accordance with American Association of State Highway Transportation Officials (AASHTO) design standards outlined in A Policy on Design Standards: Interstate System (January 2005). ADOT has developed a comprehensive set of design standards, the ADOT Roadway Design Guidelines (RDG), that supplement the AASHTO guidelines.

Field investigations and research of the as-built plans along this portion of I-19 revealed that there are several existing roadway features that do not meet current AASHTO design standards. The existing vertical clearance at the Ajo Way bridge structure does not meet the minimum AASHTO criteria. The design speed for the northbound San Xavier Road off-ramp does not meet the minimum AASHTO criteria. Other design features that do not meet current design standards at the interchanges include: narrow ramp widths, and short acceleration/deceleration lengths. Access to the existing pedestrian bridge near Michigan Street does not meet current AASHTO standards and current Americans with Disabilities Act (ADA) requirements.

1.2.5 Access

To accommodate anticipated traffic volumes resulting from future developments and predicted population growth in the project vicinity, two new TIs at Drexel Road and Los Reales Road will be provided. The new TIs will provide developing areas access to I-19.

To accommodate the 2030 projected traffic volumes resulting from future development and population growth in the vicinity of this study, two new TIs at Drexel Road and Los Reales Road will be required. The new TIs will provide developing areas access to I-19. The Drexel Road TI will relieve some of the traffic on Valencia Road, the Valencia Road TI, and the Irvington Road TI. The Los Reales Road TI will provide a direct connection between I-19 and the I-19 business loop (Tucson-Nogales Hwy), which will relieve some of the traffic on Valencia Road and the Valencia Road TI. The locations of the new TIs (at Drexel Road and Los Reales Road) were optimized to maintain reasonable spacing between the existing and new TIs of about one (1) mile. The proposed locations are the only possible locations for new TIs. As the distance between the Los Reales Road TI and the San Xavier Road TI is very close, the two interchanges were joined with Collector Distributor (CD) roads to form a split diamond TI.

Adding extra capacity to the San Xavier Road TI and San Xavier Road is not recommended

since it involves tremendous environmental impacts as San Xavier Road lies within Tohono O'Odham Nation land, and will impact Martinez Hill – a sacred mountain for the Tohono O'Odham Nation. Additionally, San Xavier Road does not have the potential for future capacity improvement since the roadway alignment to the east goes through a residential area and tees into Los Reales Road. Both Drexel Road and Los Reales Road provide direct connection between I-19 and the I-19 business loop.

1.2.6 Drainage

ADOT's current drainage standards for interstate facilities require that cross-drainage design meet a minimum 50-year storm event (ADOT RDG Chapter 600, Table 603.2B). Adequate pavement drainage is required to meet a 10-year storm event for both storm-drain systems, cut, and median ditches. Several existing cross drainage culverts do not meet current ADOT standards.

1.2.7 Summary

The projected increase in I-19 traffic volumes will result in additional operational and capacity demands. Given projected traffic volumes, operational deficiencies in the regional and local roadway networks would be anticipated, including projected unacceptable LOS between all project corridor roadway segments (Table 1-3). If the I-19 corridor is not improved, projected traffic increases will compromise the efficiency of regional and intrastate traffic, and the CANAMEX Trade Corridor. Roadway elements such as vertical clearance, ramp widths, and acceleration/deceleration lengths do not meet current AASHTO design criteria. The pedestrian bridge near Michigan Street does not meet current AASHTO and ADA requirements. New access points are needed to accommodate planned development and anticipated growth. The existing pavement and cross-drainage facilities in the project area do not meet current standards. Therefore, the purpose of the proposed improvements is as follows:

- Accommodate travel demand along the project corridor through the design Year 2030 by increasing capacity and providing a LOS that meets ADOT criteria for traffic operations (LOS D or better).
- Maintain an adequate LOS so that I-19 meets criteria for operation as part of the CANAMEX Trade Corridor, a congressionally designated high-priority corridor.
- Meet the future access needs for planned development and anticipated population growth.
- Maintain pedestrian access across I-19 near Michigan Street.
- Improve roadway geometry to meet current AASHTO, ADA, and ADOT standards.
- Improve drainage on I-19 to meet current AASHTO and ADOT standards.

1.3 Description of the Project

This study describes the development and evaluation of capacity improvement alternatives on I-19 from south of San Xavier Road (MP 56.3) to I-10 (MP 63.0). The project is approximately 6.7 miles long. This project is located in ADOT's Tucson District within Pima County in southern Arizona. The project lies within the City of Tucson and the San Xavier District of the Tohono O'Odham Nation. The project location and vicinity maps are shown in Figures 1-1 and 1-2, respectively.

This project is a long-range plan for the I-19 Corridor that will guide implementation over the next several decades. The Recommended Alternative includes widening the mainline, reconstructing existing interchanges, constructing new interchanges, reconstructing existing conventional on-ramps and off-ramps to braided ramps, and constructing new ramps.

1.3.1 Study Objectives

The primary objective of this study is to develop a Recommended Alternative for the I-19 corridor, in accordance with the approved regional and local transportation plans, that optimizes traffic operations within the corridor to meet the Year 2030 traffic demand. The Recommended Alternative will address the Projects Purpose and Need, and will address the stakeholders request for additional modifications to the 2003 Corridor Study Recommended Alternative.

The study area is within the jurisdictions of the City of Tucson, City of South Tucson, Pima County, and the San Xavier District of the Tohono O'Odham Nation. Local jurisdictions with responsibility for planning near the I-19 corridor have recognized the need to improve I-19, and their land use plans and general plans reflect that need. To ensure consistency, conformity, and compatibility, the following planning documents were reviewed:

- City of Tucson General Plan (2001)
- Pima County Comprehensive Plan (2003)
- PAG 2030 Regional Transportation Plan (RTP) (PAG 2006)
- PAG 2040 RTP Roadways Project List (PAG 2010)

Available land use planning references for the San Xavier District of the Tohono O'Odham Nation (2010) and Arizona State Land Department (ASLD) (2007) were also reviewed to ensure project conformity. These references identify the general need to improve existing infrastructure in order to keep up with the pace of growth. However, they do not specifically identify the need for an enhanced transportation facility along the I-19 corridor.

To meet the project objectives, the Recommended Alternative includes:

- Widening I-19 to four (4) lanes in each direction between San Xavier Road and I-10.
- Constructing a modified split diamond interchange between San Xavier Road and Los Reales Road connected with CD roads. Where the existing modified diamond interchange at San Xavier Road will be reconstructed to a modified half diamond interchange, a new modified half diamond interchange will be constructed at Los Reales Road, and new CD roads will be constructed to connect the two modified half diamond interchanges.
- Constructing a new Single Point Urban Interchange (SPUI) at Drexel Road.
- Reconstructing the existing diamond TI at Irvington Road to a SPUI.
- Reconstructing the existing partial clover leaf TI at Ajo Way to a SPUI.
- Providing new CD roads between Ajo Way and I-10, and providing ramp connections between Ajo Way and the CD roads, and between the CD roads and the I-19/I-10 system TI.

- Reconstructing the existing ramps in the northbound direction between Ajo Way and I-10 to braided ramps.
- Reconstructing the existing ramps in the southbound direction between I-10 and Ajo Way, and between Ajo Way and Irvington Road to braided ramps
- Reconstructing the existing southbound I-19 off-ramp at Valencia Road to accommodate the new braided ramps between Valencia Road and Drexel Road.
- Providing auxiliary lanes for northbound I-19 between Los Reales Road and Valencia Road, Valencia Road and Drexel Road, Drexel Road and Irvington Road, Irvington Road and Ajo Way, and Ajo Way and I-10.
- Providing auxiliary lanes for southbound I-19 between I-10 and Ajo Way, Irvington Road and Drexel Road, and Valencia Road and Los Reales Road.
- Widening Ajo Way to a six lane divided roadway and Drexel Road to a four lane divided roadway.

Two lane ramps will be required at the westbound I-10 to southbound I-19 flyover on-ramp, the southbound I-19 off-ramp at Irvington Road, and the southbound I-19 off-ramp at Valencia Road. Ramp metering will be required at the northbound I-19 on-ramp at Ajo Way

1.3.2 Mainline Freeway

The Recommended Alternative includes widening I-19 to four travel lanes in each direction throughout the corridor. The total pavement width in general will be 72 feet for each direction. The mainline widening will generally occur in the median. A closed median with a two foot concrete median barrier separating the directions of travel is proposed from south of San Xavier Road to north of Ajo Way, north of Ajo Way, the median will widen to tie into the I-19/I-10 system TI.

The project begins around Station 2982+00 (approximately 0.65 miles south of the San Xavier Road overpass). The project beginning point will include the roadway improvements associated with the reconstruction of the San Xavier Road TI. The I-19 mainline widening ends around Station 3320+00 (approximately 0.85 miles north of the Ajo Way underpass), where it matches the recently constructed I-19/I-10 system TI. The project ends at the I-10 interchange where minor modifications will be made to the ramps between I-19 and I-10.

All lane widths will be 12 feet throughout the corridor with 12-foot-wide inside and outside shoulders. The 12-foot-wide shoulders are desirable when truck traffic is greater than 250 trucks per hour during the peak period. Existing truck traffic currently exceeds this volume, and freight movements along the corridor are expected to increase. There will be no curb and gutter along the mainline freeway, and freeway drainage will be collected in linear ditches parallel to I-19.

The mainline horizontal and vertical alignments in the Recommended Alternative substantially conform to the existing I-19 alignment. Existing design features not meeting current design standards will be reconstructed to meet current design standards, including reconstructing the normal crown cross slope on the I-19 mainline from 1.5% to 2%, lowering the San Xavier Road profile under I-19 to meet the required vertical clearance, realigning the northbound off-ramp at San Xavier Road to meet the minimum curve radius for the required design speed, reconstructing the superelevations on the ramps, providing wider shoulders on the I-19 mainline, ramps, and crossroads, and providing longer acceleration/deceleration lanes.

The roadway improvements included in the Recommended Alternative are expected to enhance safety and operations along the corridor. These improvements include the introduction of braided ramps and auxiliary lanes that help eliminate some of the weaving movements, and correcting existing design features that do not meet current design standards. Other safety benefits are anticipated from the improved the clear zone through the introduction of flatter slopes, wider shoulders, and rumble strips, improved freeway lighting, better visibility signing and pavement marking.

1.3.3 Geotechnical

For bridge structures, the presence of very firm to hard and cemented soils at relatively shallow depths allows the use of both shallow and deep foundations. Drilled shafts are recommended for foundation support of all water crossings due to potential conflicts with existing foundation elements, or where footing excavations requires shoring.

For retaining walls and sound barriers, standard walls with spread footings are recommended. Where the proximity of new walls to existing structures or pavement is an issue, drilled shafts and L-shaped footing walls may be considered.

For pavement design, based on subgrade conditions and projected traffic volumes, the new I-19 pavement section will require a thicker PCCP sections than what currently exists.

A Geotechnical Report is being prepared in conjunction with this study.

1.3.4 Right-of-Way and Land Use

The Recommended Alternative will require approximately 75 acres of new right-of-way that will be converted into permanent transportation facilities (approximately 35 acres privately owned and 40 acres public land/land under the jurisdiction of the Tohono O'Odham Nation). The 35 acres privately owned consist of 23 acres residential, 3 acres residential owned by the Pascua Yaqui Tribe, 8 acres commercial/industrial, and 1 acre owned by TEP. The 40 acres public land/land under the jurisdiction of the Tohono O'Odham Nation land consists of 25 acres public land and 15 acres under the jurisdiction of the Tohono O'Odham Nation). An existing 100-foot-wide easement underlying a Western Area Power Administration (WAPA) electrical transmission line will also be impacted.

Approximately 109 properties will be impacted, requiring 82 property relocations/displacements and 27 partial property acquisitions. Of these properties, 82 are privately owned residences, 13 are privately owned commercial properties, 13 are government owned, and 1 is a privately owned educational facility. No businesses or facilities will be closed, relocated, or displaced (approximately 120 parking spaces will be removed from the Santa Cruz Retail center east of I-19 and north of Drexel Road).

Approximately 25 acres of existing right-of-way will be considered excess, due to the reconstruction of the TIs at Irvington Road and at Ajo Way (approximately 15 acres of right-of-way east of I-19 at the Irvington Road TI and 10 acres at the Ajo Way TI). ADOT will acquire new right-of-way for each phase of implementation separately during the design stage for that phase in accordance with FHWA and State of Arizona policy.

The predominant properties adjacent to the project area are vacant or undeveloped. The land

used for these properties will not be altered by the implementation of this project.

1.3.5 Structures

Within the project limits, 27 highway and drainage bridge structures have been identified. Nine existing structures will be widened, five existing structures will be replaced, ten new structures will be required, and three existing structures will remain.

The Recommended Alternative will require eight new sound barriers, and the existing sound barriers will be removed to accommodate the proposed roadway improvements.

1.3.6 Drainage

The Recommended Alternative will require drainage improvements to both the Wash cross culverts and the Non-Wash cross culverts. Five existing Wash cross culverts will be extended, two existing Wash cross culverts will be removed, one new Wash cross culvert will be required, two existing Non-Wash cross culverts will be extended, eleven existing Non-Wash cross culverts will be removed, and nine new Non-Wash cross culverts will be required. A Drainage Report is being prepared in conjunction with this study.

1.3.7 Utilities

The reconstruction of the I-19 corridor will have potential impacts on numerous utilities throughout the project. During final design, each utility company will receive and review the preliminary design for this project and develop plans for any relocations and/or adjustments.

Potentially impacted utilities include: WAPA, Tucson Electric Power, Southwest Gas, El Paso Natural Gas, Cox Cable Tucson, City of Tucson Water, Pima County Regional Wastewater Reclamation Department, Century Link (formerly Qwest Communications), and ADOT Street Lighting.

1.3.8 Construction Sequencing

During the construction of the I-19 mainline, traffic flow is expected to be maintained in both directions. All travel lanes on I-19 will remain open to traffic to the maximum extent possible.

During the construction of the new structures and widening of the existing structures, one 12 foot lane in each direction with 2 feet of shy distance to the barrier will be provided along I-19. A minimum of one 12 foot lane in each direction with 2 feet of shy distance to the barrier will be provided along Ajo Way, Irvington Road, Drexel Road, and San Xavier Road. Temporary pavement and lane shifts will be required throughout the construction period to maintain traffic on the crossroads. Construction phasing will be assessed further in the Bridge Selection Report.

1.3.9 Traffic Interchanges

I-19/San Xavier Road TI

At the San Xavier Road TI, the existing modified diamond TI will be reconstructed to a half-diamond TI. CD roads will be constructed between San Xavier Road and Los Reales Road. The northbound on-ramp and southbound off-ramp will be modified to connect to the CD roads. A connector road (spur) will connect San Xavier Road with the northbound CD road.

Access to San Xavier Road will be provided from the north and south. Ramps will connect San Xavier Road to the I-19 mainline (south of San Xavier Road) or to the new CD road (north of San Xavier Road).

The San Xavier Road horizontal alignment will remain in the current configuration. The vertical alignment will be modified to lower San Xavier Road to provide the required vertical clearance. One through lane in each direction will be provided on San Xavier Road within the interchange area. Two lanes will be provided on each ramp terminal (or CD road) approaching the crossroad. One westbound to southbound left-turn lane, one eastbound to northbound left-turn lane, and separate eastbound to southbound and westbound to northbound right-turn lanes will be provided. The two intersections at the ramp terminals will continue to be controlled by STOP signs.

I-19/Los Reales Road TI

At the Los Reales Road TI, a new modified half-diamond TI will be constructed. New CD roads will be constructed between San Xavier Road and Los Reales Road.

Access to Los Reales Road will be provided from the north and south. Ramps will connect Los Reales Road to the I-19 mainline (north of Los Reales Road) or to the CD road (south of Los Reales Road).

The existing Los Reales Road is a two lane road that starts and ends east of I-19 and has no access to I-19. The new Los Reales Road will be extended to the west side of I-19. The new Los Reales Road will be realigned to the north to avoid the Hughes Wash. East of I-19, a 675 foot long horizontal curve with a radius of 1,432 feet (4 degree of curvature) will be introduced.

Two through lanes in each direction will be provided on Los Reales Road within the interchange area. Three lanes will be provided on each ramp terminal (or CD road) approaching the crossroad. The two westbound through lanes will become dual left-turn lanes at the T-intersection with the CD road, the eastbound to northbound left-turn movement will be allowed from the shared through-left lane, and a separate westbound to northbound right-turn lane will be provided. The two intersections with the ramp terminals will be controlled by new traffic signals.

The two modified half-diamond interchanges at San Xavier Road and at Los Reales Road will function as a modified split diamond interchange.

I-19/Valencia Road TI

At the Valencia Road TI, the existing SPUI will be maintained. Access to Valencia Road will be provided from the north and south. Ramps will connect Valencia Road to the I-19 mainline. Braided ramps in the southbound direction between Drexel Road and Valencia Road will be provided.

The Valencia Road horizontal and vertical alignment will remain in the current configuration. Three through lanes in each direction will be provided on Valencia Road within the interchange area. Three lanes will be provided on each ramp terminal approaching the crossroad. Two westbound to southbound left-turn lanes, two eastbound to northbound left-turn lanes, and separate eastbound to southbound and westbound to northbound right-turn lanes will be provided. The intersection with the ramp terminals will continue to be controlled by traffic signal, but the traffic signal will be modified to accommodate the additional lanes on the off-ramps.

I-19/Drexel Road TI

At Drexel Road, a new SPUI will be provided. Access to Drexel Road will be provided from the north and south. Ramps will connect Drexel Road to the I-19 mainline. Braided ramps in the southbound direction between Drexel Road and Valencia Road will be provided.

The Drexel Road horizontal alignment will remain in the current configuration. The vertical alignment will be modified to raise Drexel Road to provide the required vertical clearance. Two through lanes in each direction will be provided on Drexel Road within the interchange area. Four lanes will be provided on the southbound ramp terminal approaching the crossroad, while three will be provided on the northbound ramp terminal. Two westbound to southbound left-turn lanes, two eastbound to northbound left-turn lanes, and separate eastbound to southbound and westbound to northbound right-turn lanes will be provided. The two intersections with the ramp terminals will be controlled by new traffic signals.

I-19/Irvington Road TI

At the Irvington Road TI, the existing diamond interchange will be reconstructed to a SPUI. Access to Irvington Road will be provided from the north and south. Ramps will connect Irvington Road to the I-19 mainline. Braided ramps in the southbound direction between Ajo Way and Irvington Road will be provided.

The Irvington Road horizontal alignment will remain in the current configuration. The vertical alignment will be modified to raise Irvington Road to provide the required vertical clearance. Three through lanes in each direction will be provided on Irvington Road within the interchange area. Four lanes will be required on the southbound ramp terminal approaching the crossroad, while three will be required on the northbound ramp terminal. Two westbound to southbound left-turn lanes, two eastbound to northbound left-turn lanes, and separate eastbound to southbound and westbound to northbound right-turn lanes will be required. The existing traffic signal at the existing two intersections with the ramp terminals will be replaced by one traffic signal at the new intersection location.

I-19/Ajo Way TI

At the Ajo Way TI, the existing partial clover leaf TI will be reconstructed to a SPUI. Access to Ajo Way will be provided from the north and south. Ramps will connect Ajo Way to the I-19 mainline. Braided ramps in the southbound direction between I-10 and Ajo Way, and between Ajo Way and Irvington Road will be provided. Braided ramps in the northbound direction between Ajo Way and I-10 will be provided.

The Ajo Way horizontal alignment will be shifted to the south for maintenance of traffic during construction. The vertical alignment will be modified to raise Ajo Way to provide the required vertical clearance. Three through lanes in each direction will be provided on Ajo Way within the interchange area. Three lanes will be provided on each ramp terminal approaching the crossroad. Two westbound to southbound left-turn lanes, two eastbound to northbound left-turn lanes, and separate eastbound to southbound and westbound to northbound right-turn lanes will be required. The existing traffic signal at the existing two intersections with the ramp terminals will be replaced by one traffic signal at the new intersection location.

I-19/I-10 System TI

The I-10 horizontal and vertical alignment will remain in the current configuration. At the I-19/I-10 system TI, the existing fully directional interchange will be maintained. CD roads will be constructed between Ajo Way TI and the I-19/I-10 system TI. Ramps will connect I-10 with I-19 and the collector-distributor roads. Braided ramps will be provided on the southbound direction between I-10 and Ajo Way. Braided ramps will also be provided on the northbound direction between Ajo Way and I-10. A ramp connection will be provided between the eastbound I-10 frontage road and the flyover ramp from westbound I-10 to southbound I-19. The existing ramp connection between the eastbound I-10 frontage road and southbound I-19 will be eliminated.

1.3.10 Project Funding

The overall estimate of construction cost for the Recommended Alternative is approximately $485.1 million. The estimated cost for the Recommended Alternative includes approximately $399.3 million for Construction, $31.9 million for design, $21.4 million for right-of-way/drainage easements, $28.5 million for Utility Design and Relocations, and $4.0 million in environmental mitigations.

The Recommended Alternative will be constructed in several phases. An implementation plan was developed using a logical sequence of construction phasing over time as future traffic demands warrant and funding becomes available. The implementation plan is divided into seven major construction phases:

- Phase I – Reconstruct the Ajo Way TI (MP 61.90) including the Santa Cruz River bridge on Ajo Way and the Michigan Street pedestrian bridge. Additionally, this phase includes the reconstruction to the ultimate design of portions of the mainline in immediate area of the Ajo Way TI and the construction of the southbound I-19 braided off-ramp to Irvington Road. The estimated cost of this phase is approximately $89.8 million.
- Phase II – Reconstruct the Irvington Road TI (MP 60.95). The estimated cost of this phase is approximately $48.4 million.
- Phase III – Construct/reconstruct the three inside lanes in each direction of I-19 from Valencia Road to I-10 (MP 58.82 – MP 62.3). The estimated cost of this phase is approximately $86.3 million.
- Phase IV – Construct/reconstruct the three inside lanes in each direction of I-19 from San Xavier Road to Valencia Road (MP 56.3 – MP 58.82). The estimated cost of this phase is approximately $66.4 million.
- Phase V – Construct the Drexel Road TI (MP 59.90) and the southbound I-19 braided off-ramp to Valencia Road (if the Drexel Road bridge over the Santa Cruz River is completed, the order of this phase should be reevaluated to determine if it should be constructed before phase IV). The estimated cost of this phase is approximately $45.2 million.
- Phase VI – Construct the fourth outer lane in each direction of I-19 and any auxiliary lanes from Valencia Road to I-10 (MP 58.82 – MP 62.3), including the braided ramps between Ajo Way and I-19/I-10 system TI. The estimated cost of this phase is approximately $92.2 million.
- Phase VII – Construct the San Xavier Road TI (MP 56.95) and the Los Reales Road TI (MP 58.90) including the CD roads between San Xavier Road and Los Reales Road, and

construct the fourth outer lane in each direction of I-19 and any auxiliary lanes from San Xavier Road to Valencia Road (MP 56.3 – MP 58.82). The estimated cost of this phase is approximately $56.9 million.

Current program funding identified in ADOT's 5-Year Transportation Facilities Construction Program (2012-2016) includes a total of $96.4 million. Table 1-4 provides details of the total current funding available for this project. The amount programmed in Fiscal Year 2014 will be dedicated for the completion of Phase I improvements (reconstruction of the Ajo Way TI) with construction occurring in Fiscal Year 2014. The remaining phases will be built over a long period of time as future traffic demands warrant and funding becomes available. ADOT recognizes that additional funding sources will be required to implement the remaining phases of this project.

Table 1-4: Funding Availability ($1,000)

Phase	Type of Work	Funds	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
I	Design *	NH	$10,000	-	-	-	-
I	Construction *	NH	-	-	$86,385	-	-
TOTAL			**$10,000**	**-**	**$86,385**	**-**	**-**

* Some of the funding available for Design and Construction will be used for right-of-way and drainage easement acquisitions, utility relocations, and environmental mitigations.

1.4 Characteristics of the Corridor

This section describes the corridor's existing features.

1.4.1 Topography and Natural Features

The study area has an average elevation ranging from 2,400 feet to 2,520 feet above mean sea level. Topography is relatively flat to gently sloping. Nearby topographic features include Martinez Hill, an igneous mountain that is just east of I-19 near the project's southern terminus. In addition, the Santa Cruz River, a normally dry river passes under I-19 from the east near the southern project limit, then it parallels I-19 on its west side as it continues north, and passes under Ajo Way west of I-19.

This project is located within the Arizona Upland subdivision of the Sonoran Desert Scrub biotic community. From the project's southern terminus to Irvington Road, vegetation along I-19 is predominately native, consisting of large Mesquite and Palo Verde trees within the median and along the edges of the right-of-way. In addition, Creosote bush, Prickly Pear and Cholla cacti, and Acacia shrubs are also present between the roadway and the right-of-way fence lines.

1.4.2 Mainline Freeway

I-19 is a major commercial corridor between Mexico and the United States and is designated as a CANAMEX Trade Corridor route, which connects Canada and Mexico through the states of Arizona, Nevada, Utah, Idaho, and Montana. The existing TIs within the project limits are located at San Xavier Road, Valencia Road, Irvington Road, Ajo Way, and a system TI with I-10 north of Ajo Way.

I-19, within the study limit, is classified as an "Urban Interstate" under the ADOT functional classification system. The posted speed limit on I-19 is 65 miles per hour (mph) from the southern study limit to MP 60.2, and 55 mph north of MP 60.2 (MP 60.2 is just south of Irvington Road). ADOT plans to change the speed limit to 65 MPH along the entire study limit before this project is constructed.

The existing geometric features within this project corridor were identified based on information included in as-built plans, and the project aerial survey. Table 1-5 illustrates the previous projects within the I-19 corridor.

Table 1-5: Previous Projects

Freeway Corridor	Project Number and/or TRACS Number	Milepost	As-Built Date	Description
I-19	010-D(206)A H6404 01C	N/A	Underway	Freeway Management System I-19 to Valencia Road
I-19	NON 019 A NFA H7231 01C	61.1 - 62.4	2009	Nogales - Tucson Hwy Irvington Road T.I. Mill and Replace
I-19	ACIM-10-4(175A)	259.42 - 260.43	2005	I-10 / I-19 T.I.
I-19	NH-10-4(151)	62.6	2005	RCB NB and SB
I-19	ACIM-10-4(175)A H3190 03C	62.7	2004	I-19 Ramp W-S Casa Grande - Tucson Hwy (I-10)(I-19) Interchange Volume 1,2 and 3
I-19	I19-1 (127) H2609 01C	58.3 - 59.5	2002	I-19 Valencia T.I. - Reconstruct T.I.
I-19	I-19-1 920	58.9	2001	Santa Cruz Flood Repair (Bank Protection)
I-19	I-19-1-517 H4172 01C	57.85 - 58.35	1997	Wash Bridge # 1247 - #1248 Scour Protection
I-19	IR-19-1(103) H0226 04C	54.7 - 58.5	1992	Surfacing/Safety
I-19	ACIR-19-1(101) H0225 01C	58.48 - 60.02	1992	Tucson South Pavement Rehab - ACFC Overlay
I-19	IR-19-1(49) H2014 01C	58.5 - 61.1	1992	Valencia Road - Irvington Road Landscaping
I-19	FIR-19-1 (107) H2163 01C	60.02 - 63.54	1991	I-10 and Irvington Road TI Shoulder work AC, AR, FC, Rehab Shoulders
I-19	I-19-1 (97) H0224 01C	56.9 - 56.77	1990	San Xavier Ramp Bridge Bridge Structure #1547
I-19	IR-19-1 (86) H0221 01C	60.4 - 61.2	1987	Nogales - Tucson Irvington Construct T.I. Ramps
I-19	I-19-1(99)	58.8	1986	I-19 @ Valencia Road- Traffic Signs
I-19	I-19-1 921	59.9	1986	Drexel Road Overpass fencing
I-19	ERIR 19-1(91) H0222 01C	56.7	1986	Nogales - Tucson Hwy Santa Cruz River Bridge # 1243 Repair/Widen
I-19	I-19-1 (83)	56.7	1981	Santa Cruz River Section - Flood DMG
I-19	I-19-1 (911)	55.0 - 63.4	1972	Pima Mine Road- North Structure Stress Relief
I-19	I-19-1 906	58.8	1972	I-19 Valencia Road Revamp Lighting
I-19	I-19-1 (70)	63	1971	NB OFF Ramp I-19 - EB - I-10 Impact Attenuator

Freeway Corridor	Project Number and/or TRACS Number	Milepost	As-Built Date	Description
I-19	I-19-1 (9)	55.7 - 59.0	1968	Roadway As-built Papago T.I. North
I-19	I-19-1 (5)	59.0 - 63.35	1966	Nogales - Tucson Roadway As-built Valencia Road North G.D. PCC
I-19	LSI-19-1 (55)	60.8 - 62.9	1966	Irvington Road - Jct I-10 Landscaping
I-19	I -019-A-504	N/A	N/A	Airport Wash Bridge #1121-1122

The horizontal alignment of I-19 includes long tangent sections with a total of five (5) horizontal curves along this 6.7 mile section. Of the five curves, only two horizontal curves have a degree of curvature greater than 30 minutes.

- South of the Valencia Road TI (MP 58.82), the I-19 mainline traverses a 3,400 foot long horizontal curve with a radius of 11,460 feet (0.5 degree of curvature).
- At the I-19/I-10 system TI (MP 62), the I-19 mainline traverses a 2,206 foot long horizontal curve with a radius of 4,584 feet (1.25 degree of curvature).

The existing uncurbed roadway from San Xavier Road to Ajo Way was constructed in the 1960s with a total width of 38-foot-wide for northbound and southbound I-19. Two 12-foot-wide lanes, a 10-foot-wide outside shoulder, and a 4-foot-wide inside shoulder exist in each direction of travel. The northbound and southbound centerlines are separated by 108 feet with an 84-foot-wide graded median between the pavement edges. Both roadways were constructed with a 1.5% normal crown draining toward the outside shoulder. The longitudinal profile gradient varies along I-19 ranging from 0.20% to 1.13%. The majority of the project has profile gradient of less than 1.0%. The northbound and southbound profile grade lines are generally at the same elevation throughout the project length. The existing pavement section is asphalt over Portland cement concrete pavement.

1.4.3 Traffic Interchanges

There are five existing traffic interchanges on I-19 within the study limits: the San Xavier Road TI, the Valencia Road TI, the Irvington Road TI, the Ajo Way TI, and the I-19/I-10 system TI where I-19 terminates.

The existing San Xavier Road is a curbed two-lane roadway passing under I-19. The existing San Xavier Road TI is a modified diamond interchange. Access to San Xavier Road is provided from the north and south. Ramps connect San Xavier Road to I-19. San Xavier Road within the interchange area has one through lane in each direction. The two intersections with the ramp terminals are controlled by STOP signs on the off-ramps.

The existing Valencia Road is a divided six-lane road with vertical curb. The existing Valencia Road TI is a SPUI constructed in 2002. Access to Valencia Road is provided from the north and south. Ramps connect Valencia Road to I-19. Valencia Road within the interchange area has three through lanes in each direction. The intersection with the ramp terminals is controlled by a traffic signal.

The existing Irvington Road is a curbed undivided five-lane road. The existing Irvington Road TI is a diamond interchange. Access to Irvington Road is provided from the north and south. Ramps connect Irvington Road to I-19. Irvington Road within the interchange area has two through lanes in each direction. The two intersections with the ramp terminals are controlled by traffic signals.

The existing Ajo Way is a curbed divided four-lane road east of I-19, and curbed undivided five-lane road west of I-19. The existing Ajo Way (SR 86) TI is a partial clover leaf. Access to Ajo Way (SR 86) is provided from the north and south. Ramps connect Ajo Way to I-19. Ajo Way (SR 86) within the interchange area has two through lanes in each direction. The two intersections with the ramp terminals are controlled by traffic signals.

The existing system TI at I-19/I-10 is a fully directional system interchange. ADOT completed reconstruction of the I-19/I-10 system interchange in 2003. The interchange has three lanes entering southbound I-19 from the west (two lanes from eastbound I-10, and one lane from 29th Street/ eastbound I-10 frontage road). The interchange has one lane entering southbound I-19 from the east (one lane from westbound I-10 - the flyover ramp). The flyover ramp from westbound I-10 to southbound I-19 was constructed as a two-lane ramp in anticipation of the future widening of I-19, but was striped as a one-lane ramp. The interchange has four lanes exiting I-19 northbound (one lane to eastbound I-10, two lanes to westbound I-10, and one lane to westbound I-10 frontage road.

The existing Los Reales Road is an uncurbed undivided two-lane road east of I-19 that has no access with I-19. Los Reales Road starts at Santa Clara Ave (west of 12th Ave) and ends at the Old Tucson-Nogales Hwy (I-19 Business Loop).

The existing Drexel Road is a curbed undivided two-lane road that crosses over I-19 but has no access to I-19. There are no ramps at the existing Drexel Road Bridge over I-19. Drexel Road terminates at Calle Santa Cruz west of I-19.

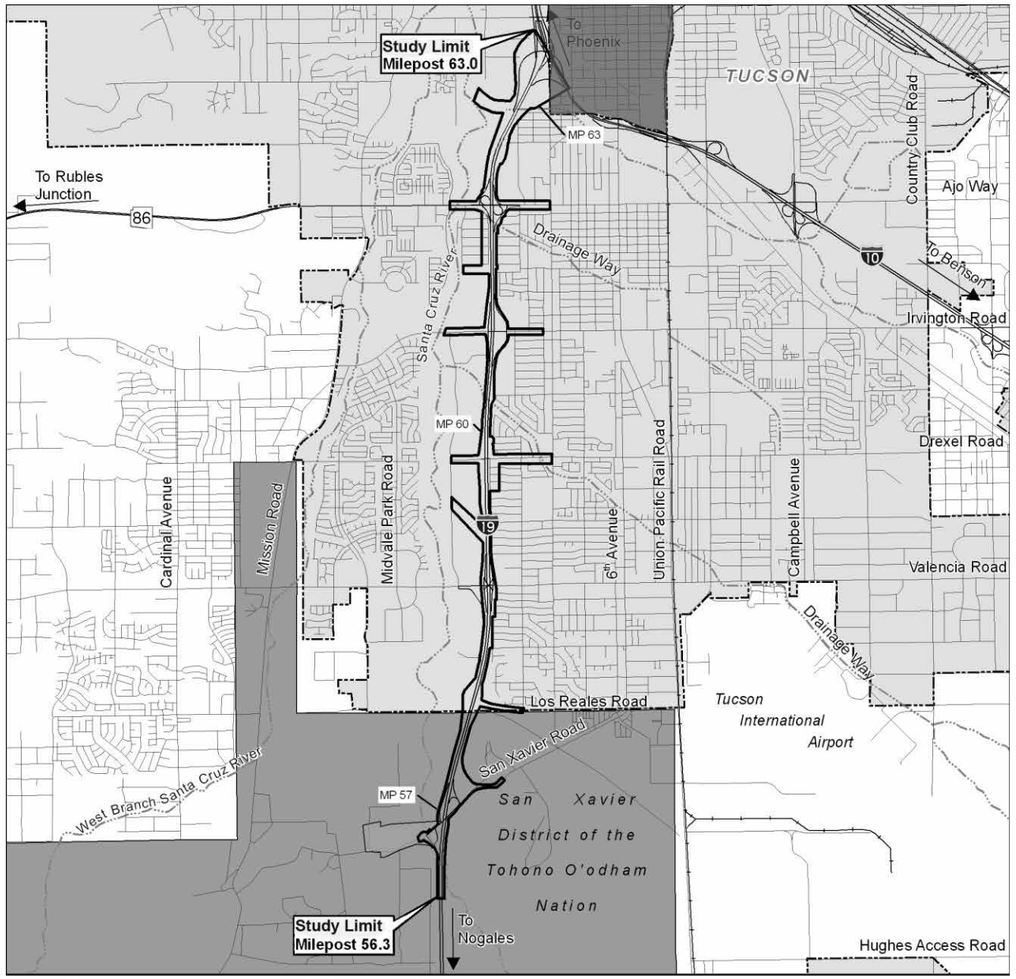
1.4.4 Land Use

The study area is within the jurisdictions of the City of Tucson, the San Xavier District of the Tohono O'Odham Nation, and the City of South Tucson (see Figure 1-3). Land use within the project area is primarily transportation (I-19 interstate and associated ADOT right-of-way). Other land uses include agriculture (in the San Xavier District), residential, commercial, industrial, public, and recreation. A 0.25-mile buffer to the boundary of the project area was evaluated for existing land use.

There are private, public, and tribal lands in the project area. Land owners include: ADOT, City of Tucson, Pima County, Tohono O'Odham Nation, Central Arizona Project, Pascua Yaqui Tribe, and private entities.

Residential land use adjacent to the project area is primarily single-family residences and is generally concentrated between I-10 and Los Reales Road. Commercial land use is concentrated along major crossroads in the project area, particularly at Ajo Way, Irvington Road, Drexel Road, and Valencia Road. The commercial land uses include gas stations, retail businesses, and motel complexes. Industrial land uses are concentrated north of Ajo Way near the I-10 and I-19 interchange.

Land use in the San Xavier District of the Tohono Nation (south of Los Reales Road) is primarily farmland/ agricultural. Recreational land uses adjacent to the project area include La Mar Park and Mission Manor Park.



Source: Land ownership GIS coverage, Arizona State Land Department

Figure 1-3: Land Jurisdiction

The west side of I-19 has various land uses. Between Los Reales Road and Valencia Road, there is a major sand and gravel operation. Between Valencia Road and Drexel Road, a Central Arizona Project electrical substation is located north of Valencia Road, and the Desert Vista Campus of Pima Community College (PCC) is located south of Drexel Road. Between the PCC and the Central Arizona Project electrical substation, there is City of Tucson land and Pima County land that also carries the Valencia Wash. The Santa Cruz River runs along the entire length of the study area west of I-19. Between Drexel Road and Irvington Road, there is a 60,000+ square-foot manufacturing facility, and a 145-acre Spectrum Mall retail center. Between Irvington Road and the I-19/I-10 system TI, the majority of the land is vacant and is owned by the City of Tucson with the exception of a subdivision south of Ajo Way. Tucson Water operates several potable water wells in this area known as the Santa Cruz field.

The east side of I-19 has various land uses. Between Los Reales Road and Valencia Road, the land uses are mainly residential, with some land owned by TEP north of Los Reales Road. Between Valencia Road and Drexel Road, the land is mainly residential, with some industrial and commercial land north of Valencia Road. Between Drexel Road and Irvington Road, the land uses are mainly residential, with some land owned by the City of Tucson. Between Irvington Road and Ajo Way, the land is mainly residential, with some industrial land north of Irvington Road, and commercial land south of Ajo Way. Between Ajo Way and I-10, there is a mix of commercial and industrial land north of Ajo Way, some land owned by the City of Tucson, and some residential land.

1.4.5 Right-of-Way

The existing right-of-way width varies along I-19 throughout the study area. South of San Xavier Road, the right-of-way is 300 feet wide. Between San Xavier Road and Valencia Road the right-of-way is generally 350 feet wide. The west side right-of-way narrows by approximately 50 feet for approximately 140 feet at the El Paso gas pipeline crossing near Los Reales Road. At Valencia Road, the right-of-way flares in the northeast, northwest, and southwest quadrants to accommodate the TI. Right-of-way in the southeast quadrant is irregular because of residential acquisitions during previous roadway improvement projects.

The existing right-of-way width between Valencia Road and Drexel Road is 280 feet. The right-of-way width between Drexel Road and the south bank of the Airport Wash is 300 feet. The east side right-of-way line departs from the roadway centerline at the south bank of the Airport Wash to accommodate the Airport Wash bridges. At the north bank of the Airport Wash the east right-of-way line returns toward the roadway centerline then jogs easterly again, following the northbound Irvington Road exit ramp. At Irvington Road, the right-of-way flares in the northeast, northwest, and southwest quadrants to accommodate the TI.

North of the Irvington Road TI, the right-of-way width is roughly 296 feet to approximately 140 feet south of the existing pedestrian bridge. After the pedestrian bridge, the west right-of-way line shifts 20 feet to the east and the east right-of-way line shifts 15 feet to the east, resulting in a 290-foot right-of-way width. The right-of-way then flares in all four quadrants for the Ajo Way interchange. Beyond the flares, the right-of-way runs approximately 325 feet wide for approximately 1,500 feet before flaring to accommodate the I-19/I-10 interchange.

1.4.6 Utilities and Railroads

There are no existing railroads within the project limits. The major existing public utilities within the I-19 corridor include the following:

- Western Area Power Administration (WAPA)
- Tucson Electric Power (TEP)
- Southwest Gas (SW Gas)
- El Paso Natural Gas (El Paso Gas)
- Cox Cable Tucson (Cox)
- City of Tucson Water - Tucson Water
- Pima County Regional Wastewater Reclamation Department (PCRWRD)
- Century Link (formerly Qwest Communications)
- ADOT Street Lighting.

Existing utilities within this project corridor were identified based on best available information, which included as-built plans provided by ADOT and facilities records/plans provided by utility companies. Stage I plans were also distributed to utility companies requesting them to verify the location of their facilities and indicate any corrections on the plans. Utility companies were also asked to indicate if their facilities were placed under permit or in own easement, and if there are any potential conflicts. Table 1-6 illustrates the existing utilities within the I-19 corridor Right-of-Way.

Table 1-6: Existing Utilities

Location	Crossing Utilities	Parallel Utilities
South of San Xavier Road TI	Underground electric – ADOT Street Lighting	Underground electric – ADOT Street Lighting
Between San Xavier Road and Los Reales Road	Underground electric – ADOT Street Lighting Overhead electric-TEP Gas line - El Paso Overhead electric - WAPA	Underground electric – ADOT Street Lighting Overhead electric-TEP
Los Reales Road	Overhead electric-TEP Overhead electric – WAPA Gas line - El Paso Telecom - Unknown	Overhead electric-TEP Overhead electric – WAPA
Between Los Reales Road & Valencia Road	Telecom - Unknown Overhead electric - WAPA Gas line –Southwest Gas	Underground electric – ADOT Street Lighting Overhead electric-TEP Overhead electric - WAPA Sanitary sewer - PCRWRD Water - Tucson Water
Valencia Road TI	Overhead electric - WAPA Underground electric – ADOT Street Lighting Sanitary sewer - PCRWRD Overhead electric - TEP Water - Tucson Water	Overhead electric – WAPA Overhead electric-TEP Underground electric – ADOT Street Lighting Telecom - Unknown Gas line - Southwest Gas Water - Tucson Water Sanitary sewer - PCRWRD
Between Valencia Road & Drexel Road	Underground electric – ADOT Street Lighting Overhead electric - WAPA Gas line –Southwest Gas Overhead electric - TEP Telecom - Unknown	Underground electric - ADOT Street Lighting Overhead electric - WAPA Sanitary sewer - PCRWRD Water - Tucson Water
Drexel Road Overpass	Overhead electric – WAPA Water - Tucson Water Telecom - Unknown Overhead electric-TEP Sanitary sewer-PCRWRD	Overhead electric WAPA Overhead electric - TEP Water - Tucson Water Telecom - Unknown Sanitary sewer-PCRWRD
Between Drexel Road & Irvington Road	Overhead electric-TEP Sanitary sewer-PCRWRD Gas line –Southwest Gas Water-Tucson Water Underground electric – ADOT Street Lighting	Overhead electric – WAPA Sanitary sewer-PCRWRD Underground electric – ADOT Street Lighting
Irvington Road TI	Overhead electric-TEP Sanitary sewer-PCRWRD Underground electric-TEP Underground electric – ADOT Street Lighting Telecom - Unknown	Overhead electric-TEP Sanitary sewer-PCRWRD Underground electric-TEP Underground electric – ADOT Street Lighting Telecom - Unknown
Between Irvington Road & Ajo Way	Water-Tucson Water Sanitary sewer-PCRWRD Underground electric – ADOT Street Lighting Gas line –Southwest Gas Overhead electric-TEP Telecom - Unknown	Underground electric – ADOT Street Lighting Sanitary sewer-PCRWRD Overhead electric-TEP Gas line –Southwest Gas
Ajo Way TI	Underground electric – ADOT Street Lighting Sanitary sewer-PCRWRD Overhead electric-TEP Gas line –Southwest Gas Water-Tucson Water Telecom - Unknown	Underground electric – ADOT Street Lighting Overhead electric-TEP Water-Tucson Water Sanitary sewer-PCRWRD Telecom - Unknown
Between Ajo Way & 29th Street	Water-Tucson Water Sanitary sewer - PCRWRD Underground electric – ADOT Street Lighting Overhead electric - TEP Gas line – El Paso Gas Underground electric - TEP	Water - Tucson Water Underground electric – ADOT Street Lighting Sanitary sewer-PCRWRD Overhead electric-TEP Gas line –Southwest Gas Gas line –El Paso Gas

1.4.7 Drainage

An Initial Drainage report has been prepared in conjunction with this study and it is included in Appendix D. ADOT's Arizona Major Drainage Basin map has the I-19 corridor within the Santa Cruz drainage basin. Within the study area, the I-19 corridor is located on the east side of the Santa Cruz River and runs predominantly parallel to the river. Rainfall runoff in the I-19 corridor is generally conveyed from east to west as sheet flow in a braided network of washes and drainage facilities. Cross drainage structures and bridges convey flows under I-19 to the Santa Cruz River. The studied watersheds consist of mild sloped topography, averaging 1.5%.

The Natural Resource Conservation Service (NRCS) compiles soil survey data and maintains soils data for the United States. A review of the data shows the predominant soil is considered mixed type. Soils in the project area are hyperthermic arid soils of the Torrifluvents Association. This association consists of well-drained soils formed on recent mixed alluvium on the floodplains of the Santa Cruz River and its tributaries. The Torrifluvents Association is characterized by deep, moderately coarse to moderately fine-textured, nearly level to gently sloping soils on floodplains and alluvial fans (Hendricks 1985).

Drainage studies have been performed for the study area by both ADOT and the City of Tucson. In April 2003, ADOT completed the *I-19 Corridor Study I-10 to Pima/ Santa Cruz County Line Drainage Report* which determined 100-year flows at the major wash crossings. The City of Tucson completed a comprehensive stormwater management program for the Tucson metropolitan area called the Tucson Stormwater Management Study (TSMS). A subcomponent of that study was the Stormwater Master Plan, a comprehensive, long-term framework for managing the City's stormwater system. Based on the hydrologic watershed modeling (HEC-1) performed as part of the TSMS study, the City has established concentration points (nodes) throughout the city. Each node has an associated watershed name, watershed identification letter, node identification number, and flow (Q) data. One of the delineated watersheds is the Rodeo Wash Watershed, which crosses the I-19 corridor at its downstream segment.

The review of drainage studies and reports is ongoing with ADOT, City of Tucson, and Pima County Regional Flood Control District offices. Table 1-7 lists the drainage reports that exist for this corridor.

Table 1-7: Existing Drainage Reports

Report	Agency	Report Date
I-19 Corridor Study: Initial Drainage Report Junction I-10 to Pima/Santa Cruz County Line, Kimley-Horn & Associates, Inc	ADOT	March 2003
I-19 - Valencia Road TI Drainage Report, Entranco	ADOT	March 1999
Final Report Tucson Stormwater Management Study, Phase II, Stormwater Master Plan (Task 11), Simons, Li & Associates, Inc.	City of Tucson	December 1995
Existing Conditions Hydrologic Modeling for the Tucson Stormwater Master Plan	City of Tucson	November 1995
Final Drainage Report: I-19/Valencia TI .Contract No. 93-26. TRACS # 019 PM 058 H 2609 01C, Federal Reference No. NH-19-1 (111), BRW Inc.	ADOT	October 1995
Santa Cruz River at I-19, ADOT Design Services	ADOT	July 1985

The Federal Emergency Management Agency (FEMA) produces Flood Insurance Rate Maps (FIRM) according to various levels of flood risk. Zone designations B, C, and X indicate low to moderate risk areas; whereas zones A, AH, and AO indicate high risk areas. Zone D indicates an undetermined risk area. A review of FEMA FIRM maps shows this project falling within the following map panels:

- 04019C2830K
- 04019C2238K
- 04019C2236K

This project has zone designations AE, A, and X within its boundaries. Zone A denotes that no base flood elevation has been determined. Zone AE denotes that a floodplain study has been performed and a 100-year Base Flood Elevation (BFE) has been determined by FEMA. Zone X denotes areas outside the 500-year floodplain. Table 1-8 lists FEMA regulated washes.

Table 1-8: FEMA Regulated Floodplain

Wash	TSMS Q100 (cfs)	FEMA Q100 (cfs)	Zone	FEMA Base Flood Elevation
Santa Clara Wash	376	705	A	No
Airport Wash	5,100	8,100	A	No
Rodeo Wash	3,437	2,922	AE	Yes

Cross Drainage

There are several major and non-major washes within the study limits. The main system adjacent to the project limits is the Santa Cruz River, which runs parallel to the corridor. Airport Wash, Hughes Wash, and Tucson Diversion Channel are the largest systems that cross the corridor with flows designated between 5,000 to 10,000 cubic feet per second (cfs). Rodeo Wash, a system with smaller flows, also crosses the corridor with flows ranging from 2,000 to 5,000 cfs. Data for existing drainage structures were obtained from as-builts, field inspections, and aerial imagery. The corridor has multiple culverts that cross I-19, both at wash and non-wash segments. Table 1-9 lists the existing major wash cross culverts, and Table 1-10 lists the existing non-major wash cross culverts.

Table 1-9: Existing Major Wash Cross Culverts

No	Location	Wash Name	Structure Type	Structure Size
1	I-19 Station 3065+00	Hughes Wash	Bridge	-
2	I-19 Station 3084+25	Santa Clara Wash	RCBC	2-8'x7'
3	I-19 Station 3104+80	El Vado Wash	RCBC	4-10'x5'
4	I-19 Station 3129+77	Valencia Wash	RCBC	4-10'x5'
5	I-19 Station 3152+00	Mission Park Wash	RCBC	2-10'x4'
6	I-19 Station 3195+00	Airport Wash	Bridge	-
7	I-19 Station 3201+70	Nebraska Wash	RCBC	2-10'x5'
8	I-19 Station 3219+85	Wyoming Wash	RCBC	3-10'x7'
9	I-19 Station 3243+50	Irvington Wash	RCBC	10'x4'
10	I-19 Station 3271+00	Rodeo Wash	RCBC	5-10'x5' 5-9'x4'
11	Irvington Road Station 485+40	Wyoming Wash at Irvington Road	RCBC	3-10'x7'
12	I-19 Station 3315+00	16th Street Wash	RCBC	4-10'x6'

Table 1-10: Existing Non-Major Wash Cross Culverts

No.	Alignment	Station	Structure Size
1	I-19 SB	3034+35	24” RCP
2	I-19	3048+40	24” CMP
3	I-19	3070+75	24” CMP
4	I-19	3074+50	24” CMP
5	I-19	3078+40	24” CMP
6	I-19	3096+50	42” RCP
7	I-19	3135+60	2-57”x38” CMPA
8	I-19	3138+66	2-45”x29” ERCP
9	I-19	3156+00	2-59”x37” CMPA
10	I-19	3165+80	2-52”x29” CMPA
11	I-19	3175+70	36” RCP
12	I-19	3178+95	2-24” RCP
13	I-19 NB & SB	3211+70	24” RCP
14	I-19	3219+70	24” RCP
15	I-19 NB & SB	3232+18	2-50”x34” CMPA
16	I-19	3249+37	54” RCP

The I-19 corridor has several ephemeral washes with defined channels that are considered waters of the U.S. Depending on the type and magnitude of the impacts to these washes, permits may be required under Sections 401 and 404 of the Clean Water Act.

Pavement Drainage, Ditches, and Area Inlets

The existing I-19 mainline has no storm drain system and drains via ditches. The northbound and southbound roadways are crowned sections, draining into v-ditches that either parallel the road or run in to the median. Median ditches are drained with a series of area inlets that discharge into cross culverts discharging flows into adjacent natural channels.

1.4.8 Structures

The existing bridge structures within the study limits were built between the years of 1965 and 2004. The sufficiency of bridge vertical clearances is summarized in the Bridge Evaluation Reports included in Appendix A.

A summary of the seventeen existing major bridge structures along I-19 within the study area is provided by corridor in Table 1-11. Vertical clearances in the table reflect the latest bridge inspection reports.

Table 1-11: Existing Major Bridge Structure Summary

Route Number	Structure Number	Milepost	Structure Name	Structure Type	Minimum Vertical Clearance (ft)
I-19	1243(NB), 1244(SB)	56.80	Santa Cruz Riv Br	Steel Plate Girders	n/a
	1547	56.94	Santa Cruz SB on Ramp	Steel Girders	n/a
	1245(NB), 1246(SB)	56.95	San Xavier TI OP	Steel Plate Girders	15.34
	1247(NB), 1248(SB)	57.82	Bridge	Cast-in-Place (CIP) T-Girder	n/a
	1943	58.82	Valencia Road TI UP	AASHTO Type V Mod.	17.75
	1120	59.90	Drexel Road UP	Steel Plate Girders	16.56
	1121(NB), 1122(SB)	60.32	Airport Wash Br	Continuous Reinforced Concrete Slab	n/a
	1123	60.95	Irvington Rd TI UP	Steel Plate Girders	16.20
	1124	61.40	Pedestrian UP	Steel Rigid Frame w/ hinged suspension	17.10
	1125	61.90	Ajo Way UP	Steel Girder	15.98
	2531	62.67	I-19 Ramp W-S	CIP Post Tensioned	15.77
	2596(NB), 2595(SB)	62.71	Julian Wash Bridge	CIP Post Tensioned	n/a
SR 86 (Ajo Way)	528	171.07	Santa Cruz River Br	Prestressed Concrete I-Girder	n/a

1.4.9 Geotechnical

A geotechnical Report is being prepared in conjunction with this study.

Geology and Geotechnical Conditions

The study site is located in the Basin and Range Geologic Province of the southwestern U.S. The Basin and Range Province is characterized by a modern landscape consisting of broad alluvial valleys interspersed with, and bounded by uplifted and fault-block mountain ranges, often with well-developed pediments and alluvial fans. Generally, the mountain ranges and valleys trend in a north-south to northwest-southeast direction. The modern landscape was formed by late Tertiary (Miocene-Pliocene) extensional tectonism and high-angle normal faulting, followed by subsequent erosion of the uplifted mountains and deposition of sediments in the newly-formed basins. The project site is primarily located in Quaternary alluvial materials, which are generally of substantial thickness. These sediments, at depth, are often well consolidated, and in many locales, are slightly indurated. Shallow volcanic bedrock is present near the south end of the project alignment (in the vicinity of San Xavier Road).

The subgrade materials encountered in the test borings consisted of predominantly fine-grained, lenticular, and typically moderately firm to hard alluvial deposits containing varying proportions of sand, silt, clay, and gravel. Generally, the harder layers are weakly to moderately cemented with calcium carbonate (lime). The alluvial soils along the majority of the project alignment are known to be at least several hundred feet thick. Occasional cobbles were encountered at the Valencia Road TI.

Borings performed near the south end of the project for the Santa Cruz River Bridge and the San Xavier bridges encountered volcanic agglomerate and basalt bedrock beneath the alluvial soils at depths of 20 to 55 feet. This rock is exposed in the hillside (Martinez Hill) to the immediate east of I-19 at San Xavier Road.

Coarser grained sand, gravel, and cobble deposits associated with stream flow deposition were encountered at varying depths at the Airport Wash and Julian Wash crossings.

Soil Moisture & Groundwater Conditions

Groundwater was encountered in two excavations performed as part of this investigation (PB1 and PB4) at depths of 41 and 45 feet, respectively. In the case of PB1 at the southern Santa Cruz bridge abutment, groundwater depth is influenced by the Santa Cruz River and water sitting on the shallow bedrock in the vicinity of Martinez Hill. In the case of PB4 (Hughes Wash), groundwater depth is influenced by the nearby Hughes Wash. Additionally, test borings previously performed for the Valencia Road Underpass Bridge encountered groundwater between depths of 57.5 and 62.5 feet in three of six test locations, and test borings for the I-10/I-19 system TI encountered groundwater in between depths of 68 and 119 feet. The moisture content of various laboratory tested samples above the water table from the auger borings and test pits ranged from approximately 1 to 25 percent. The moisture content of various soils encountered within the test pits tested in place by nuclear gauge ranged from approximately 2 to 22 percent. The moisture contents were typically identified in the test pits and test borings as being moist.

Historical groundwater maps for the project area (B.A. Murphy, and J.D. Hedley, 1982) indicate the depth to groundwater in the vicinity of the project is generally between 160 and 170 feet below ground surface. The general hydraulic gradient of groundwater flow is in a northwesterly direction. However, more recent groundwater data, showing a lowering trend of groundwater depth, available from the Sustainability of Semi-Arid Hydrology and Riparian Area (SAHRA) and City of Tucson indicates depths to groundwater of 180 to 200 feet in the vicinity of the project site.

Existing Pavement Structural Sections

As-built plans for I-19 were reviewed to determine the existing mainline, shoulder, and ramp pavement sections. The typical existing mainline pavement section along the project alignment consists of Asphalt Concrete Friction Course (ACFC) over Portland Cement Concrete Pavement (PCCP) over Aggregate Base (AB) or AB Class 2 over select material. Typical ramp sections consist of PCCP over Asphalt Concrete Base (ACB) mix; or Asphalt Concrete (AC) over AB. Typical shoulder sections match the mainline pavement or consist of ACFC over AC over AB over select material. The typical sections are summarized below. The existing pavement sections are summarized in Table 1-12.

- I-19 Mainline from the start of the project South of San Xavier Road (station 2982+14.85 NB & SB) to South of Valencia Road (station 3098+50 NB & SB): The existing mainline pavement section consists of 0.75 inches of ACFC over 8.5 inches of PCCP over 4 inches of AB over 6 inches of Select Material. The inside and outside shoulder pavement sections both consist of 0.5 inches of ACFC over 2 inches of AC (¾) over 3 inches of AB over 6 inches of select material. It should be noted that the mainline AR-ACFC overlay could not be confirmed from the start of the project (station 2982+14.85 NB & SB) to station 3084+58.2 (SB) & 3055+16.6 (NB). Based on visual observation of an asphalt driving surface in this section it is assumed that the AR-ACFC thickness and depth of PCCP milling matches the adjacent section.
- I-19 Mainline from South of Valencia Road (station 3098+50 NB & SB) to the I-19/I10 System TI (approximate station 3319+00): The existing mainline pavement section consists of 0.75 inches of AR-ACFC over 8.5 inches of PCCP over 3 inches of AB over 6 inches of Select Material. The inside and outside shoulder pavement sections consist of 0.5 inches of ACFC over 2 inches of AC (¾) over 3 inches of AB over 6 inches of select material. It should be noted that the mainline AR-ACFC overlay could not be confirmed from station 3161+37.6 (SB) & 3160+53.7 (NB) to the end of the project, station 3319+21 (NB) & 3318+77.66 (SB). Based on visual observation of an asphalt overlay in this section it is assumed that the AR-ACFC thickness and depth of PCCP milling matches the adjacent section.
- The San Xavier Road TI ramps consist of 0.5 inches of ACFC over 7.5 inches of AC over 6 inches of AB.
- The Valencia Road TI ramps consist of 0.5 inches of AR-ACFC over 6 inches of AC (¾) over 14 or 16.5 inches of AB in transition zones. Past the transition zones, the typical section consists of 9 or 10.5 inches of PCCP over 4 inches of ACB (¾).
- Ajo Way Ramps, Valencia Road, Irvington Road, Ajo Way, and Drexel Road consist of 0.5 inches of AR-ACFC over 2 inches of AC over 3 inches of AB over 12.5 inches of select material.
- I-19/I-10 System TI: The mainline I-19 pavement section consists of 15 inches of PCCP over 4 inches of ACB. The majority of ramps within the I-10/I-19 TI consist of 12.5 inches of PCCP over 4 inches of ACB. The NW and ES ramps consist of 15.5 inches of PCCP over 4 inches of ACB. Ajo Way Ramp SW consists of 6 inches of AC (¾) over 12 inches of AB.

Table 1-12: Existing Pavement Sections

Segment/ Project(s)	AR-ACFC (in)	PCCP (in)	AC (¾) (in)	AB (in)	ACB (in)	Total Thickness (in)
I-19 Mainline: San Xavier Road to Los Reales Road / I-19-1(9) SB Sta. 2982+14.85 to 3084+58.2 NB Sta. 2982+14.85 to 3055+16.6	0.75[5]	8.5[5]	-	4.0	6.0[2]	19.25
I-19 Mainline: Los Reales Road to South of Valencia Road /I-19-1(9) & ACNH-19-1(127) SB Sta. 3084+58.2 to 3098+50 NB Sta. 3055+16.6 to 3098+50	0.75	8.5	-	4.0	6.0[2]	19.25

Segment/ Project(s)	AR-ACFC (in)	PCCP (in)	AC (¾) (in)	AB (in)	ACB (in)	Total Thickness (in)
I-19 Shoulders/ I-19-1(9) SB & NB Sta. 2922+14.85 to 3098+50	0.5(1)	-	2.5(3)	10.0	6.0(2)	19.0
I-19 Mainline: South of Valencia Road to South of Drexel Road/I-19-1(5) & ACNH-19-1(127) SB Sta. 3098+50.0 to 3161+37.6 NB Sta. 3098+50.0 to 3160+53.7	0.75	8.5	-	3.0	6.0(2)	18.25
I-19 Mainline: South of Drexel Road to I-19/I-10 TI / I-19-1(5) SB Sta. 3161+37.6 to 3318+77.66 NB Sta. 3160+53.7 to 3319+21	0.75(5)	8.5(5)	-	3.0	6.0(2)	18.25
I-19 Shoulders/ I-19-1(5) SB Sta. 3098+50 to 3328+84.44 NB Sta. 3098+50 to 3327+79.84	0.5(1)	-	2.0(3)	3.0	13.0(2)	18.5
I-19 Mainline/ ACIM-10-4(175)A SB Sta. 3282+94.96 to 3318+77.66 (new) NB Sta. 3283+63.13 to 3319+21 (new) SB Sta. 61+42.30 to 97+25.00 (old) NB Sta. 60+92.13 to 96+50.00 (old)	-	15.0	-	-	4.0	19.0
I-19 Mainline/ ACIM-10-4(175)A SB Sta. 3322+40.42 to 3327+19.96 (new) NB Sta. 3322+97.61 to 3327+19.96 (new) SB Sta. 53+00.00 to 57+79.54 (old) NB Sta. 53+00.00 to 57+22.35 (old)	-	15.5	-	-	4.0	19.5
San Xavier Road Ramp A/ I-19-1(5)	0.5(1)	-	2.0(3)	3.0	12.5(2)	18.0
San Xavier Road Ramp S-4/ IR-ER-19-1(97)	0.5(1)	-	7.5(3)	6.0	-	14.0
San Xavier Road/ I-19-1(9) Sta. 488+33.2 to 511+82.83 (new) Sta. 93+19.17 to 116+68.80 (old)	-	-	2.0(3)	4.0	21.0(2)	27.0
Valencia Road; Irvington Road; Ajo Way; Drexel Road; / I-19-1(5)	0.5(1)	-	2.0	3.0	12.5(2)	18.0
Valencia Road /ACNH-19-1(127) Sta. 15+44.00 to 31+18.77 Sta. 34+43.27 to 46+26.11	-	10.5	-	-	4.0	14.5
Valencia Road /ACNH-19-1(127) Sta. 46+26.11 to 59.43.00	-	-	5.0	10.0	-	15.0
Valencia Road Ramp/ACNH-19-1(127) Ramp A Sta. 100+00.00 to 117+00.56 Ramp B Sta. 200+00.00 to 206+58.43 Ramp C Sta. 312+96.79 to 314+61.65 Ramp D Sta. 412+05.19 to 415+30.29	0.5	-	6.0	14.0	-	20.5
Valencia Road Ramps/ACNH-19-1(127) Ramp A Sta. 117+00.56 to 127+47.88 Ramp B Sta. 206+58.43 to 215+66.80 Ramp B1 Sta. 2+00.00 to 4+92.78 Ramp A1 Sta. 1+00.00 to 3+71.95	-	9.0	-	-	4.0(4)	13.0
Valencia Road Ramps/ACNH-19-1(127) Ramp C Sta. 302+78.61 to 312+96.79 Ramp C1 Sta. 3+38.62 to 6+39.42 Ramp D Sta. 403+43.79 to 412+05.19 Ramp D1 Sta. 4+50.56 to 7+24.33	-	10.5	-	-	4.0(4)	14.5
Valencia Road Ramp/ACNH-19-1(127) Ramp C Sta. 314+61.65 to 337+27.07 Ramp D Sta. 415+30.29 to 429+05.43	0.5	-	6.0	16.5	-	23.0
Ajo Way Ramp SW/ ACIM-10-4(175)A	-	-	6.0	12.0	-	18.0
I-10/I-19 Ramps SB, EB, WB, WS, NB, NE, 12th Avenue, 12SCR, 12NCR, EB & WB frontage roads/ ACIM-10-4(175)A	-	12.5	-	-	4.0	16.5
I-10/I-19 Ramps NW & ES/ACIM-10-4(175)A	-	15.5	-	-	4.0	19.5

1. ACFC used in-lieu of AR-ACFC
2. Select material used in-lieu of ACB
3. AC – Unspecified Mix
4. ACB ¾ mix
5. Unable to locate as-built plans for AR-ACFC overlay in this section. Based on visual observation of asphalt surface in these sections, AR-ACFC overlay thickness and milling of PCCP surface is assumed to be the same as adjacent sections.

Abbreviations: EB = eastbound; WB = westbound; NB = northbound; SB = southbound

I-19 Bridges/Ramp Structures

- Santa Cruz River Bridges and San Xavier TI: The subgrade materials displayed on the test boring logs for these structures generally consist of interbedded layers of finer-grained, typically moderately firm to hard alluvial soils containing varying proportions of sand, silt, clay, and gravel. The upper alluvial layer is between 17 and 55 feet thick. Below the soil strata, basaltic agglomerate, tuff agglomerate, and fractured vesicular basalt were identified.
- Structures North of the San Xavier Road: The subgrade materials described in the majority of test locations encountered predominantly low to medium plasticity, moderately firm to hard alluvial deposits containing varying proportions of sand, silt, clay, and gravel. Generally, the harder layers are weakly to moderately cemented with calcium carbonate (lime).

Retaining Walls and Sound Barriers

Existing retaining walls located along the I-19 corridor are primarily founded on spread footings. Some existing walls within the limits of the I-19/I-10 system TI are founded on 18-inch-diameter drilled shafts.

1.4.10 Signing, Pavement Marking and Lighting

The existing guide signing on I-19 between I-10 and the U.S./Mexico border is kilometer-based. The existing freeway guide signs within the study limits are installed on cantilever sign supports, truss sign supports, or tubular sign bridges. Signing and Pavement Marking plans are included in Appendix B of this report.

The existing I-19 freeway lighting consists of high mast lighting at the I-19/I-10 system TI and the Valencia Road TI. Horizontal mounted luminaires and mast arms exist at the Ajo Way TI, Irvington Road TI, and the San Xavier Road TI.

1.4.11 Freeway Management System (FMS)

The existing FMS within the project limits consists of Closed Circuit Television (CCTV) cameras, Dynamic Message Signs (DMS), and communication trunk lines. These FMS features communicate with the ADOT Traffic Operations Center (TOC) to mitigate congestion problems, minimize the effects of non-recurring congestion such as vehicular crashes, and improve operational safety for the general public.

The FMS consist of several Intelligent Transportation System (ITS) devices including CCTV cameras, DMS, and Vehicle Detection. DMS are used to communicate important messages from the TOC to the travelling public. CCTV cameras are used to remotely view traffic conditions and incidents from the TOC. Vehicle Detection is used to perform traffic monitoring by gathering traffic data. Vehicle Detection consists of either in-pavement loop detectors or non-intrusive detection such as acoustic detectors. Each of the ITS components is linked to the TOC through a communications system. Information from individual devices is collected and converted on a fiber optic transceiver or a copper twisted wire pair modem in cabinets with traffic controllers. A series of node buildings act as network hubs for the fiber optic and copper wire communications system that brings all of the data provided by the individual components to the TOC. The TOC serves as the base of operations for all of the ITS components for the FMS. Operators can control each component remotely from their workstations at the TOC, and the FMS software can ensure that all of the devices are working in concert with each other.

The existing FMS on I-19 (including the FMS project currently under construction) consists of seven CCTV cameras, four DMSs, four one-directional Vehicle Detection Sites, four two-directional Vehicle Detection Sites, and two Total Count Stations. The existing I-19 FMS trunk line is connected to the FMS truck line along I-10. The I-19 FMS trunk line runs parallel to I-19 on the east side and terminates just south of Hughes Wash. The trunk line consists of fiber optic lines enclosed in four 3 inch conduits and is generally 30 inches below the ground surface. Table 1-13 shows the locations of the different existing FMS devices within the study limits.

Table 1-13: Existing FMS Devices

Freeway Corridor	Direction	Milepost	Location Description
CCTV Camera Locations			
I-19	N/A	57.9	Hughes Wash
I-19	N/A	58.8	Valencia Road - southeast quadrant
I-19	N/A	59.9	Drexel Road - northwest quadrant
I-19	N/A	60.3	Airport Wash
I-19	N/A	60.9	Irvington Road - southeast quadrant
I-19	N/A	61.9	Ajo Way - northwest quadrant
I-19	N/A	62.7	Julian Wash (Tucson Diversion Channel) - southeast quadrant
DMS Locations			
I-19	Northbound	58.5	North of Los Reales Road
I-19	Northbound	61.4	Between Irvington Road and Ajo Way
I-19	Southbound	62.5	Between I-10 and Ajo Way
I-19	Southbound	60.4	Between Irvington Road and Drexel Road
Vehicle Detection Locations			
I-19	Northbound	57.9	South of Hughes Wash
I-19	Southbound	57.9	North of Hughes Wash
I-19	Northbound & Southbound	58.8	South of Valencia Road
I-19	Northbound & Southbound	59.9	North of Drexel Road
I-19	Northbound &	60.9	South of Irvington Road
	Southbound		
I-19	Northbound	61.9	South of Ajo Way
I-19	Southbound	61.9	North of Ajo Way
I-19	Northbound & Southbound	62.7	South of Julian Wash (Tucson Diversion Channel)
Total Count Station Locations			
I-19	Northbound & Southbound	61.4	Between Irvington Road and Ajo Way
I-19	Northbound & Southbound	62.5	Between Ajo Way and I-10

The CCTV cameras are typically installed on 55 foot high modified “T” poles that are located within the freeway right-of-way. The CCTV hardware can either be mounted on the camera pole inside of a Type 343 cabinet or mounted in a 341A cabinet near the bottom of the pole. There is one existing node building within the project limit located at the southwest quadrant of the I-19/I-10 system TI. The DMS are mounted on truss sign supports. There are no existing ramp meters within the project limits.

1.5 Agency and Public Scoping

A Public Involvement Plan was prepared in May 2003 for *I-19 Corridor Study, I-10 to Pima/Santa Cruz County Line*. The Public Involvement Plan was successful in obtaining public and agency input to develop the corridor alternatives. To ensure that the community also had ample opportunity to provide comments and be involved in the development and evaluation of alternatives, the plan included an extensive public involvement process with public meetings and project newsletters.

The scoping process identified potential issues, concerns, and opportunities to be considered in the Design Concept Study and EA. The scoping information was obtained from area residents, business owners, and government agency representatives.

The Recommended Alternative presented in this DCR incorporates some design modifications and refines the alternative identified in the 2003 Corridor Study. As indicated earlier, these modifications resulted from incorporating the most recent RTP programming and addressing other safety and operational considerations expressed by stakeholders’ including, ADOT, Pima County, City of Tucson, the San Xavier District of the Tohono O’Odham Nation, and other public entities. Input during the public involvement process resulted in a Recommended Alternative that minimized the environmental and the right-of-way impacts along the corridor (including eliminating the impacts at Martinez Hill), and providing improved traffic operations (including providing all traffic movements between Ajo Way and I-19).

1.5.1 Agency Scoping

Three agency scoping meetings were held in 2005, 2007 and 2009 at the Valencia Library Large Meeting Room. During these meetings, the team presented the proposed roadway improvements for the corridor and solicited input from the public on the project scope and any issues, concerns, or comments.

Scoping letters were sent to the following agencies and stakeholders: Arizona Game and Fish Department, Arizona State Land Department, City of South Tucson, City of Tucson, Green Valley Community Coordinating Council, PAG, Pima Community College, Pima County, Town of Sahuarita, Sunnyside Unified School District #12, San Xavier District of the Tohono O'Odham Nation, Brooks Fiber Communications, Cox Communications, El Paso National Gas Company, GST/Time Warner, Pima County Waste Water, Century Link (formerly Qwest Communications), Southwest Gas, Tucson Electric Power, US Sprint, Union Pacific Railroad Company, Western Area Power Administration, and US Fish and Wildlife Service.

Agency scoping letters were mailed to interested federal, state, and local agencies and governmental bodies on December 20, 2004, and on January 13, 2009. A supplemental scoping letter was mailed to the Pascua Yaqui Tribe on June 13, 2007. The scoping letters identified the project location and scope and requested comments. The agency scoping meetings were attended by representatives from ADOT, FHWA, Pima County, City of Tucson, PAG, and Tohono O'Odham Nation. These meetings were also open to members of the public. The purpose of the meetings was to obtain input regarding the potential social, economic, and environmental issues associated with the proposed project.

The first agency scoping meeting was held in January 25, 2005. Representatives from 13 agencies attended the meeting. Comments received included safety concerns for schools and emergency services; questions/comments regarding information provided about existing utility services; concerns about utility impacts; questions regarding project impacts on Pima Community College; questions/comments regarding the potential for sound barriers and whether landscape buffers could be used instead; and questions and comments regarding information provided about proposed trail planning and about planned commercial development along Irvington Road and Drexel Road.

The second agency scoping meeting was held in March 15, 2007. Representatives from 17 agencies attended the meeting. Comments received included specific questions about the proposed project; information provided regarding future projects in the area that may be relevant to planning for I-19, such as the Southwest Infrastructure Study; utility plans; plan amendments; trail planning; commercial development; local transportation planning; and San Xavier District concerns.

The second agency scoping meeting was held in March 31, 2009. Representatives from 11 agencies attended the meeting. Comments received included questions centered on five main topics: proposed improvements and development process; maintenance of access for commercial developments; emergency services and schools during construction; utilities impacts; drainage impacts; and general comments. Responses to comments were provided at the meeting. Comment letters were received from the USFWS, Pima County Department of Environmental Quality, Pima County Development Services, and Southwest Gas.

Ongoing scoping efforts with agency stakeholders such as ADOT, City of Tucson, Pima County, PAG, Tohono O'odham Nation, and Pascua Yaqui Tribe will continue throughout the study to supplement input received during the agency and public scoping meetings.

1.5.2 Public Scoping

There were four public scoping meeting held for this study in 2005, 2007, 2009, and 2011. During these meetings, the team presented the proposed roadway improvements for the corridor and solicited input from the public on the project scope and any issues, concerns, or comments.

The first scoping meeting was held at the Valencia Library Large Meeting Room on January 25, 2005. The meeting was advertised in the Arizona Daily Star (January 9, 2005) and La Estrella (January 12, 2005). In addition, letters were mailed to local jurisdictions, postcard invitations were mailed to local residents, notices were posted on public boards, and a news release was sent to local media on January 11, 2005. The purpose of this meeting was to obtain public input on the alternative presented in the *2003 I-19 Corridor Study*. The scoping meeting was an open-house format with a brief presentation. Comment sheets and handouts in both English and Spanish were provided at the meeting. The comment sheets provided participants an opportunity to comment on the proposed alternatives and also asked participants to identify their preferences or concerns regarding the pedestrian overpass between Irvington Road and Ajo Way. In all, 104 people attended the meeting, and 49 people submitted comments either by returning a comment form at the meeting or by submitting a letter to the project team. Of the comments received regarding the pedestrian bridge, 24 individuals currently use the pedestrian overpass (54 percent of respondents), 13 never use the overpass (30 percent) and 7 were unsure (16 percent). Twenty-six individuals favored replacing the overpass (72 percent), 6 favored not replacing the overpass (17 percent), and 4 were unsure (11 percent). Concerns expressed at the meeting included questions about the project design; construction impacts such as detours, noise, and dust; interchange design; and intersection reconstructions. Respondents wanted to make sure that future traffic volumes were being projected and considered in the analysis.

The second public scoping meeting was held at the Valencia Library Large Meeting Room on March 15, 2007. The second meeting was advertised in the Arizona Daily Star (March 1, 2007) and La Estrella (February 28, 2007). In addition, letters were mailed to local jurisdictions, and postcard invitations were mailed to local residents. This meeting provided an update on the project status and sought to gather comments and concerns about the project. The meeting began with participants reviewing displays and asking questions of ADOT and their project team. A brief presentation was provided, followed by a question-and-answer session. Additionally, participants were asked to complete a comment sheet that asked "What community and personal benefits do you hope to gain from this project?" The public comments indicated strong support for the proposed improvements. In all, 30 people signed in at the meeting; a total of 27 comment sheets were returned. Supportive comments focused on encouraging continued work to address traffic issues and to move the project forward quickly. Comments expressed at the meeting included multiple requests that the project deal with traffic noise; including requests for sound barriers; a request for a bridge over the Santa Cruz River; and air quality (dust) concerns.

The third public scoping meeting was held at the Valencia Library Large Meeting Room on March 31, 2009. The meeting was advertised in the Tucson Citizen (March 16, 2009), the Arizona Daily Star (March 16, 2009), and La Estrella (March 13, 2009). In addition, letters were mailed to local governments, postcard invitations were mailed to local residents, notices were posted on public boards, and a news release was sent to local media on March 16, 2009. The purpose of this meeting was to update the public on the status of the project and present the current preliminary design concepts for the proposed improvements. The scoping meeting consisted of an open-house format with a brief presentation. In all, 31 people signed in at the public scoping meeting, and 12 comments were received through comment sheets, e-mail, and phone calls. Comments expressed at the meeting included questions about the proposed project

design, information regarding current traffic issues, concerns about impacts during construction, concerns about impacts on existing landscaping, and questions about interchange locations and reconstructions. Comments received included encouragement to use rubberized asphalt throughout the project for noise benefits; a request to see trail connections in conjunction with washes at interstate bridges; a request to integrate the trail improvement plan with other regional projects and trail planning; a comment that sound barriers and additional pavement may create a tunnel effect on I-19; a comment that there is an existing flooding problem at El Vado Wash; a request for improved signage; and concerns about property acquisitions. Property acquisition questions included questions regarding when the acquisition process would begin and how owners would be compensated.

The fourth public scoping meeting was held at the Pueblo Senior Center on June 15, 2011 during the Draft EA thirty day review period. The meeting was advertised in the Arizona Daily Star, La Estrella, Green Valley News and the Sahuarita Sun. In addition, letters were mailed to local governments, postcard invitations were mailed to local residents, notices were posted on public boards, and a news release was sent to local media. The purpose of this meeting was to update the public on the status of the project and present the current preliminary design concepts for the proposed improvements. The scoping meeting consisted of an open-house format with a brief presentation. In all, 104 people signed in at the public scoping meeting, and 27 comments were received through comment sheets, e-mail, and phone calls. Comments expressed at the meeting included questions about the proposed project design, information regarding current traffic issues, concerns about impacts during construction, concerns about impacts on existing landscaping, and questions about right-of-way acquisition and relocations assistance. Comments received included encouragement to use rubberized asphalt throughout the project for noise benefits; requests for noise walls, requests for drainage improvements at Rodeo Wash, and requests to advance certain phases of implementation before others. Property acquisition comments included questions regarding when the acquisition process would begin and how owners would be compensated.

2.0 Traffic And Crash Data

2.1 2001 Conditions

The existing traffic volumes and existing LOS analysis were obtained from the *2003 Traffic Report* prepared by Kimley-Horn and Associates, Inc. in support of the 2003 I-19 Corridor Study – I-10 to Pima/Santa Cruz County Line.

Traffic volumes were collected in 2001 for the I-19 mainline, ramps, and crossroads. In addition, the 2003 Traffic Report included a LOS analysis for the 2001 traffic conditions.

2.1.1 2001 Traffic Volumes

In 2001, I-19 between San Xavier Road and I-10 carried an AADT of 47,350 vpd. The heaviest volume was counted on the segment between Ajo Way and I-10 (64,200 vpd), and the lowest volume was counted on the segment between San Xavier Road and Valencia Road (28,500 vpd). The directional factor (D) was 51% in the northbound direction. The peak-hour traffic volume for northbound I-19 occurred during the AM time period, while the peak-hour traffic volume for southbound I-19 occurred during the PM time period. Heavy vehicles accounted for approximately 8% of traffic (for both northbound and southbound). The 2001 traffic volumes are illustrated in Figure 2-1 for the I-19 mainline, and in Figure 2-2 for the intersections with the ramp terminals for the service interchanges.

Table 2-1 shows the AADT, K-values, D factors, and truck percentages (T) for the southbound and northbound directions of travel on I-19 that were calculated as part of the 2003 Corridor Study. The K-value shown is the percentage of the AADT that occurs during the peak hour. The truck percentage (T) is the percentage of the AADT that are heavy vehicles. In order to estimate the AADT, a rural November seasonal adjustment factor of 1.07 was used on the volume south of Valencia Road, and an urban November seasonal adjustment factor of 0.98 was used on the volumes north of Valencia Road (including the Valencia Road TI).

Table 2-2 shows the AADT, K values, D factors, and truck percentages (T) for the cross roads associated with each traffic interchange. The highest K-value (K=0.15) was estimated along San Xavier Road. Higher K-values were expected south of Valencia Road since the adjacent roadway and development environment changes at that point from urban north of Valencia Road, to rural south of Valencia Road.

Table 2-1: 2001 Average Traffic Factors on I-19 Mainline

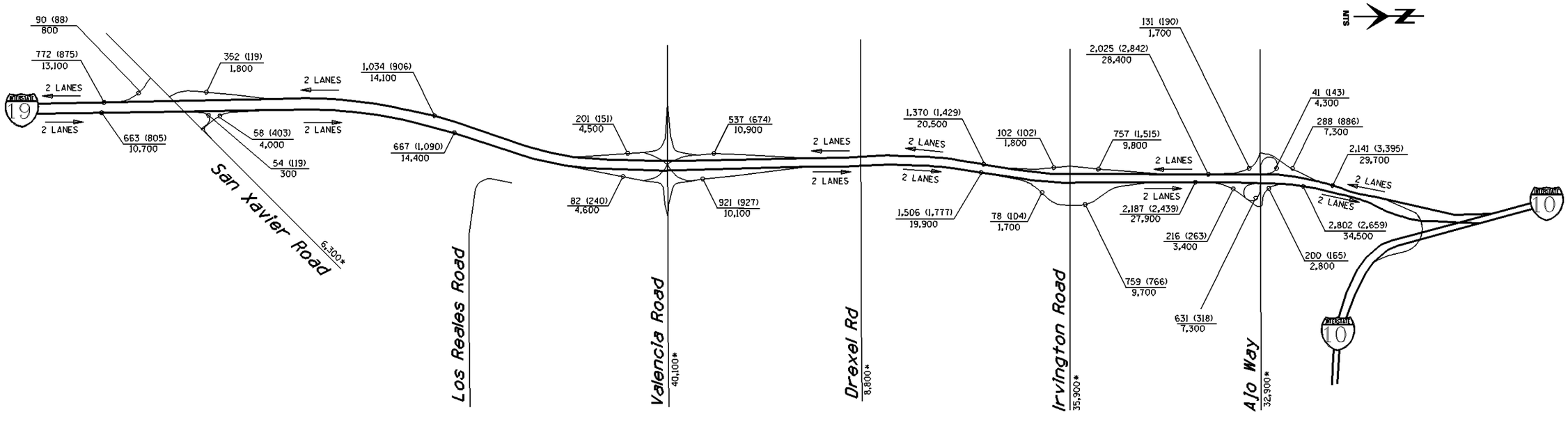
Segment Beginning	Segment Ending	AADT	K	D	T
Southbound					
I-10	Ajo Way off-ramp	29,700	0.11	n/a	9.1
Ajo Way off-ramp	Ajo Way loop on-ramp	22,400	0.11	n/a	8.5
Ajo Way loop on-ramp	Ajo Way on-ramp	26,700	0.10	n/a	9.1
Ajo Way on-ramp	Irvington Road off-ramp	28,400	0.10	n/a	9.4
Irvington Road off-ramp	Irvington Road on-ramp	18,700	0.07	n/a	8.6
Irvington Road on-ramp	Valencia Road off-ramp	20,500	0.07	n/a	9.8
Valencia Road off-ramp	Valencia Road on-ramp	9,500	0.09	n/a	n/a
Valencia Road on-ramp	San Xavier Road off-ramp	14,100	0.07	n/a	9
San Xavier Road off-ramp	San Xavier Road on-ramp	12,300	0.06	n/a	11.9
Northbound					
San Xavier Road off-ramp	San Xavier Road on-ramp	10,300	0.07	n/a	9.2
San Xavier Road on-ramp	Valencia Road off-ramp	14,400	0.08	n/a	11.2
Valencia Road off-ramp	Valencia Road on-ramp	9,800	0.09	n/a	n/a
Valencia Road on-ramp	Irvington Road off-ramp	19,900	0.09	n/a	9.5
Irvington Road off-ramp	Irvington Road on-ramp	18,200	0.09	n/a	9.6
Irvington Road on-ramp	Ajo Way off-ramp	27,900	0.09	n/a	11.3
Ajo Way off-ramp	Ajo Way loop on-ramp	24,500	0.08	n/a	9.5
Ajo Way loop on-ramp	Ajo Way on-ramp	31,700	0.09	n/a	9.4
Ajo Way on-ramp	I-10	34,500	0.08	n/a	10.4

Source: 2003 Traffic Report

Table 2-2: 2001 Traffic Factors along the Crossroads

	AADT*	K	D	T	
				Eastbound	Westbound
Ajo Way	32,900	0.11	0.54	17.6	5.3
Irvington Road	35,900	0.11	0.54	9.1	6.4
Valencia Road	40,100	0.10	0.57	n/a	n/a
San Xavier Road	6,300	0.15	0.59	2.8	3.0

Source: 2003 Traffic Report
* Reported AADT was taken from PAG Historical Volume Maps

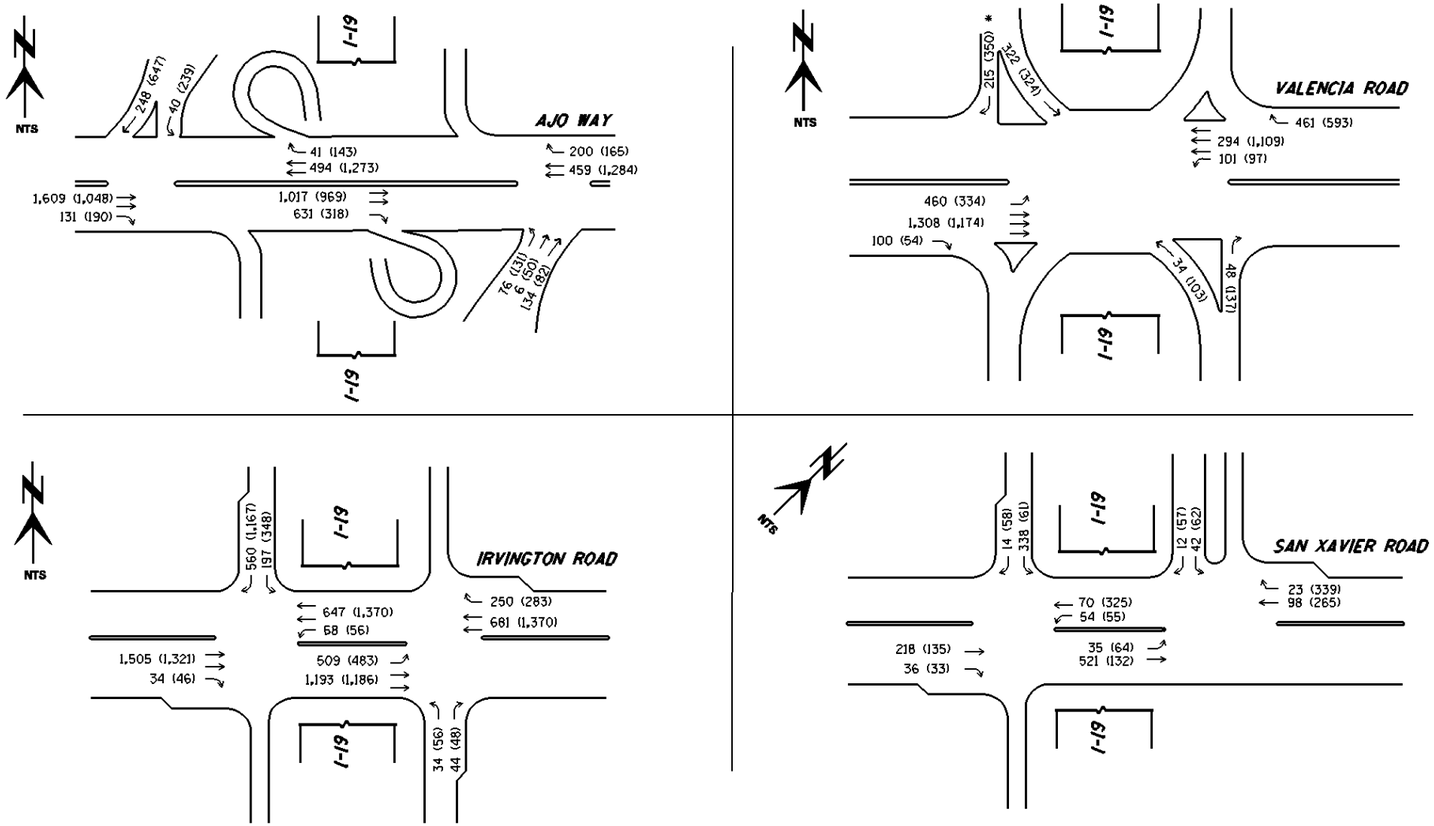


Legend:

X,XXX (X,XXX) = AM (PM) Peak hour Volume
XX,XXX ADT

XX,XXX* = Cross Street ADT

Figure 2-1: 2001 Traffic Volumes (Mainline)



Legend:

X,XXX (X,XXX) = AM (PM) Peak hour Volume

*** = Free-Flow Right Turn Lane**

Figure 2-2: 2001 Traffic Volumes (Intersections)

2.1.2 2001 Traffic Analysis

LOS analyses evaluated the operations of the mainline, the ramps, and the adjacent traffic intersections of the surrounding roadway network under the 2001 traffic and roadway conditions. The ADOT Roadway Design Guidelines (RDG) for traffic operations require freeway segments and traffic interchanges to operate at LOS "C" or better for rural conditions, and LOS "D" or better for urban conditions (Table 103.2A of the RDG). As an Urban Interstate, ADOT requires that the I-19 mainline operate at LOS D or better.

For basic freeway segments and merge/diverge ramp junctions, the LOS criteria are based on density as defined in Chapters 23 and 25 of the Highway Capacity Manual (HCM). Table 2-3 summarizes the LOS and the corresponding density level thresholds (the maximum density in passenger cars per mile per lane [pc/mi/ln] for each LOS).

Table 2-3: LOS Criteria for Basic Freeway Segments and Ramp Junctions

LOS	Maximum Density (pc/mi/ln)	
	Basic Freeway Segment	Ramp Junction
A	0-11	0 – 10
B	>11-18	>10 – 20
C	>18-26	>20 – 28
D	>26-35	>28 – 35
E	>35-45	>35
F	>45	Demand exceeds capacity
Source: HCM 2000		

For weaving segments, the LOS criteria are based on density as defined in Chapter 24 of the HCM. Table 2-4 summarizes the LOS and the corresponding density level thresholds (the maximum density in passenger cars per mile per lane [pc/mi/ln] for each LOS).

Table 2-4: LOS Criteria for Weaving Segments

LOS	Maximum Density (pc/mi/ln)	
	Freeway Weaving Segment	Multilane and Collector Distributor Weaving Segments
A	0-10	0 – 12
B	>10-20	>12 – 24
C	>20-28	>24 – 32
D	>28-35	>32 – 36
E	>35-43	>34 – 40
F	>43	>40
Source: HCM 2000		

For intersections, the LOS criteria is based on the average control delay experienced by drivers as defined in Chapters 16 and 17 of the HCM. Table 2-5 summarizes the LOS and corresponding delay levels for both signalized and unsignalized intersections.

Table 2-5: LOS Criteria for Intersections

LOS	Average Control Delay (sec/veh)	
	Signalized Intersections	Unsignalized Intersections
A	0 – 10	0 – 10
B	>10 – 20	>10 – 15
C	>20 – 35	>15 – 25
D	>35 – 55	>25 – 35
E	>55 – 80	>35 – 50
F	>80	>50
Source: HCM 2000		

The *2003 Traffic Report* followed the HCM methodologies to calculate the LOS for all elements within the corridor network. The following input assumptions were used in the LOS analyses:

- Mainline free flow speed, 55 mph
- Ramp speed, 35 mph
- A peak-hour factor (PHF), 0.92
- Percentage of trucks, 8%
- Lane width, 12 feet

I-19 Basic Freeway Segments LOS Analysis

The LOS analysis conducted for the I-19 basic freeway segments indicated that both northbound and southbound directions operated at an acceptable LOS (D or better) in 2001. The majority of the segments operated at LOS B, except the segment between Ajo Way and Irvington Road. in the southbound direction that operated at LOS C during the PM Peak hour. Table 2-6 summarizes the results of the LOS analysis.

Ramp Junctions LOS Analysis

The LOS analysis conducted for the I-19 merge/diverge ramp junctions indicated that ramp junctions in both northbound and southbound directions operated at an acceptable LOS (D or better) in 2001. The majority of the ramp junctions operated at LOS C or better, except the southbound I-19 at Irvington Road off-ramp that operated at LOS D during the PM Peak hour. Table 2-7 summarizes the results of the LOS analysis.

Table 2-6: 2001 LOS Summary for Freeway Segments

Segment Beginning	Segment Ending	LOS AM (PM)
Northbound		
San Xavier Road off-ramp	San Xavier Road on-ramp	A (A)
San Xavier Road on-ramp	Valencia Road off-ramp	A (A)
Valencia Road off-ramp	Valencia Road on-ramp	A (A)
Valencia Road on-ramp	Irvington Road off-ramp	A (A)
Irvington Road off-ramp	Irvington Road on-ramp	A (A)
Irvington Road on-ramp	Ajo Way off-ramp	B (B)
Ajo Way off-ramp	Ajo Way loop on-ramp	B (B)
Ajo Way loop on-ramp	Ajo Way on-ramp	B (B)
Ajo Way on-ramp	I-10	A (A)
Southbound		
I-10	Ajo Way off-ramp	A (B)
Ajo Way off-ramp	Ajo Way loop on-ramp	B (B)
Ajo Way loop on-ramp	Ajo Way on-ramp	B (C)
Ajo Way on-ramp	Irvington Road off-ramp	B (C)
Irvington Road off-ramp	Irvington Road on-ramp	A (A)
Irvington Road on-ramp	Valencia Road off-ramp	A (A)
Valencia Road off-ramp	Valencia Road on-ramp	A (A)
Valencia Road on-ramp	San Xavier Road off-ramp	A (A)
San Xavier Road off-ramp	San Xavier Road on-ramp	A (A)
Source: 2003 Traffic Report		

Table 2-7: 2001 LOS Summary for Ramp Junctions

Ramp Junction	LOS AM (PM)	Ramp Junction	LOS AM (PM)
Northbound		**Southbound**	
San Xavier Road off-ramp	A (B)	Ajo Way off-ramp	A (B)
San Xavier Road on-ramp	A (B)	Ajo Way loop on-ramp	B (C)
Valencia Road off-ramp	A (B)	Ajo Way on-ramp	B (C)
Valencia Road on-ramp	B (B)	Irvington Road off-ramp	C (D)
Irvington Road off-ramp	B (C)	Irvington Road on-ramp	B (B)
Irvington Road on-ramp	B (C)	Valencia Road off-ramp	B (B)
Ajo Way off-ramp	C (C)	Valencia Road on-ramp	A (A)
Ajo Way loop on-ramp	C (C)	San Xavier Road off-ramp	B (B)
Ajo Way on-ramp	C (C)	San Xavier Road on-ramp	A (A)
Source: 2003 Traffic Report			

Intersections LOS Analysis

The LOS analysis conducted for the I-19 intersections indicated that with the exception of the southbound I-19 at Irvington Road off-Ramp, the intersections in both northbound and southbound directions operated at an acceptable LOS (D or better) in 2001. The majority of the intersections operated at LOS C or better, except the southbound I-19 at Irvington Road off-ramp that operated at LOS E during the AM Peak hour. Table 2-8 summarizes the results of the LOS analysis.

Table 2-8: 2001 LOS Summary for Intersections

Intersection	Intersection Control Type	LOS AM (PM)	
		Southbound	Northbound
At Ajo Way off-ramps	Signalized	B (C)	A (A)
At Irvington Road off-ramps	Signalized	E (B)	B (B)
At Valencia Road off-ramps	Signalized (SPUI)	C (B)	
At San Xavier Road off-ramps	Unsignalized	A (A)	A (A)
Source: 2003 Traffic Report			

The *2003 Traffic Report* indicated that during the data collection in 2001, traffic congestion was observed and verified by the Technical Advisory Committee and the general public at the following locations:

- Freeway segment between I-10 and Ajo Way
- Freeway segment between Ajo Way and Irvington Road
- Ajo Way TI
- Irvington Road TI

In the summer of 2009, field observations were conducted and similar operational characteristics were observed. Traffic congestion was more pronounced on southbound I-19 approaching the Ajo Way off-ramp and the Irvington Road off-ramp.

2.2 Crash Analysis

ADOT Traffic Records Section provided historic crash data for the period from January 2001 through December 2005 from one mile south of the San Xavier Road TI to the I-19/I-10 system TI. The crash data were analyzed by location, severity, and type. A total of 1,251 reported crashes occurred during that five-year period.

Approximately 50% (621) of these crashes occurred on the freeway, 12% (151) occurred on the ramps, and 38% (479) of the crashes occurred on the crossroads within 0.5 miles of I-19. In terms of crash severity, a total of four (4) fatal crashes (two on the freeway and two on Ajo Way), 445 injury crashes, and 802 Property Damage Only (PDO) crashes occurred. Table 2-9 summarizes the crashes by location and severity.

The analyses of the crashes by daylight condition revealed that most of the crashes (71%) occurred during the day, 24% occurred during the night, and 4% occurred at dusk or dawn.

Table 2-9: Crash Summary by Location and Severity

Road Segment	Number of Crashes			
	Fatal	Injury	PDO	Total
I-19 - San Xavier Road to Valencia Road	0	18	49	67
I-19 - Valencia Road to Irvington Road	1	43	96	140
I-19 - Irvington Road to Ajo Way	0	52	86	138
I-19 - Ajo Way Road to I-10	1	78	197	276
I-19 Mainline Crashes - Subtotal	2	191	428	621
San Xavier Road Ramps	0	1	5	6
Valencia Road Ramps	0	18	39	57
Irvington Road Ramps	0	7	45	52
Ajo Way Ramps	0	11	25	36
Ramp Crashes - Subtotal	0	37	114	151
San Xavier Road	0	12	9	21
Valencia Road	0	64	87	151
Irvington Road	0	83	111	194
Ajo Way	2	58	53	113
Cross Street Crashes - Subtotal	2	217	260	479
TOTAL	4	445	802	1,251

2.2.1 Crash Analysis on I-19

The AADT for mainline I-19 obtained from ADOT permanent count stations for 2001 to 2005 was utilized to calculate crash rates. I-19 between Irvington Road and Ajo Way had the highest crash rate, followed by I-19 between Ajo Way and I-10. The crash rate analysis results are summarized in Table 2-10.

Table 2-10: Crash Rate Summary on I-19 Mainline (Crash/Million Vehicle Miles)

Segment	Average AADT*	Length (Mile)	Number of Crashes	Crash Rate
San Xavier Road to Valencia Road	32,080	2	130	1.11
Valencia Road to Irvington Road	43,420	2	192	1.21
Irvington Road to Ajo Way	64,080	1	174	1.49
Ajo Way to I-10	73,700	1.5	276	1.37
Five-year AADT from 2001-2005 from ADOT permanent count stations				

The crash data were analyzed by crash type. Of the total 772 crashes that occurred on I-19 (621 crashes on the I-19 mainline and 151 on the ramps) the most common types of crashes were rear-end at 53% (408 crashes), followed by single vehicle at 31% (238 crashes), and then sideswipe at 11% (86 crashes). Table 2-11 summarizes the number of crashes by type along the I-19 mainline.

Table 2-11: Crash Summary by Type on I-19 Mainline

Segment	Rear-End	Single Vehicle	Sideswipe	Angle	Other	Total
San Xavier Road to Valencia Road	66	42	14	3	5	130
Valencia Road to Irvington Road	88	71	24	0	9	192
Irvington Road to Ajo Way	99	51	17	0	7	174
Ajo Way to I-10	156	74	31	2	13	276
Total Crashes	**409**	**238**	**86**	**5**	**34**	**772**
Percentage	**53%**	**31%**	**11%**	**1%**	**4%**	**100%**

The crash rate analysis by type showed that I-19 between Irvington Road and Ajo Way had the highest rear-end crash rate, followed by I-19 between Ajo Way and I-10. Moreover, I-19 between Valencia Road and Irvington Road, and I-19 between Irvington Road and Ajo Way had the highest single-vehicle crash rates. The crash rate analysis results are summarized in Table 2-12.

Table 2-12: Crash Rate Summary by Type on I-19 Mainline (Crash/Million Vehicle Miles)

Segment	Rear-End	Single Vehicle	Sideswipe	Angle
San Xavier Road to Valencia Road	0.56	0.36	0.12	0.03
Valencia Road to Irvington Road	0.56	0.45	0.20	0
Irvington Road to Ajo Way	0.85	0.44	0.15	0
Ajo Way to I-10	0.77	0.37	0.26	0.01

Of the total 151 crashes that occurred on the ramps, the most common types were rear-end at 70% (105 crashes), followed by single vehicle at 21% (32 crashes), and then sideswipe at 7% (11 crashes). Table 2-13 summarizes the number of crashes by type on the I-19 ramps.

Table 2-13: Crash Summary by Crash Type on the Ramps

Location	Rear-End	Single Vehicle	Sideswipe (same)	Other	Total
San Xavier Road Ramps	1	5	0	0	6
Valencia Road Ramps	44	5	6	2	57
Irvington Road Ramps	41	7	4	0	52
Ajo Way Ramps	19	15	1	1	36
Total Crashes	**105**	**32**	**11**	**3**	**151**
Percentage	**70%**	**21%**	**7%**	**2%**	**100%**

Crash rates for the ramps were not analyzed because AADT data for the five years from 2001-2005 was not available.

2.2.2 Crash Analysis on the Crossroads

The crash data for the crossroads were analyzed by type. Of the total 479 crashes that occurred, the most common types were rear-end at 56% (270 crashes), followed by angle at 27% (127 crashes), and then by sideswipe at 9% (45) crashes. Table 2-14 summarizes the number of crashes by type on the crossroads.

Table 2-14: Crash Summary by Type on the Crossroads

Location	Rear-End	Single Vehicle	Sideswipe (same)	Angle	Other	Total
San Xavier Road	3	8	4	4	2	21
Valencia Road	80	8	22	38	3	151
Irvington Road	125	5	13	48	3	194
Ajo Way	62	3	6	37	5	113
Total Crashes	**270**	**24**	**45**	**127**	**13**	**479**
Percentage	**56%**	**5%**	**9%**	**27%**	**3%**	**100%**

Please note that crash rates for the crossroads were not analyzed because AADT data for the five years from 2001-2005 was not available.

2.2.3 Crash Mitigation

The roadway improvements included in the Recommended Alternative are expected to enhance safety and operations along the corridor. These improvements include the introduction of braided ramps and auxiliary lanes that will reduce the weaving movements. Other safety benefits are anticipated through the introduction of flatter and wider shoulders; improved roadway lighting, signing and pavement marking.

It is anticipated that rear-end crashes would be reduced by the additional capacity proposed in the Recommended Alternative. Moreover, single-vehicle crashes and night time crashes would be mitigated through the enhanced clear zone.

2.3 2030 Traffic Conditions

The *2003 Traffic Report* utilized the 2025 PAG traffic projections (which at the time was the most recent data available) to estimate the 2030 traffic volume projections. This study utilized the 2030 PAG traffic projections. The PAG projections were adjusted to account for the new commercial developments located in the area surrounding the Irvington Road TI that were not captured in the PAG 2030 socio-economic data. This study also incorporates modifications included in the most recent (2030) Regional Transportation Plan (RTP), and addresses other safety and operational considerations expressed by stakeholders, including ADOT, Pima County, City of Tucson, the San Xavier District of the Tohono O'Odham Nation, and other public entities.

The 2030 future traffic volumes were estimated for three Design Concept Alternatives:

- **No-Action Alternative -** This alternative includes the addition of one northbound and one southbound lane along I-19 from Valencia Road to I-10.
- **Alternative #1:** This alternative represents the 2003 Corridor Study Recommended Alternative.
- **Alternative #2:** This alternative represents the 2003 Corridor Study Recommended Alternative with modifications at the San Xavier Road TI, the Los Reales Road TI, and the I-19/I-10 system TI.

Table 2-15 summarizes the 2030 projected traffic volumes for all three alternatives.

Table 2-15: 2030 Traffic Volumes

Alternative	Direction of Travel	2030 Projected Average Traffic Volumes	Annual Growth
No-Action	Northbound I-19	57,500	3.2%
	Southbound I-19	58,900	
Alternative #1	Northbound I-19	66,400	3.6%
	Southbound I-19	64,800	
Alternative #2	Northbound I-19	67,200	3.6%
	Southbound I-19	64,700	

2.3.1 No-Action Alternative - 2030 Conditions

The No-Action Alternative 2030 conditions were obtained from PAG's travel demand model, which uses the 2030 RTP roadway network. The 2030 RTP roadway network is based on the existing roadway network with the addition of any ongoing roadway projects and other roadway improvements (not including the roadway improvements presented in this DCR) that have been planned for year 2030. The RTP considers what improvements need to occur, and in what timeframe, which allows for the most efficient allocation of funding for proposed transportation improvement projects.

The planned improvements for I-19 included in the No-Action Alternative consist of the addition of one lane in each direction of travel on I-19 from Valencia Road to I-10 (reflected in the RTP). This additional lane would be constructed as an inside widening and would not involve any re-profiling or improvements to the existing vertical clearances.

PAG 2030 traffic projections were used as the basis to determine the 2030 No-Action traffic volumes. PAG network simulation output was provided by PAG for the No-Action and each Build Alternative. The standard PAG RTP model was used for this project. It includes all of the planned transportation improvements in the RTP. The 2030 traffic volume projections that were received from PAG were post-processed in accordance with the procedures recommended by PAG. This process included the comparison of the 2006 PAG model to the 2030 PAG model in order to calculate the growth of the traffic projections. The resulting 2030 traffic volume projections were presented to ADOT staff.

The resultant No-Action Alternative 2030 traffic volumes are illustrated in Figure 2-3 for the I-19 mainline, and in Figure 2-4 for the intersections at the service interchanges.

2.3.2 No-Action Alternative - 2030 Traffic Analysis

LOS analyses were conducted to analyze the operations of the No-Action Alternative on the mainline and the merge/diverge ramp junctions. The latest version of Highway Capacity Software (HCS) was utilized to perform the LOS analyses. The following input assumptions were used in the LOS analyses:

- Mainline free flow speed of 55 mph
- System TI ramp free flow speed of 50 mph
- Service TI ramp free flow speed of 45 mph
- A peak hour factor (PHF) of 0.90
- Percentage of trucks of 20%
- Lane width of 12 feet

The LOS analysis conducted for the I-19 basic freeway segments indicated that most segments in both the northbound and southbound directions are expected to operate at an unacceptable LOS (E or worse) during either the AM or the PM peak hours. Table 2-16 summarizes the results of the LOS analysis.

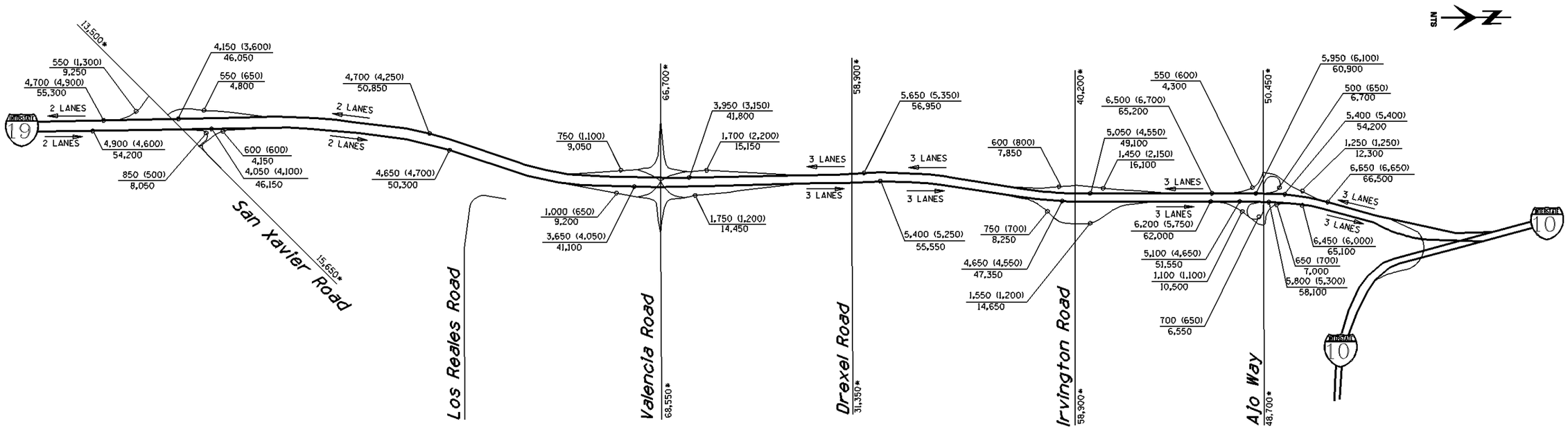
Table 2-16: No-Action Alternative - 2030 LOS Summary for Freeway Segments

Segment Beginning		Segment Ending	LOS AM (PM)
Northbound	San Xavier Road off-ramp	San Xavier Road on-ramp	F (F)
	San Xavier Road on-ramp	Valencia Road off-ramp	F (F)
	Valencia Road off-ramp	Valencia Road on-ramp	D (D)
	Valencia Road on-ramp	Irvington Road off-ramp	E (E)
	Irvington Road off-ramp	Irvington Road on-ramp	D (D)
	Irvington Road on-ramp	Ajo Way off-ramp	F (F)
	Ajo Way off-ramp	Ajo Way loop on-ramp	E (D)
	Ajo Way loop on-ramp	Ajo Way on-ramp	F (E)
	Ajo Way on-ramp	I-10	F (F)
Southbound	I-10	Ajo Way off-ramp	F (F)
	Ajo Way off-ramp	Ajo Way loop on-ramp	E (E)
	Ajo Way loop on-ramp	Ajo Way on-ramp	F (F)
	Ajo Way on-ramp	Irvington Road off-ramp	F (F)
	Irvington Road off-ramp	Irvington Road on-ramp	E (D)
	Irvington Road on-ramp	Valencia Road off-ramp	F (E)
	Valencia Road off-ramp	Valencia Road on-ramp	D (C)
	Valencia Road on-ramp	San Xavier Road off-ramp	F (F)
	San Xavier Road off-ramp	San Xavier Road on-ramp	F (E)

The LOS analysis conducted for the I-19 merge/diverge ramp junctions indicated that most ramp junctions in both the northbound and southbound directions are expected to operate at an unacceptable LOS (E or worse) during either the AM or the PM peak hours. Table 2-17 summarizes the results.

Table 2-17: No-Action Alternative - 2030 LOS Summary for Ramp Junctions

Ramp Junction	LOS AM (PM)	Ramp Junction	LOS AM (PM)
Northbound		**Southbound**	
San Xavier Road off-ramp	F (F)	Ajo Way off-ramp	F (F)
San Xavier Road on-ramp	F (F)	Ajo Way loop on-ramp	F (F)
Valencia Road off-ramp	F (F)	Ajo Way on-ramp	F (F)
Valencia Road on-ramp	F (D)	Irvington Road off-ramp	F (F)
Irvington Road off-ramp	E (E)	Irvington Road on-ramp	F (D)
Irvington Road on-ramp	F (F)	Valencia Road off-ramp	F (F)
Ajo Way off-ramp	F (F)	Valencia Road on-ramp	D (D)
Ajo Way loop on-ramp	F (D)	San Xavier Road off-ramp	F (F)
Ajo Way on-ramp	F (F)	San Xavier Road on-ramp	F (F)

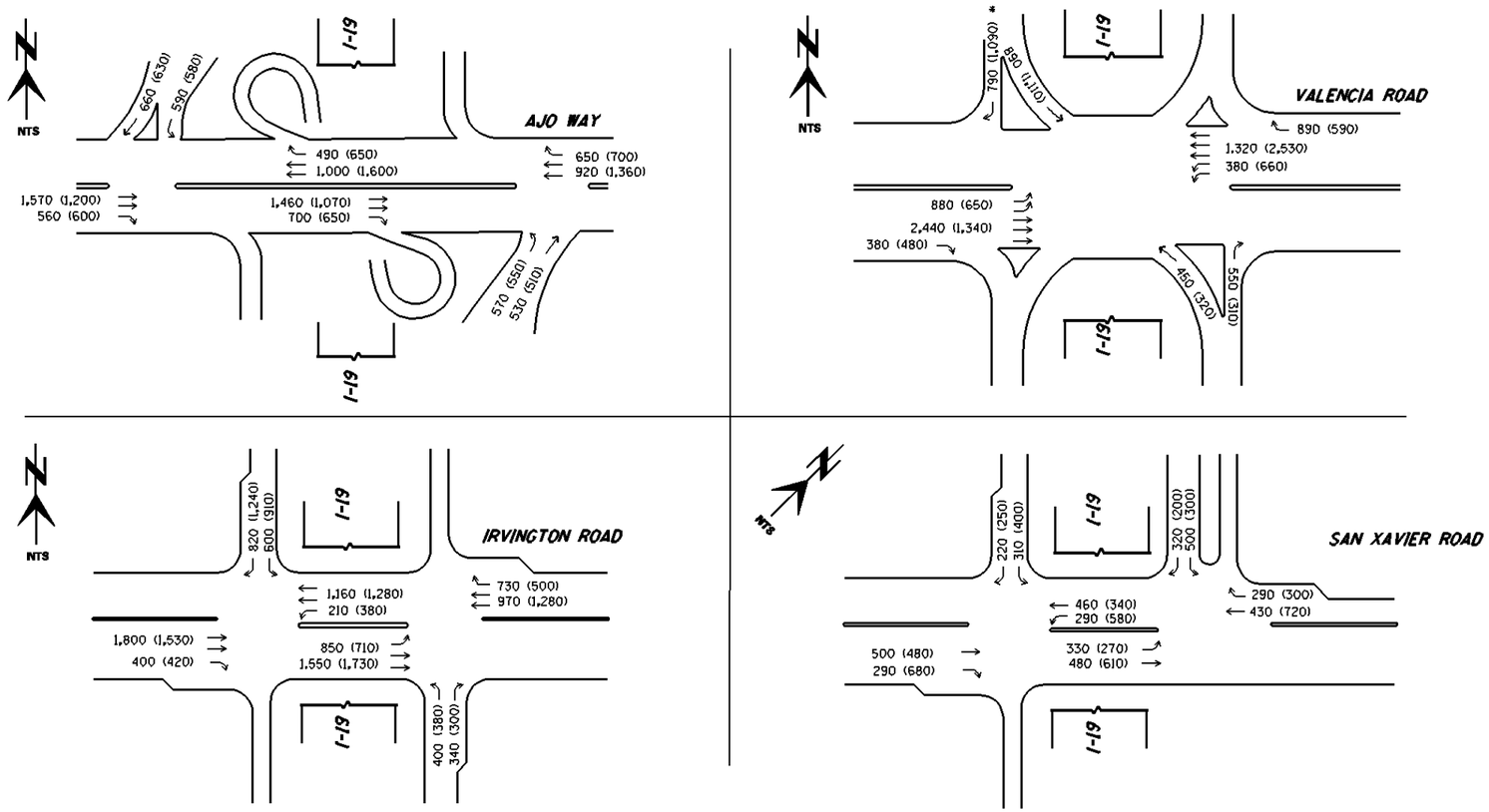


Legend:

$$\frac{\text{X,XXX (X,XXX)}}{\text{XX,XXX}} = \frac{\text{AM (PM) Peak hour Volume}}{\text{ADT}}$$

XX,XXX* = Cross Street ADT

Figure 2-3: No-Action Alternative - 2030 Traffic Volumes (Mainline)



Legend:

X,XXX (X,XXX) = AM (PM) Peak hour Volume

*** = Free-Flow Right Turn Lane**

Figure 2-4: No-Action Alternative - 2030 Traffic Volumes (Intersections)

In summary, the 2030 No-Action LOS analysis indicated that the I-19 corridor is expected to operate at an unacceptable LOS (E or F) throughout most of the study area. Although a few segments showed acceptable LOS (D or better), they will be affected by the segments on which traffic operations are expected to fail. As a result, the entire corridor is expected to operate at unacceptable LOS under the 2030 No-Action conditions.

2.3.3 Alternative #1 - Roadway Conditions

This alternative represents the 2003 Corridor Study Recommended Alternative. This alternative includes the following roadway improvements:

- Widening I-19 to four lanes in each direction
- Reconstructing the existing modified diamond TI at San Xavier Road to a diamond TI. This would involve realigning I-19 to the west of San Xavier TI to accommodate a standard northbound off-ramp.
- Constructing a new diamond TI at Los Reales Road.
- Constructing a new SPUI at Drexel Road.
- Reconstructing the existing diamond TI at Irvington Road to a SPUI.
- Reconstructing the existing partial clover leaf TI at Ajo Way to a SPUI.
- Reconstructing the existing ramps in the southbound direction between I-10 and Ajo Way, and between Ajo Way and Irvington Road to braided ramps
- Reconstructing the existing southbound I-19 off-ramp at Valencia Road to accommodate the new braided ramps between Valencia Road and Drexel Road.
- Eliminating the existing northbound I-19 on-ramp from Ajo Way, and providing a connection from Ajo Way to 12th Avenue.
- Providing auxiliary lanes for northbound I-19 between: Valencia Road and Drexel Road, Drexel Road and Irvington Road, and Irvington Road and Ajo Way.
- Providing auxiliary lanes for southbound I-19 between: I-10 and Ajo Way, and Irvington Road and Drexel Road.
- Widening Ajo Way to an 8-lane divided roadway and Drexel Road to a 6-lane divided roadway.

Alternative #1 roadway conditions were entered into the PAG model and the model was re-run by PAG. The peak hour traffic volumes were obtained by taking the K-values derived from the 2001 existing traffic volumes, and applying it to Alternative #1 daily traffic volumes. The resulting 2030 traffic volumes for Alternative #1 for the I-19 mainline are illustrated in Figure 2-5.

2.3.4 Alternative #1 - Traffic Analysis

LOS analyses were conducted to analyze the operations of Alternative #1 for the mainline, the merge/diverge ramp junctions, and the adjacent traffic intersections of the surrounding roadway network. The HCM methodologies were followed to calculate the LOS for all elements within the corridor network.

The latest versions of Corsim and Synchro software were utilized to perform the LOS analyses. Corsim 6.1 was utilized for basic freeway segments, and merge/diverge ramp junctions, and Synchro 7.0 was utilized to perform the intersection LOS analyses. The following assumptions were used in the LOS analyses:

- Mainline free flow speed of 55 mph
- System interchange ramp free flow speed of 50 mph
- Service interchange ramp free flow speed of 45 mph
- A peak hour factor (PHF) of 0.90
- Percentage of trucks 20% on the freeways, and 10% on the arterials.
- Lane width of 12 feet
- The CORSIM model was run for 2 hours which included an initialization period of 1 hour. The volumes for each hour were based on the projected peak hour demand.
- Ramp meters were included in the analysis.

Corsim provided various measures of effectiveness for individual links within the system. Outputs that were computed included vehicle density and speed, which were then related to a LOS based on the criteria established by the HCM.

Synchro is a comprehensive macroscopic traffic model developed by Trafficware. The analysis performed in Synchro followed the methodologies set forth in the HCM. Synchro provided various measures of effectiveness for individual intersections within the system. Outputs that were computed included vehicle delay, LOS based on the criteria established by the HCM, and queue lengths.

Design networks representing Alternative #1 roadway conditions were established in Corsim and Synchro, and the 2030 traffic volumes were input into the network. The results of the LOS analyses are illustrated in Figure 2-6 for the AM peak hour and Figure 2-7 for the PM peak hour.

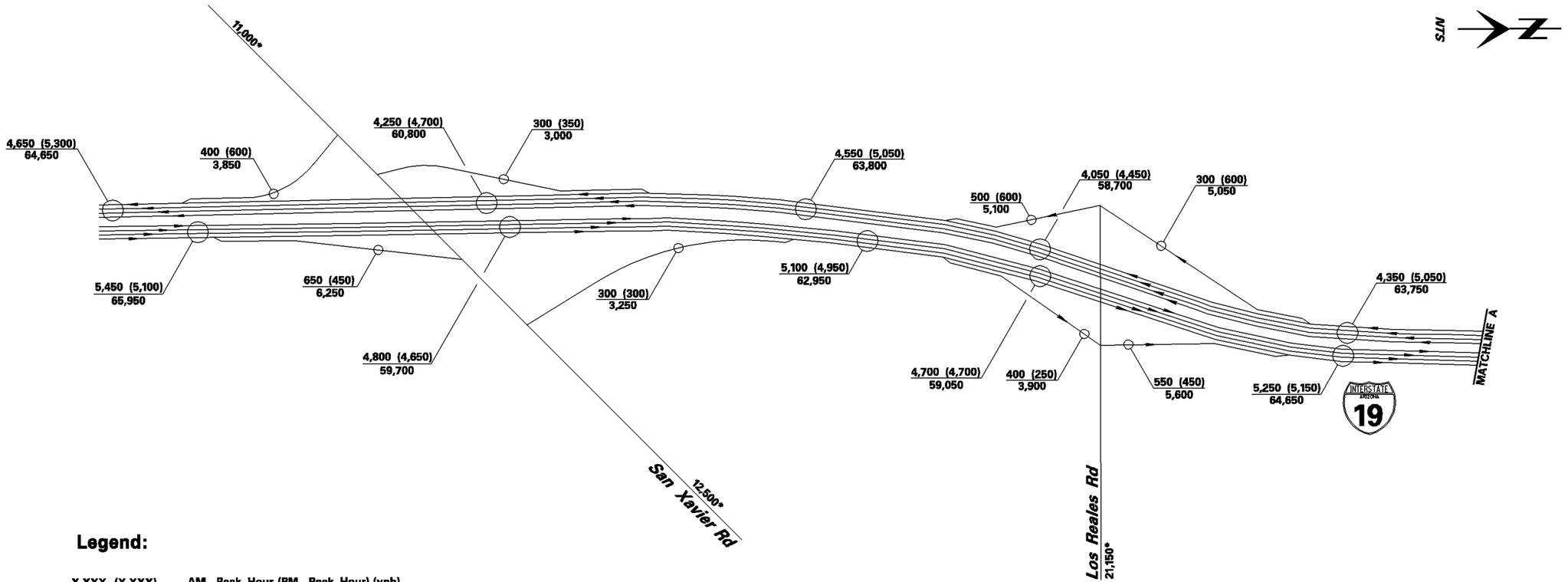
I-19 Basic Freeway Segments LOS Analysis

The LOS analysis indicated that most of the segments in both directions are expected to operate at an acceptable LOS (D or better) during both AM and PM peak hours. Two segments are expected to operate at unacceptable LOS; northbound I-19 between the Ajo Way on-ramp and I-10, and southbound I-19 between I-10 and the Ajo Way off-ramp.

Ramp Junctions LOS Analysis

The LOS analysis indicated that most of the ramp junctions in both directions are expected to operate at an acceptable LOS (D or better) during both AM and PM peak hours. One ramp junction is expected to operate at an unacceptable LOS; the southbound I-19 at the Ajo Way off-ramp.

ADOT standard 300-foot deceleration lanes and 700-foot acceleration lanes were modeled in the LOS analysis. These ramp characteristics are based on the ADOT *RDG Section 504.*



Legend:

$$\frac{\text{X,XXX (X,XXX)}}{\text{XX,XXX}} = \frac{\text{AM Peak Hour (PM Peak Hour) (vph)}}{\text{Average Daily Traffic (vpd)}}$$

XX,XXX* = Crossroad Average Daily Traffic

Figure 2-5: Alternative #1 - 2030 Traffic Volumes
(Sheet 1 of 3)

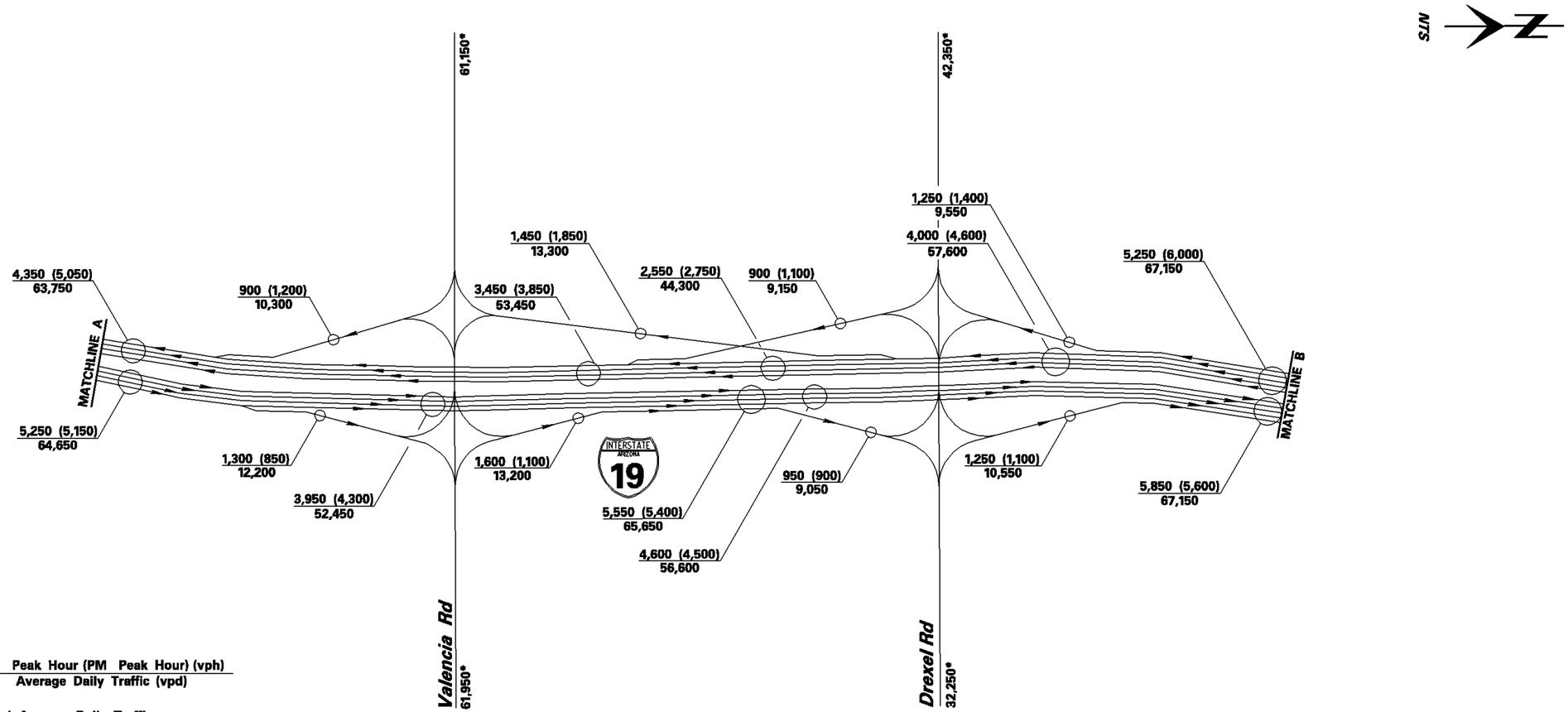
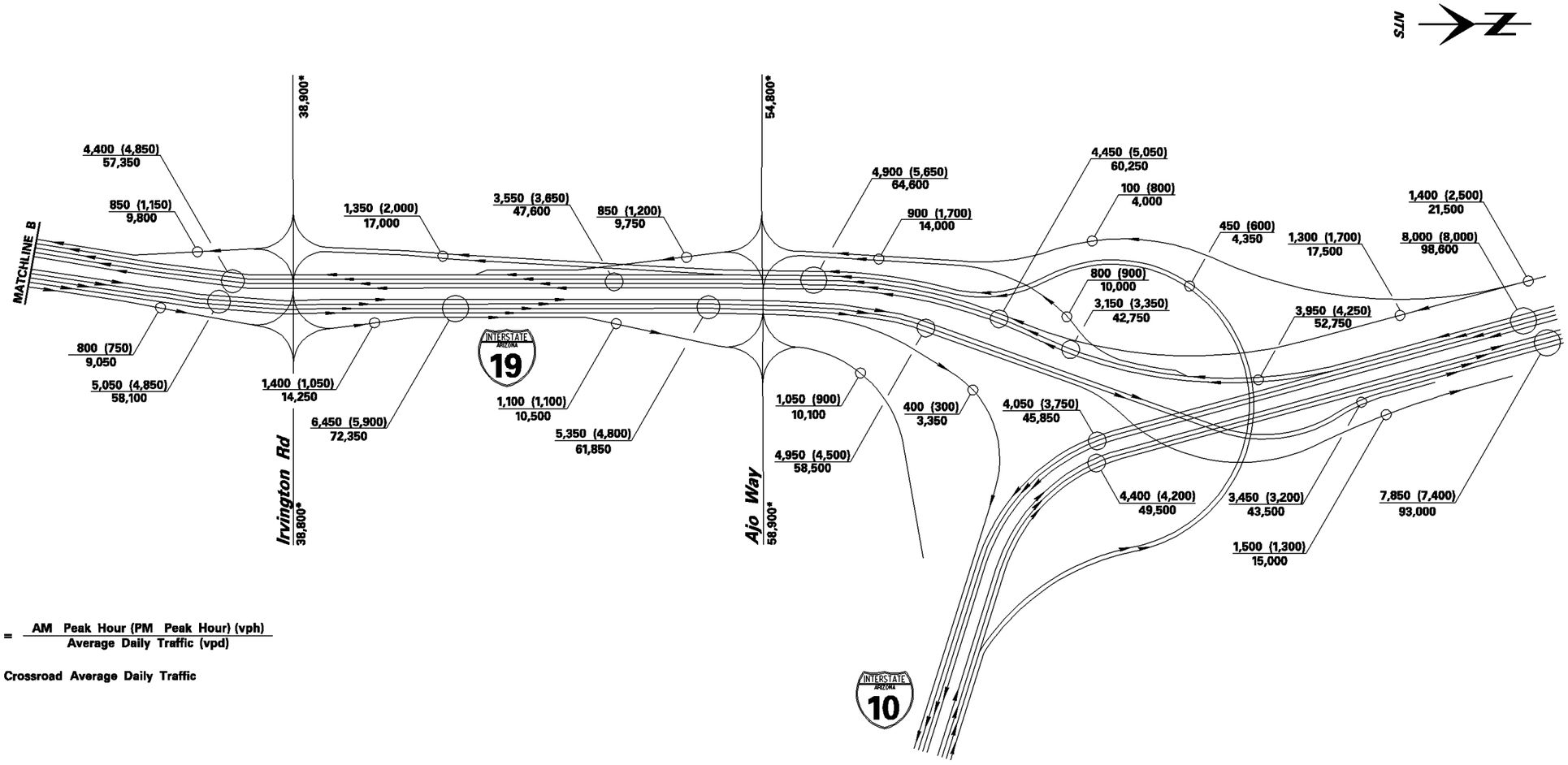


Figure 2-5: Alternative #1 - 2030 Traffic Volumes
(Sheet 2 of 3)



Legend:

$$\frac{\text{X,XXX (X,XXX)}}{\text{XX,XXX}} = \frac{\text{AM Peak Hour (PM Peak Hour) (vph)}}{\text{Average Daily Traffic (vpd)}}$$

XX,XXX* = Crossroad Average Daily Traffic

Figure 2-5: Alternative #1 - 2030 Traffic Volumes
(Sheet 3 of 3)

Figure 2-6: Alternative #1 - 2030 AM Peak Hour LOS Summary
(Sheet 1 of 3)

Figure 2-6: Alternative #1 - 2030 AM Peak Hour LOS Summary (Sheet 2 of 3)

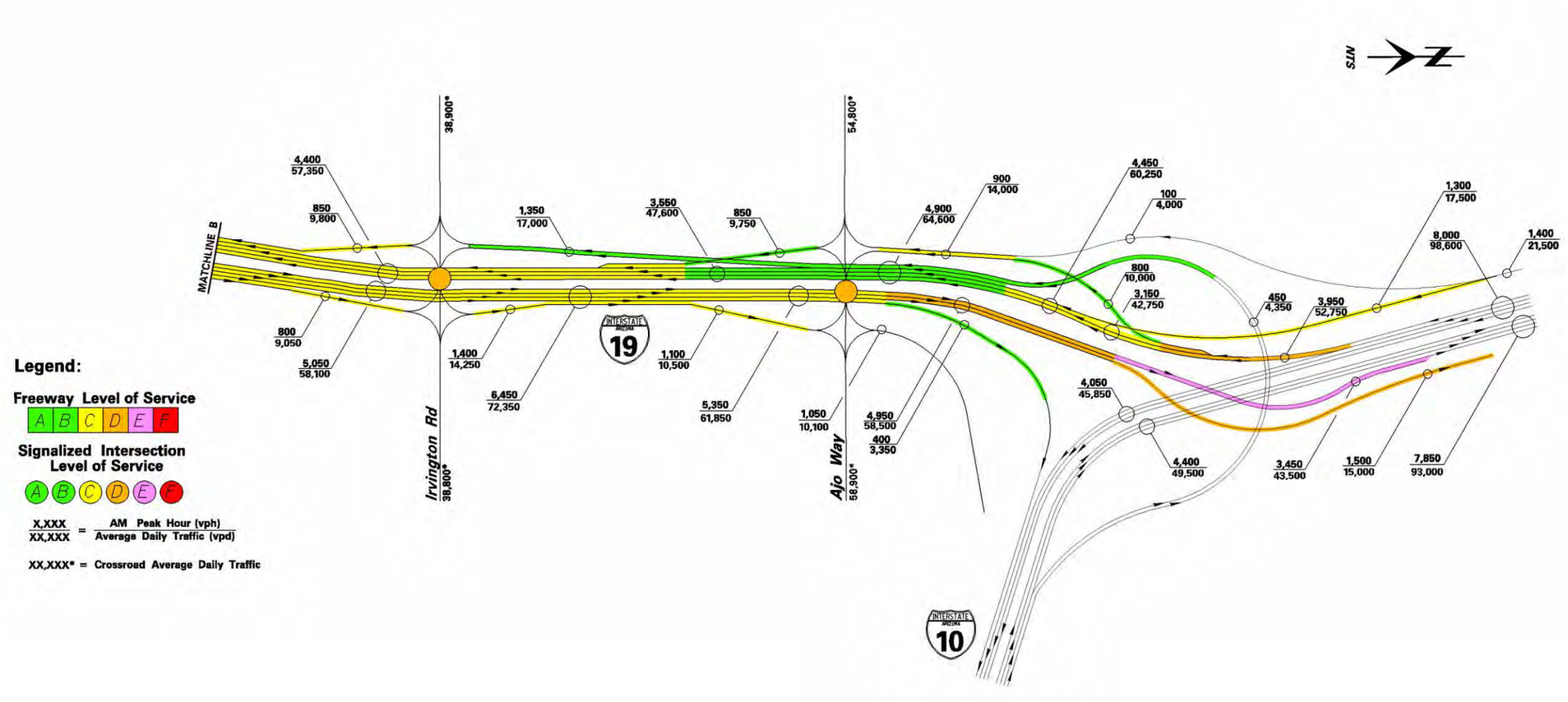


Figure 2-6: Alternative #1 - 2030 AM Peak Hour LOS Summary
(Sheet 3 of 3)

Figure 2-7: Alternative #1 - 2030 PM Peak Hour LOS Summary
(Sheet 1 of 3)

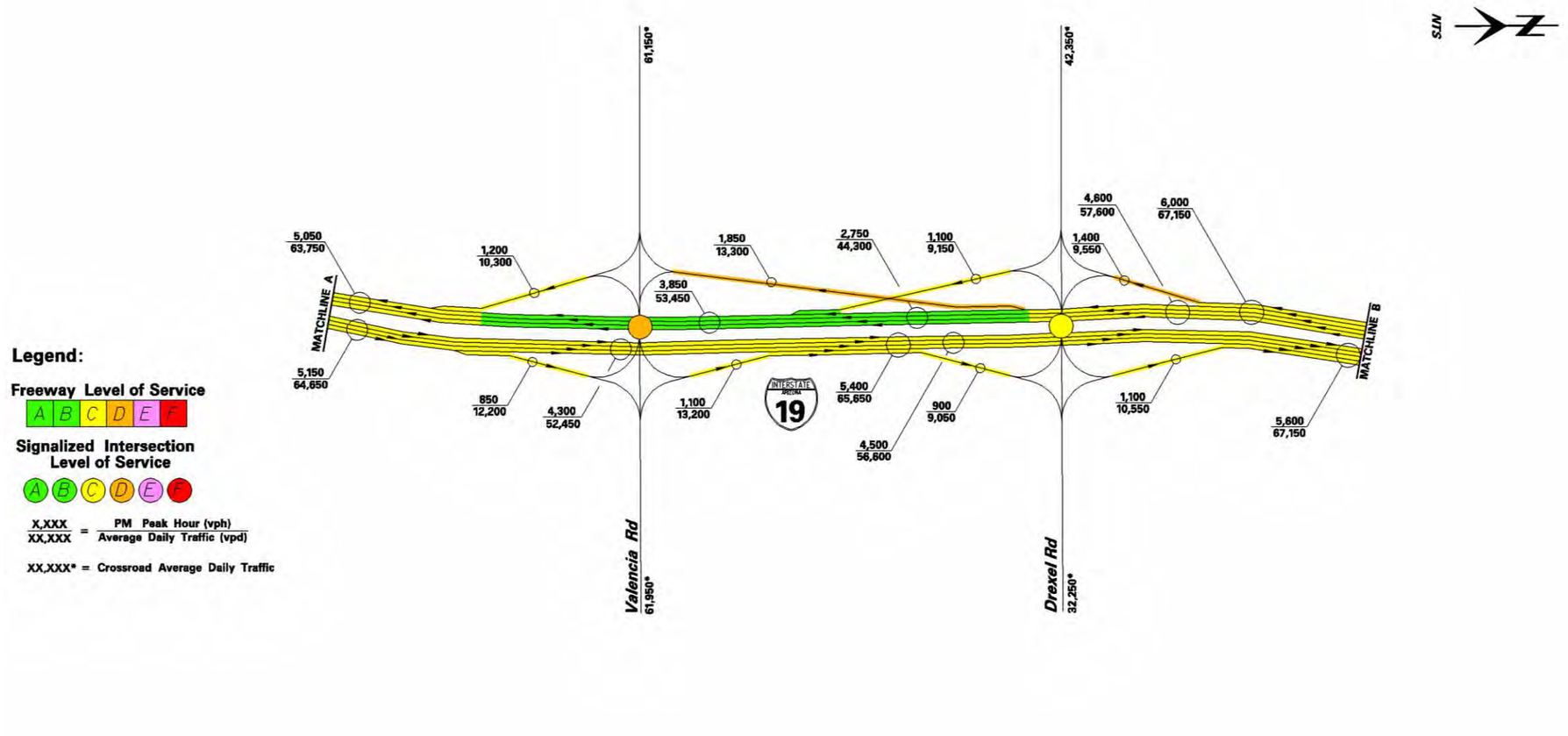


Figure 2-7: Alternative #1 - 2030 PM Peak Hour LOS Summary (Sheet 2 of 3)

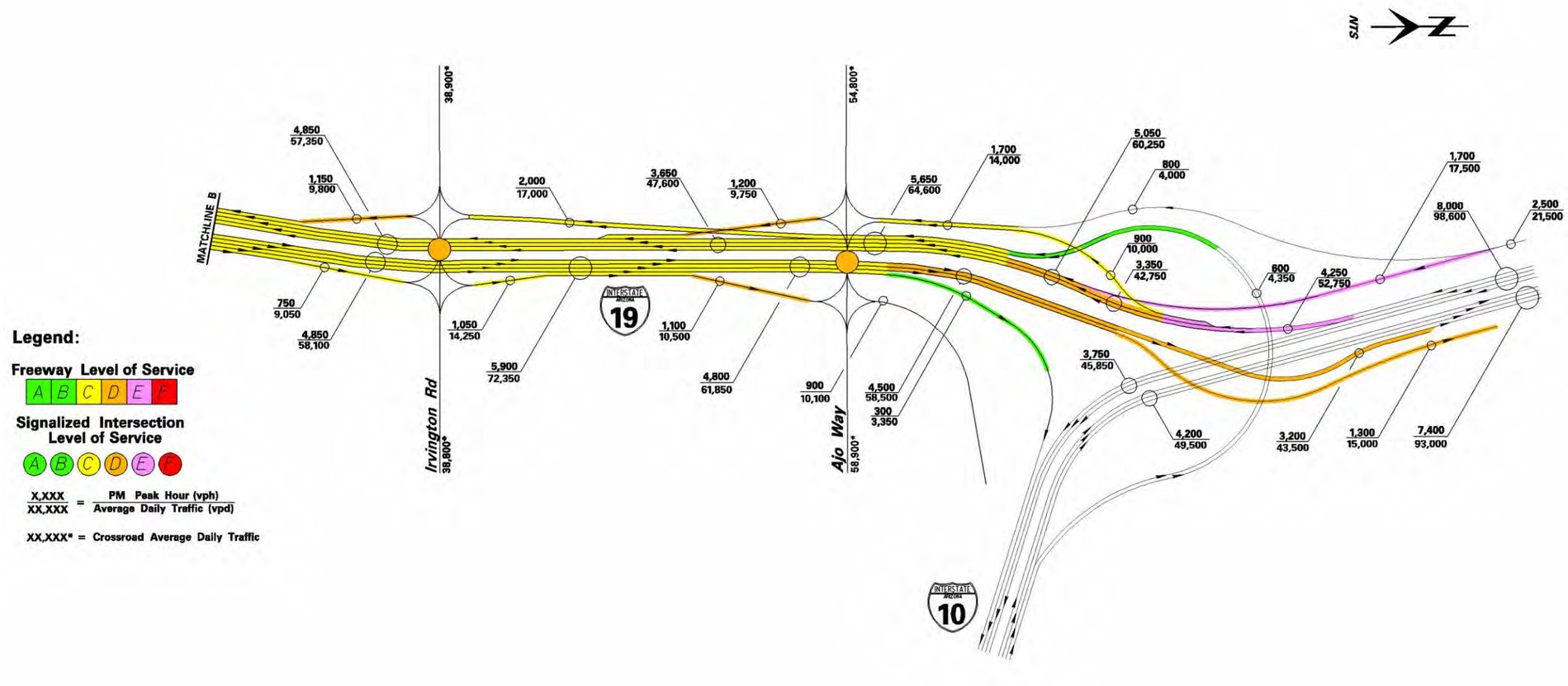


Figure 2-7: Alternative #1 - 2030 PM Peak Hour LOS Summary (Sheet 3 of 3)

I-19 Weaving Segments LOS Analysis

The LOS analysis indicated that most of the weaving segments in both directions are expected to operate at an acceptable LOS (D or better) during both AM and PM peak hours. One segment is expected to operate at an unacceptable LOS; the weaving segment between the eastbound I-10 off-ramp to I-19 and the southbound I-19 off-ramp to Ajo Way.

Intersections LOS Analysis

The LOS analysis conducted for the I-19 ramp intersections indicated that all the intersections at the TIs are expected to operate at an acceptable LOS (D or better). Table 2-18 summarizes the results of the intersection LOS analysis.

Table 2-18: Alternative #1 - 2030 LOS Summary for Intersections

Intersection	Intersection Control Type	LOS AM (PM)	
		Southbound	Northbound
At Ajo Way off-ramps	Signalized-SPUI	D (D)	
At Irvington Road off-ramps	Signalized-SPUI	D (D)	
At Drexel Road off-ramps	Signalized-SPUI	C (C)	
At Valencia Road off-ramps	Signalized-SPUI	D (D)	
At Los Reales Road off-ramps	Signalized-Diamond	B (B)	B (B)
At San Xavier Road off-ramps	Unsignalized	A (A)	B (C)

2.3.5 Alternative #2 - Roadway Conditions

This alternative is based on the 2003 Corridor Study Recommended Alternative with modifications at the San Xavier Road TI, the Los Reales Road TI, and the I-19/I-10 system TI. This alternative includes the following roadway improvements:

- Widening I-19 to 4 lanes in each direction between San Xavier Road and I-10.
- Constructing a modified split diamond interchange between San Xavier Road and Los Reales Road connected with CD roads. Where the existing modified diamond interchange at San Xavier Road will be reconstructed to a modified half-diamond interchange, a new modified half-diamond interchange will be constructed at Los Reales Road, and CD roads will be constructed to connect the two modified half-diamond interchanges.
- Constructing a new Single Point Urban Interchange (SPUI) at Drexel Road.
- Reconstructing the existing diamond TI at Irvington Road to a SPUI.
- Reconstructing the existing partial clover leaf TI at Ajo Way to a SPUI.
- Providing CD roads between Ajo Way and I-10, and providing ramp connections between Ajo Way and the CD roads, and between the CD roads and the I-19/I-10 system TI.
- Reconstructing the existing ramps in the northbound direction between Ajo Way and I-10 to braided ramps.
- Reconstructing the existing ramps in the southbound direction between I-10 and Ajo Way, and between Ajo Way and Irvington Road to braided ramps
- Reconstructing the existing southbound I-19 off-ramp at Valencia Road to accommodate the new braided ramps between Valencia Road and Drexel Road.
- Providing auxiliary lanes for northbound I-19 between: Los Reales Road and Valencia Road, Valencia Road and Drexel Road, Drexel Road and Irvington Road, Irvington Road and Ajo Way, and Ajo Way and I-10.
- Providing auxiliary lanes for southbound I-19 between: I-10 and Ajo Way, Irvington Road and Drexel Road, and Valencia Road and Los Reales Road.
- Widening Ajo Way to a 6-lane divided roadway and Drexel Road to a 4-lane divided roadway.

The alternative also includes two-lane ramps at several locations: the westbound I-10 to southbound I-19 flyover on-ramp, the southbound I-19 off-ramp at Irvington Road, and the southbound I-19 off-ramp at Valencia Road. Additionally, ramp metering was included at the northbound I-19 on-ramp at Ajo Way.

New TIs are proposed at Los Reales Road and Drexel Road to maintain reasonable spacing of approximately 1 mile between existing and new TIs. The proposed locations are the only possible locations for new TIs. As the distance between the Los Reales Road TI and the San Xavier Road TI was very close, the two interchanges were joined with CD roads to form a modified split diamond TI.

Alternative #2 roadway conditions were entered into the PAG model and the model was re-run by PAG. The peak hour traffic volumes were obtained by taking the K-values derived from the 2001 existing traffic volumes, and applying it to Alternative #2 daily traffic volumes. The resulting 2030 traffic volumes for Alternative #2 for the I-19 mainline are illustrated in Figure 2-8.

2.3.6 Alternative #2 - Traffic Analysis

LOS analyses were conducted to analyze the operations of Alternative #2 for the mainline, the merge/diverge ramp junctions, and the adjacent traffic intersections of the surrounding roadway network. The HCM methodologies were followed to calculate the LOS for all elements within the corridor network.

The latest versions of Corsim and Synchro software were utilized to perform the LOS analyses. Corsim 6.1 was utilized for basic freeway segments, and merge/diverge ramp junctions, and Synchro 7.0 was utilized to perform the LOS analyses for intersections.

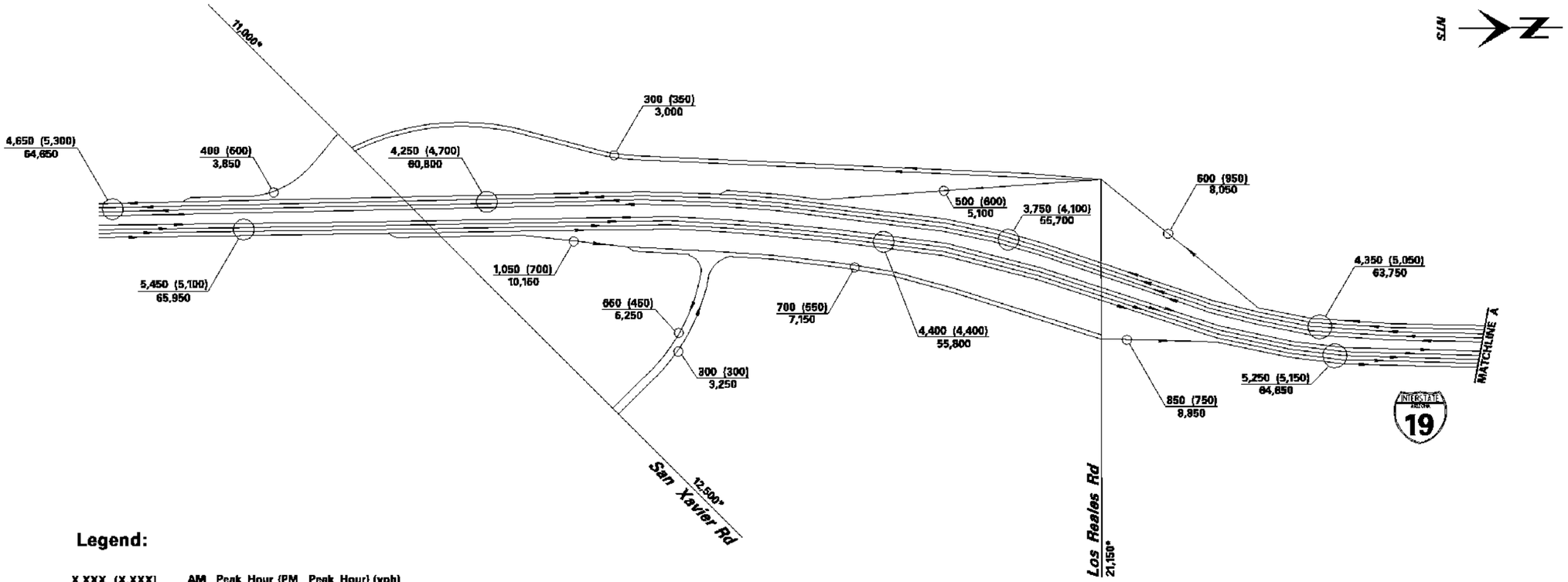


Figure 2-8: Alternative #2 – 2030 Traffic Volumes
(Sheet 1 of 3)

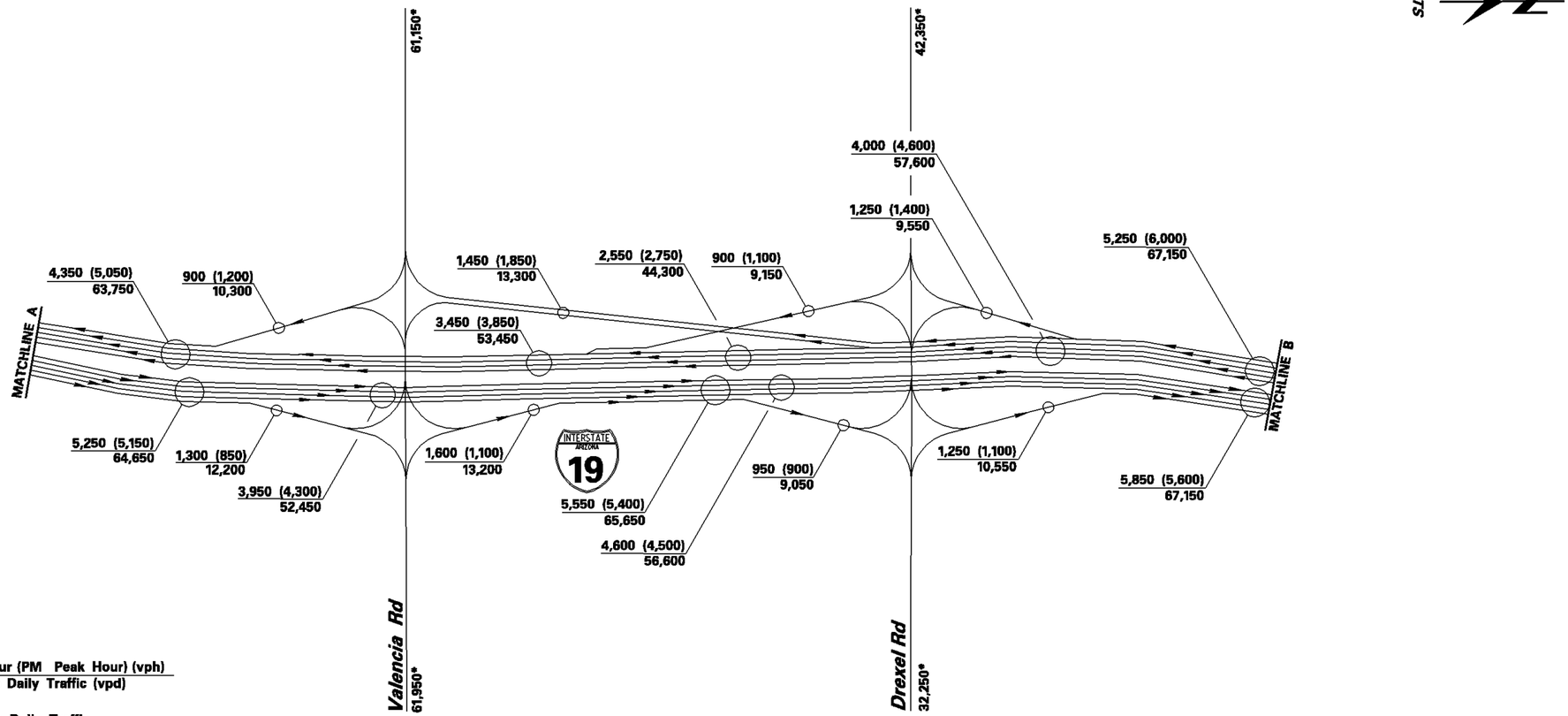
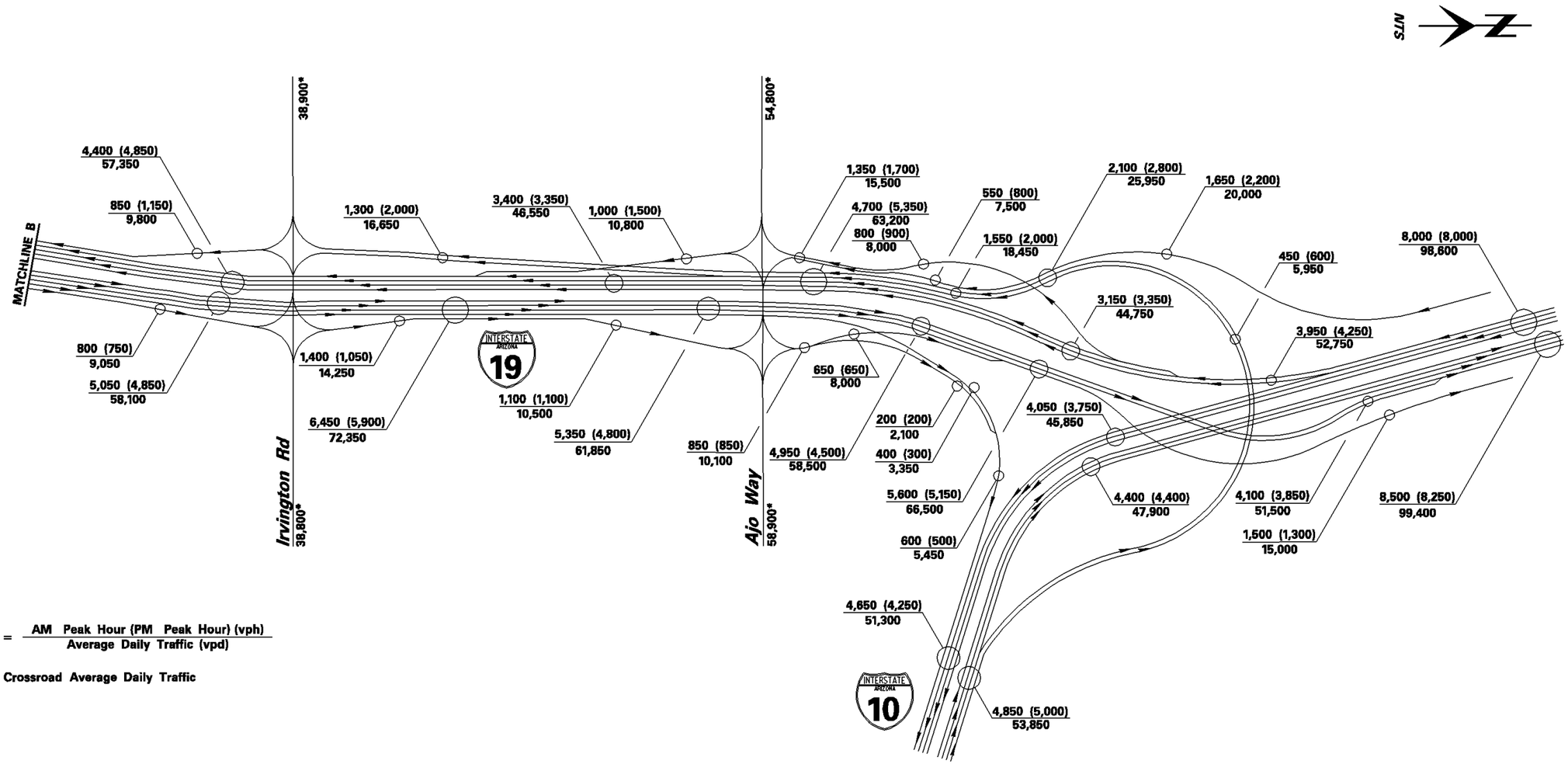


Figure 2-8: Alternative #2 – 2030 Traffic Volumes
(Sheet 2 of 3)



Legend:

$$\frac{\text{X,XXX (X,XXX)}}{\text{XX,XXX}} = \frac{\text{AM Peak Hour (PM Peak Hour) (vph)}}{\text{Average Daily Traffic (vpd)}}$$

XX,XXX* = Crossroad Average Daily Traffic

Figure 2-8: Alternative #2 – 2030 Traffic Volumes
(Sheet 3 of 3)

The following input assumptions were used in the LOS analyses:

- Mainline free flow speed of 55 mph
- System interchange ramp free flow speed of 50 mph
- Service interchange ramp free flow speed of 45 mph
- A peak hour factor (PHF) of 0.90
- Percentage of trucks 20% on the freeways, and 10% on the arterials.
- Lane width of 12 feet
- The CORSIM model was run for 2 hours, which included an initialization period of 1 hour. The volumes for each hour were based on the projected peak hour demand.
- Ramp meters were included in the analysis.

Design networks representing Alternative #2 roadway conditions were established in Corsim and Synchro, and the 2030 traffic volumes were input into the networks. The results of the LOS analyses are illustrated in Figure 2-9 for the AM peak hour and Figure 2-10 for the PM peak hour.

I-19 Basic Freeway Segments LOS Analysis

The LOS analysis indicated that most of the segments in both directions are expected to operate at an acceptable LOS (D or better) during both AM and PM peak hours. Two segments are expected to operate at an unacceptable LOS; northbound I-19 between the Ajo Way on-ramp and I-10, and southbound I-19 between I-10 and the Ajo Way off-ramp.

I-19 Weaving Segments LOS Analysis

The LOS analysis indicated that most of the weaving segments in both directions are expected to operate at an acceptable LOS (D or better) during both AM and PM peak hours. Two segments are expected to operate at an unacceptable LOS; the weaving segment between the northbound I-19 on-ramp at Ajo Way and the northbound I-19 off-ramp to the westbound I-10 Frontage Road, and the weaving segment between the eastbound I-10 off-ramp to I-19 and the southbound I-19 off-ramp to Ajo Way.

Ramp Junctions LOS Analysis

The LOS analysis indicated that most of the ramp junctions in both directions are expected to operate at an acceptable LOS (D or better) during both AM and PM peak hours. Two ramp junctions are expected to operate at an unacceptable LOS; northbound I-19 at the Ajo Way on-ramp, and southbound I-19 at the Ajo Way off-ramp.

The northbound Ajo Way on-ramp was analyzed with ramp metering. Ramp metering is a device, usually a basic traffic light (red and green, no yellow) with a signal controller that regulates the flow of traffic entering freeways according to current traffic conditions. It is installed to restrict the total flow entering the freeway by temporarily storing it on the ramp.

ADOT standard 300-foot deceleration and 700-foot acceleration lanes were modeled in the LOS analysis. These ramp characteristics are based on the ADOT *RDG Section 504*.

Intersections LOS Analysis

The LOS analysis conducted for the I-19 ramp intersections indicated that all the intersections at the TIs are expected to operate at an acceptable LOS (D or better). Table 2-19 summarizes the results of the intersection LOS analysis.

Table 2-19: Alternative #2 - 2030 LOS Summary for Intersections

Intersection	Intersection Control Type	LOS AM (PM)	
		Southbound	Northbound
At Ajo Way off-ramps	Signalized-SPUI	D (D)	
At Irvington Road off-ramps	Signalized-SPUI	D (D)	
At Drexel Road off-ramps	Signalized-SPUI	C (C)	
At Valencia Road off-ramps	Signalized-SPUI	D (D)	
At Los Reales Road off-ramps	Signalized-Diamond	B (B)	B (B)
At San Xavier Road off-ramps	Unsignalized	A (A)	B (C)

2.4 Summary of Operational Analysis

The results of the LOS analysis for the year 2030 indicated that the I-19 corridor under the No-Action Alternative will operate at an unacceptable LOS.

In general, the results of the LOS analysis for both Build Alternatives were very similar. The LOS was acceptable (D or better) for the majority of the study corridor except for two segments; northbound I-19 between the Ajo Way on-ramp and I-10, and southbound I-19 between I-10 and the Ajo Way off-ramp. The unacceptable LOS on these two segments in both 2030 Build Alternatives is due to the capacity of the two-lane ramps connecting I-10 and I-19 (the northbound I-19 to westbound I-10 and the eastbound I-10 to southbound I-19 ramps) at the system interchange. These ramps were reconstructed in 2004 as part of the I-10/I-19 system interchange project, and ADOT has no plans to widen these ramps in the near future.

The results of a LOS sensitivity analysis indicated that if these two bridges are widened to three lanes, an acceptable LOS will be achieved through the year 2030. It is anticipated that with the existing two-lane bridges, the I-19 corridor will continue to operate at an acceptable LOS through the year 2020.

Additional operational analysis was conducted to evaluate a wide range of TI alternatives at the Irvington Road TI. The alternatives included a diamond interchange, a double crossover diamond or diverging diamond interchange, and a SPUI. Based on the analysis, a SPUI was the recommended alternative for Irvington Road.

Figure 2-9: Alternative #2 - 2030 AM Peak Hour LOS Summary
(Sheet 1 of 3)

Figure 2-9: Alternative #2 - 2030 AM Peak Hour LOS Summary (Sheet 2 of 3)

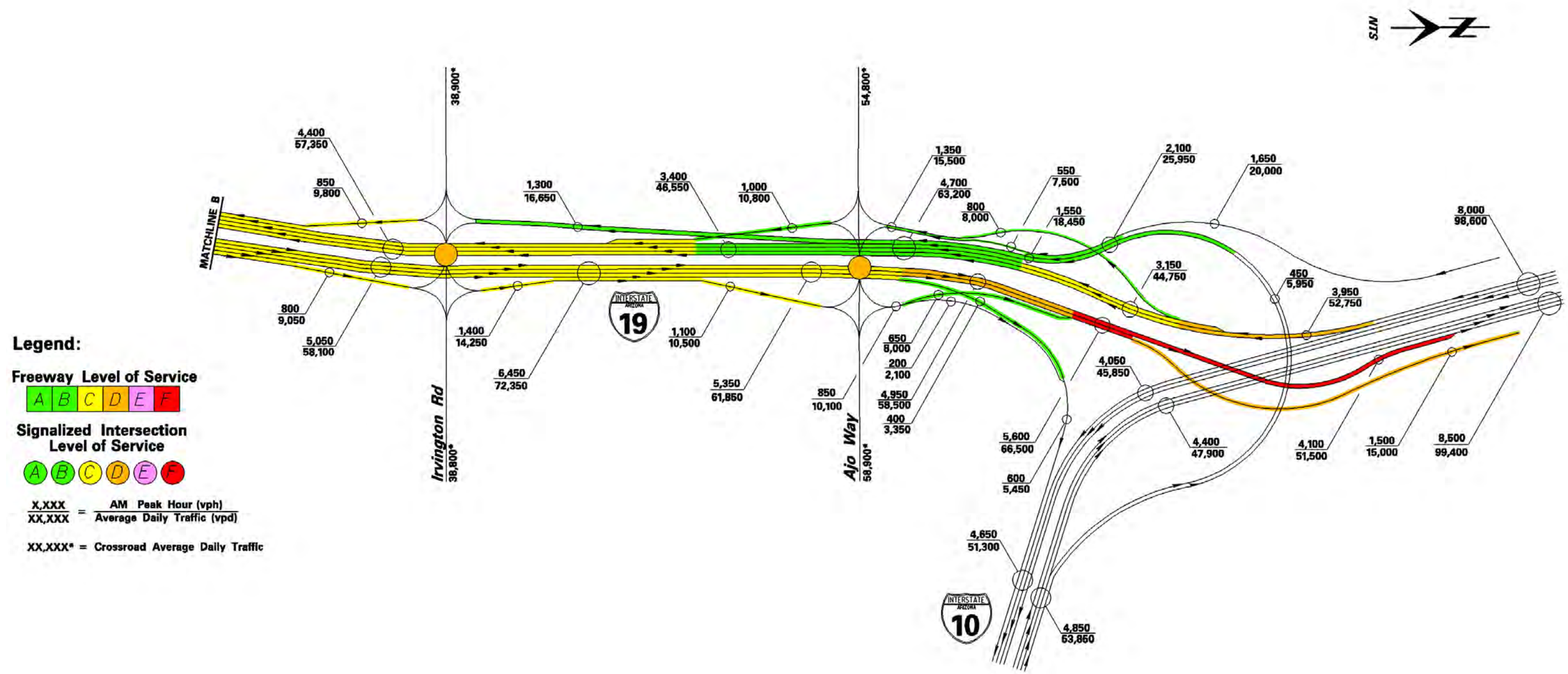


Figure 2-9: Alternative #2 - 2030 AM Peak Hour LOS Summary (Sheet 3 of 3)

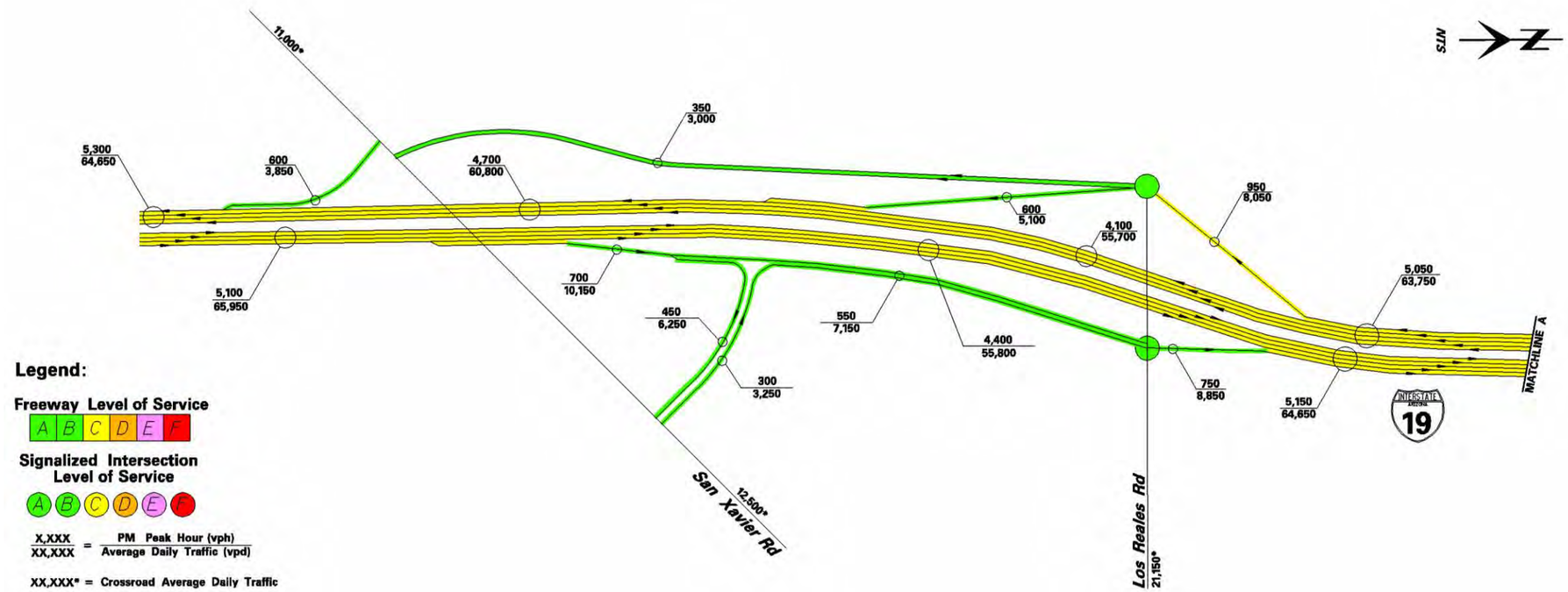


Figure 2-10: Alternative #2 - 2030 PM Peak Hour LOS Summary
(Sheet 1 of 3)

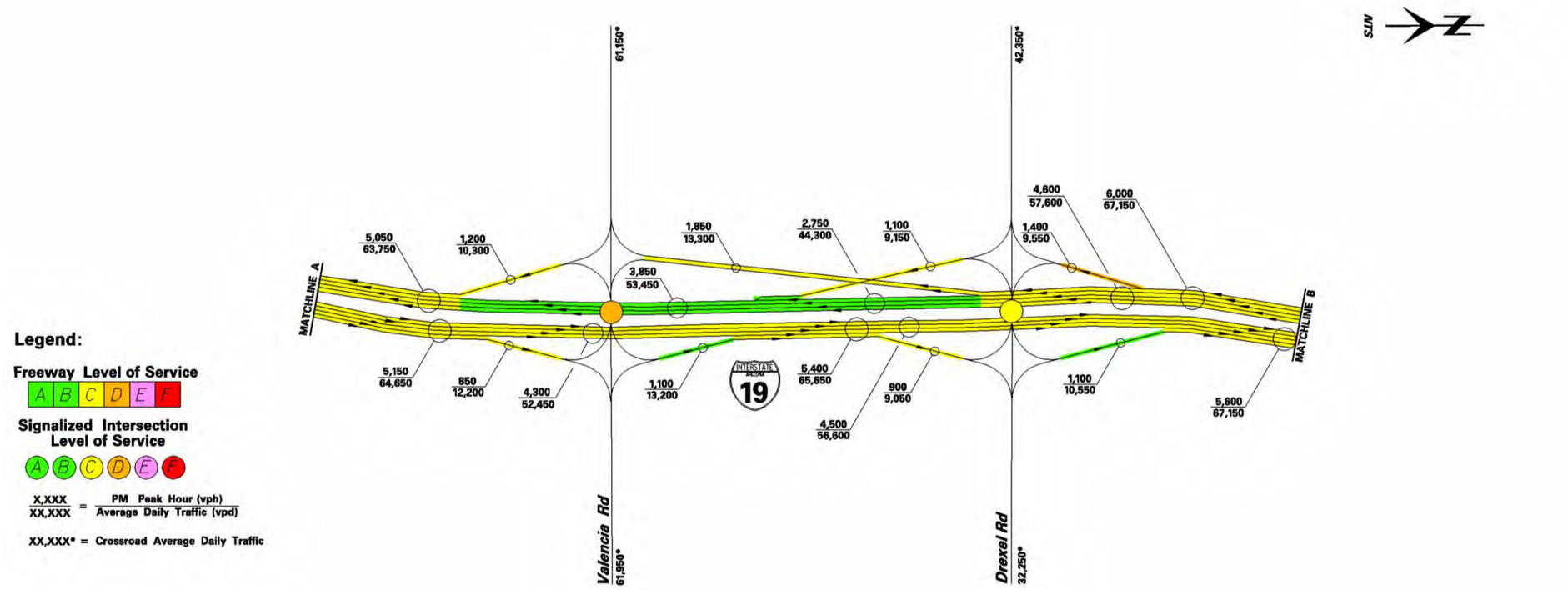


Figure 2-10: Alternative #2 - 2030 PM Peak Hour LOS Summary (Sheet 2 of 3)

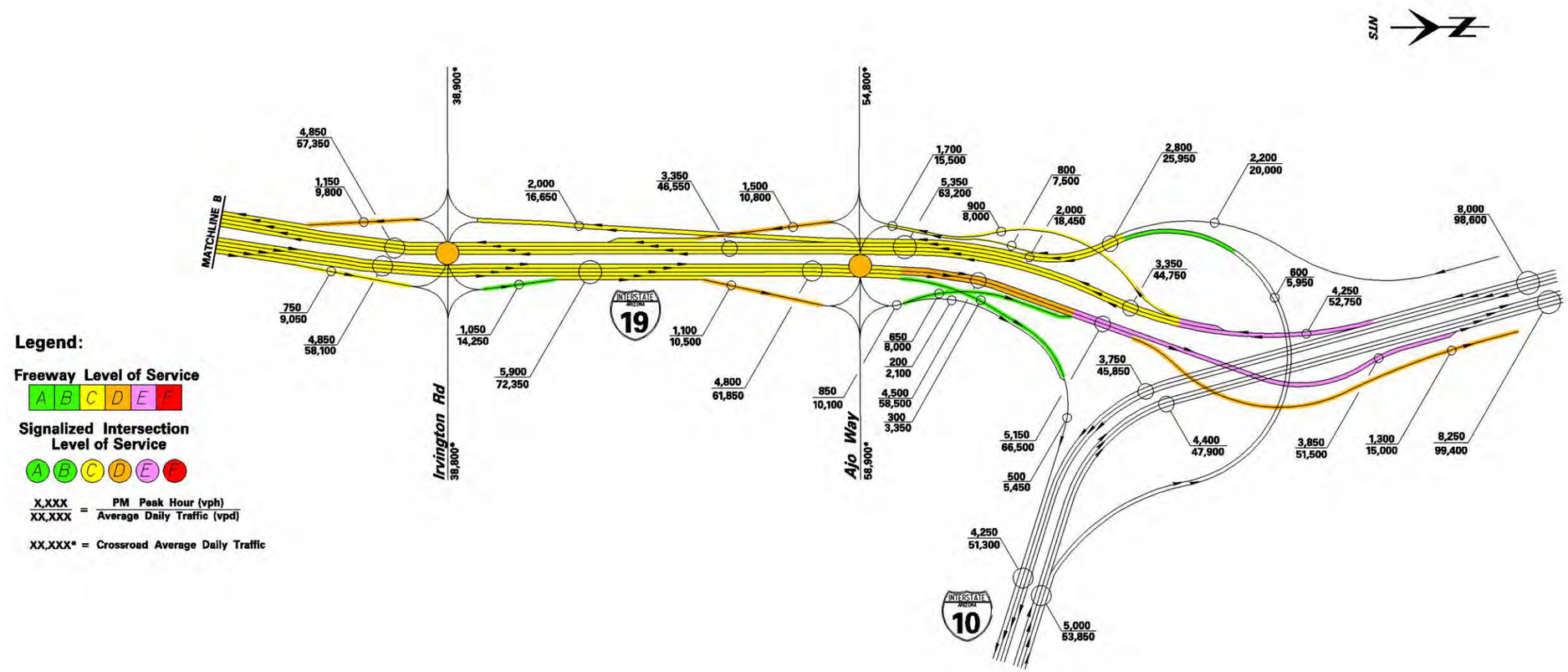


Figure 2-10: Alternative #2 - 2030 PM Peak Hour LOS Summary
(Sheet 3 of 3)

Operational analyses were conducted to evaluate a wide range of TI alternatives at the San Xavier Road TI and Los Reales Road TI. The alternatives included:

- A single interchange for the San Xavier Road and Los Reales Road located halfway between the two roads,
- A split diamond interchange with a directional northbound off-ramp to San Xavier road,
- A full diamond interchange at Los Reales Road with CD roads to San Xavier Road with no ramps south of San Xavier Road,
- A split diamond at the San Xavier Road and the Los Reales Road with a NB loop ramp at the San Xavier Road, and
- A half-diamond TI at San Xavier Road and a modified half-diamond TI at Los Reales Road connected with CD roads (Alternative #2).

Based on the evaluation of the environmental impacts, along with traffic operations and safety considerations, the alignment included in Alternative #2 is the recommended alternative for the San Xavier Road TI and Los Reales Road TI.

Note that there are no future plans to extend Los Reales Road to the west over the Santa Cruz River due to the significant environmental impacts (including tribal land and Section 404).

2.5 Traffic Interchanges

The intersection layouts and lane configurations of the traffic interchanges under the Recommended Alternative are illustrated in Figure 2-11, and are as follows:

2.5.1 I-19/San Xavier Road TI

At the San Xavier Road TI, the existing modified diamond TI will be reconstructed to a half-diamond TI. CD roads will be constructed between San Xavier Road and Los Reales Road. The northbound on-ramp and southbound off-ramp will be modified to connect to the CD roads. A connector road (spur) will connect San Xavier Road with the northbound CD road.

Access to San Xavier Road will be provided from the north and south. Ramps will connect San Xavier Road to the I-19 mainline (south of San Xavier Road) or to the CD road (north of San Xavier Road).

One through lane in each direction will be provided on San Xavier Road within the interchange area. Two lanes will be provided on each ramp terminal (or CD road) approaching the crossroad. One westbound to southbound left-turn lane, one eastbound to northbound left-turn lane, and separate eastbound to southbound and westbound to northbound right-turn lanes will be provided. The two intersections with the ramp terminals will continue to be controlled by STOP signs. With this lane configuration, this interchange is anticipated to operate at LOS B and C during the AM and PM peak hours, respectively.

2.5.2 I-19/Los Reales Road TI

At the Los Reales Road TI, a new modified half-diamond TI will be constructed. CD roads will be constructed between San Xavier Road and Los Reales Road.

Access to Los Reales Road will be provided from the north and south. Ramps will connect Los Reales Road to the I-19 mainline (north of Los Reales Road) or to the CD road (south of Los Reales Road).

Two through lanes in each direction will be provided on Los Reales Road within the interchange area. Three lanes will be provided on each ramp terminal (or CD road) approaching the crossroad. The two westbound through lanes will become dual left-turn lanes at the T-intersection with the CD road, the eastbound to northbound left-turn movement will be allowed from the shared through-left lane, and a separate westbound to northbound right-turn lane will be provided. The two intersections with the ramp terminals will be controlled by new traffic signals. With this lane configuration, this interchange is anticipated to operate at LOS B during both the AM and PM peak hours respectively.

The two modified half-diamond interchanges at San Xavier Road and at Los Reales Road will function as a modified split diamond interchange.

2.5.3 I-19/Valencia Road TI

At the Valencia Road TI, the existing SPUI will be maintained. Access to Valencia Road will be provided from the north and south. Ramps will connect Valencia Road to the I-19 mainline. Braided ramps in the southbound direction between Drexel Road and Valencia Road will be provided.

Three through lanes in each direction will be provided on Valencia Road within the interchange area. Three lanes will be provided on each ramp terminal approaching the crossroad. Two westbound to southbound left-turn lanes, two eastbound to northbound left-turn lanes, and separate eastbound to southbound and westbound to northbound right-turn lanes will be provided. The intersection with the ramp terminals will continue to be controlled by traffic signal, but the traffic signal will be modified to accommodate the additional lanes on the off-ramps. With this lane configuration, this interchange is anticipated to operate at LOS D during both the AM and PM peak hours.

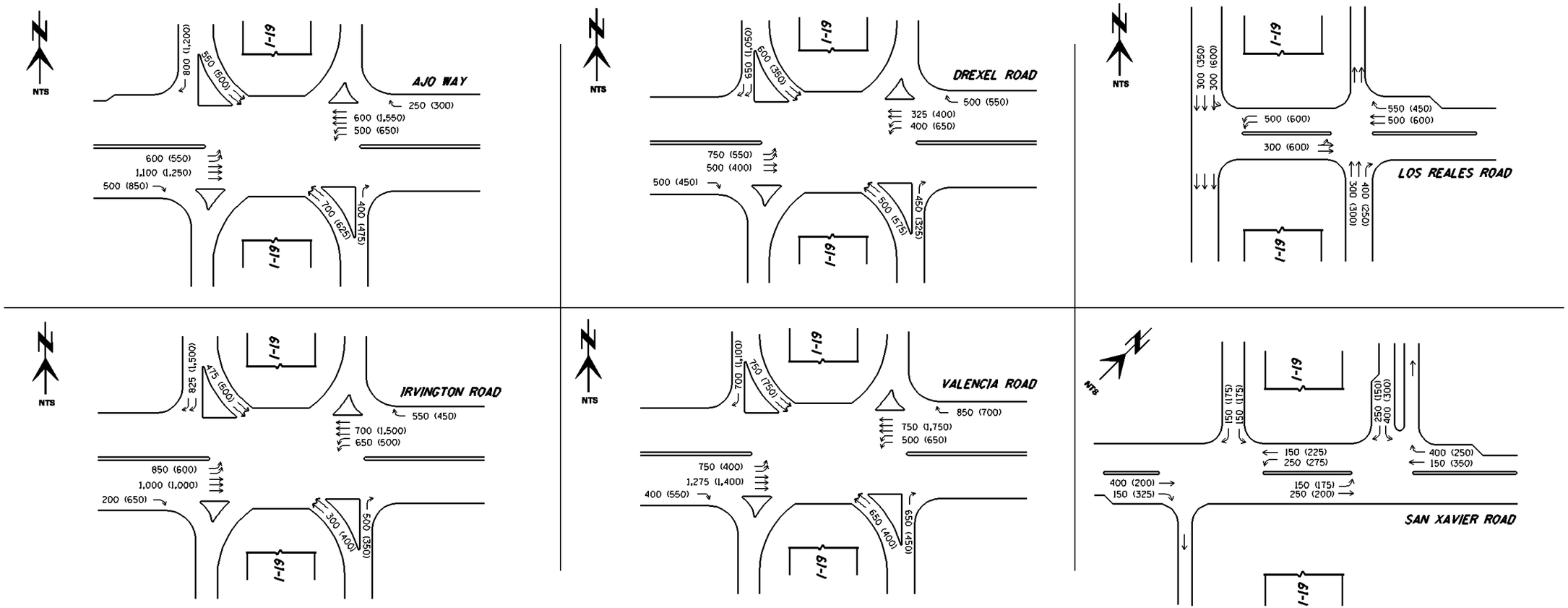
2.5.4 I-19/Drexel Road TI

At Drexel Road, a new SPUI will be provided. Access to Drexel Road will be provided from the north and south. Ramps will connect Drexel Road to the I-19 mainline. Braided ramps in the southbound direction between Drexel Road and Valencia Road will be provided.

Two through lanes in each direction will be provided on Drexel Road within the interchange area. Four lanes will be provided on the southbound ramp terminal approaching the crossroad, while three will be provided on the northbound ramp terminal. Two westbound to southbound left-turn lanes, two eastbound to northbound left-turn lanes, and separate eastbound to southbound and westbound to northbound right-turn lanes will be provided. The two intersections with the ramp terminals will be controlled by new traffic signals. With this lane configuration, this interchange is anticipated to operate at LOS C during both the AM and PM peak hours.

2.5.5 I-19/Irvington Road TI

At the Irvington Road TI, the existing diamond interchange will be reconstructed to a SPUI. Access to Irvington Road will be provided from the north and south. Ramps will connect Irvington Road to the I-19 mainline. Braided ramps in the southbound direction between Ajo Way and Irvington Road will be provided.



Legend:

X,XXX (X,XXX) = AM (PM) Peak hour Volume

*** = Free-Flow Right Turn Lane**

Figure 2-11: Alternative #2 - Intersections Layout

Three through lanes in each direction will be provided on Irvington Road within the interchange area. Four lanes will be required on the southbound ramp terminal approaching the crossroad, while three will be required on the northbound ramp terminal. Two westbound to southbound left-turn lanes, two eastbound to northbound left-turn lanes, and separate eastbound to southbound and westbound to northbound right-turn lanes will be required. The existing traffic signal at the existing two intersections with the ramp terminals will be replaced by one traffic signal at the new intersection location. With this lane configuration, this interchange is anticipated to operate at LOS D during both the AM and PM peak hours.

2.5.6 I-19/Ajo Way TI

At the Ajo Way TI, the existing partial clover leaf TI will be reconstructed to a SPUI. Access to Ajo Way will be provided from the north and south. Ramps will connect Ajo Way to the I-19 mainline. Braided ramps in the southbound direction between I-10 and Ajo Way, and between Ajo Way and Irvington Road will be provided. Braided ramps in the northbound direction between Ajo Way and I-10 will be provided.

Three through lanes in each direction will be provided on Ajo Way within the interchange area. Three lanes will be provided on each ramp terminal approaching the crossroad. Two westbound to southbound left-turn lanes, two eastbound to northbound left-turn lanes, and separate eastbound to southbound and westbound to northbound right-turn lanes will be required. The existing traffic signal at the existing two intersections with the ramp terminals will be replaced by one traffic signal at the new intersection location. With this lane configuration, this interchange is anticipated to operate at LOS D during both the AM and PM peak hours respectively.

2.5.7 I-19/I-10 System TI

At the I-19/I-10 system TI, the existing fully directional interchange will be maintained. CD roads will be constructed between Ajo Way TI and the I-19/I-10 system TI. Ramps will connect I-10 with I-19 and the CD roads. Braided ramps will be provided on the southbound direction between I-10 and Ajo Way. Braided ramps will also be provided on the northbound direction between Ajo Way and I-10. A ramp connection will be provided between the eastbound I-10 frontage road and the flyover ramp from westbound I-10 to southbound I-19. The existing ramp connection between the eastbound I-10 frontage road and southbound I-19 will be eliminated.

3.0 Design Concept Alternatives

3.1 Introduction

Three design alternatives were evaluated in this report:

- **No-Action Alternative:** This alternative includes only the addition of one northbound and one southbound lane along I-19 from Valencia Road to I-10. No ramp or TI improvements are included.
- **Alternative #1:** This alternative represents the 2003 Corridor Study Recommended Alternative.
- **Alternative #2:** This alternative represents the 2003 Corridor Study Recommended Alternative with modifications at the San Xavier Road TI, the Los Reales Road TI, and the I-19/I-10 system TI.

3.2 Design Concept Alternatives Considered and Discontinued

There were several alternatives that were considered but were discontinued due to traffic operations and safety considerations, and/or environmental impacts.

At Irvington Road, several interchange configurations were considered including: SPUI, diamond interchange, and a double crossover diamond or diverging diamond interchange (DDI).

Several interchange configurations were considered at the San Xavier Road TI and Los Reales Road TI including:

- One interchange for the San Xavier Road and Los Reales Road located halfway between the two roads.
- Split diamond interchange with a directional northbound off-ramp to San Xavier Road, a full diamond interchange at Los Reales Road with CD roads to San Xavier Road with no ramps south of San Xavier Road.
- Split diamond at San Xavier Road and Los Reales Road with a northbound loop ramp at San Xavier Road.

3.3 Design Concept Alternatives Studied in Detail

The three design concept alternatives were evaluated in terms of their technical merits and environmental impacts. A brief description of each alternative is presented below.

3.3.1 No-Action Alternative

- The No-Action Alternative conditions were obtained from PAG's travel demand model, which uses the 2030 RTP roadway network. The 2030 RTP roadway network consists of the existing roadway network with any ongoing roadway projects and roadway improvements (not including the roadway improvements of this DCR) that are included in the 2030 regional transportation plan. The planned improvements for I-19 included in the No-Action Alternative consist of the addition of one lane in each direction of travel on I-19 from Valencia Road to I-10 (as reflected in the 2030 RTP). This additional lane would be constructed as an inside widening and would not involve any re-profiling or improvements to the existing vertical clearances. No ramp or TI improvements are included in this alternative.

The roadway improvements for this alternative are illustrated in Figure 3-1.

3.3.2 Alternative #1

This alternative represents the 2003 Corridor Study Recommended Alternative. The roadway improvements for this alternative are illustrated in Figure 3-2. This alternative includes the following roadway improvements:

- Widening I-19 to four lanes in each direction
- Reconfiguring the existing modified diamond TI at San Xavier Road to a diamond TI. This would involve realigning I-19 to the west of San Xavier TI to accommodate a standard northbound off-ramp.
- Constructing a new diamond TI at Los Reales Road.
- Constructing a new SPUI at Drexel Road.
- Reconstructing the existing diamond TI at Irvington Road to a SPUI.
- Reconstructing the existing partial clover leaf TI at Ajo Way to a SPUI.
- Reconstructing the existing ramps in the southbound direction between I-10 and Ajo Way, and between Ajo Way and Irvington Road to braided ramps
- Reconstructing the existing southbound I-19 off-ramp at Valencia Road to accommodate the new braided ramps between Valencia Road and Drexel Road.
- Eliminating the existing northbound I-19 on-ramp from Ajo Way, and providing a connection from Ajo Way to 12th Avenue.
- Providing auxiliary lanes for northbound I-19 between: Valencia Road and Drexel Road, Drexel Road and Irvington Road, and Irvington Road and Ajo Way.
- Providing auxiliary lanes for southbound I-19 between: I-10 and Ajo Way, and Irvington Road and Drexel Road.
- Widening Ajo Way to an 8-lane divided roadway and Drexel Road to a 6-lane divided roadway.

3.3.3 Alternative #2

This alternative represents the 2003 Corridor Study Recommended Alternative with modifications at the San Xavier Road TI, the Los Reales Road TI, and the I-19/I-10 system TI. The roadway improvements for this alternative are illustrated in Figure 3-3. This alternative includes the following roadway improvements:

- Widening I-19 to 4 lanes in each direction between San Xavier Road and I-10.
- Constructing a modified split diamond interchange between San Xavier Road and Los Reales Road connected with CD roads. Where the existing modified diamond interchange at San Xavier Road will be reconstructed to a modified half-diamond interchange, a new modified half-diamond interchange will be constructed at Los Reales Road, and CD roads will be constructed to connect the two modified half-diamond interchanges.
- Constructing new SPUI at the Drexel Road.

- Reconstructing the existing diamond TI at Irvington Road to a SPUI.
- Reconstructing the existing partial clover leaf TI at Ajo Way to a SPUI.
- Providing CD roads between Ajo Way and I-10, and providing ramp connections between Ajo Way and the CD roads, and between the CD roads and the I-19/I-10 system TI.
- Reconstructing the existing ramps in the northbound direction between Ajo Way and I-10 to braided ramps.
- Reconstructing the existing ramps in the southbound direction between I-10 and Ajo Way, and between Ajo Way and Irvington Road to braided ramps
- Reconstructing the existing southbound I-19 off-ramp at Valencia Road to accommodate the new braided ramps between Valencia Road and Drexel Road.
- Providing auxiliary lanes for northbound I-19 between: Los Reales Road and Valencia Road, Valencia Road and Drexel Road, Drexel Road and Irvington Road, Irvington Road and Ajo Way, and Ajo Way and I-10.
- Providing auxiliary lanes for southbound I-19 between: I-10 and Ajo Way, Irvington Road and Drexel Road, and Valencia Road and Los Reales Road.
- Widening Ajo Way to a 6-lane divided roadway and Drexel Road to a 4-lane divided roadway.

Two lane ramps were required at several locations: the westbound I-10 to southbound I-19 flyover on-ramp, the southbound I-19 off-ramp at Irvington Road, and the southbound I-19 off-ramp at Valencia Road. Also, ramp metering was required at the northbound I-19 on-ramp at Ajo Way.

The new TIs were located at Los Reales Road and at Drexel road to maintain reasonable spacing of about 1 mile between existing and new TIs. The proposed locations are the only possible locations for new TIs. As the distance between the Los Reales Road TI and the San Xavier Road TI was very close, the two interchanges were joined with CD roads to form a modified split diamond TI.

3.4 Evaluation of Alternatives

Several evaluation criteria were developed to evaluate the three design alternatives. Table 3-1 presents a summary of the comparison for the three design concept alternatives.

3.5 Recommendations

Based on the evaluation of alternatives, Alternative #2 was selected as the Recommended Alternative for the following main reasons:

- Existing features that do not meet current design standards will be reconstructed.
- Traffic operations and safety will be improved.
- Environmental impacts will be minimized.
- The public and key stakeholders prefer this alternative.

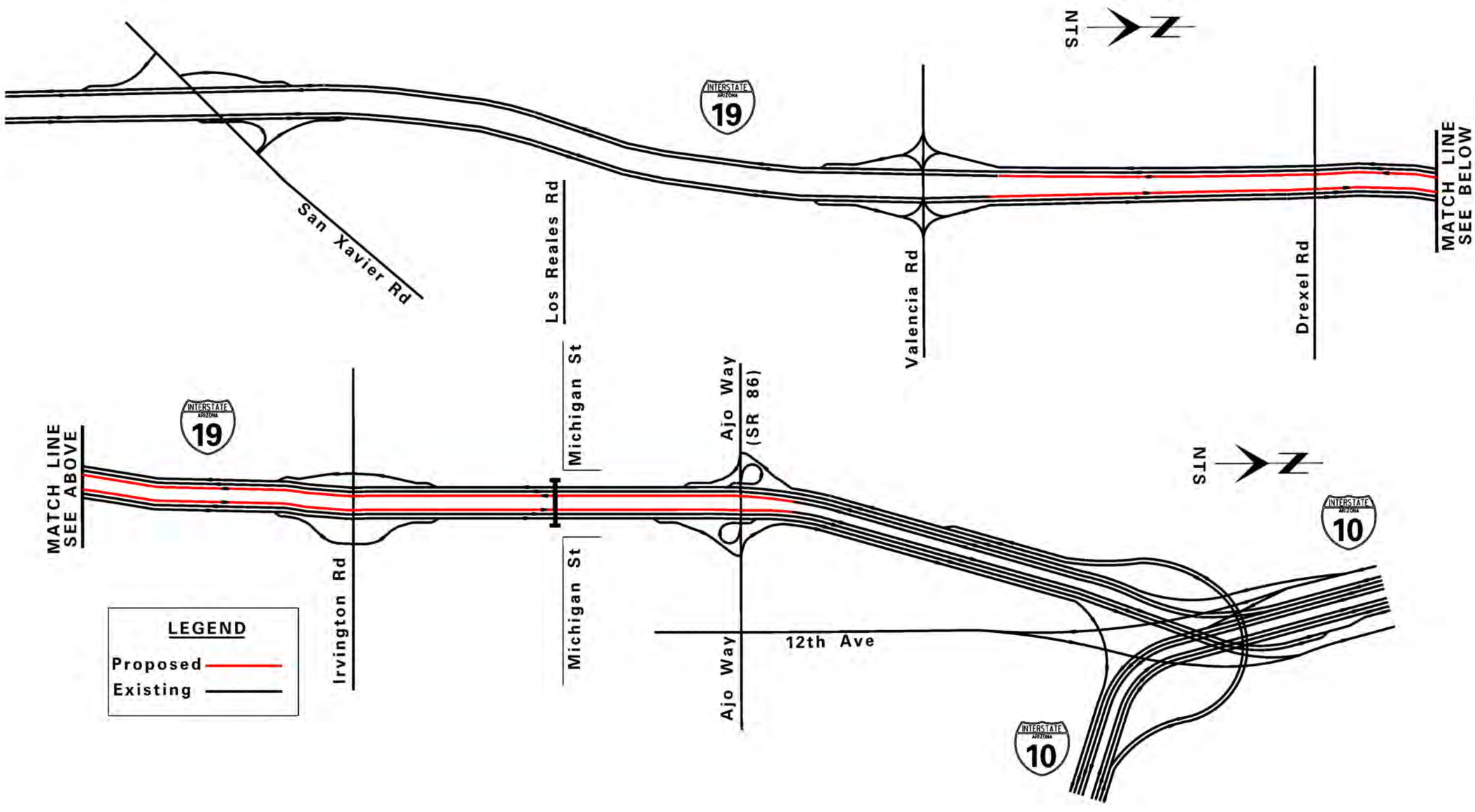


Figure 3-1: No-Action Alternative

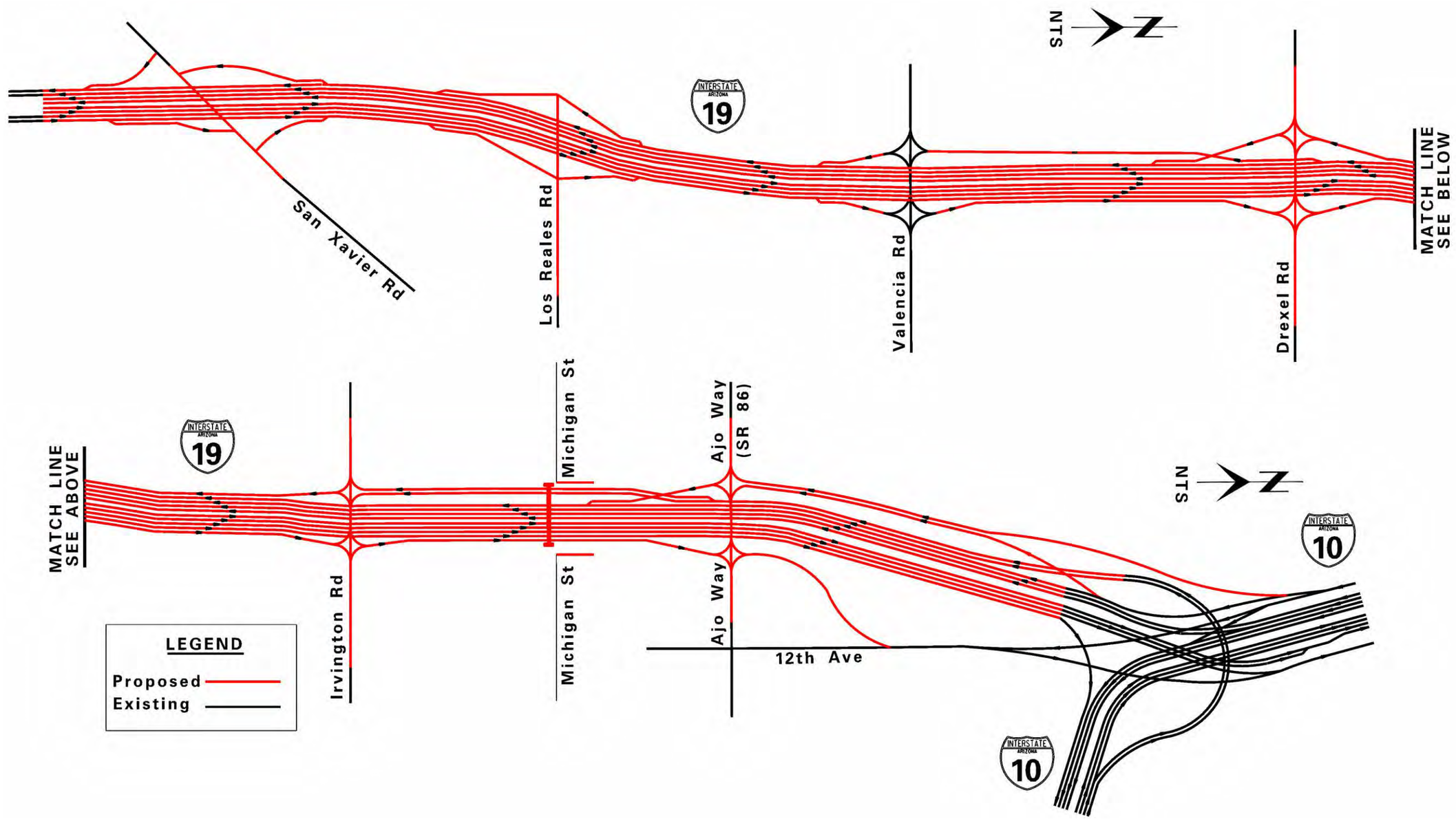


Figure 3-2: Alternative #1

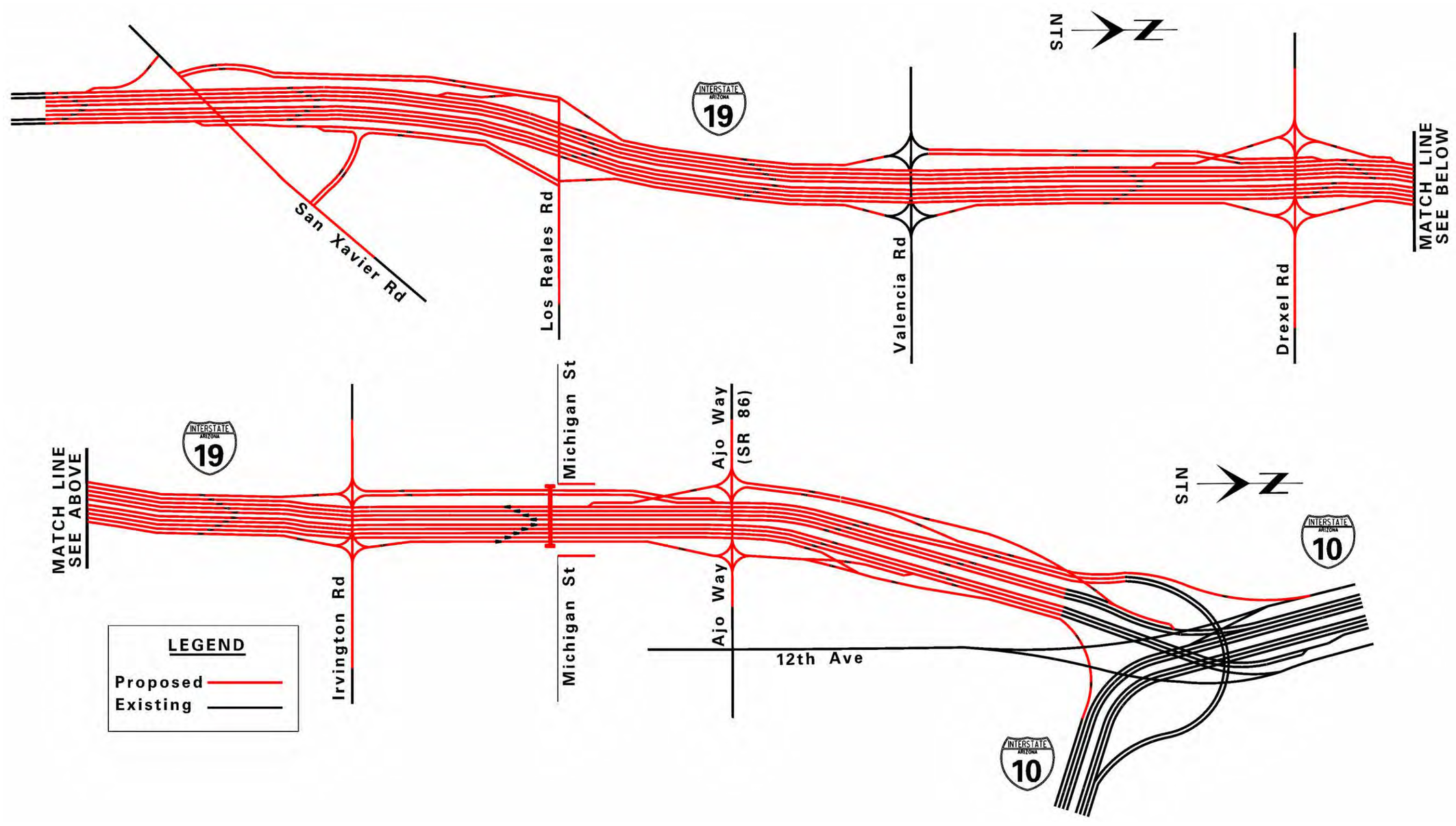


Figure 3-3: Alternative #2

Table 3-1: Evaluation of Alternatives

Design Evaluation Factors	No-Action Alternative[1]	Alternative #1[1]	Alternative #2
Existing Non-Compliant Design Features	Existing design features that do not meet current design standards will not be reconstructed to meet current design standards. The existing vertical clearance at the Ajo Way bridge structure does not meet the minimum AASHTO criteria. The design speed for the northbound San Xavier Road off-ramp does not meet the minimum AASHTO criteria. Other design features that do not meet current design standards at the interchanges include: narrow ramp widths, and short acceleration/deceleration lengths. Access to the pedestrian bridge near Michigan Street does not meet current AASHTO standards and is not compliant with ADA.	Existing design features that do not meet current design standards will be reconstructed to meet current design standards.	Existing design features that do not meet current design standards will be reconstructed to meet current design standards.
Traffic Operations & LOS	The overall LOS is anticipated to be F. The existing configuration at the TIs will not change.	The overall LOS is anticipated to be D. Northbound I-19 between Ajo Way and I-10 would operate at unacceptable LOS due to capacity of the two-lane ramps connecting I-10 and I-19. This alternative will improve traffic operations throughout the entire corridor. The main differences between Alternative #1 and Alternative #2 from a traffic operations stand point are: – Not all traffic movements between Ajo Way and the I-19/I-10 system TI will be provided: the ramp connection between Ajo Way and northbound I-19 will be replaced by a new connection between Ajo Way and 12th Avenue. – Reconfiguring the existing modified diamond interchange at San Xavier Road to a diamond interchange. This involves realigning I-19 to the west of San Xavier TI to accommodate a standard northbound off-ramp. – Adding a new diamond traffic interchange at Los Reales Road. – Providing auxiliary lanes for northbound I-19 between: Valencia Road and Drexel Road, Drexel Road and Irvington Road, and Irvington Road and Ajo Way. – Providing auxiliary lanes for southbound I-19 between: I-10 and Ajo Way, and Irvington Road and Drexel Road. – Widen Ajo Way to an 8-lane divided roadway, and widen Drexel Road to a 6-lane divided roadway.	The overall LOS is anticipated to be D. Northbound I-19 between Ajo Way and I-10 had unacceptable LOS due to the bottleneck created at the two-lane bridges on the ramps connecting I-10 and I-19. This alternative will have better traffic operations than Alternative #1 through the entire corridor. The main differences between Alternative #1 and Alternative #2 from a traffic operations stand point are: – All traffic movements between Ajo Way and the I-19/I-10 system TI will be provided. This includes braided ramps and CD roads between Ajo Way and I-10, and providing ramp connections between Ajo Way and the CD roads, and between the CD roads and the I-19/I-10 system TI. – Constructing a modified split diamond interchange at San Xavier Road / Los Reales Road. Where the existing modified diamond interchange at San Xavier Road is reconstructed to a modified half-diamond interchange, a new modified half-diamond interchange is constructed at Los Reales Road, and CD roads are constructed to connect the two modified half-diamond interchanges together. – Providing auxiliary lanes for northbound I-19 between: Los Reales Road and Valencia Road, Valencia Road and Drexel Road, Drexel Road and Irvington Road, Irvington Road and Ajo Way, and Ajo Way and I-10. – Providing auxiliary lanes for southbound I-19 between: I-10 and Ajo Way, Irvington Road and Drexel Road, and Valencia Road and Los Reales Road. – Widening Ajo Way to a 6-lane divided roadway and Drexel Road to a 4-lane divided roadway.

Table 3-1: Evaluation of Alternatives

Design Evaluation Factors	No-Action Alternative[1]	Alternative #1[1]	Alternative #2
Safety Improvements	Minimal safety improvements	The roadway improvements are expected to enhance safety and operations along the corridor. These improvements include the introduction of braided ramps and auxiliary lanes that will eliminate some of the weaving movements. Additionally, this alternative will modify existing design features that do not meet current design standards.	In addition to the safety improvements listed in Alternative #1, this alternative includes: - A consolidated intersection for the northbound on-ramp and off-ramp terminals at San Xavier Road that will combine two intersections spaced at approximately 600 ft proposed in Alternative #1. - Northbound and southbound CD roads between San Xavier Road and Los Reales Road that will eliminate the weaving movements between San Xavier Road and Los Reales Road. - Auxiliary lanes in both directions of I-19 between Los Reales Road and Valencia Road that will minimize the weaving movements between Los Reales Road and Valencia Road.
Environmental Impacts	Very minimal environmental impacts – There are no anticipated impacts to any archaeological or historic sites as this alternative involves adding one lane in each direction of I-19 as an inside widening with no re-profiling or improvements to the existing vertical clearances, and no ramp or TI improvements. – There are no anticipated biological impacts to threatened, endangered, or sensitive species. – There are minor hazmat impacts anticipated from lead-based paint, and asbestos associated with the structures.	There are minor environmental impacts associated with this alternative. The key environmental impacts are: - There are several potential archaeological/historic sites. - The realigned northbound off-ramp at San Xavier Road will impact Martinez Hill (a sacred mountain in the San Xavier District of the Tohono O'Odham Nation). - The northbound off-ramp from Ajo Way to 12th Avenue will impact a Section 4(f) property on the east side of I-19, north of Ajo Way. - The southbound braided ramp between Drexel Road and Valencia Road will impact approximately 4 acres of the City of Tucson/Pima Community College Section 4(f) joint use property on the west side of I-19. - This alternative will have minimal impacts to the Waters of the US, air quality, and noise levels. - There are no anticipated biological impacts to threatened, endangered, or sensitive species. - There are minor hazmat impacts anticipated from lead-based paint, and asbestos associated with the structures.	There are less environmental impacts associated with this alternative. The key environmental impacts are: - There are several potential archaeological/historic sites. - The southbound braided ramps between Drexel Road and Valencia Road will impact approximately 0.98 acre of the City of Tucson/Pima Community College Section 4(f) joint use property on the west side of I-19. - This alternative will have minimal impacts to the Waters of the US, air quality, and noise levels. - There are no anticipated biological impacts to threatened, endangered, or sensitive species. - There are minor hazmat impacts anticipated from lead-based paint, and asbestos associated with the structures.
Right-of Way & Land Use	This alternative does not require any right-of-way acquisition. This alternative will have no impacts on land ownership, jurisdiction, or land use.	This alternative will require 100 acres of new right-of-way. This alternative will convert approximately 100 acres into permanent transportation facility. This alternative will have long-term minor negative impacts on landownership and land use because of the conversion of private, commercial, industrial, public, and tribal land into a permanent transportation use. The land uses adjacent to the study area will not be altered by the implementation of this study.	This alternative will require 75 acres of new right-of-way. This alternative will convert approximately 75 acres into permanent transportation facility - 35 acres of existing residential, commercial, and industrial land, and 40 acres of public land and property under the jurisdiction of the Tohono O'Odham Nation. This alternative will have long-term minor negative impacts on landownership and land use because of the conversion of private, commercial, industrial, public, and tribal land into a permanent transportation use. The land uses adjacent to the study area will not be altered by the implementation of this study.

Table 3-1: Evaluation of Alternatives

Design Evaluation Factors	No-Action Alternative[1]	Alternative #1[1]	Alternative #2
Relocations/ Displacements	Because there is no acquisition of new right-of-way, this alternative will have no impacts on relocations/displacements.	Approximately 124 properties will be impacted: 95 residential property relocations/displacements, and 29 partial property acquisitions(14 are privately owned commercial properties, 14 are government owned, and 1 is a privately owned educational facility). No businesses will be closed, relocated, or displaced (approximately 120 parking spaces will be removed from the Santa Cruz Retail Center east of I-19 and north of Drexel Road).	Approximately 109 properties will be impacted: 82 residential property relocations/displacements, and 27 partial property acquisitions (13 are privately owned commercial properties, 13 are government owned, and 1 is a privately owned educational facility). No businesses will be closed, relocated, or displaced (approximately 120 parking spaces will be removed from the Santa Cruz Retail Center east of I-19 and north of Drexel Road).
Constructability & Maintenance of Traffic	There are minor constructability issues associated with this alternative This alternative will not have short-term impacts on existing access or traffic operations. However, it will have major long-term negative impacts on neighborhoods and businesses due to the degraded LOS and traffic operations.	There are several constructability issues associated with this alternative: – Reconstructing the diamond interchange at San Xavier Road will involve realigning I-19 to the west of San Xavier TI to accommodate a standard northbound off-ramp. The realignment of the mainline will affect the alignment of several existing structures including the I-19 over the Santa Cruz River bridges and the I-19 over the San Xavier Road bridges. – The location of the Los Reales TI will be immediately on top of the Hughes Wash. The westerly intersection will end up on a bridge. This presents complicated bridge design along with other constructability issues. – This alternative will have short-term, moderate negative impacts on existing access and existing traffic patterns. However, the improved facility will result in long-term benefits for the adjacent neighborhoods and businesses.	There are less constructability issues associated with this alternative, since the mainline horizontal and vertical alignments in this alternative substantially conform to the existing I-19 alignment. – The southbound braided ramp between Ajo Way and Irvington Road and between Drexel Road and Valencia Road were moved closer to the Ajo Way and Drexel Road interchanges to make use of the elevated interchange. This reduced the amount of retaining walls and borrow material needed to construct the braided ramps. – This alternative will have short-term, moderate negative impacts on existing access and existing traffic patterns. However, the improved facility will result in long-term benefits for the adjacent neighborhoods and businesses.
Impacts to Utilities	This alternative will have minimal impacts on existing utilities located in the median.	This alternative will have significant impacts on the existing utilities within the existing right-of-way, and adjacent to the right-of-way. Impacted utilities will require adjustments or relocations. The southbound braided ramp between Drexel Road and Valencia Road will impact the WAPA power lines running parallel to I-19 on the west side.	This alternative will have significant impacts on the existing utilities within the existing right-of-way, and adjacent to the right-of-way. Impacted utilities will require adjustments or relocations. The southbound braided ramps between Drexel Road and Valencia Road were realigned. Thus, the impacts to the WAPA power lines running parallel to I-19 on the west side were less than Alternative #1.
Estimated Cost	$33.0 million	$478.2 million	$485.1 million
Public & Stakeholder's Acceptance	None	This alternative has moderate public and stakeholder's acceptance. Stakeholders requested the following changes to this alternative: – Provide an alternative design at the northbound off-ramp at San Xavier Road to avoid, reduce, or otherwise mitigate the environmental impacts to Martinez Hill. – Provide an alternative design that accommodates all traffic movements between Ajo Way and the I-19/I-10 system TI. – Provide an alternative design at the southbound braided ramp between Drexel Road and Valencia Road to reduce the impacts to the City of Tucson/Pima Community College Section 4(f) joint use property on the west side of I-19.	This alternative has better public and stakeholder's acceptance. This alternative incorporates the stakeholders requested modifications to Alternative #1. Namely: – The northbound off-ramp at San Xavier Road will minimize the environmental impacts at Martinez Hill. – All traffic movements between Ajo Way and the I-19/I-10 system TI will be accommodated. – The southbound braided ramp between Drexel Road and Valencia Road will reduce the impacts to the City of Tucson/Pima Community College Section 4(f) joint use property on the west side of I-19.

1. Impacts associated with the No-Action Alternative and Alternative #1 were based on qualitative analyses. The right-of-way impacts, cost estimate, relocations/displacements were approximate. The Scope of Work for the Environmental Assessment does not include analyzing them in detail.

4.0 Major Design Features Of The Recommended Alternative

4.1 Introduction

To meet the Year 2030 traffic demand and other project objectives, the Recommended Alternative includes the following improvements to the I-19 corridor between San Xavier Road and I-10:

- Widen I-19 to 4 lanes in each direction between San Xavier Road and I-10.
- Construct a modified split diamond interchange between San Xavier Road and Los Reales Road connected with CD roads. Where the existing modified diamond interchange at San Xavier Road is reconstructed to a modified half-diamond interchange, a new modified half-diamond interchange is constructed at Los Reales Road, and CD roads are constructed to connect the two modified half-diamond interchanges together.
- Construct new SPUI at Drexel Road.
- Reconfigure the existing diamond TI at Irvington Road to a SPUI.
- Reconfigure the existing partial clover leaf TI at Ajo Way to a SPUI.
- Construct braided ramps and CD roads between Ajo Way and I-10 to accommodate all traffic movements between Ajo Way and the I-19/I-10 TI.
- Construct braided ramps in the southbound direction between Ajo Way and Irvington Road and between Drexel Road and Valencia Road.
- Providing auxiliary lanes for northbound I-19 between: Los Reales Road and Valencia Road, Valencia Road and Drexel Road, Drexel Road and Irvington Road, Irvington Road and Ajo Way, and Ajo Way and I-10.
- Providing auxiliary lanes for southbound I-19 between: I-10 and Ajo Way, Irvington Road and Drexel Road, and Valencia Road and Los Reales Road.
- Widen Ajo Way to a-6 lane divided roadway and Drexel Road to a 4-lane divided roadway.

Other improvements will include a new pedestrian bridge over I-19 near Michigan Street, sound barriers, concrete median barrier, signing and pavement markings, drainage facilities, and freeway lighting. ITS infrastructure including ramp metering will be included as needed.

The Recommended Alternative was a result of introducing refinements and design changes to the *2003 I-19 Corridor Study* Recommended Alternative, as requested by various stakeholders. To ensure that this alternative will address all of the stakeholders' concerns, several design iterations were performed on the sections of I-19 between Ajo Way and I-10, as well as the section between the Los Reales Road and San Xavier Road. These concerns and corresponding modifications to resolve the issues are described below.

ADOT, FHWA, and the Tohono O'Odham Nation requested alternatives that avoided, reduced, or otherwise mitigated the anticipated environmental impacts to Martinez Hill and provided a safer design at the San Xavier Road and Los Reales Road interchanges. Avoiding impacts to Martinez Hill resulted in moving the northbound exit ramp gore north of the San Xavier Road Bridge, which resulted in the need for a modified split diamond design. This design includes new CD roads running between the two interchanges. The Los Reales Road and San Xavier Road interchanges are spaced less than a mile apart and the use of CD roads eliminates the weaving movements between the exit and entrance ramps.

Northbound I-19 traffic will have one exit ramp located at San Xavier Road to service both San Xavier Road and Los Reales Road (via a CD road). The northbound on-ramp and southbound off-ramp will be adjusted to connect to the new CD roads. A connector road (spur) will connect San Xavier Road with the northbound CD road. San Xavier Road will be realigned at the new intersection, so that the existing design features not meeting current design standards will be reconstructed to meet current design standards.

Southbound I-19 traffic will have one exit ramp located at Los Reales Road to service both Los Reales Road and San Xavier Road (via a CD road). The Los Reales Road southbound entrance ramp will be retained because of the circuitous movements required at the San Xavier Road intersections. Due to the skew of San Xavier Road, the ramp/CD road intersections will remain staggered. See the roadway plans provided in Appendix B.

The southbound braided ramp between Ajo Way and Irvington Road and between Drexel Road and Valencia Road were moved closer to the Ajo Way and Drexel Road interchanges to make use of the elevated interchange. This move shortened the retaining walls and reduced the amount of borrow material needed to construct the braided ramps. The traffic analysis also identified the need for a southbound auxiliary lane between Irvington Road and Drexel Road due to the close proximity of the two TIs.

ADOT and FHWA requested alternatives that provide a full range of movements between Ajo Way and the I-19/I-10 system TI. Northbound braided ramps were added between I-19 and I-10 to eliminate weaving between the I-19 exit and I-19 entrance ramps. A new CD road was added between the northbound I-19 entrance ramp and the I-19 exit ramp to I-10 eastbound ramp, which gives northbound traffic coming from Ajo Way the option to either enter I-19 northbound or go to I-10 eastbound. Southbound braided ramps were added between I-10 and I-19 to eliminate weaving between the southbound exit ramp to Ajo Way and the southbound entrance ramp from westbound I-10. The westbound I-10 to southbound I-19 on-ramp also splits to provide I-10 westbound to I-19 southbound traffic the option to exit to Ajo Way directly without entering the I-19 mainline. A new CD road was also added connecting the eastbound I-10 frontage road to the southbound I-19 ramp, which also gives travelers the option to either go to southbound I-19 or directly to Ajo Way. Roadway plans for the Recommended Alternative are included in Appendix B.

4.2 Design Controls

Under the ADOT functional classification system, I-19 within the study limits is classified as an Urban Interstate. A summary of the design controls for the mainline lanes is provided in Table 4-1, for service ramps in Table 4-2, for the CD roads in Table 4-3, for the urban arterials (Ajo Way, Irvington Road, Drexel Road, Valencia Road, and Los Reales Road) in Table 4-4, and for the fringe urban undivided highway (San Xavier Road) in Table 4-5.

Table 4-1: Design Controls for Urban Freeways

DESCRIPTION OF CRITERIA	VALUES FOR DESIGN
Design Year	2030
Design Speed	65 mph
Superelevation	0.06 ft./ft. maximum, RDG Table 202.3B
Cross Slope	2.0%
Lane Width	12 ft.
Outside Shoulder Width	12 ft.
Inside Shoulder Width	12 ft.
Maximum Horizontal Curve (Degree of Curvature)	2 degrees, 30 minutes
Minimum Gradient Maximum Gradient	0.4% - with curb and gutter 0.25% - without curb and gutter 3%
Taper Rate	65:1 (Design Speed:1)
Cut Slopes: Fill Slopes:	Varies; 3:1 maximum Varies; 3:1 maximum
Minimum Vertical Clearance: Highway Structure Pedestrian Overpass	 16.5 ft. 17.5 ft.
Design Vehicle	WB-67

Table 4-2: Design Controls for Service Ramps

DESCRIPTION OF CRITERIA	VALUES FOR DESIGN
Design Year:	2030
Design Speed:	
Ramp Terminus	35 mph
Ramp Body	50 mph
Entrance Ramp Gore	55 mph
Exit Ramp Gore	60 mph
Superelevation:	0.06 ft./ft. maximum, RDG Table 202.3B
Horizontal Curve:	
Minimum Length Low Speed	300 ft.
Minimum Length High Speed	500 ft.
	Use tangent alignment with 160 feet min of crossroad EP
Ratio of Successive Curves	2:1 or less
Maximum Gradient:	
Upgrade:	4%
Downgrade	5%
400’ Advance of Stop Bar	3%
Min Grade with Curb	0.40%
Max Grade Breaks at Terminus	2% or less Desirable; 4% max
Maximum Grade Breaks	0.2%
Minimum Vertical Curve Length	
Terminus	200 ft
Body	400 ft
Design Vehicle	WB-67

Table 4-3: Design Controls for CD Roads/Connector Roads (Spur)

DESCRIPTION OF CRITERIA	VALUES FOR DESIGN
Design Year:	2030
Design Speed:	
CD Roads- Between Interchanges	55 mph
CD Roads- At Terminus with Crossroad	35 mph
Connector Road (Spur)	30 mph
Superelevation	0.06 ft./ft. maximum, RDG Table 202.3B
Lane Width	12 ft.
Shoulder Width:	
Inside	2 ft.
Outside	4 ft.
Maximum Horizontal Curve (Degree of Curvature)	3 degree
Minimum Length	500 ft.
Maximum Gradient	6%
Maximum Grade Breaks	0.2% Grade Breaks are Undesirable
Minimum Vertical Curve Length	3 x Design Speed
Slope Standards:	
Cut Slopes	Varies, 3:1 maximum
Fill Slopes	Varies, 3:1 maximum
Minimum Vertical Clearance:	
Highway Structure	16.5 ft.
Sign Structure	17.0 ft.
Design Vehicle	WB-67

Table 4-4: Design Controls for Urban Arterials

DESCRIPTION OF CRITERIA	VALUES FOR DESIGN
Design Year	2030
Design Speed:	
Between Interchanges	50 mph
At Terminus with Crossroad	35 mph
Superelevation	0.04 ft./ft. maximum
Lane Width	12 ft.
Shoulder Width:	
Inside	2 ft.
Outside	5 ft. (Includes 2-ft Gutter Width)
Median Width	16 ft. (Divided)
Sidewalk Width	5 ft.
Maximum Horizontal Curve (Degree of Curvature)	1 degree
Minimum Length	15 x Design Speed
Maximum Gradient:	6%
Maximum Grade Breaks	0.2% Grade Breaks are Undesirable
Minimum Vertical Curve	3 x Design Speed
Slope Standards:	
Cut Slopes	Varies, 3:1 maximum
Fill Slopes	Varies, 3:1 maximum
Minimum Vertical Clearance:	
Highway Structure	16.5 ft.
Sign Structure	17.0 ft.
Design Vehicle	WB-67

Table 4-5: Design Controls for Fringe-Urban Undivided Highway

DESCRIPTION OF CRITERIA	VALUES FOR DESIGN
Design Year	2030
Design Speed	50 mph
Superelevation	0.06 ft./ft. maximum
Lane Width	12 ft.
Shoulder Width:	
Inside:	2 ft.
Outside:	8 ft. (4 ft. adjacent to right turn lanes)
Maximum Horizontal Curve (Degree of Curvature)	1 degree
Minimum Length	15 x Design Speed
Maximum Gradient	6%
Maximum Grade Breaks	0.2% Grade Breaks are Undesirable
Minimum Vertical Curve	3 x Design Speed = 150 ft.
Slope Standards:	
Cut Slopes:	Varies, 3:1 maximum
Fill Slopes:	Varies, 2:1 maximum
Minimum Vertical Clearance:	
Highway Structure	16.5 ft.
Sign Structure	17.0 ft.

4.3 Horizontal and Vertical Alignment

The project begins around Station 2982+00 (approximately 0.65 miles south of the San Xavier Road overpass). The project beginning point will include the roadway improvements associated with the reconstruction of the San Xavier Road TI. The I-19 mainline widening ends around Station 3320+00 (approximately 0.85 miles north of the Ajo Way underpass), where it will match the recently constructed I-19/I-10 system TI. The project ends at the I-10 interchange where the connector ramps between I-19 and I-10 are being widened.

The mainline horizontal and vertical alignments in the Recommended Alternative substantially conform to the existing I-19 alignment. The horizontal alignment of I-19 includes long tangent sections with a total of 5 horizontal curves along this 6.7 mile section. Of the five curves, only two horizontal curves have a degree of curvature greater than 30 minutes.

- South of the Valencia Road TI (MP 58.82), the I-19 mainline traverses a 3,400 foot long horizontal curve with a radius of 11,460 feet (0.5 degree of curvature).
- At the I-19/I-10 system TI (MP 62), the I-19 mainline traverses a 2,206 foot long horizontal curve with a radius of 4,584 feet (1.25 degree of curvature).

Along the crossroads, the horizontal and vertical alignments will be as follows:

- The San Xavier Road horizontal alignment will remain in the current configuration. The vertical alignment will be modified to lower San Xavier Road to provide the required vertical clearance.
- The existing Los Reales Road is a two lane road that starts and ends east of I-19 and has no access with I-19. The new Los Reales Road will be extended to the west side of I-19. The new Los Reales Road will be realigned to the north to avoid the Hughes Wash. East of I-19, a 675 foot long horizontal curve with a radius of 1,432 feet (4 degree of curvature) will be introduced.
- The Valencia Road horizontal and vertical alignment will remain in the current configuration.
- The Drexel Road horizontal alignment will remain in the current configuration. The vertical alignment will be modified to raise Drexel Road to provide the required vertical clearance.
- The Irvington Road horizontal alignment will remain in the current configuration. The vertical alignment will be modified to raise Irvington Road to provide the required vertical clearance.
- The Ajo Way horizontal alignment will be shifted to the south for maintenance of traffic during construction. The vertical alignment will be modified to raise Ajo Way to provide the required vertical clearance.
- The I-10 horizontal and vertical alignment will remain in the current configuration.

Existing design features not meeting current design standards are reconstructed to meet current design standards, including reconstructing the normal crown cross slope on the I-19 mainline from 1.5% to 2%, lowering the San Xavier Road profile under I-19 to meet the required vertical clearance, realigning the northbound off-ramp at San Xavier Road to meet the minimum curve radius for the required design speed, reconstructing the superelevations on the ramps, providing wider shoulders on the I-19 mainline, ramps, and crossroads, and providing longer acceleration/deceleration lanes. Plan and profile drawings for the Recommended Alternative are presented in Appendix B.

4.4 Access Control

A determination of Engineering and Operational Acceptability Report was prepared for the *2003 I-19 Corridor Study* Recommended Alternative (Alternative #1) in October, 2003. This Design Concept Report as well as the Environmental Assessment being prepared in support of this study evaluated the three alternatives and selected Build Alternative #2 as the Recommended Alternative. A Change of Access Report is being prepared for the Recommended Alternative (Build Alternative #2) in conjunction with this study. The Change of Access Report addresses any changes to the existing access control, including new access points and modifications to existing access points.

The Recommended Alternative will add two new TIs located at Drexel Road and at Los Reales Road. The new TIs were located to maintain reasonable spacing of about one (1) mile between existing and new TIs. The proposed locations are the only possible locations for these new TIs. The Recommended Alternative will also modify several of the existing TI configurations, add or remove new ramps, and modify existing ramps into braided ramps. The locations where a Change of Access is requested are illustrated in Table 4-6.

The existing and proposed access control on I-19 and along the crossroads is shown on the roadway concept plans contained in Appendix B.

Table 4-6: Requested Change of Access Locations

Traffic Interchange	Type of Modification
San Xavier Road	Reconfigure the existing modified diamond TI into a modified half-diamond TI, provide CD roads between San Xavier Road and Los Reales Road, and reconstruct the existing ramps north of San Xavier Road to connect to the CD roads instead of I-19.
Los Reales Road	Construct a new modified half-diamond TI.
Drexel Road	Construct a new TI.
I-19/I-10 system TI	Provide CD roads between Ajo Way and I-10, and provide ramp connections between Ajo Way and the CD roads. Provide a ramp connection between the eastbound I-10 frontage road and the flyover ramp from westbound I-10 to southbound I-19. Remove the existing ramp connection between the eastbound I-10 frontage road and southbound I-19.

San Xavier Road TI

Access control along San Xavier Road east of I-19 will be modified: on the south side of San Xavier Road, the access control will be extended easterly to the new location of the northbound ramp terminal. On the north side of San Xavier Road, the access control will be extended easterly to the new location of the northbound ramp while allowing for a driveway access about 600 ft west of the ramp terminal. Access along the connector road (spur) and along the CD road will be controlled.

Access control along San Xavier Road west of I-19 will remain unchanged.

Los Reales Road TI

Access control along Los Reales Road east of I-19 will extend to Santa Clara Avenue. Access control along Los Reales Road west of I-19 will extend to the southbound ramp terminal. Access along the CD road will be controlled.

Drexel Road TI

Access control along Drexel Road west of I-19 will be modified: on the south side of Drexel Road, the access control will extend to Calle Santa Cruz. On the north side of Drexel Road, the access control will extend to the existing driveway about 1,200 feet west of I-19. Access to the existing driveway will be changed to right-in right-out.

Access control along Drexel Road east of I-19 will extend to Santa Clara Avenue.

4.5 Right-of-Way and Land Use

The mainline widening will not require new right-of-way as the widening will occur in the median. The new right-of-way width varies along I-19 throughout the study area. New right-of-way will be required to:

- Construct new TIs at Los Reales Road and Drexel Road. The new right-of-way will flare at all four quadrants.
- Accommodate the new CD roads between San Xavier Road and Los Reales Road. The new CD road west of I-19 will fit within the existing right-of-way, while new right-of-way will be required to accommodate the CD road east of I-19. The new right-of-way will also be required to accommodate the realigned northbound on-ramp at San Xavier Road.
- Accommodate the new braided ramps between Valencia Road and Drexel Road west of I-19, between Irvington Road and Ajo Way west of I-19, and between Ajo Way and the I-19/I-10 system TI east and west of I-19.

The ultimate right-of-way width will be generally 300 feet south of San Xavier Road, 370 feet between San Xavier Road and Los Reales Road, 350 feet between Los Reales Road and Valencia Road, 370 feet between Valencia Road and Drexel Road, 300 feet between Drexel Road and Irvington Road, 350 feet between Irvington Road and Ajo Way, and 550 feet between Ajo Way and I-10.

The Recommended Alternative will require approximately 75 acres of new right-of-way (approximately 35 acres privately owned and 40 acres public land/land under the jurisdiction of the Tohono O'Odham Nation). The 35 acres privately owned consist of 23 acres residential, 3 acres residential owned by the Pascua Yaqui Tribe, 8 acres commercial/industrial, and 1 acre owned by TEP. The 40 acres of public land/land under the jurisdiction of the Tohono O'Odham Nation land consists of 25 acres of public land and 15 acres under the jurisdiction of the Tohono O'Odham Nation). An existing 100-foot-wide easement underlying a WAPA electrical transmission line will also be impacted. The new right-of-way acquisition will be as follows:

- Acquisition of 13 acres of new right-of-way (mostly east of I-19) is anticipated to construct CD roads northbound from San Xavier Road to the new Los Reales TI. This property is currently owned by the Tohono O'Odham Nation.
- Acquisition of 11 acres of new right-of-way (3 acres west of I-19, and 8 acres east of I-19) is anticipated to construct the new Los Reales TI. West of I-19, 2 acres are commercial and 1 acre is owned by the Tohono O'Odham Nation. East of I-19, 1 acre is owned by TEP, 1 acre is owned by the Tohono O'Odham Nation, and 6 acres are private residential.
- Acquisition of 16.5 acres of new right-of-way west of I-19 is anticipated to construct the new southbound on-ramp and off-ramp at Drexel Road and reconstruct the existing southbound off-ramp at Valencia Road to a braided ramp. Of this property, 2 acres are owned by Pima County, 3 acres are owned by the City of Tucson, 6.5 acres are owned or leased by Pima Community College (a 100-foot-wide easement underlies a WAPA electrical transmission line within this property), 1 acre is owned by WAPA, and 4 acres of commercial land is held by the Tucson Spectrum Mall.
- Acquisition of 9.5 acres of new right-of-way east of I-19 is anticipated in order to construct the new northbound on-ramp and off-ramp at Drexel Road. This property is an established residential area.
- Acquisition of 11 acres of new right-of-way west of I-19 is anticipated to reconstruct the existing southbound on and off-ramps between Irvington Road and Ajo Way to braided ramps. Of this property, 3.5 acres are currently owned by the City of Tucson, and 7.5 acres are private residential properties.
- Acquisition of 13.5 acres of new right-of-way (8 acres west of I-19 and 5.5 acres east of I-19) is anticipated to reconstruct the existing ramps between Ajo Way and I-10, to braided ramps. West of I-19, 8 acres are currently owned by the City of Tucson. East of I-19, 1 acre is owned by the City of Tucson, 1.5 acres are zoned commercial, and 3 acres are zoned residential property owned by the Pascua Yaqui Nation. However, this property

is not designated as part of the Pascua Yaqui Nation. The EA for this project addresses the impacts to the Pascua Yaqui Nation owned property.

ADOT will acquire new right-of-way for each phase of implementation separately during the design stage for that phase in accordance with FHWA and State of Arizona policy.

Approximately 109 properties will be impacted, 82 property relocations/displacements and 27 partial property acquisitions. Of these properties, 82 are privately owned residences, 13 are privately owned commercial properties, 13 are government owned, and 1 is a privately owned educational facility. No businesses or facilities will be closed, relocated, or displaced (approximately 120 parking spaces will be removed from the Santa Cruz Retail Center east of I-19 and north of Drexel Road).

The Recommended Alternative will convert 75 acres into a permanent transportation facility. Approximately 35 acres are residential, commercial, and industrial land (of which, 3 acres owned by the Pascua Yaqui Tribe, and 1 acre owned by TEP), and approximately 40 acres are public land and property under the jurisdiction of the San Xavier District. The predominant land uses adjacent to the project area are residential, commercial, public, and vacant or undeveloped. These land uses will not be altered by the implementation of this project.

A temporary construction easement will be required to erect the new pedestrian overpass at Michigan Street (between the Irvington Road and Ajo Way TIs).

The Recommended Alternative could result in approximately 25 acres of existing excess right-of-way due to the reconstruction of the TIs at Irvington Road and at Ajo Way (approximately 15 acres of right-of-way east of I-19 at the Irvington Road TI and 10 acres at the Ajo Way TI).

4.6 Drainage

ADOT Operational Drainage Frequency Classes system has classified all state highway routes into four classes of relative operational importance. For each class, an operational storm frequency has been established that identifies the acceptable level of risk that highway capacity will be reduced or the highway will be damaged during a storm. I-19 is designated as a Class 1 facility in ADOT's system. Thus the cross drainage design within the corridor will be required to meet a minimum of the 50-year storm event with a check for the 100-year storm documented in the analysis (ADOT RDG Chapter 600, Table 603.2B). Pavement drainage will be required to meet a 10-year storm event for both storm drain systems and cut and median ditches. The RDG states that storm frequency may be controlled by other considerations such as FEMA regulations.

Procedures and methods outlined in ADOT's Highway Drainage Manual and ADOT's RDG were used in designing the drainage facilities. Cross drainage structures were evaluated using, where applicable, flow values generated in the *City of Tucson's Master Stormwater Study* (1995) and ADOT's *I-19 Corridor Drainage Report Study* (2003).

A Drainage report has been prepared in conjunction with this study. This Drainage report is included in Appendix D of this report.

4.6.1 Cross Drainage

The cross culvert improvements are generally augmentations and extensions to existing structures. A complete evaluation of the downstream channel capacity is being prepared in conjunction with this DCR. A system of Reinforced Concrete Box Culverts (RCBCs) and channels conveying Rodeo Wash flows parallel to Ajo Way will replace the existing channel to the Santa Cruz River. A new RCBC planned to carry a portion of the 16th Street Wash flow under I-19 will require a channel to the Santa Cruz River.

Hydraulic analyses were performed for all cross culverts, excluding the bridge structures. Watersheds and wash flow paths that cross I-19 with the use of bridge structures, such as Hughes Wash and Airport Wash, will be analyzed during the structure selection process during final design. Wash cross culverts analysis utilized the 50-year and 100-year flows to ascertain if deficiencies in existing facilities exist. Also, where applicable, initial evaluations were made using the FEMA regulated washes that have a 100-year base flood elevation.

The existing cross drainage structures were evaluated to identify deficiencies and recommended structure augmentations and extensions. The findings were documented in the Initial Drainage Report. The 100-year surface water elevations along FEMA regulated washes will need further study to ensure that backwater effects are mitigated. All structures will need to be evaluated to identify utility conflicts and design revisions. The proposed improvements stem from a conservative estimate of off-site storm drainage project needs. Table 4-7 illustrates the major wash cross culvert recommendations, and Table 4-8 illustrates the non-major wash cross culvert recommendations. These tables list the existing and proposed cross culvert structures, the culvert size, material type, and number of barrels.

A detailed drainage report will be required during final design to verify the conceptual cross drainage design, refine the estimated flows, verify the 100-year surface water elevations along FEMA regulated washes, and design necessary protective measures for culverts and channels.

Table 4-7: Existing and Proposed Major Washes Cross Culvert Recommendations

Wash ID	Existing Culvert	Existing Material	Existing No. of Barrels	Retain Existing	Extend Inlet	Extend Outlet	Proposed Culvert	Proposed Material	Additional No. of Barrels
Hughes	Bridge Structures, Widen								
Santa Clara	8'X7'	RCBC	2	Yes	No	No	8'X7'	RCBC	2
El Vado	10'X5'	RCBC	4	Yes	No	No	10'X5'	RCBC	4
Valencia	10'X5'	RCBC	4	Yes	No	Yes	10'X5'	RCBC	4
Mission Park	10'X4'	RCBC	2	Yes	No	Yes	10'X4'	RCBC	2
Airport	Bridge Structures, Widen								
Nebraska	10'X5'	RCBC	2	Yes	No	No	10'X5'	RCBC	2
Wyoming	10'X7'	RCBC	3	No	-	-	10'X6'	RCBC	4
Irvington	10'X4'	RCBC	1	No	-	-	6'X6'	RCBC	2
Irvington 485+40	10'X7'	RCBC	3	Yes	No	Yes	10'X7'	RCBC	3
Rodeo	9'X4'	RCBC	5	Yes	Yes	Yes	9'X4' 9'X5'	RCBC RCBC	5 1
Rodeo at Ajo	-	-	-	-	-	-	8'X8'	RCBC	4
16th Street	10'X6'	RCBC	4	Yes	Yes	Yes	10'X6'	RCBC	4

Table 4-8: Existing and Proposed Non-Major Washes Cross Culvert Recommendations

Station	Existing Culvert	Existing Material	Existing No. of Barrels	Retain Existing	Extend Inlet	Extend Outlet	Proposed Culvert	Proposed Material	Additional No. of Barrels
3070+21	-	-	-	-	-	-	36”	CMP	1
3070+75	24”	CMP	1	No	-	-	Relocate to 3070+21	-	-
3074+50	24”	CMP	1	No	-	-	Remove existing	-	-
3078+40	24”	CMP	1	No	-	-	24”	CMP	3
3096+50	42”	RCP	1	No	-	-	42”	RCP	1
3135+60	57"X38"	CMPA	3	No	-	-	57"X38"	CMPA	3
3138+66	45"X29"	ERCP	4	Yes	No	Yes	45”X29”	ERCP	4
3156+00	59"X37"	CMPA	1	Yes	Yes	Yes	59”X37”	CMPA	2
3165+80	52"X29"	CMPA	2	No	-	-	Relocate to 3166+65	-	-
3168+10	-	-	-	-	-	-	36”	RCP	4
3175+50							36”	RCP	3
3175+70	36”	RCP	1	No	-	-	Relocate to 3175+50		
3178+95	24”	RCP	2	No	-	-	24”	RCP	2
3211+70	24”	RCP	1	No	-	-	Channel to Wyo. Wash	-	-
3232+18	50"X34"	CMPA	2	No	-	-	24”	RCP	2
3243+50	10’X4’	RCBC	1	No			Relocate to 3249+35		
3249+35	-	-	-	-	-	-	6’X6’	RCBC	2
3249+37	54”	RCP	1	No	-	-	Relocate to 3249+35	-	-
3291+47	-	-	-	-	-	-	6’ X 6’	RCBC	2
San Xavier 529+14	-	-	-	-	-	-	78”	CMP	2
San Xavier Ramp B 14+77	-	-	-	-	-	-	36”	RCP	2
Los Reales 503+45	-	-	-	-	-	-	36”	RCP	2
Los Reales 513+80	-	-	-	-	-	-	36”X23”	RCPA	7
10W19S 18+81	-	-	-	-	-	-	10'X6'	RCBC	1

Abbreviations: CMP = corrugated metal pipe; CMPA = corrugated metal pipe arch; ERCP = Elliptical Reinforced Concrete Pipe; RCBC = reinforced concrete box culvert; RCP = reinforced concrete pipe; RCPA = reinforced concrete pipe arch

4.6.2 Pavement Drainage, Ditches and Area Inlets

The I-19 mainline has no existing storm drain system and drains via ditches. The northbound and southbound roadways are crowned sections, draining into v-ditches that either parallel the road or run in to the median. Median ditches are drained with a series of area inlets that discharge into cross culverts discharging flows into adjacent natural channels. Area drains will be provided at traffic interchanges and in the landscaped median north of Ajo Way to prevent ponding.

The CD roads have curb and gutter and contain a storm drain system. Analysis of the capacity will be forthcoming with the final design submittals.

4.7 Sections 401 and 404 of the Clean Water Act

Discharges of dredged and fill material into waters of the U.S. are regulated under Section 404 of the Clean Water Act. The U.S. Army Corps of Engineers issues authorizations for activities regulated under Section 404. Additionally, Section 401 of the Clean Water Act requires that the state, or appropriate jurisdiction, provide certification that a draft 404 permit is in compliance with effluent limits, the state’s water quality standards, or any other appropriate requirements of state law. Within the majority of the state, Arizona Department of Environmental Quality issues water quality certification under Section 401 of the Clean Water Act.

A Section 404 Jurisdictional Delineation for this project was approved by the Corps of Engineers on February 22, 2010 (Corps of Engineers file No. SPL-2005-2032-KAT). The Santa Cruz River and several washes located within the project limits are considered waters of the U.S. and under the jurisdiction of the Corps of Engineers. The project is anticipated to involve disturbance to waters of the U.S. in excess of one-half acre, and therefore, an A Section 404 Individual Permit will be required. Specific permit requirements under Section 404 of the Clean Water Act will be determined during final design, and the appropriate permit will be obtained prior to construction. All construction activities will comply with the terms and conditions of the Corps of Engineers Section 404 Permit

The National Pollutant Discharge Elimination System (NPDES) stormwater program, created under Section 402 of the Clean Water Act requires any construction project that will disturb one or more acres of land to obtain a permit for stormwater discharge (Permit No. AZG2008-001). Improvements to I-19 will require authorization under the Construction General Permit and preparation of a Stormwater Pollution Prevention Plan (SWPPP) as directed by Section 402(p) of the Clean Water Act since disturbance areas will exceed 1 acre.

4.8 Floodplain Considerations

A review of the FEMA Flood Insurance Map indicates that the project area is partially located within the 100-year floodplain. Impacts on floodplains typically occur when the topography of the project area is substantially modified by either placement or removal of materials within the floodplain. Several of the existing culverts will be removed and replaced with larger culverts, and several culverts will have additional culverts installed adjacent to them so that the existing 100-year floodplain elevations are not exceeded. The potential for the proposed project to affect the 100-year floodplain will be addressed in the EA.

4.9 Earthwork

The Recommended Alternative will be primarily a borrow project. The earthwork required to construct the I-19 mainline widening includes approximately 1.6 million cubic yards of borrow. Table 4-9 summarizes the earthwork quantities needed for each phase of implementation.

Table 4-9: Earthwork Quantities

Phase	Excavation (CY)	20% Shrink (CY)	Embankment (CY)	Borrow (CY)	Waste (CY)
Phase I	6,690	1,338	298,860	293,508	0
Phase II	4,411	882	363,454	359,925	0
Phase III	0	0	60,393	60,393	0
Phase IV	0	0	39,737	39,737	0
Phase V	11,633	2,327	397,826	388,520	0
Phase VI	237,232	47,446	359,789	170,003	0
Phase VII	115,464	23,093	351,323	297,352	0
Total	**375,430**	**75,086**	**1,871,382**	**1,609,438**	**0**

There are many commercial permitted materials sources located in Tucson that routinely supply aggregate and borrow for ADOT projects. These sources are within close proximity to the project site, but none have been identified within the project limits. For the purpose of this study, a shrinkage/swell factor of 20% was assumed. A preliminary geotechnical investigation report addressing earthwork in greater detail is being prepared in conjunction with this study.

4.10 Construction Phasing and Traffic Control

The Recommended Alternative will be constructed in phases. An implementation plan was developed using a logical sequence of construction phasing over time as future traffic demands warrant and funding becomes available. The plan is divided into seven major construction phases:

- Phase I – Reconstruct the Ajo Way TI (MP 61.90) including the Santa Cruz River bridge on Ajo Way and the Michigan Street pedestrian bridge. Additionally, this phase includes the reconstruction of portions of the I-19 mainline in the immediate area of the Ajo Way TI and the construction of the southbound I-19 braided off-ramp to Irvington Road. The estimated cost of this phase is approximately $89.8 million.
- Phase II – Reconstruct the Irvington Road TI (MP 60.95). The estimated cost of this phase is approximately $48.4 million.
- Phase III – Reconstruct the existing mainline to three lanes in each direction from Valencia Road to I-10 (MP 58.82 – MP 62.3). The estimated cost of this phase is approximately $86.3 million.
- Phase IV – Reconstruct the exiting mainline to three lanes in each direction from San Xavier Road to Valencia Road (MP 56.3 – MP 58.82). The estimated cost of this phase is approximately $66.4 million.
- Phase V – Construct the Drexel Road TI (MP 59.90) and the southbound I-19 braided off-ramp to Valencia Road (if the Drexel Road bridge over the Santa Cruz River is completed, the order of this phase should be reevaluated). The estimated cost of this phase is approximately $45.2 million.
- Phase VI – Construct the fourth outer lane in each direction of I-19 and any auxiliary lanes from Valencia Road to I-10 (MP 58.82 – MP 62.3), including the braided ramps between Ajo Way and I-19/I-10 system TI. The estimated cost of this phase is approximately $92.2 million.
- Phase VII – Reconstruct the San Xavier Road TI (MP 56.95) and construct Los Reales Road TI (MP 58.90) including the CD roads between San Xavier Road and Los Reales Road. Additionally, construct the fourth outer lane in each direction of I-19 and any auxiliary lanes from San Xavier Road to Valencia Road (MP 56.3 – MP 58.82). The estimated cost of this phase is approximately $56.9 million.

The Recommended Alternative will require construction along the mainline of I-19 and at San Xavier Road, Los Reales Road, Drexel Road, Irvington Road, Ajo Way, and the I-19/I-10 interchange ramps. The planned construction traffic plan in these areas will be as follows:

Traffic control shall be specified by a traffic control plan or procedures and guidelines specified in the ADOT Traffic Control Manual for Highway Construction and Maintenance and the Manual on Uniform Traffic Control Devices (MUTCD). The final construction phasing and traffic control plans will be developed during final design.

Coordination will be required with the local agencies to determine the project phasing restrictions that will be used for this project. These restrictions could include limits in the number of crossroads and ramp connections that will be under construction at the same time.

Access to adjacent properties during construction will be maintained. Access to police and emergency vehicles will be maintained at all times. The final construction phasing and traffic control plans will be prepared during final design.

I-19 Mainline Construction

Work along I-19 will require temporary lane closures, flaggers or both throughout construction. Traffic flow will be maintained in both directions throughout construction and two 12-foot-wide travel lanes with 2 feet of “shy distance” to the barriers will be provided.

During the construction of the new I-19 structures or widening of the existing structures, one 12-

foot-wide lane in each direction with 2 feet of shy distance to the barrier will be provided along I-19. Temporary pavement and lane shifts will be required throughout the construction period to maintain traffic on the crossroads. Construction phasing will be assessed further in the bridge selection report.

Temporary ramps and lane shifts will be required throughout the construction period to retain all service interchange connections with all freeways, and arterial street access.

Temporary concrete barrier will be placed adjacent to the existing freeway outside shoulders. All grading, drainage, pavement widening, local lanes construction, bridge widening, retaining wall demolition and construction, sign structure foundations, and other items will be protected by temporary concrete barrier.

San Xavier Road TI

Traffic flow will be maintained in both directions on I-19 throughout construction at San Xavier Road and one 12-foot-wide travel lane in each direction with 2 feet of shy distance to the barriers will be provided. Traffic control will be needed on San Xavier Road to accommodate construction activities.

Los Reales Road TI

Traffic flow will be maintained in both directions on I-19 throughout construction at Los Reales Road and one 12-foot-wide travel lane in each direction with 2 feet of shy distance to the barriers will be provided. Approach roadways will not be constructed until the bridge is completed; therefore, crossroad traffic control will not be required. Temporary night time closures on I-19 will be required during erection of the girders.

Drexel Road TI

Traffic flow will be maintained in both directions on I-19 throughout construction at Drexel Road and one 12-foot-wide travel lane in each direction with 2 feet of shy distance to the barriers will be provided. Traffic control will be needed on Drexel Road to accommodate construction activities and provide temporary traffic lanes. One lane of travel in each direction will be accommodated during construction. Temporary night time closures on I-19 will be required during removal and erection of the girders.

Irvington Road TI

Traffic flow will be maintained in both directions on I-19 throughout construction at Irvington Road and one 12-foot-wide travel lane in each direction with 2 feet of shy distance to the barriers will be provided. Traffic control will be needed on Irvington Road to accommodate construction activities and provide temporary traffic lanes. One lane of travel in each direction will be accommodated during construction. Temporary night time closures on I-19 will be required during removal and erection of the girders.

Ajo Way TI

Traffic flow will be maintained in both directions on I-19 throughout construction at Ajo Way and one 12-foot-wide travel lane in each direction with 2 feet of shy distance to the barriers will be provided. Traffic control will be needed on Ajo Way to accommodate construction activities and provide temporary traffic lanes. It is anticipated that one lane of travel in each direction will be accommodated during construction. Temporary night time closures on I-19 will be required during removal and erection of the girders.

I-19/I-10 System TI

The westbound I-10 to southbound I-19 flyover ramp traffic will be detoured around while the bridge structure over the new I-19 southbound off-ramp to Ajo Way is constructed.

The westbound I-10 to southbound I-19 flyover ramp traffic will be detoured around while the bridge structure over Julian Wash is widened. Traffic flow is expected to be detoured onto southbound I-19 before the bridge.

Michigan Street pedestrian bridge

The new structure will be located approximately 100 feet south of its existing location. The new bridge will be constructed to accommodate pedestrian traffic before the existing bridge is demolished. Traffic flow will be maintained in both directions on I-19 throughout construction and one 12-foot-wide travel lane in each direction with 2 feet of shy distance to the barriers will be provided. Temporary night time closures on I-19 will be required during removal and erection of the girders.

4.11 Traffic Design

I-19 will be widened to four travel lanes in each direction throughout the corridor. The total pavement width will be 72 feet for each direction. The mainline widening will generally occur in the median. A closed median with a 2 foot concrete median barrier separating the directions of travel is proposed from south of San Xavier Road to north of Ajo Way, where the median will widen to tie into the I-19/I-10 system TI.

All lane widths are proposed to be 12 feet throughout the corridor with 12-foot-wide inside and outside shoulders. The 12-foot (10-foot minimum) inside shoulder width should be provided at all bridge locations (offset from bridge pier for underpasses or offset from bridge concrete barrier for overpasses). The 12-foot-wide shoulders are desirable when truck traffic is greater than 250 trucks per direction during the peak period. Existing truck traffic currently exceeds this volume and freight movements along the corridor are expected to increase. Curb and gutter is not proposed along the mainline freeway and freeway drainage will be collected in linear ditches typically located east and west of I-19.

4.11.1 Traffic Interchanges

I-19/San Xavier Road TI and I-19/Los Reales Road TI

At the San Xavier Road TI, the existing modified diamond TI will be reconstructed to a half-diamond TI. CD roads will be constructed between San Xavier Road and Los Reales Road. The northbound on-ramp and southbound off-ramp will be adjusted to connect to the CD roads. A connector road (spur) will connect San Xavier Road with the northbound CD road.

Access to San Xavier Road will be provided from the north and south. Ramps will connect San Xavier Road to the I-19 mainline (south of San Xavier Road) or to the CD road (north of San Xavier Road).

One through lane in each direction will be provided on San Xavier Road within the interchange area. Two lanes will be provided on each ramp terminal (or CD road) approaching the crossroad. One westbound to southbound left-turn lane, one eastbound to northbound left-turn lane, and separate eastbound to southbound and westbound to northbound right-turn lanes will be provided. The intersections with the ramp terminals will continue to be controlled by STOP signs.

I-19/Los Reales Road TI

At the Los Reales Road TI, a new modified half-diamond TI will be constructed. CD roads will be constructed between San Xavier Road and Los Reales Road.

Access to Los Reales Road will be provided from the north and south. Ramps will connect Los Reales Road to the I-19 mainline (north of Los Reales Road) or to the CD road (south of Los Reales Road).

Two through lanes in each direction will be provided on Los Reales Road within the interchange area. Three lanes will be provided on each ramp terminal (or CD road) approaching the crossroad. The two westbound through lanes will become dual left-turn lanes at the T-intersection with the CD road, the eastbound to northbound left-turn movement will be allowed from the shared through-left lane, and a separate westbound to northbound right-turn lane will be provided. The two intersections with the ramp terminals will be controlled by new traffic signals.

The two modified half-diamond interchanges at San Xavier Road and at Los Reales Road will function as a modified split diamond interchange.

I-19/Valencia Road TI

At the Valencia Road TI, the existing SPUI will be maintained. Access to Valencia Road will be provided from the north and south. Ramps will connect Valencia Road to the I-19 mainline. Braided ramps in the southbound direction between Drexel Road and Valencia Road will be provided.

Three through lanes in each direction will be provided on Valencia Road within the interchange area. Three lanes will be provided on each ramp terminal approaching the crossroad. Two westbound to southbound left-turn lanes, two eastbound to northbound left-turn lanes, and separate eastbound to southbound and westbound to northbound right-turn lanes will be provided. The intersection with the ramp terminals will continue to be controlled by a traffic signal, but the traffic signal will be modified to accommodate the additional lanes on the off-ramps.

I-19/Drexel Road TI

At Drexel Road, a new SPUI will be provided. Access to Drexel Road will be provided from the north and south. Ramps will connect Drexel Road to the I-19 mainline. Braided ramps in the southbound direction between Drexel Road and Valencia Road will be provided.

Two through lanes in each direction will be provided on Drexel Road within the interchange area. Four lanes will be provided on the southbound ramp terminal approaching the crossroad, while three will be provided on the northbound ramp terminal. Two westbound to southbound left-turn lanes, two eastbound to northbound left-turn lanes, and separate eastbound to southbound and westbound to northbound right-turn lanes will be provided. The two intersections with the ramp terminals will be controlled by new traffic signals.

I-19/Irvington Road TI

At the Irvington Road TI, the existing diamond interchange will be reconstructed to a SPUI. Access to Irvington Road will be provided from the north and south. Ramps will connect Irvington Road to the I-19 mainline. Braided ramps in the southbound direction between Ajo Way and Irvington Road will be provided.

Three through lanes in each direction will be provided on Irvington Road within the interchange area. Four lanes will be required on the southbound ramp terminal approaching the crossroad, while three will be required on the northbound ramp terminal. Two westbound to southbound left-turn lanes, two eastbound to northbound left-turn lanes, and separate eastbound to southbound and westbound to northbound right-turn lanes will be required. The existing traffic signal at the existing two intersections with the ramp terminals will be replaced by one traffic signal at the new intersection location.

I-19/Ajo Way TI

At the Ajo Way TI, the existing partial clover leaf TI will be reconstructed to a SPUI. Access to Ajo Way will be provided from the north and south. Ramps will connect Ajo Way to the I-19 mainline. Braided ramps in the southbound direction between I-10 and Ajo Way, and between Ajo Way and Irvington Road will be provided. Braided ramps in the northbound direction between Ajo Way and I-10 will be provided.

Three through lanes in each direction will be provided on Ajo Way within the interchange area. Three lanes will be provided on each ramp terminal approaching the crossroad. Two westbound to southbound left-turn lanes, two eastbound to northbound left-turn lanes, and separate eastbound to southbound and westbound to northbound right-turn lanes will be required. The existing traffic signal at the existing two intersections with the ramp terminals will be replaced by one traffic signal at the new intersection location.

I-19/I-10 System TI

At the I-19/I-10 system TI, the existing fully directional interchange will be maintained. CD roads will be constructed between Ajo Way TI and the I-19/I-10 system TI. Ramps will connect I-10 with I-19 and the CD roads. Braided ramps will be provided on the southbound direction between I-10 and Ajo Way. Braided ramps will also be provided on the northbound direction between Ajo Way and I-10. A ramp connection will be provided between the eastbound I-10 frontage road and the flyover ramp from westbound I-10 to southbound I-19. The existing ramp connection between the eastbound I-10 frontage road and southbound I-19 will be eliminated.

4.11.2 Signing and Lighting

The existing guide signing will be modified to accommodate the braided ramps, the new TI at Drexel Road, and the new modified split diamond interchange at Los Reales/San Xavier. The new freeway guide signs within the project limits will be installed on cantilever sign supports, truss sign supports, or tubular sign bridges. The two changeable message signs within the project limits (mounted on truss sign supports) will be relocated to accommodate the braided ramps. Signing and Pavement Marking plans are included in Appendix B of this report. Signing and Pavement Marking design throughout the project was completed using the appropriate ADOT standards. No other special conditions are anticipated.

The existing high mast freeway lighting at the Valencia Road TI and the I-19/I-10 system TI will be retained. Minor lighting modifications will be made to the entrance and exit ramps within the study areas. New high mast lighting will be added to the proposed concrete median barrier along the I-19 mainline from San Xavier Road to the I-19/I-10 system TI. The median lighting system will include 69-foot-tall U-poles with two 400-watt high-pressure sodium high mast fixtures. The pole spacing is estimated to be 400 feet.

At the Ajo Way TI, Irvington Road TI, and the Drexel Road TI, high mast lighting will be added

within the interchange limits. Horizontal mounted luminaries and mast arms will be added to the San Xavier Road/Los Reales Road modified split diamond TI.

4.11.3 Freeway Management System (FMS)

Most of the existing FMS devices were installed in 2011. The roadway improvements under the Recommended Alternative will have minor impacts to the existing CCTV cameras and DMSs. A few CCTV Cameras and/or DMSs may need to be adjusted or relocated. The existing node building located at the southwest quadrant of the I-19/I-10 system TI will be maintained. The existing in-pavement loops for the Vehicle Detection System and Total Count Stations will be replaced.

ADOT has previously achieved communication redundancy through a primary and secondary fiber path on both sides of the freeway. The existing FMS trunk line will be extended from Hughes Wash (where it currently ends) to San Xavier Road. The trunk line will consist of fiber optic lines enclosed in four 3 inch conduits located outside the shoulders on both sides of I-19.

Additional FMS devices will be installed including CCTV cameras, Vehicle Detection Systems, and Total Count Stations. The proposed FMS devices would be provided through ADOT's procurement program. Table 4-10 shows the recommended locations of the additional FMS devices. The exact location, type, and number of FMS devices will be better defined during final design in coordination with the ADOT Multimodal Planning Division Group. The following section is intended to provide the general concept for the use and placement of the FMS devices upon completion of the construction of the roadway improvements under the Recommended Alternative.

According to the ADOT FMS Design Guidelines, DMS's shall be provided in each direction at three miles intervals. The existing DMS's are currently located at three mile intervals and it is not anticipated that additional DMS's will be required.

Table 4-10: Proposed FMS Devices

Freeway Corridor	Direction	Milepost	Location Description
CCTV Camera Locations			
I-19	N/A	57.0	San Xavier Road
Vehicle Detection System Locations			
I-19	Northbound & Southbound	57.0	San Xavier Road
Total Count Station Locations			
I-19	Northbound & Southbound	60.4	Between Drexel Road and Irvington Road
I-19	Northbound & Southbound	58.5	Between Los Reales Road and Drexel Road
I-19	Northbound & Southbound	57.5	Between San Xavier Road and Los Reales Road

CCTV cameras are typically installed at one mile intervals and are placed at the crossroad interchanges. Two cameras are typically located at a service TI. Spacing is often reduced where the horizontal and vertical alignments necessitate additional cameras for complete roadway coverage. One CCTV camera will be required at the San Xavier Road TI.

Vehicle Detection Systems are typically installed at locations where a traffic volume or speed change is anticipated. These locations would be at one-mile intervals, at entrance and exit ramps, and at the system interchange ramps. One two-directional Vehicle Detection System will be required at the San Xavier Road TI.

Total Count Stations are typically installed half way between two subsequent interchanges. Total Count Stations will be required between Drexel Road and Irvington Road, between Los Reales Road and Drexel Road, and between San Xavier Road and Los Reales Road.

4.12 Utilities, Railroads, and Irrigation Systems

The reconstruction of the I-19 corridor will have potential impacts on numerous utilities throughout the project. During final design, each utility company will receive and review the preliminary design for this project and develop plans for any relocations and/or adjustments.

Existing utilities within this project corridor were identified based on best available information, which included as-built plans provided by ADOT and facilities records/plans provided by utility companies. Stage I plans were also distributed to utility companies requesting them to verify the location of their facilities and indicate any corrections on the plans. Utility companies were also asked to indicate if their facilities were placed under permit or in own easement, and if there are any potential conflicts. The size, type of the utility (when available), and the owner of that utility was identified to the best information available.

Using the as-built plans and the conceptual plans developed for the I-19 mainline widening as a reference, it is anticipated that utilities impacted by this work will include:

- **El Paso Natural Gas.** Several gas transmission lines cross the I-19 corridor. Some of these lines may need to be relocated. Crossing locations include:

  South of the new Los Reales Road bridge (26" and 30" lines).

  At the I-19/I-10 system TI (two 10.75" lines).

- **Southwest Gas.** Several gas lines cross the I-19 corridor. Some of these lines may need to be relocated. Crossing locations include:

  North of the new Los Reales Road TI (4" line).

  North of Valencia Road TI.

  South of Ajo Way TI (2" line, and three others - unknown sizes).

- **Western Area Power Administration.** Several transmission lines cross the corridor. Some of these lines may be in private easements and may need to be relocated. Crossing locations include:

  At the new Los Reales Road bridge.

  North and south of Valencia Road.

  Along the west side of I-19 (parallel to the freeway) from the Bureau of Reclamation substation in the northwest quadrant of Valencia Road and I-19 to the Airport Wash.

- **Tucson Electric Power.** Several overhead power lines cross the I-19 corridor. Some of these lines will need to be relocated. Crossing locations include:

  Between San Xavier Road and the new Los Reales Road bridge (38 kV, and three others unknown sizes).

  North of Valencia Road (14 kV).

  South of Drexel Road (14 kV).

  North of Drexel Road at the Airport Wash (138 kV).

  South of Ajo Way (46 kV).

  North of Ajo Way (14 kV).

- **Pima County Regional Wastewater Reclamation Department.** Several waste water lines cross the corridor. Some of these lines will need to be relocated. Crossing locations include:

  At the new Drexel Road TI (21" clay).

  At the Irvington Road TI (21" clay, 20" clay, 8" clay, and 8" polyvinyl chloride (pvc)).

  Between Irvington Road and Ajo Way (21" clay, 10" clay, 8", and other unknown size).

  North of the Ajo Way TI (24").

  At the northbound I-19 to eastbound I-10 off-ramp (12" pvc).

- **Tucson Water**. Several water lines cross the corridor. Some of these lines will need to be relocated. Crossing locations include:

  At the northbound Valencia Road off-ramp (6" and 4" Cement Asbestos (CA)).

  At the new Drexel Road TI (8" CA).

  South of the Irvington Road TI.

  North of Irvington Road.

  South of Ajo Way Road.

  North of Ajo Way Road.

  At the westbound I-10 to southbound I-19 connector ramp (30" Ductile Iron (DI)).

  At the eastbound I-10 frontage road to southbound I-19 ramp (8").

- **ADOT**. Several street lighting lines cross the I-19 corridor. Some of the lines will need to be relocated. Crossing locations include:

  At the San Xavier Road TI.

  At the Valencia Road TI.

  At the Irvington Road TI.

  At the Ajo Way TI.

- **Other utilities:** Several other utility lines cross the corridor. Some of the lines will need to be relocated. Crossing locations include:

  A telecommunication line north of the new Los Reales Road.

  A telecommunication line north of Valencia Road.

  A fiber optic line south of Drexel Road.

  A telecommunication line south of Ajo Way.

  Some of these lines will need to be relocated.

There are no existing or proposed railroads within the study limits.

4.13 Structures

Structures located along the mainline between the Santa Cruz River and the I-19/I-10 system TI will be widened to accommodate the ultimate section of I-19. Structures listed as being widened at the time of this report may eventually become replacements depending on the future condition of the structure at final design. Table 4-11 lists all the structures within the study area for this DCR. Additional information for an individual structure may be found in the site-specific discussions that follow.

Table 4-11: Existing and New Structures

Structure Number	Milepost	Structure Name	Profile Type	Construction Type	Original Project No.	No. of Spans	Existing Super	Length (ft.)	Minimum Vertical Clearance (ft.)
1243	56.80	Santa Cruz Riv Br northbound	Bridge	Widen and Replace Deck	I-19-1(9)	5	Steel Plate Girders	517	n/a
1244	56.80	Santa Cruz Riv Br southbound	Bridge	Widen and Replace Deck	I-19-1(9)	4	Steel Plate Girders	411	n/a
1245	56.95	San Xavier TI OP northbound	Overpass	Widen	I-19-1(9)	3	Steel Plate Girders	197	15.34
1246	56.95	San Xavier TI OP southbound	Overpass	Widen	I-19-1(9)	3	Steel Plate Girders	195	15.44
1247	57.85	Bridge northbound	Bridge	Widen	I-19-1(9)	3	CIP T-Girders	109	n/a
1248	57.82	Bridge southbound	Bridge	Widen	I-19-1(9)	3	CIP T-Girders	109	n/a
n/a	57.80	Los Reales Ramp B	Bridge	New	n/a	TBD	n/a	97	n/a
n/a	57.90	Los Reales Ramp A	Bridge	New	n/a	TBD	n/a	117	n/a
n/a	58.00	Los Reales TI UP	Underpass	New	n/a	TBD	n/a	186	n/a
1943	58.82	Valencia Rd TI UP	Underpass	None	I-19-1(127)	2	AASHTO TYPE V Mod.	204	17.60
n/a	n/a	Drexel Ramp A	Underpass	New	n/a	TBD	n/a	42	n/a
1120	59.90	Drexel Road UP	Underpass	Replace	I-19-1(5)	4	Steel Plate Girders	250	16.50
1121	60.32	Airport Wash Br northbound	Bridge	Widen	I-19-1(5)	4	Concrete Slab	147	n/a
1122	60.32	Airport Wash Br southbound	Bridge	Widen	I-19-1(5)	4	Concrete Slab	147	n/a
1123	60.95	Irvington Rd TI UP	Underpass	Replace	I-19-1(5)	4	Steel Plate Girders	250	16.20
1124	61.40	Pedestrian UP	Underpass	Replace and Relocate	I-19-1(5)	5	Steel Rigid Frame w/ suspension	282	17.10

Structure Number	Milepost	Structure Name	Profile Type	Construction Type	Original Project No.	No. of Spans	Existing Super	Length (ft.)	Minimum Vertical Clearance (ft.)
n/a	n/a	Ajo Way Ramp A	Underpass	New	n/a	TBD	n/a	42	n/a
1125	61.90	Ajo Way UP	Underpass	Replace	I-19-1(5)	4	Steel Girders	263	15.98
528	SR 86 171.07	Santa Cruz River Br	Bridge	Replace	S-222(14)	3	Prestressed I-Girder	208	n/a
n/a	n/a	Ramp 19N-10E/ Ajo Way Ramp D	Underpass	New	n/a	TBD	n/a	31	n/a
n/a	n/a	Ajo Way Ramp C4	Bridge	New	n/a	TBD	n/a	230	n/a
2531	62.67	I-19 Ramp W-S	Bridge	Replace	NH-10-4(175)	2	CIP PT	198	15.77
2595	62.71	Julian Wash Bridge SB	Bridge	None	10-4(175)	2	CIP PT	210	n/a
2596	62.72	Julian Wash Bridge NB	Bridge	None	NH-19-4(175)	2	CIP PT	210	n/a
n/a	n/a	I-19 Ramp N-E	Bridge	New	n/a	TBD	n/a	234	n/a
n/a	n/a	I-19 Ramp W-S/ Ajo Ramp C4	Underpass	New	n/a	TBD	n/a	234	n/a
n/a	n/a	29th Street Connector	Overpass	New	n/a	TBD	n/a	426	n/a

Abbreviations: CIP = cast-in-place; n/a = not applicable; OP = overpass; PT = post-tensioned; TBD = to be determined; TI = traffic interchange; UP = underpass

This document categorizes the structures into five separate categories as described briefly below:

- **Widen Existing Structures** – Existing structures that are geometrically and structurally adequate will be widened to accommodate the proposed roadway template. Nine structures within the project limits will require widening. These structures are discussed in Section 4.13.1 and are presented in direction of increasing milepost from south to north.
- **Replace Existing Structures** – Existing structures that cannot accommodate the proposed improvements will be removed and replaced. Five structures fall within this category and are discussed in Section 4.13.2 and are presented from south to north.
- **New Structures** – Features are proposed to be added to the I-19 corridor within the study limits that will require new structures to be constructed. Features that require major structures are discussed in Section 4.13.3 and are presented from south to north.
- **Noise Abatement Walls** – Noise abatement walls are proposed to be added along the right-of-way along the I-19 corridor. The proposed walls are discussed in Section 4.13.4.
- **Retaining Walls** – Retaining walls are proposed to be added to the entire I-19 corridor. The proposed walls are discussed in Section 4.13.5.

Structures that are being widened will be designed using AASHTO Standard Specifications for Highway Bridges, 17th Edition – 2002, as amended by the ADOT Bridge Practice Guidelines. Components of the widened structures will be designed using Working Stress Design or Load Factored design as outlined in the ADOT Bridge Practice Guidelines. New structures, barriers and overhangs will be designed using AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specification, Customary U.S. Units, 5th Edition 2010 with current interims (or current edition accepted by ADOT Bridge Group) as amended by the ADOT Bridge Design Guidelines for LRFD. ADOT Standard Drawings will be used where applicable for all structures.

4.13.1 Widen Existing Structures

Santa Cruz River Bridges (Northbound & Southbound)

Location

The Santa Cruz River Bridges on I-19 are located at MP 56.8 approximately 6.3 miles south of the I-19/I-10 system TI. The I-19 mainline profile is at grade and the bridges are at a constant longitudinal slope as they convey traffic on I-19, over the Santa Cruz River with a curved horizontal alignment. The bridges are not considered to have historic significance.

Existing Structures

The parallel bridge superstructures are identical in section about the I-19 median construction centerline with the exception of the cross slope direction. The southbound bridge is sloped at 0.015’/ft toward the interior and the northbound is sloped at 0.015’/ft toward the exterior. The distance from the northbound and southbound construction centerlines is 105'-0". The bridges have a clear distance of 67'-10" between them. A previous widening added a girder line and 5'-0" of bridge deck to both sides of the bridges. Information on the existing Santa Cruz River Bridges was taken from the Arizona State Highway System Bridge Record and is summarized in Table 4-12.

Table 4-12: Existing Santa Cruz River Bridges Information

Item	Santa Cruz Riv Br northbound	Santa Cruz Riv Br southbound
Structure No.	1243	1244
Route	19	19
Mile Post	56.80	56.80
Project Number	I-19-1(9)	I-19-1(9)
Year Built	1967	1967
Skew	Varies	Varies
Structure Type	Continuous Steel Plate Girder (6 girders @ 9’-3” Max.)	Continuous Steel Plate Girder (6 girders @ 9’-3” Max.)
Number of Spans	5	4
Maximum Span	114’	114’
Structure Length	517'	411
Roadway Width	42’ Clear Roadway	42’ Clear Roadway
Additional Information:		
Sufficiency Rating	95.48	96.50
Minimum Vertical Clearance	NA	NA
Barriers	Concrete Barrier	Concrete Barrier

The superstructures are 6'-9 ¾" in depth, including the 7.5-inch deck. The piers are comprised of circular sectioned vertical columns supported by spread footings below original ground. The abutments are founded on steel H-piles. The abutment slopes are soil cement. A recent ADOT bridge evaluation gives the structures an acceptable live load rating of HS-20 and the as-built plans for the structures do not indicate they were designed for a future wearing surface load. The most current inspection report indicates that the components of the structures are in satisfactory to good condition.

At the time of this report, a Draft Scoping Letter by T.Y. Lin indicated rehabilitation is recommended for the decks of these structures.

The Santa Cruz River is channelized in the immediate vicinity of the bridges and flows from east to west. Several projects have retrofitted the bank protection in the vicinity of the bridges.

Proposed Conditions

The I-19 roadway will be widened toward the median and completely close it in. The project will provide two 12-foot-wide general-purpose lanes and a 12-foot-wide shoulder. In addition to the median widening in the vicinity of the San Xavier TI, the northbound roadway will be widened to the outside to provide one 12-foot-wide exit ramp lane. These improvements require an additional structure width of 31.34 feet for the southbound bridge and 41.34 feet for the northbound bridge. The existing decks will also be replaced. Widening and deck replacement is considered to be the most cost-effective alternative at this time.

The widening will increase the roadway cross slope to 0.020'/ft. and the proposed roadway drainage pattern will remain the same. It is anticipated that adequate freeboard will be maintained with the widening.

Constructability/Traffic Control

During the widening, traffic flow is expected to be maintained in both directions providing two 12-foot-wide travel lanes with 2 feet of shy distance to the barriers.

The Santa Cruz River is considered a water of the U.S. by the Corps. It is anticipated that the drainage channel will need to be protected during construction to maintain the necessary capacity. Any necessary permit requirements will be identified and in place prior to beginning any construction activities.

Santa Cruz SB on Ramp

Location

The Santa Cruz SB on Ramp Bridge is on San Xavier road located at I-19 MP 56.94, approximately 6.2 miles south of the I-19/I-10 system interchange. The San Xavier road profile is at-grade and the bridge is at a constant longitudinal slope as it conveys southbound ramp traffic and San Xavier road traffic, over the Santa Cruz River with a tangent horizontal alignment. The I-19 mainline is elevated and nearly parallel to the Santa Cruz SB on Ramp Bridge. The bridge is not considered to have historic significance.

Existing Structures

The Santa Cruz SB on Ramp is a two-lane bridge that carries eastbound and westbound San Xaiver Road traffic and I-19 SB on Ramp traffic over the Santa Cruz River. The superstructure is symmetrical in section about the San Xavier Road centerline concrete barriers at the exterior edges. Information on the existing San Cruz SB on Ramp Bridge was taken from the Arizona State Highway System Bridge Record and is summarized in Table 4-13.

Table 4-13: Santa Cruz SB on Ramp OP Information

Item	Santa Cruz SB on Ramp OP NB
Structure No.	1547
Route	I-19
Mile Post	56.94
Project Number	S-248(2)
Year Built	1956
Skew	0
Structure Type	Steel Girder (4 girders @ 7'-8")
Number of Spans	9
Maximum Span	54'
Structure Length	446'
Roadway Width	27' Clear Roadway
Additional Information:	
Sufficiency Rating	73.37
Minimum Vertical Clearance	n/a
Barriers	Concrete Barrier

The superstructures are 2'-9 ½" in depth including the 6.5-inch deck. The eight piers are comprised of full height pier walls supported by steel H-piles below original ground. The abutments are founded on steel H-piles. The abutment slopes are soil cement. A recent ADOT bridge evaluation gives the structures an acceptable live load rating of HS-20 and the as-built plans for the structure indicates it was designed for a ½" future wearing surface load. The most current inspection reports indicate that the components of the structures are in satisfactory to good condition.

Proposed Conditions

The existing structure is located where no work will occur with this project.

Constructability/Traffic Control

It is not anticipated that the Santa Cruz SB on Ramp Bridge will affect the constructability of the widening project.

San Xavier TI OP (NB & SB)

Location

The San Xavier TI Overpass (OP) Bridges on I-19 are located at MP 56.95, approximately 6.2 miles south of the I-19/I-10 system TI. The I-19 mainline profile is at grade and the bridges are at a constant longitudinal slope as they convey traffic on I-19, over the San Xavier Road with a curved horizontal alignment. San Xavier Road is depressed in the vicinity of the structures with eastbound and westbound profiles in a sag vertical curve. The bridges are not considered to have historic significance.

Existing Structures

The parallel superstructures are identical in section about the I-19 median construction centerline with the exception of the cross slope direction. The southbound bridge is sloped at 1.5’/ft toward the interior and the northbound is sloped at 1.5’/ft toward the exterior. The distance from the eastbound and westbound construction centerlines is 108'-0". The bridges are separated by a clear distance of 70'-10". Information on the existing San Xavier TI OP Bridges was taken from the Arizona State Highway System Bridge Record and is summarized in Table 4-14.

The superstructures are 5'-1 1/8" in depth including the 7-inch deck. The two piers are comprised of four circular sectioned vertical columns supported by spread footings below original ground. The abutments are founded on steel H-piles. The abutment slopes are paved. San Xavier Road fully utilizes the main span of the structures. A recent ADOT bridge evaluation gives the structures an acceptable live load rating of HS-20 and the as-built plans for the structures indicate they were not designed for a future wearing surface load. The most current inspection report indicates that the components of the structures are in satisfactory to good condition.

Table 4-14: Existing San Xavier TI OP Information

Item	San Xavier TI OP northbound	San Xavier TI OP southbound
Structure No.	1245	1246
Route	19	19
Mile Post	56.95	56.95
Project Number	I-19-1(9)	I-19-1(9)
Year Built	1967	1967
Skew	50	50
Structure Type	Steel Girder (5 girders @ 7’-6”)	Steel Girder (5 girders @ 7’-6”)
Number of Spans	3	3
Maximum Span	99’	99’
Structure Length	197'	195'
Roadway Width	38’ Clear Roadway	38’ Clear Roadway
Additional Information:		
Sufficiency Rating	96.40	96.40
Minimum Vertical Clearance	15.34'	15.44'
Barriers	Concrete Barrier	Concrete Barrier

Proposed Conditions

The I-19 roadway will be widened toward the median. The project will provide two 12-foot-wide general-purpose lanes and a 12-foot-wide shoulder. In addition to the median widening in the vicinity of the San Xavier TI the northbound roadway will be widened to the outside to provide one 12-foot-wide exit ramp lane. These improvements require an additional structure width of 39.69 feet for the southbound bridge. The northbound bridge will require adding 38.92 feet toward the median and a tapered amount on the exterior ranging from 14.76 to 21.08 feet. The profile of San Xavier Road in the vicinity of the structures will be adjusted to provide adequate vertical clearance. Widening is considered to be the most cost-effective alternative at this time.

The widening will increase the roadway cross slope to 0.020’/ft. and the proposed roadway drainage pattern will remain the same. It is anticipated that adequate freeboard will be maintained with the widening.

Constructability/Traffic Control

During the widening, traffic flow is expected to be maintained in both directions providing two 12-foot-wide travel lanes with 2 feet of shy distance to the barriers.

It is anticipated that traffic control will be needed on San Xavier Road to accommodate construction activities. One travel lane in each direction will be maintained on San Xavier Road.

Bridge NB & Bridge SB

Location

The NB and SB bridges on I-19 are located at MP 57.85, approximately 5.1 miles south of the I-19/I-10 system interchange. The I-19 mainline profile is at-grade and the bridges are at a constant longitudinal slope as they convey traffic on I-19 over Hughes Wash in a tangent horizontal alignment. The bridges are not considered to have historic significance.

Existing Structures

The parallel bridge superstructures are identical in section about the I-19 median construction centerline and are sloped at 0.010’/ft. toward the exterior. The distance from the eastbound and westbound construction centerlines is 108'-0". The bridges are separated by a clear distance of 73'- 5". Information on the existing structures was taken from the Arizona State Highway System Bridge Record and is summarized in Table 4-15.

Table 4-15: Existing Bridge NB and Bridge SB Information

Item	Bridge Northbound	Bridge Southbound
Structure No.	1247	1248
Route	19	19
Mile Post	57.85	57.82
Project Number	I-19-1(9)	I-19-1(9)
Year Built	1967	1967
Skew	50	50
Structure Type	CIP RC Tee Girders (7 Girders @ 6'-0")	CIP RC Tee Girders (7 Girders @ 6'-0")
Number of Spans	3	3

Item	Bridge Northbound	Bridge Southbound
Maximum Span	40'	40'
Structure Length	109'	109'
Roadway Width	38.2' Clear Roadway	38.2' Clear Roadway
Additional Information:		
Sufficiency Rating	95.69	95.79
Minimum Vertical Clearance	n/a	n/a
Barriers	Concrete Barrier	Concrete Barrier
Abbreviations: CIP RC = cast-in-place reinforced concrete; n/a = not applicable		

The superstructures are 3'-2" in depth including the 6.5-inch deck. The two piers are comprised of full width walls supported by spread footings below original ground. The abutments are supported on circular columns founded on spread footings. The abutment slopes are paved. A recent ADOT bridge evaluation gives the structures an acceptable live load rating of HS-20 and the as-built plans for the structures do not indicate they were designed for a future wearing surface load. The most current inspection report indicates that the components of the structures are in satisfactory to good condition.

The Hughes Wash channel section narrows as it passes under the bridges. A scour protection project has been completed on both bridges.

Proposed Conditions

The I-19 roadway will be widened toward the median. The project will provide two 12-foot-wide general-purpose lanes and a 12-foot-wide shoulder. These improvements require an additional structure width of 38.92 feet for each bridge. Widening is considered to be the most cost-effective alternative at this time.

The portion of the bridge deck to remain will be overlayed with micro-silica modified concrete. The overlay will be constructed at a cross slope of 0.020'/ft. The overlay will be placed so that the proposed roadway drainage pattern will remain the same. It is anticipated that adequate freeboard will be maintained with the widening.

Constructability/Traffic Control

During the widening traffic flow is expected to be maintained in both directions providing two 12-foot-wide travel lanes with 2 feet of shy distance to the barriers.

An overhead power line crosses I-19 at approximately the mid-span of the proposed widening. The line may affect the constructability of certain bridge types and will be assessed further in the bridge selection stage.

Valencia Rd TI UP

Location

The Valencia Road TI Underpass (UP) is located on I-19 at MP 58.82, approximately 4 miles south of the I-19/I-10 system TI. The bridge is in a crest vertical curve as it crosses above I-19 with a tangent horizontal alignment. The alignment of I-19 under the bridge follows a tangent alignment and northbound and southbound follow a constant slope.

Existing Structures

The superstructure is 6'-1" in depth, including the 8 inch deck. The pier is comprised of multiple arch connected columns founded on spread footings located approximately on the I-19 median construction centerline. The abutments are full-height supported by a single shallow spread footing. The minimum vertical clearance along the existing edge of median pavement is 18.67 feet along the northbound lanes, and 17.75 feet at the southbound lanes. Information for the existing Valencia Road TI UP was taken from the Arizona State Highway System Bridge Record and is summarized in Table 4-16.

Proposed Conditions

The I-19 roadway will be widened toward the median and completely close it in. The project will provide two 12-foot-wide general-purpose lanes and a 12-foot-wide shoulder. The new section of roadway will have a cross slope of 0.020’/ft. and reduce the vertical clearance at the northbound interior edge of the median pavement to 18.33 feet.

Constructability/Traffic Control

It is not anticipated that the Valencia Road TI UP will affect the constructability of the I-19 project.

Table 4-16: Existing Valencia Rd TI UP Information

Item	Valencia RD TI UP
Structure No.	1943
Route	19
Mile Post	58.82
Project Number	I-19-1(127)
Year Built	2001
Skew	0
Structure Type	AASHTO Type V Modified Girders (31 Girders @ 8'-9.75")
Number of Spans	2
Maximum Span	100'
Structure Length	204’
Roadway Width	110’
Additional Information:	
Sufficiency Rating	70.00
Minimum Vertical Clearance	17.75’
Barrier and Deck	Vehicle Ped Railing

Airport Wash BR (NB & SB)

Location

The Airport Wash Bridges on I-19 are located at MP 60.32, approximately 3.1 miles south of the I-19/I-10 system TI. The I-19 mainline profile is at grade and the bridges are at a constant longitudinal slope as they convey traffic on I-19, over Airport Wash in a tangent horizontal alignment. The bridges are not considered to have historic significance.

Existing Structures

The parallel bridge superstructures are identical in section about the I-19 median construction centerline and are sloped at 0.010’/ft. toward the exterior. The distance from the eastbound and westbound construction centerlines is 108'-0". The bridges are separated by a clear distance of 70'-10". Information on the existing Airport Wash Bridges was taken from the Arizona State Highway System Bridge Record and is summarized in Table 4-17.

The superstructures vary in depth with 1'-11" being the maximum dimension, including the 1'-5" deck. The three piers and abutments are comprised of full width walls supported by spread footings below original ground. A recent ADOT bridge evaluation gives the structures an acceptable live load rating of HS-20 and the as-built plans for the structures do not indicate they were designed for a future wearing surface load. The most current inspection report indicates that the components of the structures are in satisfactory to good condition.

Airport Wash narrows as it passes under the bridges. A scour protection project has been completed on both bridges.

Table 4-17: Existing Airport Wash Bridges Information

Item	Airport Wash Br Northbound	Airport Wash Br Southbound
Structure No.	1121	1122
Route	19	19
Mile Post	60.32	60.32
Project Number	I-19-1(5)	I-19-1(5)
Year Built	1965	1965
Skew	55	55
Structure Type	Continuous R.C. Slab	Continuous R.C. Slab
Number of Spans	4	4
Maximum Span	40'	40'
Structure Length	147'	147'
Roadway Width	38’ Clear Roadway	38’ Clear Roadway
Additional Information:		
Sufficiency Rating	95.20	82.76
Minimum Vertical Clearance	NA	NA
Barriers	Concrete Barrier	Concrete Barrier

Proposed Conditions

The I-19 roadway will be widened toward the median. The project will provide two 12-foot-wide general-purpose lanes and a 12-foot-wide shoulder. These improvements require an additional structure width of 38.92 feet for each bridge. Widening is considered to be the most cost-effective alternative at this time.

The portion of the bridge deck to remain will be overlayed with micro-silica modified concrete. The overlay will be constructed at a cross slope of 0.020'/ft. The overlay will be placed so that the proposed roadway drainage pattern will remain the same. It is anticipated that adequate freeboard will be maintained with the widening.

Constructability/Traffic Control

During the widening traffic flow is expected to be maintained in both directions providing two 12-foot-wide travel lanes with 2 feet of shy distance to the barriers.

An overhead power line crosses I-19 at the south end of the bridges. The line may affect the constructability of certain bridge types and will be assessed further in the bridge selection stage.

I-19 Ramp W-S

Location

The I-19 Ramp W-S is located on I-19 at MP 62.71 at the junction of I-19/I-10. The I-19 mainline profile is elevated and the bridge is in a crest vertical curve as it conveys traffic on I-19 Ramp W-S over the future 39th Street alignment, Julian Wash, and a multi-use path with a curvilinear horizontal alignment. The bridge is not considered to have historic significance.

Existing Structure

The I-19 Ramp W-S Bridge is a one-lane bridge that carries traffic onto southbound I-19. The superstructure is symmetrical in section about the ramp centerline with 32-inch concrete barriers at the exterior edges of the deck. Information on the existing I-19 Ramp W-S Bridge was taken from the Arizona State Highway System Bridge Record and is summarized in Table 4-18.

Proposed Conditions

The I-19 Ramp profile will be widened to add two 12-foot lanes. The inside and outside shoulders will remain at 12-feet and 8-feet respectively. These improvements require an additional structure width of 24 feet. Widening is considered to be the most cost-effective alternative at this time.

Constructability/Traffic Control

During the widening, traffic flow is expected to be detoured onto southbound I-19 before the bridge; therefore, widening can occur with unrestricted access to the bridge by the contractor.

The Julian Wash is considered Waters of the U.S. by the Corps. It is anticipated that the drainage channel will need to be protected during construction to maintain the necessary capacity. An assessment of the necessary permit requirements should be completed prior to beginning any construction activities. Pedestrian access under the bridge will need to be restricted for construction.

Table 4-18: Existing I-19 Ramp W-S Information

Item	I-19 Ramp W-S
Structure No.	2531
Route	19
Mile Post	62.67
Project Number	NH-10-4(175)
Year Built	2004
Skew	19
Structure Type	Post-tensioned Concrete Box Girder
Number of Spans	2
Maximum Span	109’
Structure Length	198’
Roadway Width	32’
Sufficiency Rating	86.19
Minimum Vertical Clearance	16.63'
Barrier and Deck	Concrete Barrier

Julian Wash Bridges (NB & SB)

Location

The Julian Wash Bridges are located on I-19 at MP 62.71 at the junction of I-19/I-10. The I-19 mainline profile is elevated and the bridges are in crest vertical curves as they convey traffic on I-19 over the future 39th Street alignment, Julian Wash, and two multi-use paths with a tangent horizontal alignment. The bridges are not considered to have historic significance.

Existing Structures

The parallel bridge superstructures vary in section about the I-19 median construction centerline and are sloped at 0.020’/ft. toward the exterior. The distance from the eastbound and westbound construction centerlines is 108'-0". The bridges are separated by a clear distance of 33'-2". Information on the existing I-19 Julian Wash Bridges was taken from the Arizona State Highway System Bridge Record and is summarized in Table 4-19.

Table 4-19: Existing Julian Wash Bridges Information

Item	Julian Wash Bridge Northbound	Julian Wash Bridge Southbound
Structure No.	2596	2595
Route	19	19
Mile Post	62.72	62.71
Project Number	NH-19-4(175)	10-4(175)
Year Built	2004	2003
Skew	28	28
Structure Type	CIP Post Tensioned Box Girder (9 webs @ 8'-6")	CIP Post Tensioned Box Girder (8 webs @ 8'-0")
Number of Spans	2	2
Maximum Span	115'	115'
Structure Length	210'	210'
Roadway Width	72' Clear Roadway	60' Clear Roadway
Additional Information:		
Sufficiency Rating	98.00	80.00
Minimum Vertical Clearance	n/a	n/a
Barriers	Concrete Barrier	Concrete Barrier

Proposed Conditions

The bridges were constructed to accommodate the ultimate section of I-19. No widening of the bridges is required.

Constructability/Traffic Control

It is not anticipated that the Julian Wash Bridges will affect the constructability of the widening project.

4.13.2 Replace Existing Structures

Drexel Road UP

Location

The Drexel Road structure over I-19 is located at MP 59.90, approximately 3.1 miles south of the I-19/I-10 system TI. The structure is elevated in a crest vertical curve as it conveys traffic on Drexel Road in a tangent horizontal alignment. The alignment of I-19 under the structure follows a tangent horizontal alignment, and the northbound and southbound profiles follow a constant grade. The structure is not considered to have historic significance.

Existing Structures

The superstructure is 3'-7" in depth, including the 6.5-inch deck and is symmetrical in section about the Drexel Road centerline. The structure is a 4-span continuous steel girder structure with three piers founded on spread footings. The center pier is located at the median centerline of I-19. The structure has spill through abutments founded on driven piles. The structure provides one 12-foot-wide lane of traffic in each direction. Information for the existing Drexel Road UP was taken from the Arizona State Highway System Bridge Record and is summarized in Table 4-20.

Table 4-20: Existing Drexel Road UP Information

Item	Drexel Road UP
Structure No.	1120
Route	19
Mile Post	59.9
Project Number	I-19-1(5)
Year Built	1965
Skew	0
Structure Type	5 Steel Girders @ 7'-10"

Item	Drexel Road UP
Number of Spans	4
Maximum Span	78’
Structure Length	250’
Roadway Width	30’
Additional Information:	
Sufficiency Rating	F71.52
Minimum Vertical Clearance	16.56
Barrier and Deck	H-2-1 Railing

Proposed Conditions

The Drexel Road roadway will be widened to accommodate a proposed SPUI. The project will provide two 12-foot-wide general-purpose lanes in each direction of travel, a 5-foot-wide bike lane, and 6-foot-wide sidewalks in both directions on Drexel Road. Concrete F-shaped barriers will be constructed along the exterior edge of travel lanes. Widening the existing structure to accommodate the SPUI configuration was investigated and determined to be infeasible due to the difference between the proposed and existing vertical profiles; therefore, a complete replacement is presented in this report for consideration.

To accommodate the proposed SPUI, the new bridge will be 198.5' in length, and 227' in width. The bridge superstructure will be in a normal crown at 0.02’/ft. toward each exterior side.

A precast alternative is considered the most accommodating superstructure type and is presented in this report for consideration. The framing layout of precast girders results in a wasted deck concept with bridge deck behind the back of the bridge barrier at the pier and no deck behind the barrier at the abutments.

The I-19 roadway will be widened toward the median and completely close it in. The project will provide two 12-foot-wide general-purpose lanes and a 12-foot-wide shoulder.

Constructability/Traffic Control

During the widening traffic flow is expected to be maintained in both directions on I-19, providing two 12-foot-wide travel lanes with 2 feet of shy distance to the barriers.

Traffic control will be needed on Drexel Road to accommodate construction activities and provide temporary traffic lanes. It is anticipated that one lane of travel in each direction can be accommodated during construction. Construction phasing will be assessed further in the bridge selection stage.

Cox Communications fiber optic cables, Tucson Water, Southwest Gas Corporation, and Tucson Gas & Electric are utilities in the vicinity of the bridge. The lines may affect the constructability of certain bridge types and will be assessed further in the bridge selection stage.

Irvington Rd TI UP

Location

The Irvington Road TI UP is located on I-19 at MP 60.95, approximately 2.1 miles south of the I-19/I-10 system TI. The structure is elevated in a crest vertical curve as it conveys traffic on Irvington Road in a tangent horizontal alignment. The alignment of I-19 under the structures follows a tangent horizontal alignment, and the northbound and southbound profiles follow a constant grade. The structure is not considered to have historic significance.

Existing Structures

The superstructure is 5'-7" in depth including the 6.5-inch deck and is symmetrical in section about the Irvington Road centerline. The structure is a 4-span continuous steel girder structure with three piers founded on spread footings. The center pier is located at the median centerline of I-19. The structure has spill through abutments founded on driven piles. The structure provides two 12-foot-wide lanes of traffic in each direction. Information for the existing Irvington Road TI UP was taken from the Arizona State Highway System Bridge Record and is summarized in Table 4-21.

Table 4-21: Existing Irvington Road TI UP Information

Item	Irvington Rd TI UP
Structure No.	1123
Route	19
Mile Post	60.95
Project Number	I-19-1(5)
Year Built	1965
Skew	3
Structure Type	11 Steel Girders @ 7’-10”
Number of Spans	4
Maximum Span	78
Structure Length	250
Roadway Width	72
Sufficiency Rating	F73.71
Minimum Vertical Clearance	16.20
Barrier and Deck	Concrete Barrier

Proposed Conditions

Irvington Road will be widened to accommodate a proposed SPUI. The project will provide three 12-foot-wide general-purpose lanes in each direction of travel, dual left-turn lanes, a 5-foot-wide bike lane, and 6-foot-wide sidewalks in both directions on Irvington Road. Concrete F-shaped barriers will be constructed along the exterior edge of travel lanes. Widening the existing structure to accommodate the SPUI configuration was investigated and determined to be infeasible due to the differences between the proposed and existing vertical profiles; therefore, a complete replacement is presented in this report for consideration.

To accommodate the proposed SPUI, the new bridge will be 199.5' in length, and 219.5' in width. The bridge superstructure will be in a normal crown at 0.020’/ft. toward each exterior side.

A precast alternative is considered the most accommodating superstructure type and is presented in this report for consideration. The framing layout of a precast girders results in a wasted deck concept with bridge deck behind the back of the bridge barrier at the pier and no deck behind the barrier at the abutments.

The I-19 roadway will be widened toward the median. The project will provide two 12-foot-wide general-purpose lanes and a 12-foot-wide shoulder.

Constructability/Traffic Control

During the widening traffic flow is expected to be maintained in both directions of I-19, providing two 12-foot-wide travel lanes with 2 feet of shy distance to the barriers.

Traffic control will be needed on Irvington Road to accommodate construction activities and provide temporary traffic lanes. It is anticipated that in order to provide a new bridge structure wide enough to accommodate one lane of travel in each direction on Irvington Road during construction, a portion of the existing bridge will need to be demolished. Construction phasing will be assessed further in the bridge selection stage.

The utilities attached to the superstructure will require relocation.

Ajo Way UP

Location

The Ajo Way UP is located on I-19 at MP 61.9, approximately 1.2 miles south of the I-19/I-10 system TI. The I-19 mainline profile is on a tangent with a constant grade. Ajo Way is elevated in a crest vertical curve as it conveys traffic eastbound and westbound on Ajo Way over I-19 with a tangent horizontal alignment. The structure is not considered to have historic significance.

Existing Structure

The superstructure is 5'-9" in depth, including the 8-inch deck and is symmetrical in section about the Ajo Way centerline. The structure is a 4-span continuous steel girder structure with three piers founded on spread footings. The center pier is located at the median centerline of I-19. The structure has spill through abutments founded on driven piles. The structure provides two 12-foot-wide lanes of traffic in each direction. Information for the existing Ajo Way UP was taken from the Arizona State Highway System Bridge Record and is summarized in Table 4-22.

Table 4-22 Existing Ajo Way UP Information

Item	Ajo Way UP
Structure No.	1125
Route	19
Mile Post	61.90
Project Number	I-19-1(5)
Year Built	1965
Skew	0
Structure Type	8 Steel Girders @ 9’-4”
Number of Spans	4
Maximum Span	85’
Structure Length	263’
Roadway Width	60’
Sufficiency Rating	83
Minimum Vertical Clearance	15.98’
Barrier and Deck	Concrete Barrier

Proposed Conditions

The Ajo Way roadway will be widened to accommodate a proposed SPUI. The project will provide three 12-foot-wide general-purpose lanes in each direction of travel, dual left-turn lanes, 5-foot-wide bike lanes, and 6-foot-wide sidewalks in both directions on Ajo Way. Concrete F-shaped barriers will be constructed along the exterior edge of travel lanes. Widening the existing structure to accommodate the SPUI configuration was investigated and determined to be infeasible due to difference between the proposed and existing vertical profiles; therefore, a complete replacement is presented in this report for consideration.

To accommodate the proposed SPUI, the new bridge will be 200.5' in length, and 219.5' in width. The bridge superstructure will be in a normal crown at 0.020’/ft. toward each exterior side.

A precast alternative is considered the most accommodating superstructure type and is presented in this report for consideration. The framing layout of precast girders results in a wasted deck concept with bridge deck behind the back of the bridge barrier at the pier and no deck behind the barrier at the abutments.

The I-19 roadway will be widened toward the median and completely close it in. The project will provide two 12-foot-wide general-purpose lanes and a 12-foot-wide shoulder.

Constructability/Traffic Control

During the widening traffic flow is expected to be maintained in both directions on I-19, providing two 12-foot-wide travel lanes with 2 feet of shy distance to the barriers.

Traffic control will be needed on Ajo Way to accommodate construction activities and provide temporary traffic lanes. It is anticipated that one lane of travel in each direction can be accommodated during construction. Construction phasing will be assessed further in the bridge selection stage.

Tucson Water has a line in the vicinity of the bridge. The line may affect the constructability of certain bridge types and will be assessed further in the bridge selection stage.

SR 86 Santa Cruz River Bridge

Location

The Santa Cruz River Bridge is located on SR 86 at MP 171.07 adjacent to and west of the SR 86/I-19 junction. The SR 86 profile is at grade and the bridges are at a constant longitudinal slope as they convey traffic on SR 86, over the Santa Cruz River in a tangent horizontal alignment. The bridges are not considered to have historic significance.

Existing Structures

The Santa Cruz River Bridge is a four-lane bridge that carries traffic eastbound and westbound on SR 86. The superstructure is symmetrical in section about the SR 86 centerline with sidewalks and concrete barriers at the exterior edges. Information on the existing SR 86 Santa Cruz River Bridge was taken from the Arizona State Highway System Bridge Record and is summarized in Table 4-23.

Table 4-23: Existing SR 86 Santa Cruz River Bridge Information

Item	SR 86 Santa Cruz River Bridge
Structure No.	528
Route	SR 86
Mile Post	171.07
Project Number	S-222(14)
Year Built	1958

Item	SR 86 Santa Cruz River Bridge
Skew	30
Structure Type	Prestressed Girder (11 Girders @ 6'-0")
Number of Spans	3
Maximum Span	66’
Structure Length	208’
Roadway Width	54’
Sufficiency Rating	68.98
Minimum Vertical Clearance	NA
Barrier and Deck	Concrete Parapet w/Tube Rail

The superstructures are 4'-3.5" in depth, including the 6.5-inch decks. The two piers are comprised of full width walls supported by driven piles below original ground. The abutments are full height and supported on driven piles. A recent ADOT bridge evaluation gives the structures an acceptable live load rating of HS-20 and the as-built plans for the structures do not indicate they were designed for a future wearing surface load. The most current inspection report indicates that the components of the structures are in satisfactory to good condition.

Utilities are attached to the bridge superstructure.

A rehabilitation project was recently completed on the bridge. A 3/8-inch epoxy overlay was placed on the bridge.

Proposed Conditions

The SR 86 roadway will be widened to match improvements to the I-19/SR 86 intersection. The project will provide six 12-foot-wide general-purpose lanes, 2-foot-wide inside shoulder, a 5-foot wide bike lane and 6-foot-wide sidewalk. These improvements require an additional structure width of 55.61 feet. The existing deck will also be replaced. Replacement is considered to be the most cost-effective alternative at this time.

The new deck will maintain the existing roadway cross slope of 0.02’/ft. Therefore, the proposed roadway drainage pattern will remain the same. It is anticipated that adequate freeboard will be maintained with the new bridge.

Constructability/Traffic Control

During the widening traffic flow is expected to be maintained in both directions providing two 12-foot-wide travel lanes with 2 feet of shy distance to the barriers.

An overhead power line crosses SR 86 at approximately the mid-span of the proposed widening. The line may affect the constructability of certain bridge types and will be assessed further in the bridge selection stage. The utilities attached to the superstructure will require relocation.

The Santa Cruz River is considered a Water of the U.S. by the Corps. It is anticipated that the drainage channel will need to be protected during construction to maintain the necessary capacity. Any necessary permit requirements will be identified and in place prior to beginning any construction activities

Pedestrian UP

Location

The Pedestrian UP is located on I-19 at MP 61.4, approximately 1.7 miles south of the I-19/I-10 system TI. The I-19 mainline profile is on a tangent with a constant grade. The pedestrian bridge is elevated in a crest vertical curve as it conveys pedestrian traffic over I-19 in a tangent alignment. The structure is not considered to have historic significance.

Existing Structure

The existing bridge is a 5-span continuous steel rigid frame structure with a suspended center span and four piers founded on spread footings. The superstructure is 282' in length and 6'-6" wide. Information for the existing Pedestrian UP was taken from the Arizona State Highway System Bridge Record and is summarized in Table 4-24.

Table 4-24: Existing Pedestrian UP Information

Item	Pedestrian UP
Structure No.	1124
Route	19
Mile Post	61.4
Project Number	I-19-1(5)
Year Built	1965
Skew	3
Structure Type	Steel Rigid Frame w/ suspension
Number of Spans	5
Maximum Span	64’
Structure Length	282'
Walkway Width	5'
Sufficiency Rating	NA
Minimum Vertical Clearance	17.10'
Barrier and Deck	NA

The superstructure is 9'-0" in depth, including the 7'-4" pedestrian fence. The abutments are founded on concrete landings. Two piers are located in the median of I-19 adjacent to the existing inside shoulders. The most current inspection report indicates that the components of the structure are in satisfactory to good condition.

Proposed Conditions

The I-19 roadway will be widened toward the median and completely close it in. The project will provide two 12-foot-wide general-purpose lanes and increase the shoulder by 8 feet. Therefore, the structure will need to be replaced. It is anticipated that the new bridge will be located approximately 100 feet south of its existing location. Further investigation of the pedestrian bridge location should be evaluated during the bridge selection stage.

Constructability/Traffic Control

During the widening, traffic flow is expected to be maintained in both directions on I-19, providing two 12-foot-wide travel lanes with 2 feet of shy distance to the barriers.

It is anticipated that the new bridge can be constructed to accommodate pedestrian traffic while the existing bridge is demolished. Construction phasing should be investigated further in final design.

4.13.3 New Structures

In recent history, design and construction of bridges in Pima County has produced a knowledge base of economical and constructible bridge configurations for ramp flyovers and typical overpass/underpass structures. Typical structure types considered in this DCR include:

- Cast-in-place post-tensioned concrete box girder
- Precast, prestressed concrete AASHTO girders
- Structural steel welded plate girders or welded steel box girders
- Cast-in-place portal frame structures

Table 4-25 summarizes some of the representative characteristics and the advantages/disadvantages of each of these structure types.

Table 4-25: Structure Types

Features	Cast-In-Place Post-Tensioned Concrete Box Girder	Precast, Prestressed Concrete AASHTO Girders	Structural Steel Welded Girders	Cast-In-Place Portal Frame Structures
Practical Span Limit	250'	140'+/- for AASHTO Super VI girders	300'	40'
Corresponding Structure Depth	10'	7.5'	12'	3'
Variable Depth	Haunches can be used as required	Commonly available precast girder types come in depth increments of 9" and are uniform in section throughout the girder length	Haunches can be used as required.	The upper slab is uniform in section. Adjustments in profile can be made with fill placed on top of the structure
Horizontal Geometry	Cast-in-place concrete can readily conform to any straight or curvilinear geometry and has very high torsional rigidity	Line girders are cast straight and result in chorded spans with eccentric arc-to-chord variations on curvilinear alignments; girders have moderate torsional rigidity	Welded girders can be fabricated straight or curvilinear; torsional factors become more critical for longer spans and/or smaller radius of curvature	Cast-in-place concrete can readily conform to any straight or curvilinear geometry and can accommodate an intersection with a high degree of skew
Flares and Tapers, Gore Areas	Cast-in-place concrete can easily accommodate variable deck widths, ramp merge/diverge conditions, cross slope breaks, and superelevation transitions	Girder framing has limited flexibility in variable deck width, cross slope, and transitions	Girder framing has limited flexibility in variable deck width, cross slope, and transitions	Cast-in-place concrete can easily accommodate variable roadway widths, ramp merge/diverge conditions, cross slope breaks, and superelevation transitions
Diaphragms and Pier Caps	Diaphragms and pier caps are internally integral with the superstructure	Diaphragms are integral with the superstructure; pier caps are typically cast below the superstructure; However, they can be made integral by using recessed girder ends supported on inverted T pier caps	Diaphragms are integral with the superstructure; pier caps are typically cast below the superstructure but can also be made integral	Typical considered single span structures; therefore, no piers or diaphragms are required
Economy	Very economical for both initial and life-cycle cost	Very economical for both initial and life-cycle cost	Historically, steel has been higher in initial cost due to lack of local suppliers and fabricators; inspection and maintenance needs also increase total life-cycle costs	Very economical for both initial and life-cycle cost
Aesthetics and Visual Compatibility	Considered to be the most aesthetically pleasing of the alternatives	Typically considered to be less aesthetically pleasing than a CIP P/T concrete box girder	Steel plate girders are typically considered to be the least desirable; when painted to match concrete structures, steel box girders are considered acceptable in appearance	Typically considered to be less aesthetically pleasing than a CIP P/T concrete box girder
Constructability	Additional vertical separation is required to allow for falsework depth and to provide minimum construction vertical clearance when constructed over traffic	Can be erected quickly with minimum impacts to traffic; short term, off-peak closures are necessary during girder erection and deck/barrier concrete placement	Can be erected quickly with minimum impacts to traffic; short term off-peak closures are needed during girder erection and deck/barrier concrete placement	Additional vertical separation is required to allow for falsework depth and to provide minimum construction vertical clearance when constructed over traffic

The use of concrete segmental and/or spliced girder bridges is not anticipated for this project at this stage of design development. Segmental construction requires special equipment and is not cost competitive for conditions on this project. Precast segmental construction becomes more cost competitive when large numbers of repetitive precast segments are required. The use of spliced precast girders spanning directly over traffic in combination with a post-tensioned box girder bridge system is considered a viable option for longer spans.

Table 4-26 summarizes the new bridges that will be constructed to support the Recommended Alternative and are presented from south to north.

Special Design Considerations for Structures

Table 4-26 presented a feasible span configuration and maximum superstructure depth for each bridge. Additional alternatives and vertical profile refinement should be investigated through subsequent Bridge Selection Reports with attention to the constraints/issues discussed in this section.

Table 4-26: New Bridge Structure Concepts

Structure Description	Structure Length (ft.)	Number of Spans	CL-CL Span Lengths (ft.)	Deck Width (ft.)	Skew (deg.)	Max. Superstructure Depth (ft.)
Los Reales Ramp B	97	1	89.5	Varies (45.1 to 46.8)	43	10.00*
Los Reales Ramp A	117	1	111.5	52.83	0	10.00*
Los Reales TI UP	186	2	93,93	43.17	10	7.50
Drexel Ramp A	42	1	40	248	76	5.00
Ajo Way Ramp A	42	1	40	230.5	75	5.00
Ajo Way Ramp D	31	1	29	260	79	5.00
Ajo Way Ramp C4	230	2	115,115	29.17	28.5	8.00*
I-19 Ramp N-E	234	2	117,117	41.17	28.5	8.00*
I-19 Ramp W-S/Ajo Ramp C4	135	1	130	34.83	57	8.00*
29th Street Connector	426	3	3 @ 142	26	0	8.00*

* Maximum structure depths include falsework.

Los Reales Ramp B and Ramp A Bridges

Although a post-tensioned structure is feasible for these structures, the required long-term falsework to support such an option will need to be placed over a waterway. ADOT has historically avoided this type of construction. AASHTO precast girder construction is feasible and is anticipated to be the recommended structural alternative, although Table 4-26 reflects the maximum superstructure depth for a post-tensioned structure built on falsework.

Southwest Gas and overhead power lines cross the ramp alignments in the vicinity of the bridges and will need to be investigated further in the bridge selection phase.

Los Reales TI UP

During construction of the Los Reales Road TI, traffic flow is expected to be maintained in both directions on I-19, providing two 12-foot-wide travel lanes. AASHTO precast girder construction is feasible and is considered to be the most accommodating structure type. Precast girders are anticipated to be the recommended structural alternative and are presented in this report for consideration.

It is anticipated that the approach roadways will not be constructed until the bridge is completed; therefore, cross road traffic control will not be required. Temporary night time closures on I-19 will be required during erection of the girders.

The I-19 roadway will be widened toward the median and completely close it in. The project will provide two 12-foot-wide general-purpose lanes and a 12-foot-wide shoulder.

Drexel Ramp A, Ajo Way Ramp A, and Ajo Way Ramp D Overpasses

The planned ramp roadways at Drexel Ramp A, Ajo Way Ramp A, and Ajo Way Ramp D pass over the frontage roads or adjacent ramps in braided configurations with high skew angles. Although post-tensioned and precast structures are feasible at these locations, historically, high skew angles cause long-term maintenance issues with these structure types. Alternatively, the structures could be supported with straddle bents, which will significantly add to the structure cost. A portal frame structure is also feasible and is anticipated to be the recommended structural alternative. It is anticipated that the portal frame structures could be constructed off-line, therefore no traffic control will be required.

The maximum deck width of the portal frames will be less than 300 feet; therefore, the provisions of *NFPA 502, Road Tunnels, Bridges, and Other Limited Access Highways* will not apply.

I-19 Ramp W-S/Ajo Ramp C4

Traffic on-ramp W-S is anticipated to be detoured around the structure location onto southbound I-19. Ajo Way Ramp C4 is not anticipated to be open to traffic during construction. Although a post-tensioned structure is feasible, the span length is not considered economical for this structure type. Precast girders are anticipated to be the recommended structural alternative and are presented in this report for consideration.

4.13.4 Sound Barrier Walls

A Noise Analysis Technical Report was prepared in support of this report. The results of the noise analysis were furnished in a separate document. Table 4-27 summarizes the sound barriers recommended in the Noise Analysis Technical Report.

Final design of all sound barrier walls will be in accordance with AASHTO LRFD, ADOT *Bridge Practice Guidelines*, and the recommendations of the Geotechnical Report.

Table 4-27: New Sound Barriers

Barrier Name	Starts	Ends	Length (ft.)	Height (ft.)
Barrier 01NB	3069+40	3096+60	2,805	16 to 20
Barrier 02NB	3148+04	3167+45	1,955	16 to 20
Barrier 02SB	3137+55	3158+21	2,080	12 to 20
Barrier 03NB	3171+55	3222+32	4,835	14 to 20
Barrier 04NB	3228+61	3270+50	4,220	14 to 20
Barrier 04SB1	3262+70	3274+64	1,200	16 to 20
Barrier 04SB2	3233+85	3269+52	3,530	18 to 20
Barrier 05NB	3300+45	59+18*	3,225	14 to 20

* Station information from 19NB-I10EB Ramp.

4.13.5 Retaining Walls

New retaining walls will be required throughout the corridor to accommodate the roadway widening. At the time of this report, it is understood from ADOT Materials Section that retaining walls and sound barriers will be designed in accordance with the latest *LRFD Bridge Design Specifications – Customary U.S. Units,* AASHTO, if the walls are designed after October 2010. All walls designed prior to this date will utilize the *Standard Specifications for Highway Bridges, 17th Edition (2002)* and the ADOT *Bridge Practice Guidelines.*

Retaining wall alternatives that could be considered for this project are cantilevered walls on spread footings, cantilevered walls on drilled shaft foundations, mechanically stabilized earth walls, soil nail walls, and soldier/tieback walls. During final design, an evaluation will be required to determine the feasibility of each wall alternative. The evaluation criteria should include right-of-way constraints, construction access availability, maintenance of traffic during construction,

and estimated construction costs.

Table 4-28 summarizes the retaining walls used for cost estimating purposes, presented south to north.

Table 4-28: New Retaining Walls

Location	Wall No.	Length (ft.)	Average Height (ft.)
San Xavier Ramp C/SB CD Road (Lt)	RW 1	613	11
San Xavier Ramp C/SB CD Road (Rt)	RW 2	241	21
San Xavier Ramp C/SB CD Road (Rt)	RW 3	60	37
San Xavier Ramp C/SB CD Road (Lt)	RW 4	873	25
Los Reales Ramp B/NB CD Road (Lt)	RW 5	397	22
Los Reales Ramp B/NB CD Road (Lt)	RW 6	97	16
Los Reales Ramp B/NB CD Road (Rt)	RW 7	52	15
Los Reales Ramp B/NB CD Road (Rt)	RW 8	85	16
Valencia Ramp D (Rt)	RW 9	312	15
Drexel Ramp A (Rt)	RW 10	580	5
Drexel Ramp A (Rt)	RW 11	462	18
Drexel Ramp A (Lt)	RW 12	291	14
Drexel Ramp B (Rt)	RW 13	210	22
Drexel Ramp B1 (Lt)	RW 14	167	24
Drexel Ramp C1 (Rt)	RW 15	703	11
Drexel Ramp D (Rt)	RW 16	225	15
Drexel Road (Rt)	RW 17	510	10
Drexel Road (Lt)	RW 18	436	7
Irvington Ramp A (Lt)/Irvington Rd	RW 19	1,485	18
Irvington Ramp A1 (Rt)	RW 20	224	21
Irvington Ramp B1 (Lt)	RW 21	193	21
Irvington Ramp C1 (Rt)	RW 22	152	20
Irvington Ramp D (Lt)	RW 23	229	22
Ajo Ramp A (Lt)	RW 24	348	11
Ajo Ramp A (Rt)	RW 25	461	7
Ajo Ramp A (Lt)	RW 26	1,377	20
Ajo Ramp A (Rt)	RW 27	408	18
Ajo Ramp B	RW 28	492	9
Ajo Ramp C	RW 29	596	10
Ajo Ramp C4 (Rt)	RW 51	45	15
Ajo Ramp C4 (Rt)	RW 52	45	15
Ajo Ramp C4 (Lt)	RW 53	45	15
Ajo Ramp C4 (Lt)	RW 54	45	15
Ajo Ramp D (Lt)	RW 30	1,550	15
Ajo Ramp D (Lt)	RW 31	457	19
Ajo Ramp D (Rt)	RW 32	3,125	20
Ajo Ramp D (Rt)	RW 33	648	12
Ajo Ramp D (Rt)	RW 34	285	17
I-10 WB to I-19 SB Ramp (Lt)	RW 35	59	16
I-10 WB to I-19 SB Ramp (Rt)	RW 36	100	16
I-10 WB to I-19 SB Ramp (Lt)	RW 36a	46	15
Irvington Road (Rt)	RW 37	693	16
Irvington Road (Rt)	RW 38	242	8
Irvington Road (Lt)	RW 39	935	15
Irvington Road (Lt)	RW 40	784	19
Ajo Way (Rt)	RW 41	15	10
Ajo Way (Rt)	RW 42	15	10
Ajo Way (Lt)	RW 43	15	10
Ajo Way (Lt)	RW 44	116	10
Ajo Way (Rt)	RW 45	390	6
Ajo Way (Lt)	RW 46	550	16
I-19 NB to I-10 EB (Rt)	RW 47	78	10
I-19 NB to I-10 EB (Rt)	RW 48	55	10
I-19 NB to I-10 EB (Lt)	RW 49	55	10
I-19 NB to I-10 EB (Lt)	RW 50	78	10

4.14 Geotechnical and Pavement Design

4.14.1 I-19 Bridges/Ramp Structures Recommended Foundation Types

Based on review of previous geotechnical reports and as-built plans, the opportunity exists for using both shallow and deep foundations to support the planned widening of bridge structures, given the presence of very firm to hard and cemented soils at relatively shallow depths within many areas of the project site. However, from a preliminary standpoint, drilled shafts may be preferred for foundation support of all water crossings and all bridge widenings due to potential conflicts with existing foundation elements. Drilled shafts will also likely be preferred for locations where footing excavations will require shoring or which might otherwise impact traffic. Drilled shaft diameters of 3.5 feet or larger should generally be considered acceptable in most locations given the finer grained nature of the soils. At the southern end of the project (all structures from the Santa Cruz River to Valencia Road), shaft diameters of at least 4 feet should be used due to the presence of cobbles and boulders at depth. Borings advanced at Hughes Wash, Airport Wash, and Julian Wash bridges also indicate possible gravel to cobble layers at depth, which may require the use of 4-foot-diameter shafts. Table 4-29 presents the preliminary recommended foundation types for each structure location along with the as-built reports for the respective structures.

Table 4-29: Preliminary Recommended Bridge Structures Foundations

Structure	Reference	Recommended Foundation Type	As-built Foundation Type	General Soil Description
I-19 northbound Santa Cruz River Bridge No. 1243 - Widen	I-19-1(9)	Piers and abutments on drilled shafts	Piers and abutment on piles	Sand & fine gravel to depths of 15 to 25 feet over volcanic agglomerate over Basalt bedrock. Depth to basalt varies from about 20 to 60 feet from north to south.
I-19 southbound Santa Cruz River Bridge No. 1244 - Widen	I-19-1(9)	Piers and abutments on drilled shafts	Piers and abutment on piles	Sand with fine gravel at south end of bridge to silty sand with variable amounts of gravel at north end. Below 15 to 25 feet volcanic agglomerate 26 to 37.5 feet thick over basalt bedrock.
San Xavier TI OP (I-19 southbound) No. 1246 - Replace	I-19-1(9)and IR-ER-19-1(97)	Piers and abutments on drilled shafts	Abutments and piers on 14” diameter C.I.P. concrete piles	5 feet of clayey silt over 25 feet of sand, over possible agglomerate with sand, gravel, and cobbles.
San Xavier TI OP (I-19 northbound) No. 1245 – Replace	I-19-1(9) and IR-ER-19-1(97)	Piers and abutments on drilled shafts	Abutments and piers on 14” diameter C.I.P. concrete piles	5 feet of cemented clay over 2 feet of sand over 6 feet of sandy clay over sand. Possible agglomerate or dense sand and gravel below 30 feet.
I-19 Bridge (STA 3063) Nos. 1247 (NB) and 1248 (SB) - Widen	I-19-1(19)	Piers and abutments on drilled shafts	Abutments and piers on spread footings	Silt with gravel and cobbles, or silt with gravel upper 6 to 10 feet over 2 to 9 feet of caliche with sand, over dense gravel.
Los Reales Ramp B (NB) - New	I-19-1(9)	Piers and abutments on drilled shafts		Dense silt with gravel and cobbles, or silt with gravel upper 6 to 10 feet over 2 to 9 feet of caliche with sand, over dense gravel
Los Reales Ramp A - New	I-19-1(9)	Piers and abutments on drilled shafts	Abutments and piers on spread footings	Varying amounts of dense, cemented gravel, sand, silt and clay.
Los Reales TI UP (I-19 northbound & southbound) - New	N/A	Piers and abutments on drilled shafts or spread footings at piers (depending on materials encountered during investigation)		
Drexel Ramp A (Portal Frame Structure) - New	N/A	Piers and Abutments on drilled shafts or spread footings, depending on materials encountered during investigation		
Drexel Road TI UP (I-19 northbound and southbound) No. 1120 - Replace	I-19-1(5)	Abutments on drilled shafts and Piers on Spread Footings or Drilled Shafts	Abutments on piles and piers on spread footings	3 to 5 feet dense gravelly sand over hard, cemented sand and clay to 15 feet over lenses of hard, clay, sand and silt.
Airport Wash Bridges (I-19 northbound and southbound) Nos. 1121 and 1122 - Widen	I-19-1(5)	Piers and abutments on drilled shafts	Abutments and piers on spread footings	Silty sandy clay with gravel. Varying cementation below 5 to 15 feet. Possible sand, gravel, and cobbles below 20 feet.
Irvington Road TI UP No. 1123 - Replace	I-19-1(5)	Abutments on Drilled Shafts Piers on Drilled Shafts or Spread Footings	Abutments on piles and piers on spread footings	0 to 5 feet of sandy, silty clay over silty clay; cementation and hardness increasing with depth
Proposed Pedestrian Bridge UP - New	N/A	Drilled Shafts or Spread Footings		
Ajo Way Ramp A (Portal Frame Structure) - New	N/A	Abutments and piers on drilled shafts or possibly spread footings		
Ajo Way TI UP No. 1125 - Replace	I-19-1(5)	Abutments on drilled shafts piers on spread footings or drilled shafts	Abutments on piles and piers on spread footings	Silt with clay and fine sand, cemented below 5 to 10 feet with gravel below 25 to 30 feet
SR 86 Santa Cruz River Bridge No. 528 - Replace	I-19-1(5) and S-222(14)	Bridge replaced see S-222(14) abutments and piers on drilled shafts	Abutments and piers on drilled shafts	Silt, clay and sand from 0 to 5 feet over hard, cemented silt, clay and sand
Ramp 19N-10E/Ajo Way Ramp D (Portal Structure) - New	N/A	Piers and abutments on drilled shafts	Abutments and piers on drilled shafts or spread footings, depending on materials encountered	Moderately firm to hard clayey sand to sandy clay 0 to 20 feet over hard sandy gravel and clayey sand
Ajo Way Ramp C4 – New	N/A	Piers and abutments on drilled shafts		Moderately firm to very firm silty to clayey sand from 0 to 20 to 30 feet over hard silty to clayey sand
I-19 Ramp W-S OP No. 2531 – Replace	NH-10-4(175)	Piers and abutments on drilled shafts	Abutments and piers on drilled shafts	See Ajo Way Ramp C4
I-10 Ramp N-E – New	N/A	Piers and abutments on drilled shafts		See Ajo Way Ramp C4
I-19 Ramp W-S – New	N/A	Piers and abutments on drilled shafts		See Ajo Way Ramp C4
Frontage Road Connector/29th Street (EBFR-10W-19S)	New	Piers and abutments on drilled shafts		See Ajo Way Ramp C4

4.14.2 Retaining Walls and Sound Barriers

The majority of new retaining walls and sound barriers can be constructed as standard walls with spread footings at relatively low to moderate allowable soil bearing pressures. Variations of the actual wall types selected will likely be based more upon constructability around existing structures versus the soil conditions. Standard wall footings should be constructible provided the new walls are located a sufficient distance from existing structures (laterally and vertically). The use of drilled shafts may be preferred in some locations depending on the proximity to existing structures and in isolated areas as dictated by poor subgrade conditions. Other special design walls, such as L-shaped footing walls, may be considered where the proximity of new walls to existing structures or pavement is an issue.

4.14.3 Preliminary Pavement Design

Based on subgrade conditions and projections of future traffic, the widening of I-19 will require thicker PCCP sections than what currently exists. The recommended pavement sections for the Recommended Alternative are provided in Table 4-30.

Table 4-30: Preliminary Recommended Pavement Sections

Location	Station Limits	AR-ACFC (Overlay) (inches)	Jointed (Dowels) PCCP (inches)	Plain PCCP (inches)	AC (3/4) (inches)	AB Class 2 (inches)	Total Thickness (inches)
New Construction I-19, San Xavier Road to I-10 Mainline	See Plans	1.0	15.0	--	--	4.0	20.0
New Construction I-19, San Xavier Road to I-10 Auxiliary Lanes & Shoulders Ramps: Ramp EBFR-10W-19S	See Plans	1.0	-	15.0	--	4.0	20.0
New Construction Ramps: Ramp10W-19S	See Plans	1.0	-	16.0	-	4.0	21.0
New Construction Ramps: Irvington Road Ramps	See Plans	0.0 to 1.0(1)	-	13.0	--	4.0	17.0 to 18.0
New Construction Ramps: Ajo Way Ramps Drexel Road Ramps Valencia Road Ramps 19N-10E 10W-19S Crossroads: Irvington Road Drexel Road Ajo Way	See Plans	0.0 to 1.0(1)	-	12.0	--	4.0	16.0 to 17.0
New Construction Ramps: Los Reales Road Ramps	See Plans	0.0 to 1.0(1)	-	11.0	--	4.0	15.0 to 16.0
San Xavier Road Ramps							
New Construction Crossroad: Los Reales Road	See Plans	-	-	--	7.0	4.0	11.0
New Construction Crossroad: San Xavier Road	See Plans	-	-	--	6.0	4.0	10.0
(1) No AR-ACFC Overlay at intersection of service ramps/crossroads (Limits: 300' from end of exit ramps, 100' from beginning of entrance ramps, 300' from beginning/end of crossroads							

The recommended pavement sections for this project are based on an assumed subgrade R-value of 30 with a seasonal variation factor (from ADOT Materials Preliminary Engineering and Design Manual, Table 202.02-4) of 1.7 for the Tucson area. Design traffic volumes were interpolated from 2001 existing condition traffic volumes and 2030 Proposed Alternative projected traffic volumes extrapolated over a 20-year service life. The recommended pavement sections provided in Table 4-30 may be consolidated into fewer groupings to accommodate roadway design preferences.

4.15 Habitat Connectivity

The proposed improvements will not impact designated critical habitat, wild and scenic rivers, wetlands, riparian areas, prime or unique farmlands, or national natural landmarks.

4.16 Transit

There are several SunTrans's routes along I-19, Ajo Way, Irvington Road, Valencia Road and San Xavier Road (Routes 220X, 203X, 23, 430, 421, 27, 29, and 440). Based on the agency scoping meetings held for this project, no additional transit facilities were required. The Recommended Alternative will reconstruct any existing transit facilities impacted by the proposed roadway improvements.

4.17 Design Exceptions

All AASHTO non-conforming existing features within the study limits will be reconstructed to meet current AASHTO design criteria. Therefore, no AASHTO design exceptions/variances are anticipated.

All of the ADOT non-conforming existing features within the study limits will be reconstructed to meet current ADOT design criteria; except for the I-19/I-10 system ramps and the San Xavier Road southbound entrance ramp. These ramps will require ADOT design exceptions/variances.

4.18 Intergovernmental Agreements

The construction of the roadway improvements identified under the Recommended Alternative will not require IGAs. New IGAs will potentially be required to set the new ADOT maintenance limits on cross roads. These IGAs will be identified during the design phase.

5.0 Itemized Cost Estimate

5.1 Cost Estimate of the Recommended Alternative

The overall estimate of construction cost for the Recommended Alternative is approximately $485.1 million. The estimated cost for the Recommended Alternative includes approximately $399.3 million for construction, $31.9 million for design, $21.4 million for right-of-way/drainage easements, $28.5 million for utility design and relocations, and $4.0 million in environmental mitigations. The cost estimate in this phased approach includes some temporary, interim improvements (needed for maintaining traffic) that are built in one phase, but will be replaced in a future phase.

The Implementation Plan for the Recommended Alternative includes a logical sequence of construction phasing that will systematically build the ultimate I-19 Corridor improvements over time as future traffic demands warrant and funding becomes available. The plan is divided into seven major construction phases as follows:

- Phase I – Reconstruct the Ajo Way TI (MP 61.90) including the Santa Cruz River bridge on Ajo Way and the Michigan Street pedestrian bridge. Additionally, this phase includes the reconstruction to the ultimate design of portions of the mainline in immediate area of the Ajo Way TI and the construction of the southbound I-19 braided off-ramp to Irvington Road. The estimated cost of this phase is approximately $89.8 million.
- Phase II – Reconstruct the Irvington Road TI (MP 60.95). The estimated cost of this phase is approximately $48.4 million.
- Phase III – Reconstruct the three inside lanes in each direction of I-19 from Valencia Road to I-10 (MP 58.82 – MP 62.3). The estimated cost of this phase is approximately $86.3 million.
- Phase IV – Reconstruct the three inside lanes in each direction of I-19 from San Xavier Road to Valencia Road (MP 56.3 – MP 58.82). The estimated cost of this phase is approximately $66.4 million.
- Phase V – Construct the Drexel Road TI (MP 59.90) and the southbound I-19 braided off-ramp to Valencia Road (if the Drexel Road bridge over the Santa Cruz River is completed, the order of this phase should be reevaluated to determine if it should be constructed before phase IV). The estimated cost of this phase is approximately $45.2 million.
- Phase VI – Construct the fourth outer lane in each direction of I-19 and any auxiliary lanes from Valencia Road to I-10 (MP 58.82 – MP 62.3), including the braided ramps between Ajo Way and I-19/I-10 system TI. The estimated cost of this phase is approximately $92.2 million.
- Phase VII – Construct the San Xavier Road TI (MP 56.95) and the Los Reales Road TI (MP 58.90) including the CD roads between San Xavier Road and Los Reales Road. Additionally, construct the fourth outer lane in each direction of I-19 and any auxiliary lanes from San Xavier Road to Valencia Road (MP 56.3 – MP 58.82). The estimated cost of this phase is approximately $56.9 million.

Table 5-1 provides a summary of the overall cost estimate for the Recommended Alternative. The overall itemized cost estimate is included in Table 5-2. The itemized cost estimate for each phase of implementation is included in Tables 5-3 through 5-9.

Table 5-1: Summary of Overall Cost Estimate ($1,000)

Phase	Construction Cost	Design Cost	ROW & Drainage Easements	Utility Design and Relocations	Environmental Mitigation	Total Cost
Phase I	$75,252	$6,020	$2,381	$5,352	$753	$89,757
Phase II	$41,690	$3,335	$-	$2,961	$417	$48,403
Phase III	$67,565	$5,405	$7,856	$4,838	$676	$86,340
Phase IV	$53,363	$4,269	$4,450	$3,788	$534	$66,404
Phase V	$38,916	$3,113	$-	$2,748	$389	$45,166
Phase VI	$76,185	$6,095	$3,629	$5,483	$762	$92,154
Phase VII	$46,330	$3,706	$3,076	$3,335	$463	$56,911
Total	$399,300	$31,944	$21,392	$28,505	$3,993	$485,134

The following assumptions were used as the basis for this estimate:

- The standard ADOT bid item list was used to identify bid items to be included.
- Unit prices were developed based on recent ADOT bid results and construction cost estimates. Unit prices are in 2011 dollars and do not include anticipated future inflation.
- Bid items and quantities were based on the 30% design plans. Engineering judgment was applied for anticipated construction elements that have not yet been designed.
- A shrinkage/ swell factor of 20% was assumed.
- The following pavement sections were assumed:

  I-19 mainline: a 20-inch pavement section consisting of 1 inch of rubberized asphalt over 15 inches doweled PCCP over 4 inches AB Class 2.

  Auxiliary lanes & shoulders and Ramp EBFR-10W-19S: a 20-inch pavement section consisting of 1 inch of rubberized asphalt over 15 inches of PCCP over 4 inches AB Class 2.

  Ramp 10W-19S: a 21-inch pavement section consisting of 1 inch of rubberized asphalt over 16 inches of PCCP over 4 inches AB Class 2.

  Irvington Road ramps: a 17-inch to 18-inch pavement section consisting of 0-1 inches of rubberized asphalt over 13 inches of PCCP over 4 inches AB Class 2.

  Ajo Way ramps, Drexel Road ramps, Valencia Road ramps, Ramp 19N-10E, Ramp 10W-19S, Irvington Road, Drexel Road, and Ajo Way: a 16-inch to 17-inch pavement section consisting of 0-1 inches of rubberized asphalt over 12 inches of PCCP over 4 inches AB Class 2.

Los Reales Road ramps and San Xavier Road ramps: a 15-inch to 16-inch pavement section consisting of 0-1 inches of rubberized asphalt over 11 inches of PCCP over 4 inches AB Class 2.

Los Reales Road: an 11-inch pavement section consisting of 7 inches AC (¾) over 4 inches AB Class 2.

San Xavier Road: a 10-inch pavement section consisting of 6 inches AC (¾) over 4 inches AB Class 2.

- Roadway signing and pavement marking costs are based on an average cost per mile experienced in the Tucson Metro Area. The Recommended Alternative will include overhead signing throughout the corridor, and all sign structures will be replaced.
- Drainage costs include preliminary estimates for cross drainage and onsite pavement drainage facilities. Cross drainage facilities were estimated based on the recommendations of the *I-19 Draft Drainage Report*. Onsite pavement drainage costs were estimated based on an average cost per mile experienced in the Tucson Metro Area.
- This estimate includes provisions for continuous roadway lighting and Freeway Management System features, including ramp metering and variable message signs.
- The Recommended Alternative will affect most of the existing bridge structures within the project limits. Some existing structures will be widened, others will be replaced, and some will be new structures. Bridge costs were derived by classifying each bridge type and applying a unit cost per square-foot for each structure.
- Sound barriers and retaining walls cost include standard surface treatment and exclude the costs of any additional aesthetic treatments.
- The Recommended Alternative will have several potential utility conflicts. The estimate currently projects utility relocations at 7% of construction costs. The utility relocation estimate includes the costs of relocating the existing WAPA utility lines, a new WAPA utility easement and general utility relocations along the corridor. General utility relocations were estimated based on an average cost per mile and is considered an average cost per mile regardless of utility type or complexity of the relocations encountered.
- New landscaping is included for the corridor. Costs were estimated based on an average cost per mile experienced in the Tucson Metro Area for freeway landscaping.
- Right-of-way unit costs through the communities of Tucson, South Tucson, and the Tohono O'Odham Nation were estimated at $5.00 per square-foot ($217,800 per acre) for residential areas, and $8.00 per square-foot ($348,480 per acre) for commercial areas. For cost estimate purposes, land owned by the Tohono O'Odham Nation was considered commercial.
- The Recommended Alternative impacts one billboard that will require either relocation or acquisition. Impacts are currently estimated at $500,000.

Table 5-2: Recommended Alternative - Overall Itemized Cost Estimate

	Item Description	Unit	Quantity	Unit Price	Amount
2020002	Remove Bridge	EACH	5	$100,000.00	$500,000
2020008	Pavement Removal	SQ.YD.	502,795	$1.75	$879,891
2020021	Removal of Concrete Curb And Gutter	L.FT.	46,832	$3.00	$140,496
2020022	Remove Guard Rail	L.FT.	14,552	$3.00	$43,656
2020023	Remove Fence	L.FT.	54,836	$1.00	$54,836
2020024	Remove (Billboards Sign)	EACH	1	$500,000.00	$500,000
2020041	Removal of Pipe	L. FT.	4,135	$15.00	$62,025
2030201	Roadway Excavation	CU.YD.	375,430	$8.00	$3,003,440
2030902	Borrow (In Place)	CU.YD.	1,609,438	$10.00	$16,094,380
3030022	Aggregate Base, Class 2	CU.YD.	114,124	$21.00	$2,396,607
40100xx	Portland Cement Concrete Pavement (Ramps/Crossroads)	SQ.YD.	329,806	$36.00	$11,873,008
40100xx	Portland Cement Concrete Pavement (Mainline)	SQ.YD.	583,970	$45.00	$26,278,635
4060006	Asphaltic Concrete (3/4" Mix)	TON	15,301	$30.00	$459,035
4140040	Asphaltic Concrete Friction Course (Asphalt Rubber)(1")	TON	35,506	$37.00	$1,313,727
4140042	Asphalt Rubber Material (for AR-ACFC)	TON	3,196	$600.00	$1,917,331
4140044	Mineral Admixture (for AR-ACFC)	TON	320	$90.00	$28,760
501xxxx	Pipe Culverts	L.SUM	1	$1,488,790.00	$1,488,790
504xxxx	Onsite/Pavement Drainage	L.SUM	1	$9,820,900.00	$9,820,900
601xx25	Reinforced Concrete Box Culverts	L.SUM	1	$8,978,160.00	$8,978,160
7020001	Impact Attenuation Device	EACH	35	$25,000.00	$875,000
704xxxx	Signing And Pavement Markings	L.SUM	1	$5,727,576.25	$5,727,576
733xxxx	Traffic Signals	EACH	7	$300,000.00	$2,100,000
735xxxx	Lighting	L.SUM	1	$2,777,121.21	$2,777,121
736xxxx	ITS	L.SUM	1	$1,257,840.91	$1,257,841
806xxxx	Landscaping	L.SUM	1	$12,854,030.00	$12,854,030
9080085	Concrete Curb And Gutter	L.FT.	143,102	$15.00	$2,146,530
9080086	Concrete Sidewalk	SQ.FT.	182,455	$3.00	$547,365
9080087	Concrete Sidewalk Ramp	EACH	92	$1,500.00	$138,000
9080150	Concrete Median Pavement	SQ.YD.	13,266	$30.00	$397,977
9100001	Concrete Barrier	L.FT.	76,900	$40.00	$3,076,000
9100201	Concrete Median Barrier	L.FT.	29,784	$50.00	$1,489,200
9140118	Retaining Wall	SQ.FT.	362,368	$65.00	$23,553,920
9140131	Sound Barrier Wall	SQ.FT.	419,920	$30.00	$12,597,600
9201008	Concrete Channel Lining (8")	SQ.YD.	13,403	$60.00	$804,167
999x004	Bridge Structures	L.SUM	1	$50,391,905.60	$50,391,906

	Item Description	Unit	Quantity	Unit Price	Amount
				SUBTOTAL	**$206,567,909**
934xx01	Miscellaneous Work (15%)	COST	15%		$30,985,186
				SUBTOTAL	**$237,553,095**
2070001	Dust Palliative (1%)	COST	1%		$2,375,531
2090005	Furnish Water (1%)	COST	1%		$2,375,531
7010001	Maintenance And Protection Of Traffic (10%)	COST	10%		$23,755,310
8101013	Erosion Control And Pollution Prevention (1%)	COST	1%		$2,375,531
9240170	Contractor Quality Control (2%)	COST	2%		$4,751,062
9250001	Construction Surveying And Layout (2%)	COST	2%		$4,751,062
				SUBTOTAL	**$277,937,122**
9010001	Mobilization (10%)	COST	10%		$27,793,712
				SUBTOTAL	**$305,730,834**
	Contingencies (10%)	COST	10%		$30,573,083
	Construction Engineering (15%)	COST	15%		$45,859,625
414x001	AR-ACFC Smoothness Incentive	LANE MILE	88	$11,000.00	$962,833
924xx02	PCCP Smoothness Incentive	LANE MILE	88	$3,500.00	$306,356
925xx01	Indirect Cost Allocation (5.19%)	COST	5.19%		$15,867,430
				SUBTOTAL	**$399,300,162**
OTHER COST					
	Design (8%)	COST	8%		$31,944,013
	Subsurface Utility Engineering	L.SUM	1	$554,276.50	$554,277
	Right-Of-Way (Residential)	ACRE	34	$217,800.00	$7,477,074
	Right-Of-Way (Commercial)	ACRE	40	$348,480.00	$13,914,806
	Drainage Easement	ACRE			$-
	Utility Relocation (7%)	COST	7%		$27,951,011
	Environmental Mitigations (1%)	COST	1%		$3,993,002
				OTHER COST	**$85,834,183**
					TOTAL
			CONSTRUCTION COST		**$399,300,162**
			OTHER COST		**$85,834,183**
			TOTAL PROJECT COST		**$485,134,345**

Table 5-3: Recommended Alternative - Phase I Itemized Cost Estimate

	Item Description	Unit	Quantity	Unit Price	Amount
2020002	Remove Bridge	EACH	2	$100,000.00	$200,000
2020008	Pavement Removal	SQ.YD.	44,155	$1.75	$77,271
2020021	Removal of Concrete Curb And Gutter	L.FT.	16,503	$3.00	$49,509
2020022	Remove Guard Rail	L.FT.	640	$3.00	$1,920
2020023	Remove Fence	L.FT.	6,331	$1.00	$6,331
2020024	Remove (Billboards Sign)	EACH	0	$500,000.00	$-
2020041	Removal of Pipe	L. FT.	301	$15.00	$4,515
2030201	Roadway Excavation	CU.YD.	6,690	$8.00	$53,520
2030902	Borrow (In Place)	CU.YD.	293,508	$10.00	$2,935,080
3030022	Aggregate Base, Class 2	CU.YD.	21,005	$21.00	$441,111
40100xx	Portland Cement Concrete Pavement (Ramps/Crossroads)	SQ.YD.	74,092	$36.00	$2,667,316
40100xx	Portland Cement Concrete Pavement (Mainline)	SQ.YD.	92,283	$45.00	$4,152,740
4060006	Asphaltic Concrete (3/4" Mix)	TON	3,061	$30.00	$91,824
4140040	Asphaltic Concrete Friction Course (Asphalt Rubber)(1")	TON	6,458	$37.00	$238,964
4140042	Asphalt Rubber Material (for AR-ACFC)	TON	581	$600.00	$348,758
4140044	Mineral Admixture (for AR-ACFC)	TON	58	$90.00	$5,231
501xxxx	Pipe Culverts	L.SUM	1	$-	$-
504xxxx	Onsite/Pavement Drainage	L.SUM	1	$818,650.00	$818,650
601xx25	Reinforced Concrete Box Culverts	L.SUM	1	$5,288,790.00	$5,288,790
7020001	Impact Attenuation Device	EACH	4	$25,000.00	$100,000
704xxxx	Signing And Pavement Markings	L.SUM	1	$636,480.00	$636,480
733xxxx	Traffic Signals	EACH	1	$300,000.00	$300,000
735xxxx	Lighting	L.SUM	1	$250,000.00	$250,000
736xxxx	ITS	L.SUM	1	$50,000.00	$50,000
806xxxx	Landscaping	L.SUM	1	$575,200.00	$575,200
9080085	Concrete Curb And Gutter	L.FT.	29,113	$15.00	$436,695
9080086	Concrete Sidewalk	SQ.FT.	53,740	$3.00	$161,220
9080087	Concrete Sidewalk Ramp	EACH	26	$1,500.00	$39,000
9080150	Concrete Median Pavement	SQ.YD.	2,729	$30.00	$81,883
9100001	Concrete Barrier	L.FT.	14,342	$40.00	$573,680
9100201	Concrete Median Barrier	L.FT.	0	$50.00	$-
9140118	Retaining Wall	SQ.FT.	68,117	$65.00	$4,427,605
9140131	Sound Barrier Wall	SQ.FT.	92,200	$30.00	$2,766,000
9201008	Concrete Channel Lining (8")	SQ.YD.	2,389	$60.00	$143,333
999x004	Bridge Structures	L.SUM	1	$11,078,360.00	$11,078,360

	Item Description	Unit	Quantity	Unit Price	Amount
				SUBTOTAL	**$39,000,988**
934xx01	Miscellaneous Work (15%)	COST	15%		$5,850,148
				SUBTOTAL	**$44,851,136**
2070001	Dust Palliative (1%)	COST	1%		$448,511
2090005	Furnish Water (1%)	COST	1%		$448,511
7010001	Maintenance And Protection Of Traffic (10%)	COST	10%		$4,485,114
8101013	Erosion Control And Pollution Prevention (1%)	COST	1%		$448,511
9240170	Contractor Quality Control (2%)	COST	2%		$897,023
9250001	Construction Surveying And Layout (2%)	COST	2%		$897,023
				SUBTOTAL	**$52,475,829**
9010001	Mobilization (10%)	COST	10%		$5,247,583
				SUBTOTAL	**$57,723,412**
	Contingencies (10%)	COST	10%		$5,772,341
	Construction Engineering (15%)	COST	15%		$8,658,512
414x001	AR-ACFC Smoothness Incentive	LANE MILE	7	$11,000.00	$77,083
924xx02	PCCP Smoothness Incentive	LANE MILE	7	$3,500.00	$24,527
925xx01	Indirect Cost Allocation (5.19%)	COST	5.19%		$2,995,845
				SUBTOTAL	**$75,251,720**
OTHER COST					
	Design (8%)	COST	8%		$6,020,138
	Subsurface Utility Engineering	L.SUM	1	$84,143.00	$84,143
	Right-Of-Way (Residential)	ACRE	11	$217,800.00	$2,380,554
	Right-Of-Way (Commercial)	ACRE	0	$348,480.00	$-
	Drainage Easement	ACRE			$-
	Utility Relocation (7%)	COST	7%		$5,267,620
	Environmental Mitigations (1%)	COST	1%		$752,517
				OTHER COST	**$14,504,972**
					TOTAL
			CONSTRUCTION COST		**$75,251,720**
			OTHER COST		**$14,504,972**
			TOTAL PROJECT COST		**$89,756,692**

Table 5-4: Recommended Alternative - Phase II Itemized Cost Estimate

	Item Description	Unit	Quantity	Unit Price	Amount
2020002	Remove Bridge	EACH	1	$100,000.00	$100,000
2020008	Pavement Removal	SQ.YD.	36,893	$1.75	$64,562
2020021	Removal of Concrete Curb And Gutter	L.FT.	7,440	$3.00	$22,320
2020022	Remove Guard Rail	L.FT.	270	$3.00	$810
2020023	Remove Fence	L.FT.	0	$1.00	$-
2020024	Remove (Billboards Sign)	EACH	0	$500,000.00	$-
2020041	Removal of Pipe	L. FT.	0	$15.00	$-
2030201	Roadway Excavation	CU.YD.	4,411	$8.00	$35,288
2030902	Borrow (In Place)	CU.YD.	359,925	$10.00	$3,599,250
3030022	Aggregate Base, Class 2	CU.YD.	5,163	$21.00	$108,427
40100xx	Portland Cement Concrete Pavement (Ramps/Crossroads)	SQ.YD.	46,469	$36.00	$1,672,868
40100xx	Portland Cement Concrete Pavement (Mainline)	SQ.YD.	0	$45.00	$-
4060006	Asphaltic Concrete (3/4" Mix)	TON	0	$30.00	$-
4140040	Asphaltic Concrete Friction Course (Asphalt Rubber)(1")	TON	1,681	$37.00	$62,203
4140042	Asphalt Rubber Material (for AR-ACFC)	TON	151	$600.00	$90,783
4140044	Mineral Admixture (for AR-ACFC)	TON	15	$90.00	$1,362
501xxxx	Pipe Culverts	L.SUM	1	$87,360.00	$87,360
504xxxx	Onsite/Pavement Drainage	L.SUM	1	$478,905.00	$478,905
601xx25	Reinforced Concrete Box Culverts	L.SUM	1	$1,940,890.00	$1,940,890
7020001	Impact Attenuation Device	EACH	2	$25,000.00	$50,000
704xxxx	Signing And Pavement Markings	L.SUM	1	$271,915.00	$271,915
733xxxx	Traffic Signals	EACH	2	$300,000.00	$600,000
735xxxx	Lighting	L.SUM	1	$250,000.00	$250,000
736xxxx	ITS	L.SUM	1	$50,000.00	$50,000
806xxxx	Landscaping	L.SUM	1	$639,800.00	$639,800
9080085	Concrete Curb And Gutter	L.FT.	16,869	$15.00	$253,035
9080086	Concrete Sidewalk	SQ.FT.	31,990	$3.00	$95,970
9080087	Concrete Sidewalk Ramp	EACH	26	$1,500.00	$39,000
9080150	Concrete Median Pavement	SQ.YD.	3,909	$30.00	$117,283
9100001	Concrete Barrier	L.FT.	4,355	$40.00	$174,200
9100201	Concrete Median Barrier	L.FT.	0	$50.00	$-
9140118	Retaining Wall	SQ.FT.	82,470	$65.00	$5,360,550
9140131	Sound Barrier Wall	SQ.FT.	0	$30.00	$-
9201008	Concrete Channel Lining (8")	SQ.YD.	0	$60.00	$-
999x004	Bridge Structures	L.SUM	1	$5,430,600.00	$5,430,600

	Item Description	Unit	Quantity	Unit Price	Amount
				SUBTOTAL	**$21,597,381**
934xx01	Miscellaneous Work (15%)	COST	15%		$3,239,607
				SUBTOTAL	**$24,836,988**
2070001	Dust Palliative (1%)	COST	1%		$248,370
2090005	Furnish Water (1%)	COST	1%		$248,370
7010001	Maintenance And Protection Of Traffic (10%)	COST	10%		$2,483,699
8101013	Erosion Control And Pollution Prevention (1%)	COST	1%		$248,370
9240170	Contractor Quality Control (2%)	COST	2%		$496,740
9250001	Construction Surveying And Layout (2%)	COST	2%		$496,740
				SUBTOTAL	**$29,059,276**
9010001	Mobilization (10%)	COST	10%		$2,905,928
				SUBTOTAL	**$31,965,203**
	Contingencies (10%)	COST	10%		$3,196,520
	Construction Engineering (15%)	COST	15%		$4,794,780
414x001	AR-ACFC Smoothness Incentive	LANE MILE	5	$11,000.00	$56,250
924xx02	PCCP Smoothness Incentive	LANE MILE	5	$3,500.00	$17,898
925xx01	Indirect Cost Allocation (5.19%)	COST	5.19%		$1,658,994
				SUBTOTAL	**$41,689,646**
OTHER COST					
	Design (8%)	COST	8%		$3,335,172
	Subsurface Utility Engineering	L.SUM	1	$43,025.00	$43,025
	Right-Of-Way (Residential)	ACRE	0	$217,800.00	$-
	Right-Of-Way (Commercial)	ACRE	0	$348,480.00	$-
	Drainage Easement	ACRE			$-
	Utility Relocation (7%)	COST	7%		$2,918,275
	Environmental Mitigations (1%)	COST	1%		$416,896
				OTHER COST	**$6,713,368**
					TOTAL
			CONSTRUCTION COST		**$41,689,646**
			OTHER COST		**$6,713,368**
			TOTAL PROJECT COST		**$48,403,014**

Table 5-5: Recommended Alternative - Phase III Itemized Cost Estimate

	Item Description	Unit	Quantity	Unit Price	Amount
2020002	Remove Bridge	EACH	0	$100,000.00	$-
2020008	Pavement Removal	SQ.YD.	314,019	$1.75	$549,533
2020021	Removal of Concrete Curb And Gutter	L.FT.	0	$3.00	$-
2020022	Remove Guard Rail	L.FT.	5,112	$3.00	$15,336
2020023	Remove Fence	L.FT.	12,775	$1.00	$12,775
2020024	Remove (Billboards Sign)	EACH	0	$500,000.00	$-
2020041	Removal of Pipe	L. FT.	2,083	$15.00	$31,245
2030201	Roadway Excavation	CU.YD.	0	$8.00	$-
2030902	Borrow (In Place)	CU.YD.	60,393	$10.00	$603,930
3030022	Aggregate Base, Class 2	CU.YD.	31,145	$21.00	$654,039
40100xx	Portland Cement Concrete Pavement (Ramps/Crossroads)	SQ.YD.	0	$36.00	$-
40100xx	Portland Cement Concrete Pavement (Mainline)	SQ.YD.	280,302	$45.00	$12,613,601
4060006	Asphaltic Concrete (3/4" Mix)	TON	0	$30.00	$-
4140040	Asphaltic Concrete Friction Course (Asphalt Rubber)(1")	TON	14,015	$37.00	$518,559
4140042	Asphalt Rubber Material (for AR-ACFC)	TON	1,261	$600.00	$756,816
4140044	Mineral Admixture (for AR-ACFC)	TON	126	$90.00	$11,352
501xxxx	Pipe Culverts	L.SUM	1	$881,190.00	$881,190
504xxxx	Onsite/Pavement Drainage	L.SUM	1	$1,697,400.00	$1,697,400
601xx25	Reinforced Concrete Box Culverts	L.SUM	1	$360,000.00	$360,000
7020001	Impact Attenuation Device	EACH	4	$25,000.00	$100,000
704xxxx	Signing And Pavement Markings	L.SUM	1	$1,409,215.00	$1,409,215
733xxxx	Traffic Signals	EACH	0	$300,000.00	$-
735xxxx	Lighting	L.SUM	1	$627,992.42	$627,992
736xxxx	ITS	L.SUM	1	$470,994.32	$470,994
806xxxx	Landscaping	L.SUM	1	$3,315,800.00	$3,315,800
9080085	Concrete Curb And Gutter	L.FT.	0	$15.00	$-
9080086	Concrete Sidewalk	SQ.FT.	0	$3.00	$-
9080087	Concrete Sidewalk Ramp	EACH	0	$1,500.00	$-
9080150	Concrete Median Pavement	SQ.YD.	0	$30.00	$-
9100001	Concrete Barrier	L.FT.	8,644	$40.00	$345,760
9100201	Concrete Median Barrier	L.FT.	16,298	$50.00	$814,900
9140118	Retaining Wall	SQ.FT.	0	$65.00	$-
9140131	Sound Barrier Wall	SQ.FT.	222,405	$30.00	$6,672,150
9201008	Concrete Channel Lining (8")	SQ.YD.	3,403	$60.00	$204,167
999x004	Bridge Structures	L.SUM	1	$2,256,200.00	$2,256,200
				SUBTOTAL	**$34,922,954**
934xx01	Miscellaneous Work (15%)	COST	15%		$5,238,443
				SUBTOTAL	**$40,161,398**
2070001	Dust Palliative (1%)	COST	1%		$401,614
2090005	Furnish Water (1%)	COST	1%		$401,614
7010001	Maintenance And Protection Of Traffic (10%)	COST	10%		$4,016,140
8101013	Erosion Control And Pollution Prevention (1%)	COST	1%		$401,614
9240170	Contractor Quality Control (2%)	COST	2%		$803,228
9250001	Construction Surveying And Layout (2%)	COST	2%		$803,228
				SUBTOTAL	**$46,988,835**
9010001	Mobilization (10%)	COST	10%		$4,698,884
				SUBTOTAL	**$51,687,719**
	Contingencies (10%)	COST	10%		$5,168,772
	Construction Engineering (15%)	COST	15%		$7,753,158
414x001	AR-ACFC Smoothness Incentive	LANE MILE	19	$11,000.00	$207,238
924xx02	PCCP Smoothness Incentive	LANE MILE	19	$3,500.00	$65,939
925xx01	Indirect Cost Allocation (5.19%)	COST	5.19%		$2,682,593
				SUBTOTAL	**$67,565,418**
OTHER COST					
	Design (8%)	COST	8%		$5,405,233
	Subsurface Utility Engineering	L.SUM	1	$108,748.50	$108,749
	Right-Of-Way (Residential)	ACRE	10	$217,800.00	$2,095,236
	Right-Of-Way (Commercial)	ACRE	17	$348,480.00	$5,760,374
	Drainage Easement	ACRE			$-
	Utility Relocation (7%)	COST	7%		$4,729,579
	Environmental Mitigations (1%)	COST	1%		$675,654
				OTHER COST	**$18,774,826**
					TOTAL
			CONSTRUCTION COST		**$67,565,418**
			OTHER COST		**$18,774,826**
			TOTAL PROJECT COST		**$86,340,243**

Table 5-6: Recommended Alternative - Phase IV Itemized Cost Estimate

	Item Description	Unit	Quantity	Unit Price	Amount
2020002	Remove Bridge	EACH	0	$100,000.00	$-
2020008	Pavement Removal	SQ.YD.	25,740	$1.75	$45,045
2020021	Removal of Concrete Curb And Gutter	L.FT.	0	$3.00	$-
2020022	Remove Guard Rail	L.FT.	3,465	$3.00	$10,395
2020023	Remove Fence	L.FT.	13,830	$1.00	$13,830
2020024	Remove (Billboards Sign)	EACH	0	$500,000.00	$-
2020041	Removal of Pipe	L. FT.	1,751	$15.00	$26,265
2030201	Roadway Excavation	CU.YD.	0	$8.00	$-
2030902	Borrow (In Place)	CU.YD.	39,737	$10.00	$397,370
3030022	Aggregate Base, Class 2	CU.YD.	8,365	$21.00	$175,663
40100xx	Portland Cement Concrete Pavement (Ramps/Crossroads)	SQ.YD.	0	$36.00	$-
40100xx	Portland Cement Concrete Pavement (Mainline)	SQ.YD.	75,284	$45.00	$3,387,784
4060006	Asphaltic Concrete (3/4" Mix)	TON	0	$30.00	$-
4140040	Asphaltic Concrete Friction Course (Asphalt Rubber)(1")	TON	3,764	$37.00	$139,276
4140042	Asphalt Rubber Material (for AR-ACFC)	TON	339	$600.00	$203,267
4140044	Mineral Admixture (for AR-ACFC)	TON	34	$90.00	$3,049
501xxxx	Pipe Culverts	L.SUM	1	$156,160.00	$156,160
504xxxx	Onsite/Pavement Drainage	L.SUM	1	$1,255,860.00	$1,255,860
601xx25	Reinforced Concrete Box Culverts	L.SUM	1	$-	$-
7020001	Impact Attenuation Device	EACH	5	$25,000.00	$125,000
704xxxx	Signing And Pavement Markings	L.SUM	1	$1,146,310.00	$1,146,310
733xxxx	Traffic Signals	EACH	0	$300,000.00	$-
735xxxx	Lighting	L.SUM	1	$510,833.33	$510,833
736xxxx	ITS	L.SUM	1	$383,125.00	$383,125
806xxxx	Landscaping	L.SUM	1	$2,697,200.00	$2,697,200
9080085	Concrete Curb And Gutter	L.FT.	0	$15.00	$-
9080086	Concrete Sidewalk	SQ.FT.	0	$3.00	$-
9080087	Concrete Sidewalk Ramp	EACH	0	$1,500.00	$-
9080150	Concrete Median Pavement	SQ.YD.	0	$30.00	$-
9100001	Concrete Barrier	L.FT.	3,508	$40.00	$140,320
9100201	Concrete Median Barrier	L.FT.	13,486	$50.00	$674,300
9140118	Retaining Wall	SQ.FT.	0	$65.00	$-
9140131	Sound Barrier Wall	SQ.FT.	50,490	$30.00	$1,514,700
9201008	Concrete Channel Lining (8")	SQ.YD.	7,611	$60.00	$456,667
999x004	Bridge Structures	L.SUM	1	$14,116,425.60	$14,116,426
				SUBTOTAL	**$27,578,845**
934xx01	Miscellaneous Work (15%)	COST	15%		$4,136,827
				SUBTOTAL	**$31,715,672**
2070001	Dust Palliative (1%)	COST	1%		$317,157
2090005	Furnish Water (1%)	COST	1%		$317,157
7010001	Maintenance And Protection Of Traffic (10%)	COST	10%		$3,171,567
8101013	Erosion Control And Pollution Prevention (1%)	COST	1%		$317,157
9240170	Contractor Quality Control (2%)	COST	2%		$634,313
9250001	Construction Surveying And Layout (2%)	COST	2%		$634,313
				SUBTOTAL	**$37,107,336**
9010001	Mobilization (10%)	COST	10%		$3,710,734
				SUBTOTAL	**$40,818,070**
	Contingencies (10%)	COST	10%		$4,081,807
	Construction Engineering (15%)	COST	15%		$6,122,710
414x001	AR-ACFC Smoothness Incentive	LANE MILE	15	$11,000.00	$168,563
924xx02	PCCP Smoothness Incentive	LANE MILE	15	$3,500.00	$53,634
925xx01	Indirect Cost Allocation (5.19%)	COST	5.19%		$2,118,458
				SUBTOTAL	**$53,363,241**
OTHER COST					
	Design (8%)	COST	8%		$4,269,059
	Subsurface Utility Engineering	L.SUM	1	$52,430.00	$52,430
	Right-Of-Way (Residential)	ACRE	0	$217,800.00	$-
	Right-Of-Way (Commercial)	ACRE	13	$348,480.00	$4,450,090
	Drainage Easement	ACRE			$-
	Utility Relocation (7%)	COST	7%		$3,735,427
	Environmental Mitigations (1%)	COST	1%		$533,632
				OTHER COST	**$13,040,638**
					TOTAL
			CONSTRUCTION COST		**$53,363,241**
			OTHER COST		**$13,040,638**
			TOTAL PROJECT COST		**$66,403,879**

Table 5-7: Recommended Alternative - Phase V Itemized Cost Estimate

	Item Description	Unit	Quantity	Unit Price	Amount
2020002	Remove Bridge	EACH	1	$100,000.00	$100,000
2020008	Pavement Removal	SQ.YD.	24,720	$1.75	$43,261
2020021	Removal of Concrete Curb And Gutter	L.FT.	12,047	$3.00	$36,141
2020022	Remove Guard Rail	L.FT.	0	$3.00	$-
2020023	Remove Fence	L.FT.	6,530	$1.00	$6,530
2020024	Remove (Billboards Sign)	EACH	0	$500,000.00	$-
2020041	Removal of Pipe	L. FT.	0	$15.00	$-
2030201	Roadway Excavation	CU.YD.	11,633	$8.00	$93,064
2030902	Borrow (In Place)	CU.YD.	388,520	$10.00	$3,885,200
3030022	Aggregate Base, Class 2	CU.YD.	7,815	$21.00	$164,114
40100xx	Portland Cement Concrete Pavement (Ramps/Crossroads)	SQ.YD.	61,585	$36.00	$2,217,052
40100xx	Portland Cement Concrete Pavement (Mainline)	SQ.YD.	0	$45.00	$-
4060006	Asphaltic Concrete (3/4" Mix)	TON	1,181	$30.00	$35,438
4140040	Asphaltic Concrete Friction Course (Asphalt Rubber)(1")	TON	1,144	$37.00	$42,319
4140042	Asphalt Rubber Material (for AR-ACFC)	TON	103	$600.00	$61,763
4140044	Mineral Admixture (for AR-ACFC)	TON	10	$90.00	$926
501xxxx	Pipe Culverts	L.SUM	1	$-	$-
504xxxx	Onsite/Pavement Drainage	L.SUM	1	$1,007,510.00	$1,007,510
601xx25	Reinforced Concrete Box Culverts	L.SUM	1	-	$-
7020001	Impact Attenuation Device	EACH	5	$25,000.00	$125,000
704xxxx	Signing And Pavement Markings	L.SUM	1	$248,625.00	$248,625
733xxxx	Traffic Signals	EACH	2	$300,000.00	$600,000
735xxxx	Lighting	L.SUM	1	$250,000.00	$250,000
736xxxx	ITS	L.SUM	1	$50,000.00	$50,000
806xxxx	Landscaping	L.SUM	1	$585,000.00	$585,000
9080085	Concrete Curb And Gutter	L.FT.	30,141	$15.00	$452,115
9080086	Concrete Sidewalk	SQ.FT.	36,735	$3.00	$110,205
9080087	Concrete Sidewalk Ramp	EACH	26	$1,500.00	$39,000
9080150	Concrete Median Pavement	SQ.YD.	4,456	$30.00	$133,667
9100001	Concrete Barrier	L.FT.	6,141	$40.00	$245,640
9100201	Concrete Median Barrier	L.FT.	0	$50.00	$-
9140118	Retaining Wall	SQ.FT.	43,178	$65.00	$2,806,570
9140131	Sound Barrier Wall	SQ.FT.	0	$30.00	$-
9201008	Concrete Channel Lining (8")	SQ.YD.	0	$60.00	$-
999x004	Bridge Structures	L.SUM	1	$6,820,200.00	$6,820,200

	Item Description	Unit	Quantity	Unit Price	Amount
				SUBTOTAL	**$20,159,340**
934xx01	Miscellaneous Work (15%)	COST	15%		$3,023,901
				SUBTOTAL	**$23,183,241**
2070001	Dust Palliative (1%)	COST	1%		$231,832
2090005	Furnish Water (1%)	COST	1%		$231,832
7010001	Maintenance And Protection Of Traffic (10%)	COST	10%		$2,318,324
8101013	Erosion Control And Pollution Prevention (1%)	COST	1%		$231,832
9240170	Contractor Quality Control (2%)	COST	2%		$463,665
9250001	Construction Surveying And Layout (2%)	COST	2%		$463,665
				SUBTOTAL	**$27,124,392**
9010001	Mobilization (10%)	COST	10%		$2,712,439
				SUBTOTAL	**$29,836,831**
	Contingencies (10%)	COST	10%		$2,983,683
	Construction Engineering (15%)	COST	15%		$4,475,525
414x001	AR-ACFC Smoothness Incentive	LANE MILE	5	$11,000.00	$53,858
924xx02	PCCP Smoothness Incentive	LANE MILE	5	$3,500.00	$17,137
925xx01	Indirect Cost Allocation (5.19%)	COST	5.19%		$1,548,532
				SUBTOTAL	**$38,915,565**
OTHER COST					
	Design (8%)	COST	8%		$3,113,245
	Subsurface Utility Engineering	L.SUM	1	$23,630.00	$23,630
	Right-Of-Way (Residential)	ACRE	0	$217,800.00	$-
	Right-Of-Way (Commercial)	ACRE	0	$348,480.00	$-
	Drainage Easement	ACRE			$-
	Utility Relocation (7%)	COST	7%		$2,724,090
	Environmental Mitigations (1%)	COST	1%		$389,156
				OTHER COST	**$6,250,120**
					TOTAL
			CONSTRUCTION COST		**$38,915,565**
			OTHER COST		**$6,250,120**
			TOTAL PROJECT COST		**$45,165,686**

Table 5-8: Recommended Alternative - Phase VI Itemized Cost Estimate

	Item Description	Unit	Quantity	Unit Price	Amount
2020002	Remove Bridge	EACH	1	$100,000.00	$100,000
2020008	Pavement Removal	SQ.YD.	35,202	$1.75	$61,603
2020021	Removal of Concrete Curb And Gutter	L.FT.	7,337	$3.00	$22,011
2020022	Remove Guard Rail	L.FT.	4,580	$3.00	$13,740
2020023	Remove Fence	L.FT.	12,468	$1.00	$12,468
2020024	Remove (Billboards Sign)	EACH	1	$500,000.00	$500,000
2020041	Removal of Pipe	L. FT.	0	$15.00	$-
2030201	Roadway Excavation	CU.YD.	237,232	$8.00	$1,897,856
2030902	Borrow (In Place)	CU.YD.	170,003	$10.00	$1,700,030
3030022	Aggregate Base, Class 2	CU.YD.	18,572	$21.00	$390,004
40100xx	Portland Cement Concrete Pavement (Ramps/Crossroads)	SQ.YD.	56,139	$36.00	$2,021,000
40100xx	Portland Cement Concrete Pavement (Mainline)	SQ.YD.	111,006	$45.00	$4,995,249
4060006	Asphaltic Concrete (3/4" Mix)	TON	0	$30.00	$-
4140040	Asphaltic Concrete Friction Course (Asphalt Rubber)(1")	TON	5,550	$37.00	$205,360
4140042	Asphalt Rubber Material (for AR-ACFC)	TON	500	$600.00	$299,715
4140044	Mineral Admixture (for AR-ACFC)	TON	50	$90.00	$4,496
501xxxx	Pipe Culverts	L.SUM	1	$-	$-
504xxxx	Onsite/Pavement Drainage	L.SUM	1	$2,503,715.00	$2,503,715
601xx25	Reinforced Concrete Box Culverts	L.SUM	1	$1,388,480.00	$1,388,480
7020001	Impact Attenuation Device	EACH	11	$25,000.00	$275,000
704xxxx	Signing And Pavement Markings	L.SUM	1	$1,218,538.75	$1,218,539
733xxxx	Traffic Signals	EACH	0	$300,000.00	$-
735xxxx	Lighting	L.SUM	1	$388,295.45	$388,295
736xxxx	ITS	L.SUM	1	$153,721.59	$153,722
806xxxx	Landscaping	L.SUM	1	$3,166,930.00	$3,166,930
9080085	Concrete Curb And Gutter	L.FT.	22,621	$15.00	$339,315
9080086	Concrete Sidewalk	SQ.FT.	0	$3.00	$-
9080087	Concrete Sidewalk Ramp	EACH	0	$1,500.00	$-
9080150	Concrete Median Pavement	SQ.YD.	1,663	$30.00	$49,877
9100001	Concrete Barrier	L.FT.	29,617	$40.00	$1,184,680
9100201	Concrete Median Barrier	L.FT.	0	$50.00	$-
9140118	Retaining Wall	SQ.FT.	120,328	$65.00	$7,821,320
9140131	Sound Barrier Wall	SQ.FT.	54,825	$30.00	$1,644,750
9201008	Concrete Channel Lining (8")	SQ.YD.	0	$60.00	$-
999x004	Bridge Structures	L.SUM	1	$7,021,720.00	$7,021,720

	Item Description	Unit	Quantity	Unit Price	Amount
				SUBTOTAL	**$39,379,873**
934xx01	Miscellaneous Work (15%)	COST	15%		$5,906,981
				SUBTOTAL	**$45,286,854**
2070001	Dust Palliative (1%)	COST	1%		$452,869
2090005	Furnish Water (1%)	COST	1%		$452,869
7010001	Maintenance And Protection Of Traffic (10%)	COST	10%		$4,528,685
8101013	Erosion Control And Pollution Prevention (1%)	COST	1%		$452,869
9240170	Contractor Quality Control (2%)	COST	2%		$905,737
9250001	Construction Surveying And Layout (2%)	COST	2%		$905,737
				SUBTOTAL	**$52,985,619**
9010001	Mobilization (10%)	COST	10%		$5,298,562
				SUBTOTAL	**$58,284,181**
	Contingencies (10%)	COST	10%		$5,828,418
	Construction Engineering (15%)	COST	15%		$8,742,627
414x001	AR-ACFC Smoothness Incentive	LANE MILE	21	$11,000.00	$231,129
924xx02	PCCP Smoothness Incentive	LANE MILE	21	$3,500.00	$73,541
925xx01	Indirect Cost Allocation (5.19%)	COST	5.19%		$3,024,949
				SUBTOTAL	**$76,184,846**
OTHER COST					
	Design (8%)	COST	8%		$6,094,788
	Subsurface Utility Engineering	L.SUM	1	$150,175.00	$150,175
	Right-Of-Way (Residential)	ACRE	8	$217,800.00	$1,751,112
	Right-Of-Way (Commercial)	ACRE	5	$348,480.00	$1,878,307
	Drainage Easement	ACRE			$-
	Utility Relocation (7%)	COST	7%		$5,332,939
	Environmental Mitigations (1%)	COST	1%		$761,848
				OTHER COST	**$15,969,170**
					TOTAL
			CONSTRUCTION COST		**$76,184,846**
			OTHER COST		**$15,969,170**
			TOTAL PROJECT COST		**$92,154,016**

Table 5-9: Recommended Alternative - Phase VII Itemized Cost Estimate

	Item Description	Unit	Quantity	Unit Price	Amount
2020002	Remove Bridge	EACH	0	$100,000.00	$-
2020008	Pavement Removal	SQ.YD.	22,066	$1.75	$38,616
2020021	Removal of Concrete Curb And Gutter	L.FT.	3,505	$3.00	$10,515
2020022	Remove Guard Rail	L.FT.	485	$3.00	$1,455
2020023	Remove Fence	L.FT.	2,902	$1.00	$2,902
2020024	Remove (Billboards Sign)	EACH	0	$500,000.00	$-
2020041	Removal of Pipe	L. FT.	0	$15.00	$-
2030201	Roadway Excavation	CU.YD.	115,464	$8.00	$923,712
2030902	Borrow (In Place)	CU.YD.	297,352	$10.00	$2,973,520
3030022	Aggregate Base, Class 2	CU.YD.	22,060	$21.00	$463,250
40100xx	Portland Cement Concrete Pavement (Ramps/Crossroads)	SQ.YD.	91,521	$36.00	$3,294,772
40100xx	Portland Cement Concrete Pavement (Mainline)	SQ.YD.	25,095	$45.00	$1,129,261
4060006	Asphaltic Concrete (3/4" Mix)	TON	11,059	$30.00	$331,774
4140040	Asphaltic Concrete Friction Course (Asphalt Rubber)(1")	TON	2,893	$37.00	$107,046
4140042	Asphalt Rubber Material (for AR-ACFC)	TON	260	$600.00	$156,229
4140044	Mineral Admixture (for AR-ACFC)	TON	26	$90.00	$2,343
501xxxx	Pipe Culverts	L.SUM	1	$364,080.00	$364,080
504xxxx	Onsite/Pavement Drainage	L.SUM	1	$2,058,860.00	$2,058,860
601xx25	Reinforced Concrete Box Culverts	L.SUM	1	$-	$-
7020001	Impact Attenuation Device	EACH	4	$25,000.00	$100,000
704xxxx	Signing And Pavement Markings	L.SUM	1	$796,492.50	$796,493
733xxxx	Traffic Signals	EACH	2	$300,000.00	$600,000
735xxxx	Lighting	L.SUM	1	$500,000.00	$500,000
736xxxx	ITS	L.SUM	1	$100,000.00	$100,000
806xxxx	Landscaping	L.SUM	1	$1,874,100.00	$1,874,100
9080085	Concrete Curb And Gutter	L.FT.	44,358	$15.00	$665,370
9080086	Concrete Sidewalk	SQ.FT.	59,990	$3.00	$179,970
9080087	Concrete Sidewalk Ramp	EACH	14	$1,500.00	$21,000
9080150	Concrete Median Pavement	SQ.YD.	509	$30.00	$15,267
9100001	Concrete Barrier	L.FT.	10,293	$40.00	$411,720
9100201	Concrete Median Barrier	L.FT.	0	$50.00	$-
9140118	Retaining Wall	SQ.FT.	48,275	$65.00	$3,137,875
9140131	Sound Barrier Wall	SQ.FT.	0	$30.00	$-
9201008	Concrete Channel Lining (8")	SQ.YD.	0	$60.00	$-
999x004	Bridge Structures	L.SUM	1	$3,668,400.00	$3,668,400

	Item Description	Unit	Quantity	Unit Price	Amount
				SUBTOTAL	**$23,928,528**
934xx01	Miscellaneous Work (15%)	COST	15%		$3,589,279
				SUBTOTAL	**$27,517,808**
2070001	Dust Palliative (1%)	COST	1%		$275,178
2090005	Furnish Water (1%)	COST	1%		$275,178
7010001	Maintenance And Protection Of Traffic (15%)	COST	10%		$2,751,781
8101013	Erosion Control And Pollution Prevention (1%)	COST	1%		$275,178
9240170	Contractor Quality Control (2%)	COST	2%		$550,356
9250001	Construction Surveying And Layout (2%)	COST	2%		$550,356
				SUBTOTAL	**$32,195,835**
9010001	Mobilization (10%)	COST	10%		$3,219,583
				SUBTOTAL	**$35,415,418**
	Contingencies (10%)	COST	10%		$3,541,542
	Construction Engineering (15%)	COST	15%		$5,312,313
414x001	AR-ACFC Smoothness Incentive	LANE MILE	15	$11,000.00	$168,713
924xx02	PCCP Smoothness Incentive	LANE MILE	15	$3,500.00	$53,681
925xx01	Indirect Cost Allocation (5.19%)	COST	5.19%		$1,838,060
				SUBTOTAL	**$46,329,727**
OTHER COST					
	Design (8%)	COST	8%		$3,706,378
	Subsurface Utility Engineering	L.SUM	1	$92,125.00	$92,125
	Right-Of-Way (Residential)	ACRE	6	$217,800.00	$1,250,172
	Right-Of-Way (Commercial)	ACRE	5	$348,480.00	$1,826,035
	Drainage Easement	ACRE			$-
	Utility Relocation (7%)	COST	7%		$3,243,081
	Environmental Mitigations (1%)	COST	1%		$463,297
				OTHER COST	**$10,581,088**
					TOTAL
			CONSTRUCTION COST		**$46,329,727**
			OTHER COST		**$10,581,088**
			TOTAL PROJECT COST		**$56,910,815**

5.2 Estimate of Future Maintenance Costs

The future maintenance cost resulting from the additional roadway lane miles within the corridor was estimated. Unit prices for "Other Locations" were used for this project. The additional maintenance costs for the ultimate I-19 freeway are estimated to be approximately $812,656 per year, as shown in Table 5-10. The Length of Project (LP) shown in the table is the length along the I-19 mainline. The Total Pavement width (PW) shown in the table is the equivalent pavement width of added pavement for mainline, CD roads, ramps, and crossroads.

Table 5-10: Future Maintenance Costs

Annual Maintenance Cost Per Lane Mile Using PeCoS Latest FY Data[1]	
Category	**Other Locations**
1. Paved Surfaces & Shoulders	$420
2. Roadside	$230
3. Drainage & Environmental	$100
4. Rest Areas	$230
5. Traffic Operations - Signal & Lighting; Signing & Striping - ITS	$935
6. Landscaping	$85
7. Winter Storms	$155
8. Emergency Response	$30
9. Miscellaneous Maintenance[2]	$300
10. Support and Other Operating Expenses	$1,165
11. Other Specialty Items[3]	
MCL = Maintenance Cost per Lane Mile	**$3,650**
Annual Maintenance Cost of Project at PA/DCR Phase	**Other Locations[6]**
PW = Total Pavement Width[4]	135.7
NL = Number of Lane Miles	11.3
LP = Length of Project in Miles	6.4
PMC = Current Project Maintenance Cost	**$263,144**
Annual Maintenance Cost of Project at Beginning of Maintenance Phase	**Other Locations[6]**
IF = Inflation Factor[5]	1.058
N = Number of Years to Maintenance Phase	20
PMCI = Project Maintenance Cost including Inflation	**$812,656**

Notes:
1 Lane mile width is 12 ft, Total maintenance lane miles = 27,722 miles, Metropolitan Phoenix maintenance lane miles = 2016 miles, Other Locations = 25,706 miles.
2 Miscellaneous maintenance include building and yard maintenance, work for other divisions, training, material handling, vegetation control and contract administration for categories not considered in the maintenance cost breakdown.
3 For Other Specialty Items, contact Central Maintenance.
4 Total pavement width includes the mainline, ramps and shoulders (only the newly constructed or added pavement width).
5 Based on increase in maintenance costs of 76% over the last 10 years.
6 Numbers for maintenance cost at PA/DCR Phase and Beginning of Maintenance Phase represent an Example Project, 24 feet wide, 2 miles long, going into the maintenance phase 3 years later.
Only Gray Areas require manual entry
NL = PW / 12
PMC = MCL x NL x LP
PMCI = PMC x (IF^N)

5.3 Detailed Cost Estimates of Other Alternatives Considered

The roadway plans for Alternative #1 were conceptual, while no plans were available for the No-Action Alternative. The cost estimates for the other alternatives were based on lane miles.

5.3.1 Cost Estimate of Alternative #1

The overall construction cost estimate for Alternative #1 is approximately $478.2 million. The estimated cost for Alternative #1 includes approximately $386.3 million for construction, $30.9 million for design, $29.5 million for right-of-way/drainage easements, $27.0 million for Utility Relocations, and $3.9 million in environmental mitigations. The cost estimate for this phased approach includes interim improvements (needed for maintaining traffic) that are built in one phase but will be replaced in a future phase. The overall itemized cost estimate is included in Table 5-11.

5.3.2 Cost Estimate of the No-Action Alternative

The overall construction cost estimate for the No-Action Alternative is approximately $33.0 million. The estimated cost for the No-Action Alternative includes approximately $28.3 million for Construction, $2.3 million for design, $2.0 million for Utility Relocations, and $0.3 million in environmental mitigations. The cost estimate for this phased approach includes interim improvements (needed for maintaining traffic) that are built in one phase but will be replaced in a future phase. The overall itemized cost estimate is included in Table 5-12.

Table 5-11: Alternative #1 - Overall Itemized Cost Estimate

	Item Description	Unit	Quantity	Unit Price	Amount
	Recommended Alternative SUBTOTAL				$206,407,162
	Recommended Alternative Lane miles		87.5		
	Cost Per Lane Mile				$2,358,122
	Alternative #1 Lane Miles		84.5		
				SUBTOTAL	**$199,332,795**
934xx01	Miscellaneous Work (15%)	COST	15%		$29,899,919
				SUBTOTAL	**$229,232,714**
2070001	Dust Palliative (1%)	COST	1%		$2,292,327
2090005	Furnish Water (1%)	COST	1%		$2,292,327
7010001	Maintenance And Protection Of Traffic (15%)	COST	15%		$34,384,907
8101013	Erosion Control And Pollution Prevention (1%)	COST	1%		$2,292,327
9240170	Contractor Quality Control (2%)	COST	2%		$4,584,654
9250001	Construction Surveying And Layout (2%)	COST	2%		$4,584,654
				SUBTOTAL	**$279,663,911**
9010001	Mobilization (10%)	COST	10%		$27,966,391
				SUBTOTAL	**$307,630,302**
	Contingencies (5%)	COST	5%		$15,381,515
	Construction Engineering (15%)	COST	15%		$46,144,545
414x001	AR-ACFC Smoothness Incentive	LANE MILE	85	$11,000.00	$929,833
924xx02	PCCP Smoothness Incentive	LANE MILE	85	$3,500.00	$295,856
925xx01	Indirect Cost Allocation (5.19%)	COST	5.19%		$15,966,013
				SUBTOTAL	**$386,348,065**
OTHER COST					
	Design (8%)	COST	8%		$30,907,845
	Subsurface Utility Engineering	L.SUM	1	$554,276.50	$554,277
	Right-Of-Way (Residential)	ACRE	41	$217,800.00	$9,001,674
	Right-Of-Way (Commercial)	ACRE	59	$348,480.00	$20,445,322
	Drainage Easement	ACRE			$-
	Utility Relocation (7%)	COST	7%		$27,044,365
	Environmental Mitigations (1%)	COST	1%		$3,863,481
				OTHER COST	**$91,816,962**
					TOTAL
			CONSTRUCTION COST		**$386,348,065**
			OTHER COST		**$91,816,962**
			TOTAL PROJECT COST		**$478,165,027**

Table 5-12: No-Action Alternative - Overall Itemized Cost Estimate

	Item Description	Unit	Quantity	Unit Price	Amount
	Recommended Alternative SUBTOTAL				$206,407,162
	Recommended Alternative Lane miles		87.5		
	Cost Per Lane Mile				$2,358,122
	No-Action Alternative Lane Miles		6.2		
				SUBTOTAL	**$14,620,358**
934xx01	Miscellaneous Work (15%)	COST	15%		$2,193,054
				SUBTOTAL	**$16,813,412**
2070001	Dust Palliative (1%)	COST	1%		$168,134
2090005	Furnish Water (1%)	COST	1%		$168,134
7010001	Maintenance And Protection Of Traffic (15%)	COST	15%		$2,522,012
8101013	Erosion Control And Pollution Prevention (1%)	COST	1%		$168,134
9240170	Contractor Quality Control (2%)	COST	2%		$336,268
9250001	Construction Surveying And Layout (2%)	COST	2%		$336,268
				SUBTOTAL	**$20,512,363**
9010001	Mobilization (10%)	COST	10%		$2,051,236
				SUBTOTAL	**$22,563,599**
	Contingencies (5%)	COST	5%		$1,128,180
	Construction Engineering (15%)	COST	15%		$3,384,540
414x001	AR-ACFC Smoothness Incentive	LANE MILE	6	$11,000.00	$68,200
924xx02	PCCP Smoothness Incentive	LANE MILE	6	$3,500.00	$21,700
925xx01	Indirect Cost Allocation (5.19%)	COST	5.19%		$1,171,051
				SUBTOTAL	**$28,337,270**
OTHER COST					
	Design (8%)	COST	8%		$2,266,982
	Subsurface Utility Engineering	L.SUM	1	$108,748.50	$108,749
	Right-Of-Way (Residential)	ACRE	0	$217,800.00	$-
	Right-Of-Way (Commercial)	ACRE	0	$348,480.00	$-
	Drainage Easement	ACRE			$-
	Utility Relocation (7%)	COST	7%		$1,983,609
	Environmental Mitigations (1%)	COST	1%		$283,373
				OTHER COST	**$4,642,712**
					TOTAL
			CONSTRUCTION COST		**$28,337,270**
			OTHER COST		**$4,642,712**
			TOTAL PROJECT COST		**$32,979,981**

6.0 Implementation Plan

The Implementation Plan includes a logical sequence of construction phasing that will systematically build the ultimate I-19 corridor improvements over time as future traffic demands warrant and funding becomes available. The plan considers the availability of funds, the need for improvements based on traffic demand, and construction staging to maintain traffic and minimize traffic congestion and delays during the construction phases.

From a traffic demand aspect, AECOM conducted a traffic operational analysis to determine the elements of study corridor that are more susceptible to experience an unacceptable LOS. The results of analysis indicated that the operations at the Ajo Way TI and the Irvington Road TI are expected to reach an unacceptable LOS before other elements of the corridor. Therefore, the implementation phases will be needed in the following order: the Ajo Way TI as Phase I, and Irvington Road TI as Phase II, 6 lanes on I-19 from Valencia Road to I-10 by the year 2020 (Phase III), 6 lanes on I-19 from San Xavier Road to Valencia Road (Phase IV), the traffic interchange at Drexel Road (Phase V), 8 lanes on I-19 from Valencia Road to I-10 (Phase VI), and the traffic interchanges at San Xavier Road and Los Reales Road, and 8 lanes on I-19 from San Xavier Road to Valencia Road (Phase VII). Figure 6.1 illustrates the implementation plan for the I-19 corridor.

If the Drexel Road Bridge over the Santa Cruz River is constructed, the order of the implementation should be reevaluated to determine if the TI at Drexel Road (Phase V) should be constructed before the 6 lanes on I-19 from San Xavier Road to Valencia Road (Phase IV).

Phase I: Reconstruct the Ajo Way TI and the southbound I-19 braided off-ramp to Irvington Road

The first phase of implementation is the Ajo Way TI (MP 61.9). This phase also includes the southbound braided off-ramp to Irvington Road, which would prevent traffic from the Irvington TI to affect operations on I-19 southbound. The estimated cost of this phase is approximately $89.8 million. The improvements are shown in Figure 6.2 and include:

- Reconstructing the I-19/Ajo Way TI. This includes constructing a new bridge structure, retaining walls and the permanent Ajo Way southbound on-ramp.
- Reconstructing southbound I-19 in the proximity of the Ajo Way TI.
- Constructing Irvington Road permanent southbound braided off-ramp. Note that this improvement does not include the ultimate improvements at the Irvington Road TI.
- Reconstructing Ajo Way east and west of I-19, including a new bridge structure over the Santa Cruz River.
- Replacing the pedestrian bridge structure over I-19 near Michigan Street.
- Improving drainage culverts at Rodeo Wash, Irvington Wash, and other locations.

Phase II: Construct the Irvington Road TI

The second phase is the Irvington Road TI (MP 60.95). This phase does not include any I-19 mainline widening. The estimated cost of this phase is approximately $48.4 million. The improvements include:

- Reconstructing the I-19/Irvington Road TI. This includes constructing a new bridge structure and retaining walls, a connection to the southbound braided off-ramp (built in Phase I), and remaining permanent ramps.
- Reconstructing Irvington Road east and west of I-19.
- Improving drainage at the Wyoming Wash and other locations.

Phase III: Construct/reconstruct the three inside lanes in each direction of I-19 from Valencia Road to I-10

The third phase is the construction of I-19 mainline from Valencia Road to north of Ajo Way (MP 58.82 – MP 62.72). The estimated cost of this phase is approximately $86.3 million. The improvements include:

- Constructing/reconstructing the three inside lanes in each direction of I-19 from Valencia Road to I-10, including the construction of the median and median barrier.
- Widening the bridge structures at Airport Wash.
- Improving drainage at the Valencia Wash, Mission Park Wash, and other drainage improvements.

Phase IV: Construct/reconstruct the three inside lanes in each direction of I-19 from San Xavier Road to Valencia Road

The fourth phase is the construction of I-19 mainline from San Xavier Road to Valencia Road (MP 56.3 – MP 58.82). The estimated cost of this phase is approximately $66.4 million. The improvements include:

- Constructing/reconstructing the three inside lanes in each direction of I-19 from San Xavier Road to Valencia Road, including the construction of the median and median barrier.
- Widening the bridge structures at Santa Cruz River, at San Xavier Road, and at Hughes Wash.
- Other drainage improvements.

Phase V: Construct the Drexel Road TI and the southbound I-19 braided off-ramp to Valencia Road

The fifth phase of implementation is the Drexel Road TI (MP 59.90) and the southbound I-19 braided off-ramp to Valencia Road. This phase does not include any I-19 mainline widening. The estimated cost of this phase is approximately $45.2 million. The improvements include:

- Constructing a new TI at Drexel Road. This includes a new bridge structure and retaining walls, and constructing permanent Drexel Road ramps.
- Constructing the Valencia Road permanent southbound braided off-ramp.
- Reconstructing Drexel Road east and west of I-19.
- Other drainage improvements.

If the Drexel Road Bridge over the Santa Cruz River project is constructed, the order of this phase should be reevaluated.

Phase VI: Construct the fourth outer lane in each direction of I-19 and any auxiliary lanes from Valencia Road to I-10

The sixth phase is the ultimate widening of I-19 mainline from Valencia Road to north of Ajo Way (MP 58.82 – MP 63.0). The estimated cost of this phase is approximately $92.2 million. The improvements include:

- Constructing the fourth outer lane in each direction of I-19 from Valencia Road to I-10 including any auxiliary lanes.
- Constructing the braided ramps between Ajo Way and I-10 including the new bridge structures and retaining walls.
- Constructing the ramp from the eastbound I-10 frontage Road to fly-over between (westbound I-10 and southbound I-19) including new bridge structure and retaining walls.
- Reconstructing the Valencia Road northbound on-ramp including any retaining walls.
- Other drainage improvements.

Phase VII: Construct the San Xavier Road TI and the Los Reales Road TI including the CD roads between San Xavier Road and Los Reales Road, and construct the fourth outer lane in each direction of I-19 and any auxiliary lanes from San Xavier Road to Valencia Road

The last phase of implementation is constructing the San Xavier Road TI (MP 56.95) and Los Reales Road TI (MP 58.9) including the CD roads between San Xavier Road and Los Reales Road, and constructing the fourth outer lane in each direction of I-19 and any auxiliary lanes from San Xavier Road to Valencia Road (MP 56.3 – MP 58.82). The estimated cost of this phase is approximately $56.9 million. The improvements include:

- Constructing the modified split diamond TI at the San Xavier Road and Los Reales Road. This includes constructing a new bridge structure at Los Reales Road, constructing new bridge structures at the Hughes Wash to accommodate the new Los Reales ramps, and building retaining walls at both interchanges.
- Constructing the new ramps and connector road (spur) at the San Xavier Road TI and Los Reales Road TI including the CD roads between San Xavier Road and Los Reales Road.
- Constructing the fourth outer lane in each direction of I-19 from San Xavier Road to Valencia Road including any auxiliary lanes.
- Reconstructing the Valencia Road northbound off-ramp and southbound on-ramp including any retaining walls.
- Other drainage improvements.

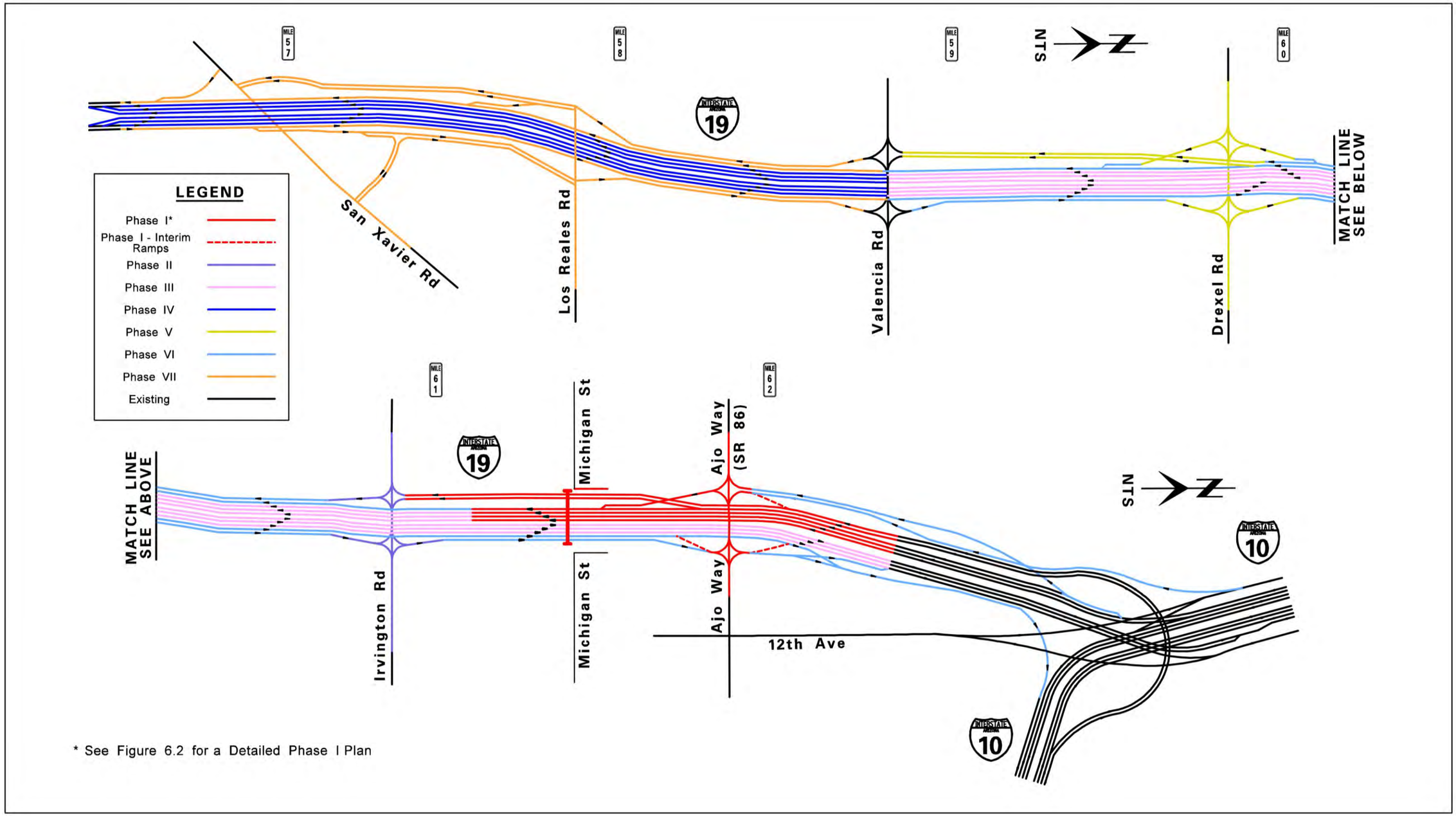


Figure 6-1: Implementation Plan for the Recommended Alternative

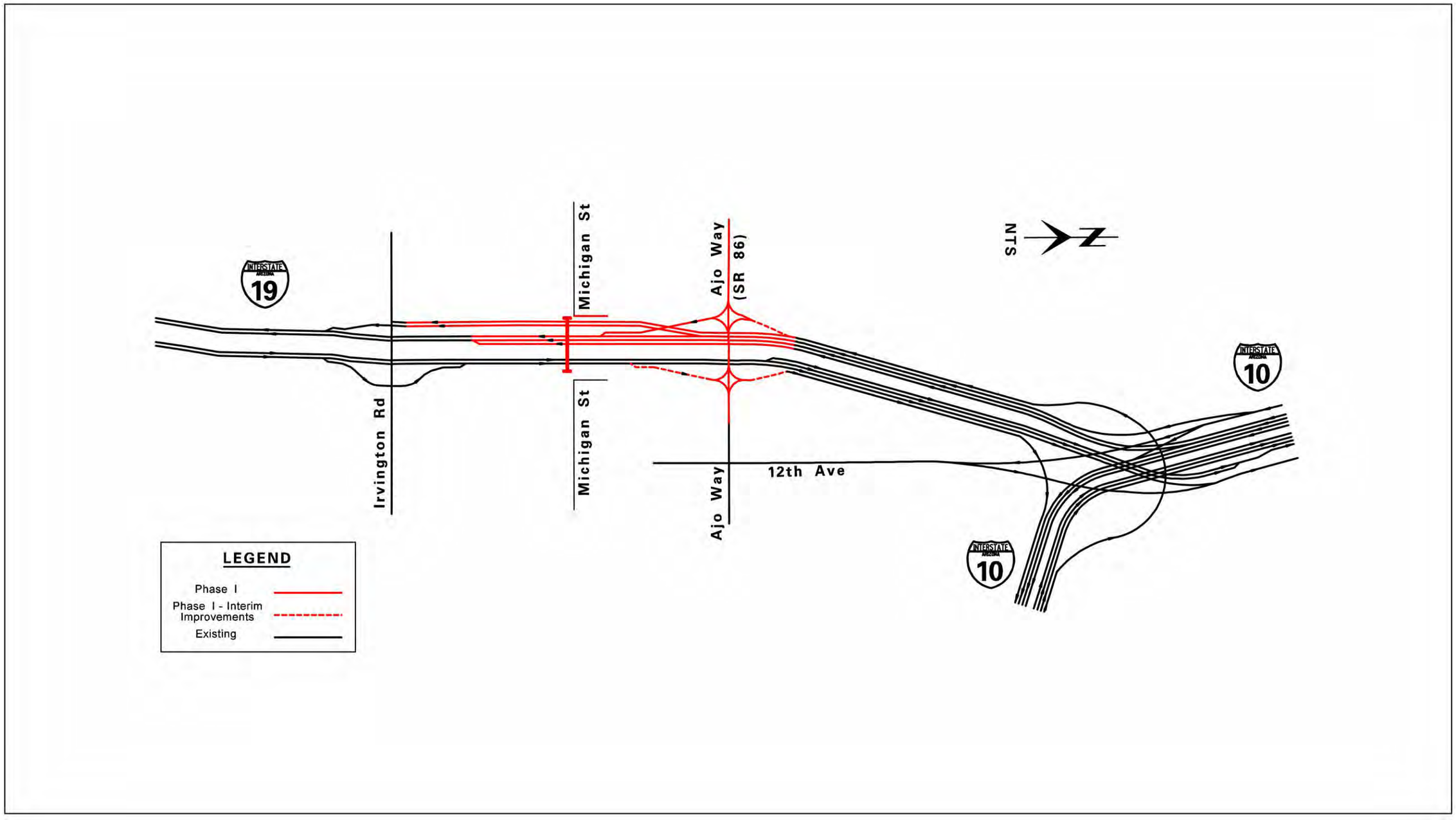


Figure 6-2: Phase I Plan

7.0 AASHTO Controlling Design Criteria and Design Exceptions

The existing features of the I-19 corridor between San Xavier Road and I-10 were analyzed using AASHTO Controlling Design Criteria set forth in two AASHTO documents: “A Policy on Design Standards: Interstate System”, 2005 and “Geometric Design of Highways and Streets”, 2004. The existing features were also analyzed using the ADOT design criteria outlined in ADOT’s RDG.

7.1 AASHTO Non-Conforming Geometric Design Elements

A complete listing of the existing I-19 features and evaluation results of the AASHTO criteria are presented within the AASHTO Controlling Design Criteria Report prepared in 2007 and located in Appendix F. However, the ADOT “Guide for Review of the AASHTO Controlling Design Criteria on Existing ADOT Roadways” was updated in November 2009. Since all elements in the corridor will be upgraded to meet AASHTO standards, the February 2007 AASHTO report prepared for this project was not updated. It will be kept in the project file but not included in this report since it is now outdated.

Under the Recommended Alternative, all of the AASHTO non-conforming existing features within the study limits will be reconstructed to meet current AASHTO design criteria. Therefore, no AASHTO design exceptions/variances are anticipated.

7.2 AASHTO Design Exceptions

Based on the AASHTO controlling design criteria, AASHTO design exceptions are not required for this project.

7.3 ADOT RDG Non-Conforming Geometric Design Elements

Under the Recommended Alternative, all of the ADOT non-conforming existing features within the study limits will be reconstructed to meet current ADOT design criteria; except for the I-10/I-19 system ramps and the San Xavier Road southbound entrance ramp. These ramps will require ADOT design exceptions/variances.

7.4 ADOT Design Exceptions

Based on the ADOT controlling design criteria, ADOT design exceptions/variances are required at the following locations:

- The horizontal curve for the 10W-19S flyover system ramp: this is an existing ramp constructed in 2004 as part of the I-10 widening project, and a design exception was obtained during the design. This ramp was constructed as a two-lane ramp in anticipation of the future widening of I-19, but was striped as a one-lane ramp. This ramp will be restriped as a two-lane ramp.
- The horizontal curve for the 19N-10E system ramp: this is an existing ramp constructed in 2004 as part of the I-10 widening project, and a design exception was obtained during the design. Due to environmental concerns (Section 4F property), the ramp will be reconstructed using similar geometry that does not meet current ADOT design standards.
- The horizontal curve for the San Xavier Road southbound entrance ramp: the existing ramp geometry does not meet current ADOT design standards. Due to environmental concerns, the ramp will be reconstructed using similar geometry that does not meet current ADOT current standards. The acceleration lane was lengthened to accommodate slower speeds of vehicles entering I-19.

8.0 Social, Economic And Environmental Concerns

Throughout the study limits, the proposed I-19 corridor improvements will impact several archeological sites, protected native plants and designated critical habitats, parks, and Waters of the US.

8.1 Environmental Documentation

An Environmental Assessment is being prepared in support of this study.

8.2 Mitigation Measures

The following mitigation measures were presented in the Draft EA and are listed here in their final version. ADOT will implement these mitigation measures by incorporating them into the project construction documents. These mitigation measures supersede any of those identified in the Draft EA. The following mitigation measures and commitments are not subject to modification without the prior written approval of the FHWA.

Arizona Department of Transportation Design Responsibilities

- During final design, ADOT will coordinate with the City of Tucson and commercial property owners to determine a final design that meets the purpose and need of the project but that minimizes impacts to the commercial properties. (Refer to Environmental Assessment page 13.)
- During final design, appropriate mitigation measures, including testing and data recovery plans, will be developed and implemented by the Arizona Department of Transportation Environmental Planning Group Historic Preservation Team, in consultation with the State Historic Preservation Office and other consulting parties, for those National Register of Historic Places-eligible properties and cultural resources that require testing to determine eligibility that cannot be avoided. A memorandum of agreement will be executed for this project that stipulates a process for review of all cultural resources documentation generated from any future archaeological investigations. Construction activities will not occur in areas requiring testing and data recovery until cultural resources investigations are complete. (Refer to Environmental Assessment page 52.)
- During final design, the Project Manager will contact the Arizona Department of Transportation Noise Coordinator (602-712-7767) to arrange for qualified personnel to review and update the noise analysis. (Refer to Environmental Assessment page 74.)
- During final design, if noise abatement measures are recommended, the Arizona Department of Transportation will meet with each property owner whose site meets the criteria for abatement by the Arizona Department of Transportation Noise Abatement Policy, and an agreement will be reached with the property owners on whether a noise barrier wall is wanted. (Refer to Environmental Assessment page 22).
- The Arizona Department of Transportation will prepare and submit an application to the United States Army Corps of Engineers for a Clean Water Act Section 404 permit for the project. No work will occur within jurisdictional Waters of the United States until the appropriate Clean Water Act Section 401 Water Quality Certification and Section 404 permits are obtained. (Refer to Environmental Assessment page 78.)
- The City of Tucson Planning and Development Services (520-791-5550), the City of Tucson Department of Transportation Stormwater Management Section (520-791-4251), and the Pima County floodplain administrator (520-243-1800) will be provided an opportunity to review and comment on the design plans. (Refer to Environmental Assessment page 82.)
- All disturbed soils that will not be landscaped or otherwise permanently stabilized by construction will be seeded using species native to the project vicinity. (Refer to Environmental Assessment page 86.)
- During final design, if more than five years have elapsed between approval of the biological report and final design, the Arizona Department of Transportation Biologist will reevaluate the status of the Endangered Species Act listed species and initiate consultation with the United States Fish and Wildlife Service, if necessary. (Refer to Environmental Assessment page 88.)
- During final design, the Arizona Department of Transportation Project Manager will coordinate with the Arizona Department of Transportation Hazardous Materials Coordinator (602-712-7767) to complete testing for asbestos and lead-based paint within the project limits and, if necessary, recommend remediation measures. (Refer to Environmental Assessment page 89.)
- The Arizona Department of Transportation Project Manager will contact the Arizona Department of Transportation Hazardous Materials Coordinator (602-712-7767) 30 calendar days prior to bid advertisement to determine the need for additional site assessment. (Refer to Environmental Assessment page 89.)

Arizona Department of Transportation Roadside Development Section Responsibilities

- Protected native plants within the project limits will be impacted by this project; therefore, the Arizona Department of Transportation Roadside Development Section will determine if Arizona Department of Agriculture notification is needed. If notification is needed, the Arizona Department of Transportation Roadside Development Section will send the notification at least 60 calendar days prior to the start of construction. (Refer to Environmental Assessment page 86.)

Arizona Department of Transportation Tucson District Responsibilities

- Construction activities will not occur in areas requiring testing and data recovery until cultural resources investigations are complete. (Refer to Draft Environmental Assessment page 52.)
- No work will occur within jurisdictional Waters of the United States until the appropriate Clean Water Act Section 401 Water Quality Certification and Section 404 permit are obtained. (Refer to Environmental Assessment page 79.)
- The Engineer will submit the contractor's Arizona Pollutant Discharge Elimination System Notice of Intent and the Notice of Termination to the Environmental Coordinator. (Refer to Environmental Assessment page 83.)

- The Engineer will submit the National Pollutant Discharge Elimination System Notice of Intent and the Notice of Termination to the Environmental Protection Agency only after the District has reviewed and approved the Stormwater Pollution Prevention Plan. (Refer to Environmental Assessment page 83.)
- The Engineer will review the National Emissions Standards for Hazardous Air Pollutants notification received from the contractor. The contractor shall not start work associated with Arizona Department of Transportation structures until 10 working days have passed since the submittal of the National Emissions Standards for Hazardous Air Pollutants notification to the regulatory agencies. (Refer to Environmental Assessment page 89.)

Contractor Responsibilities

- The contractor shall coordinate with the Superintendent of the Tucson Unified School District (520-225-6000), Sunnyside Unified School District (520-545-2000), Pima Community College (520-206-4500), and San Xavier Mission School (520-294-0628) a minimum of 14 calendar days prior to traffic-disrupting activities to allow for coordination of school bus routes during construction. (Refer to Environmental Assessment page 37.)
- The contractor shall coordinate with the City of Tucson Fire Department (520-791-4512), the City of South Tucson Fire Department (520-792-2424), Tohono O'odham Nation Fire Department (520-383-8276), Tohono O'odham Nation Police Department (520-383-3275), and the Pima County Sheriff's Department (520-351-4600) a minimum of 14 calendar days prior to construction activities to inform them of the construction schedule. (Refer to Environmental Assessment page 39.)
- Construction activities shall not occur in areas requiring testing and data recovery until cultural resources investigations are complete. (Refer to EA page 52.)
- The contractor shall contact the Arizona Department of Transportation Historic Preservation Team (602-712-7767) at least 10 business days prior to the start of ground-disturbing activities to arrange for a qualified archeologist archaeologist to flag avoidance areas. (Refer to Environmental Assessment page 52.)
- The contractor shall avoid all flagged and/or otherwise designated sensitive resource avoidance areas within or adjacent to the project area. (Refer to Environmental Assessment page 52.)
- The contractor, in association with the District, shall submit the Arizona Pollution Discharge Elimination System Notice of Intent and the Notice of Termination to the Arizona Department of Environmental Quality only after the District has reviewed and approved the Stormwater Pollution Prevention Plan. (Refer to Environmental Assessment page 83.)
- The contractor, in association with the District, shall submit the National Pollution Discharge Elimination System Notice of Intent and the Notice of Termination to the Environmental Protection Agency only after the District has reviewed and approved the Stormwater Pollution Prevention Plan. (Refer to Environmental Assessment page 83.)
- All disturbed soils that will not be landscaped or otherwise permanently stabilized by construction shall be seeded using species native to the project vicinity. (Refer to Environmental Assessment page 86.)
- To prevent the introduction of invasive species, all earth-moving and hauling equipment shall be washed at the contractor's storage facility prior to entering the construction site. (Refer to Environmental Assessment page 86.)
- To prevent invasive species seeds from leaving the site, the contractor shall inspect all construction equipment and remove all attached plant/vegetation and soil/mud debris prior to leaving the construction site. (Refer to Environmental Assessment page 86.)
- The contractor shall complete a National Emissions Standards for Hazardous Air Pollutants notification for work associated with the Arizona Department of Transportation structures and submit to the Engineer for review. After Engineer approval, the notification shall be submitted to the Arizona Department of Transportation Hazardous Materials Coordinator (602-712-7767) for a five-working-day 5 working day review and approval. Upon approval by the Arizona Department of Transportation Hazardous Materials Coordinator, the contractor shall file the notification with Arizona Department of Environmental Quality and the Pima County Air Quality Department at least 10 working days prior to demolition/renovation associated with the Arizona Department of Transportation structures (Arizona Department of Transportation 2004a). (Refer to Environmental Assessment page 89.)
- The contractor shall not start work associated with the demolition/renovation of structures until 10 working days have passed since the submittal of the National Emissions Standards for Hazardous Air Pollutants notification to the regulatory agencies. (Refer to Environmental Assessment page 89.)

Standard Specifications Included as Mitigation Measures

- Traffic control will be in accordance with the United States Department of Transportation's most current Manual on Uniform Traffic Control Devices for Streets and Highways, and the Arizona Supplement to the Manual on Uniform Traffic Control Devices, including any revisions or additions, and/or associated provisions in the project plans, as determined by the Arizona Department of Transportation Traffic Design Section during design. (Refer to Environmental Assessment page 38.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 701 Maintenance and Protection of Traffic, Subsection 3.01 General (2008), "The contractor shall provide for the adequate protection of all vehicular and pedestrian traffic and workers through any portion of the work where construction operations interfere with, obstruct, or create a hazard to the movement of traffic." Further, "At the pre-construction conference, the contractor shall provide the Engineer with the name of the contractor's employee who is responsible for implementing, monitoring and altering, as necessary, the traffic control plan. The Engineer will then advise the local law enforcement agency having jurisdiction, or the names of the contractor's representative and a representative of the Department who will act in a similar capacity." (Refer to Environmental Assessment page 39.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 107 Legal Relations and Responsibility to Public, Subsection 05 Archaeological Features (2008), "When archaeological, historical, or paleontological features are encountered or discovered during any activity related to the

construction of the project, the contractor shall stop work immediately at that location and shall take all reasonable steps to secure the preservation of those resources and notify the Engineer. The Engineer would direct how to protect the features. The contractor shall not resume work until it is so directed by the Engineer." The Arizona Department of Transportation Engineer will, in turn, notify the Arizona Department of Transportation Environmental Planning Group Historic Preservation Team (602-712-7767) to evaluate the significance of the resources. (Refer to Environmental Assessment page 52.)

- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 107 Legal Relations and Responsibility to Public, Section 104 Scope of Work, Subsection 08 Prevention of Air and Noise Pollution (2008), "The contractor shall control, reduce, remove or prevent air pollution in all its forms, including air contaminants, in the performance of the contractor's work. The contractor shall comply with applicable requirements of Arizona Revised Statutes Section 49-401 et seq. (Air Quality) and with the Arizona Administrative Code, Title 18, Chapter 2 (Air Pollution Control)." (Refer to Environmental Assessment page 64.)
- Fugitive dust generated from construction activities will be controlled in accordance with Department's Standard Specifications for Road and Bridge Construction, Section 104.08 (2008), special provisions, and local rules or ordinances, including Maricopa County Air Pollution Control Regulation Rule 310 (Fugitive Dust) and Arizona Administrative Code, Title 18, Chapter 2 (Air Pollution Control) and Pima County Code Title 17 - Air Quality Control, Pima County Department of Environmental Quality Fugitive Dust Activity Permit. (Refer to Environmental Assessment page 64.)
- The contractor shall be required to meet the noise abatement requirements of Section 104.08, Prevention of Air and Noise Pollution, of Department's Standard Specifications for Road and Bridge Construction (2008) during the roadway construction. If blasting is required for construction of the improvements, the contractor shall adhere to Section 107.10, Use of Explosives of Department's Standard Specifications for Road and Bridge Construction (2008). (Refer to Environmental Assessment page 74.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 104 Scope of Work, Subsection 08 Prevention of Air and Noise Pollution (2008), "The contractor shall comply with all local sound control and noise level rules, regulations and ordinances which apply to any work performed pursuant to the contract. Each internal combustion engine used for any purpose on the work or related to the work shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated during construction without its muffler being in good working condition." (Refer to Environmental Assessment page 74.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 104 Scope of Work, Subsection 09 Prevention of Landscape Defacement; Protection of Streams, Lakes, and Reservoirs (2008), "The contractor shall give special attention to the effect of its operations upon the landscape and shall take special care to maintain natural surroundings undamaged." (Refer to Environmental Assessment page 77.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 104 Scope of Work, Subsection 09 Prevention of Landscape Defacement; Protection of Streams, Lakes, and Reservoirs (2008), "The contractor shall take sufficient precautions, considering various conditions, to prevent pollution of streams, lakes, and reservoirs with fuels, oils, bitumens, calcium chloride, fresh Portland cement, fresh Portland cement concrete, raw sewage, muddy water, chemicals or other harmful materials. None of these materials shall be discharged into any channels leading to such streams, lakes or reservoirs." (Refer to Environmental Assessment page 83.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 810, Erosion Control and Pollution Prevention, Subsection 1.02, Other-Pollutants Controls (2008), "The work shall include implementing controls to eliminate the discharge of pollutants, such as fuels, lubricants, bitumens, dust palliatives, raw sewage, wash water, and other harmful materials; into storm and other off-site waters. The work shall include the implementation of spill prevention and material management controls and practices to prevent the release or wash off of pollutants. These controls and practices shall be specified in the Stormwater Pollution Prevention Plan and shall include storage procedures for chemicals and construction materials, disposal and cleanup procedures, the contractor's plan for handling of potential pollutants, and other pollution prevention measures as required." (Refer to Environmental Assessment page 83.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 107 Legal Relations and Responsibility to Public, Subsection 07 Sanitary, Health, and Safety Provisions (2008), "During construction operations, should material be encountered which the contractor believes to be hazardous or contaminated, the contractor shall immediately do the following: (1) stop work and remove workers within the contaminated areas, (2) barricade the area and provide traffic controls, and (3) notify the Engineer." The Arizona Department of Transportation Engineer will arrange for proper assessment, treatment, or disposal of those materials. Such locations will be investigated and proper action implemented prior to the continuation of work in that location. (Refer to Environmental Assessment page 89.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 1001 Material Sources, Subsection 2 General (2008), any material sources required for this project outside of the project area shall be examined for environmental effects, by the contractor, prior to use, through a separate environmental analysis. (Refer to Environmental Assessment page 90.)
- According to the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Section 107, Legal Relations and Responsibility to Public, Subsection 11, Protection and Restoration of Property and Landscape (2008), "Materials removed during construction operations such as trees, stumps, building materials, irrigation and drainage structures, broken concrete, and other similar materials shall not be dumped on either private or public property unless the contractor has obtained written permission from the owner or public agency with jurisdiction over the land. Written permission would not be required, however, when materials are disposed of at an operating, public dumping ground." Excess waste material and construction debris will be

disposed of at sites supplied by the contractor, at a municipal landfill approved under Title D of the Resources Conservation and Recovery Act, at a construction debris landfill approved under Article 3 of the Arizona Revised Statutes 49-241 (Aquifer Protection Permit) administered by Arizona Department of Environmental Quality, at an inert landfill or at another approved site. (Refer to Environmental Assessment page 90.)

Appendix A: Bridge Evaluation Reports

ROADWAY ENGINEERING GROUP
ROADWAY PREDESIGN SECTION

DATE: 10/30/2009

TO: SUNIL ATHALYE
BRIDGE GROUP
BRIDGE MANAGEMENT SECTION, MD 635E

FROM: Richard D. Alexander, P.E.
AECOM, 2777 E Camelback Rd Ste 200
Phoenix, AZ 85016

FEDERAL REFERENCE NO: N/A TRACS NO: H 5105 01D
HIGHWAY: I-19
LOCATION: Tucson, AZ
MP LIMITS: 55.78 TO: 62.67
PROJECT DESCRIPTION: I-19 San Xavier to Ajo Way - DCR

SUBJECT: BRIDGE EVALUATION REQUEST

Please evaluate the following structures per AASHTO guidelines:

ROUTE NO.	MILEPOST	STR. NO. AND NAME	BRIDGE LENGTH	BRIDGE ROADWAY WIDTH	BRIDGE RAIL / BARRIER TYPE	GEOM. OK	STRUC OK	AC OVERLAY THICKNESS (EXISTING)	AC OVERLAY REMOVE (MINIMUM)	AC OVERLAY REPLACE/NEW (MAXIMUM)	VERTICAL CLEARANCE (MINIMUM) NB/EB	VERTICAL CLEARANCE (MINIMUM) SB/WB	BRIDGE LOAD RATING	BRIDGE SUFFICIENCY RATING
I-19	55.78	1241 San Xavier OP NB	69'	38'	Conc. barrier	Yes	Yes	**3"	**3"	**1"		WB: 14.35'	HS 18.33*	F 90.91
		Dirt service road under bridge subject to occasional grading. Posted VC sign: 12' - 8". *The structure is currently carrying legal load w/o showing any significant distress. **Existing AC overlay on bridge deck should be removed full depth, bare concrete deck top be inspected and reported to BMS and then be overlaid with 1 inch thick AR-ACFC.												
I-19	55.78	1242 San Xavier OP SB	69'	38'	Conc. barrier	Yes	Yes	**3"	**3"	**1"	EB: 14.16'		HS 18.33*	F 90.95
		Dirt service road under bridge subject to occasional grading. Posted VC sign: 12' - 8". *The structure is currently carrying legal load w/o showing any significant distress. **Existing AC overlay on bridge deck should be removed full depth, bare concrete deck top be inspected and reported to BMS and then be overlaid with 1 inch thick AR-ACFC.												
I-19	56.80	1243 Santa Cruz Riv NB	517'	42'	Conc. barrier	Yes	Yes	0"	0"	0"	N.A.	N.A.	HS 20+	95.48
		Seal cracks and patch spalls of the deck. Replace modular joint at pier #4. Repair spalls at east and west sides of north abutment.												
I-19	56.80	1244 Santa Cruz Riv SB	411'	42'	Conc. barrier	Yes	Yes	0"	0"	0"	N.A.	N.A.	HS 20+	96.50
		Seal cracks and patch spalls of the deck. Tighten north abutment joint cover and replace south approach slab joint seal. Remove debris piled on north abutment seat and repair erosion gullies in front of both abutments.												

ROADWAY ENGINEERING GROUP
ROADWAY PREDESIGN SECTION

DATE: 10/30/2009

TO: SUNIL ATHALYE
BRIDGE GROUP
BRIDGE MANAGEMENT SECTION, MD 635E

FROM: Richard D. Alexander, P.E.
AECOM, 2777 E Camelback Rd Ste 200
Phoenix, AZ 85016

FEDERAL REFERENCE NO: N/A TRACS NO: H 5105 01D
HIGHWAY: I-19
LOCATION: Tucson, AZ
MP LIMITS: 55.78 TO: 62.67
PROJECT DESCRIPTION: I-19 San Xavier to Ajo Way - DCR

SUBJECT: BRIDGE EVALUATION REQUEST

Please evaluate the following structures per AASHTO guidelines:

ROUTE NO.	MILEPOST	STR. NO. AND NAME	BRIDGE LENGTH	BRIDGE ROADWAY WIDTH	BRIDGE RAIL / BARRIER TYPE	GEOM. OK	STRUC OK	AC OVERLAY THICKNESS (EXISTING)	AC OVERLAY REMOVE (MINIMUM)	AC OVERLAY REPLACE/NEW (MAXIMUM)	VERTICAL CLEARANCE (MINIMUM) NB/EB	VERTICAL CLEARANCE (MINIMUM) SB/WB	BRIDGE LOAD RATING	BRIDGE SUFFICIENCY RATING
I-19	56.94	1547 Santa Cruz SB on Ramp	446'	27'	Conc. barrier	Yes	Yes	0"	0"	0"	N.A.	N.A.	HS 16.67*	F 73.37
		*The structure is currently carrying legal load w/o showing any significant distress. Repair delaminated areas and spalls of the deck. Replace joint seals at abutments and pier #4. Repair eroded slope in front of abutment #2. Replace missing railing timber blocks at southeast corner at 7th and 13th timber post from bridge.												
I-19	56.95	1245 San Xavier TI OP NB	197'	38'	Conc. barrier	Yes	Yes	**2"	**2"	**1"	EB: 15.34'	WB: 15.68'	HS 20+	96.40
		Posted VC sign over WB: 15' - 1". **Existing AC overlay on bridge deck should be removed full depth, bare concrete deck top be inspected and reported to BMS and then be overlaid with 1 inch thick AR-ACFC.												
I-19	56.95	1246 San Xavier TI OP SB	195'	38'	Conc. barrier	Yes	Yes	**1"	**1"	**1"	EB: 15.44'	WB: 15.72'	HS 20+	96.40
		Posted VC sign over EB: 15' - 1". **Existing AC overlay on bridge deck should be removed full depth, bare concrete deck top be inspected and reported to BMS and then be overlaid with 1 inch thick AR-ACFC.												
I-19	57.82	1248 Bridge SB	109'	38.2'	Conc. barrier	Yes	Yes	**2"	**2"	**1"	N.A.	N.A.	HS 20+	95.79
		Grade banks near bridge abutments and protect slope against erosion. **Existing AC overlay on bridge deck should be removed full depth, bare concrete deck top be inspected and reported to BMS and then be overlaid with 1 inch thick AR-ACFC.												

ROADWAY ENGINEERING GROUP
ROADWAY PREDESIGN SECTION

DATE: 10/30/2009

TO: SUNIL ATHALYE
BRIDGE GROUP
BRIDGE MANAGEMENT SECTION, MD 635E

FROM: Richard D. Alexander, P.E.
AECOM, 2777 E Camelback Rd Ste 200
Phoenix, AZ 85016

FEDERAL REFERENCE NO: N/A TRACS NO: H 5105 01D
HIGHWAY: I-19
LOCATION: Tucson, AZ
MP LIMITS: 55.78 TO: 62.67
PROJECT DESCRIPTION: I-19 San Xavier to Ajo Way - DCR

SUBJECT: BRIDGE EVALUATION REQUEST

Please evaluate the following structures per AASHTO guidelines:

ROUTE NO.	MILEPOST	STR. NO. AND NAME	BRIDGE LENGTH	BRIDGE ROADWAY WIDTH	BRIDGE RAIL / BARRIER TYPE	GEOM. OK	STRUC OK	AC OVERLAY THICKNESS (EXISTING)	AC OVERLAY REMOVE (MINIMUM)	AC OVERLAY REPLACE/NEW (MAXIMUM)	VERTICAL CLEARANCE (MINIMUM) NB/EB	VERTICAL CLEARANCE (MINIMUM) SB/WB	BRIDGE LOAD RATING	BRIDGE SUFFICIENCY RATING
I-19	57.85	1247 Bridge NB	109'	38.2'	Conc. barrier	Yes	Yes	**2"	**2"	**1"	N.A.	N.A.	HS 20+	95.69
		**Existing AC overlay on bridge deck should be removed full depth, bare concrete deck top be inspected and reported to BMS and then be overlaid with 1 inch thick AR-ACFC.												
I-19	59.90	1120 Drexel RD UP	250'	30'	H-2-1 railing	Yes	Yes	0"	0"	0"	NB: 17.61'	SB: 16.56'	HS 20+	F 71.52
		Repair cracks and spalls on deck surface. Replace joint seals at both abutments. Measure new minimum clearances for both traffic directions after new overlay and report them to Bridge Management Section.												
I-19	60.32	1121 Airport Wash NB	147'	38'	Conc. barrier	Yes	Yes	0"	0"	0"	N.A.	N.A.	HS 20+	95.20
		Seal deck cracks & patch minor spalls or pop-outs.												
I-19	60.32	1122 Airport Wash SB	147'	38'	Conc. barrier	Yes	Yes	0"	0"	0"	N.A.	N.A.	HS 20+	82.76
		Repair spalls at top of both abutments. Seal vertical through cracks in pier walls and abutments. Seal deck cracks & patch minor spalls or pop-outs. Epoxy seal soffit cracks.												

ROADWAY ENGINEERING GROUP
ROADWAY PREDESIGN SECTION

DATE: 10/30/2009

TO: SUNIL ATHALYE
BRIDGE GROUP
BRIDGE MANAGEMENT SECTION, MD 635E

FROM: Richard D. Alexander, P.E.
AECOM, 2777 E Camelback Rd Ste 200
Phoenix, AZ 85016

FEDERAL REFERENCE NO: N/A TRACS NO: H 5105 01D
HIGHWAY: I-19
LOCATION: Tucson, AZ
MP LIMITS: 55.78 TO: 62.67
PROJECT DESCRIPTION: I-19 San Xavier to Ajo Way - DCR

SUBJECT: BRIDGE EVALUATION REQUEST

Please evaluate the following structures per AASHTO guidelines:

ROUTE NO.	MILEPOST	STR. NO. AND NAME	BRIDGE LENGTH	BRIDGE ROADWAY WIDTH	BRIDGE RAIL / BARRIER TYPE	GEOM. OK	STRUC OK	AC OVERLAY THICKNESS (EXISTING)	AC OVERLAY REMOVE (MINIMUM)	AC OVERLAY REPLACE/NEW (MAXIMUM)	VERTICAL CLEARANCE (MINIMUM) NB/EB	VERTICAL CLEARANCE (MINIMUM) SB/WB	BRIDGE LOAD RATING	BRIDGE SUFFICIENCY RATING
I-19	60.95	1123 Irvington RO TI UP	250'	72'	Conc. barrier	Yes	Yes	0"	0"	0"	NB: 16.70'	SB: 16.20'	HS 15.56*	F 73.71
		*The structure is currently carrying legal load w/o showing any significant distress. Repair deck surface spall in eastbound left lane. Replace compression joint seal at both abutments. Replace one sheared off bolt and another partially sheared off bolt at girder #3 in span #3 over NB lanes. Replace missing guardrail transition at southwest approach. Measure new minimum clearances for both traffic directions after new overlay and report them to Bridge Management Section.												
I-19	61.40	1124 Pedestrian UP	282'	5'	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	NB: 17.16'	SB: 17.10'	N.A.	N.A.
		Sandblast and paint all the rusted areas in the pedestrian bridge. Measure new minimum clearances for both traffic directions after new overlay and report them to Bridge Management Section.												
I-19	61.90	1125 Ajo Way UP	263'	60'	Conc. barrier	Yes	Yes	0"	0"	0"	NB: 16.67'	SB: 15.98'	HS 20+	83.00
		Replace failed joint seal & missing guardangle at both abutments. Measure new minimum clearances for both traffic directions after new overlay and report them to Bridge Management Section. Posted VC sign for SB: 15' -10".												
I-19	62.67	2531 I-19 Ramp W-S	198'	32'	Conc. barrier	Yes	Yes	0"	0"	0"	N side 16.63'	S side 16.81'	HS 20	86.19
		Road under bridge is a dirt road with possible service use. No regular traffic under bridge at this time. Posted VC sign: at N side of waterway 15' - 3" , at S side of waterway 15' - 7"												

Evaluation Completed by: Homer Saidi, P.E. Date: 11/2/2009

ROADWAY ENGINEERING GROUP
ROADWAY PREDESIGN SECTION

DATE: 11/9/2009

TO: **SUNIL ATHALYE**
BRIDGE GROUP
BRIDGE MANAGEMENT SECTION, MD 635E

FROM: Richard D. Alexander, P.E.
AECOM, 2777 E Camelback Rd Ste 200
Phoenix, AZ 85016

FEDERAL REFERENCE NO: N/A TRACS NO: H 5105 01D
HIGHWAY: I-19
LOCATION: Tucson, AZ
MP LIMITS: 58.82 TO: 58.82
PROJECT DESCRIPTION: I-19 San Xavier to Ajo Way - DCR

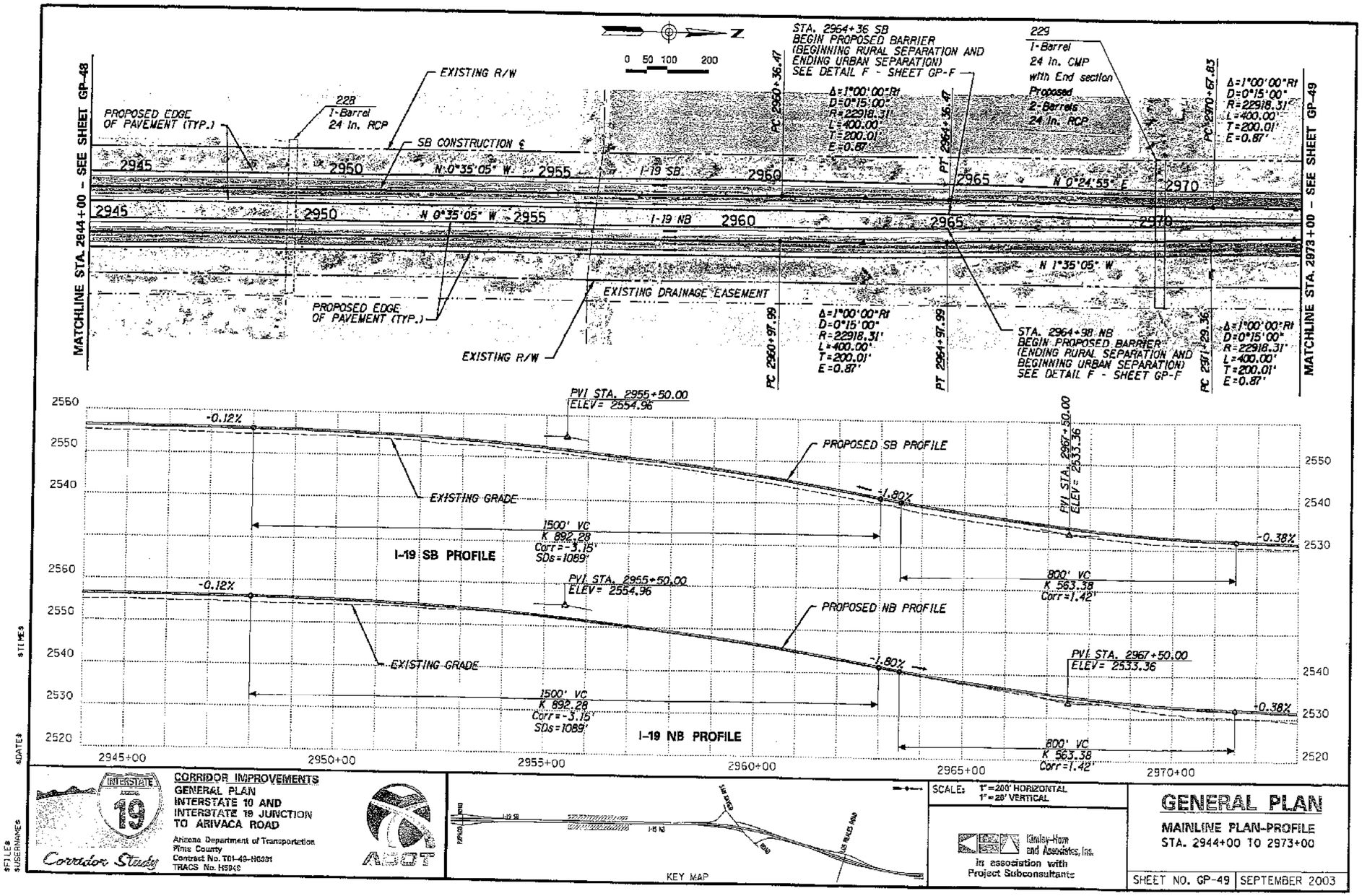
SUBJECT: **BRIDGE EVALUATION REQUEST**

Please evaluate the following structures per AASHTO guidelines:

ROUTE NO.	MILEPOST	STR. NO. AND NAME	BRIDGE LENGTH	BRIDGE ROADWAY WIDTH	BRIDGE RAIL / BARRIER			AC OVERLAY			VERTICAL CLEARANCE (MINIMUM)		BRIDGE LOAD RATING	BRIDGE SUFFICIENCY RATING
					TYPE	GEOM. OK	STRUC OK	THICKNESS (EXISTING)	REMOVE (MINIMUM)	REPLACE/NEW (MAXIMUM)	NB/EB	SB/WB		
I-19	58.82	1943 Valencia RD TI UP	**204'**	**121.1'**	**Vehicle Ped railing**	**Yes**	**Yes**	**0"**	**0"**	**0"**	**NB: 18.67'**	**SB: 17.75'**	**HS 20+**	**70.00**
		Bridge is relatively new. If I-19 is overlaid, measure new minimum clearances for both traffic directions after new overlay and report them to Bridge Management Section.												

Evaluation Completed by: Homer Saidi, P.E. Date: 11/9/2009

Appendix C: Design Concept Plans – Alternative #1



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$USERNAME$

CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD

Arizona Department of Transportation
Pima County
Contract No. T01-43-H6381
TRACS No. H594

Corridor Study

KEY MAP

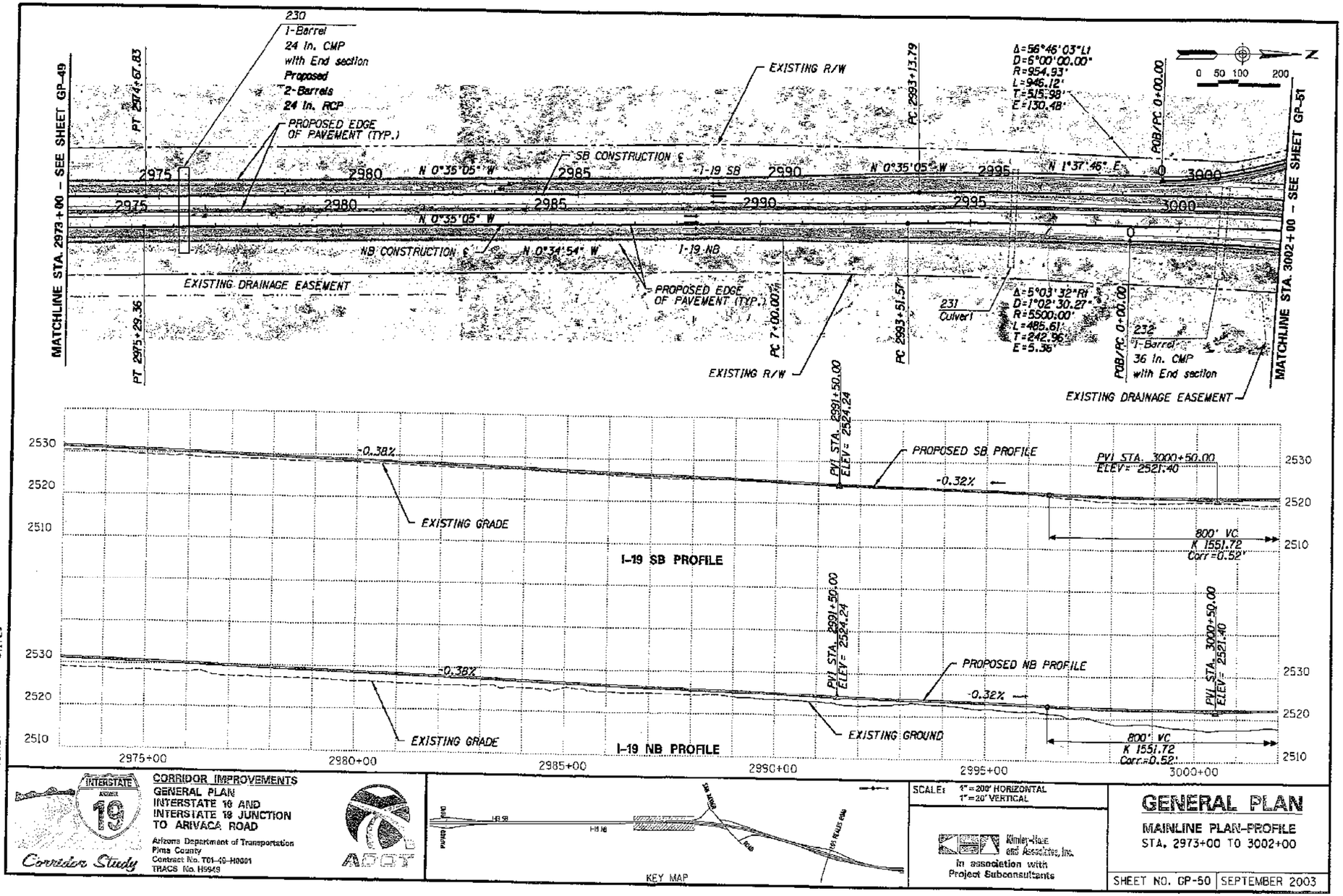
SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL

Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants

GENERAL PLAN

MAINLINE PLAN-PROFILE
STA. 2944+00 TO 2973+00

SHEET NO. GP-49 | SEPTEMBER 2003



CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 19 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD

Arizona Department of Transportation
Pima County
Contract No. T01-49-H0001
TRACS No. H594S

Corridor Study

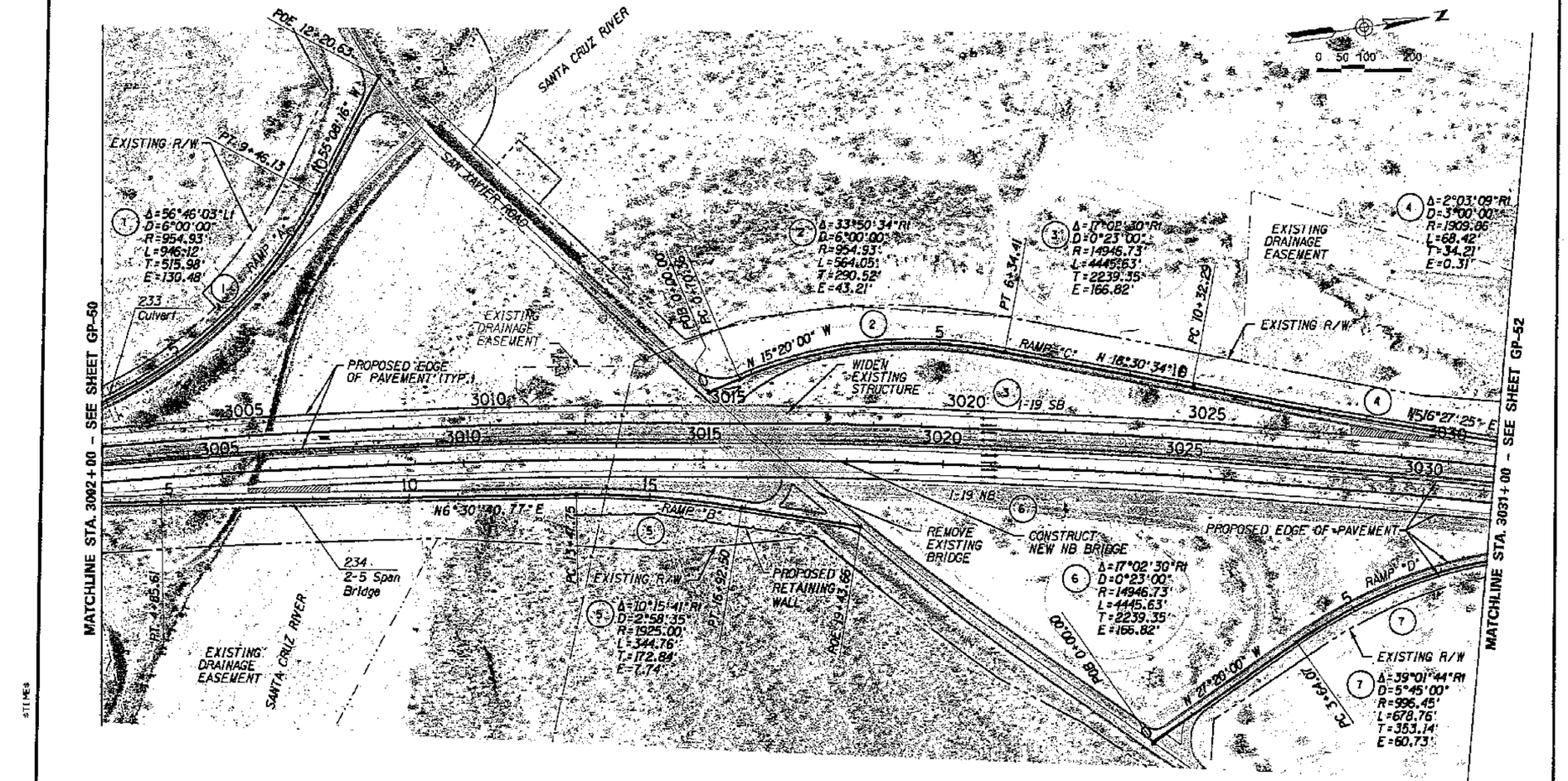
KEY MAP

SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL

Kimley-Horn and Associates, Inc.
In association with
Project Subconsultants

GENERAL PLAN
MAINLINE PLAN-PROFILE
STA. 2973+00 TO 3002+00

SHEET NO. GP-50 | SEPTEMBER 2003



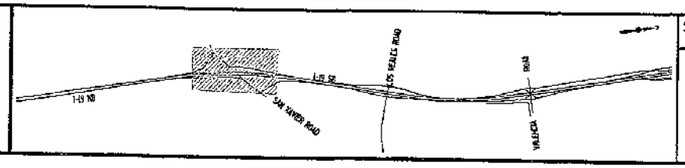
REFER TO SHEET GP-51A FOR MAINLINE PROFILE
GP-51B AND GP-51C FOR RAMP PROFILES
GP-74 FOR SAN XAVIER ROAD PLAN AND PROFILE

INTERSTATE 19 Corridor Study

CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND INTERSTATE 19 JUNCTION TO ARIVACA ROAD

Arizona Department of Transportation
Pima County
Contract No. T01-46-H0001
TRACS No. H5649

ADOT



SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL

Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants

GENERAL PLAN
MAINLINE PLAN
STA. 3002+00 TO 3031+00
SAN XAVIER ROAD

SHEET NO. GP-51 | SEPTEMBER 2003

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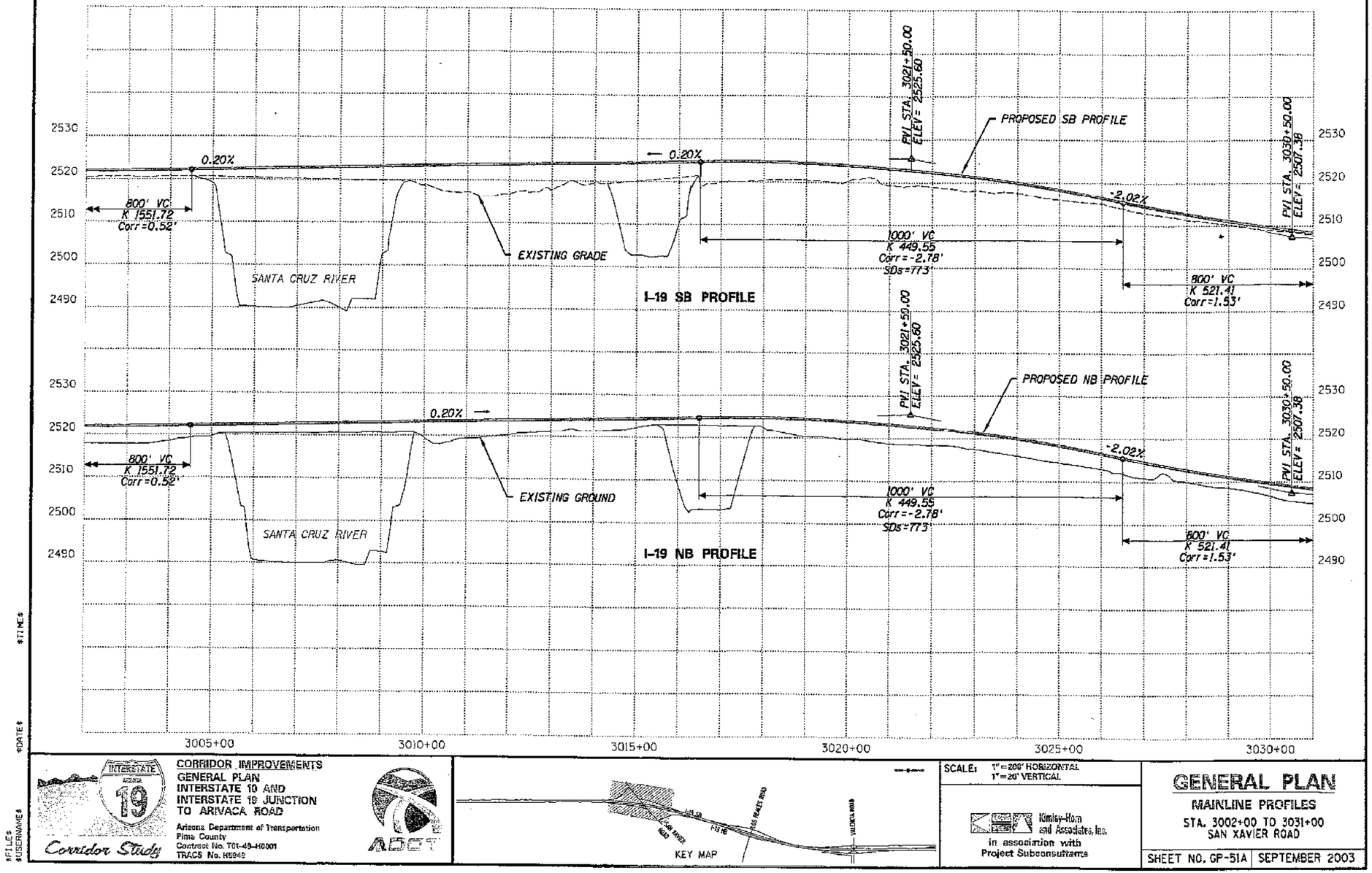
#USERNAME#
#TIME#
#DATE#



CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD

Arizona Department of Transportation
Pima County
Contract No. T01-49-H0001
TRACS No. H5949

Corridor Study

KEY MAP

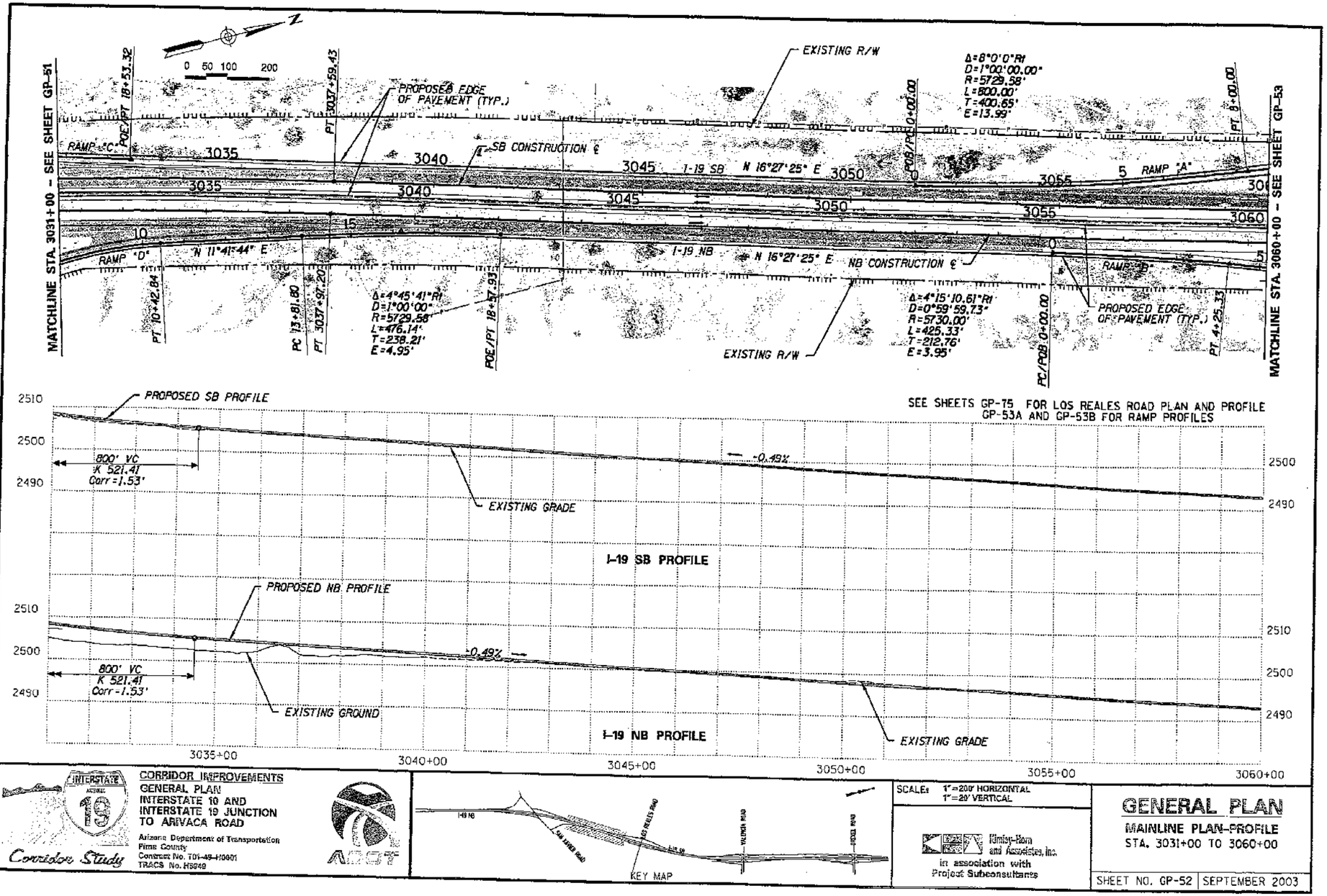
SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL

Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants

GENERAL PLAN

MAINLINE PROFILES
STA. 3002+00 TO 3031+00
SAN XAVIER ROAD

SHEET NO. GP-51A | SEPTEMBER 2003



SEE SHEETS GP-75 FOR LOS REALES ROAD PLAN AND PROFILE
GP-53A AND GP-53B FOR RAMP PROFILES

$TIME$
$DATE$
$FILE$
$USERNAME$

Corridor Study

CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD

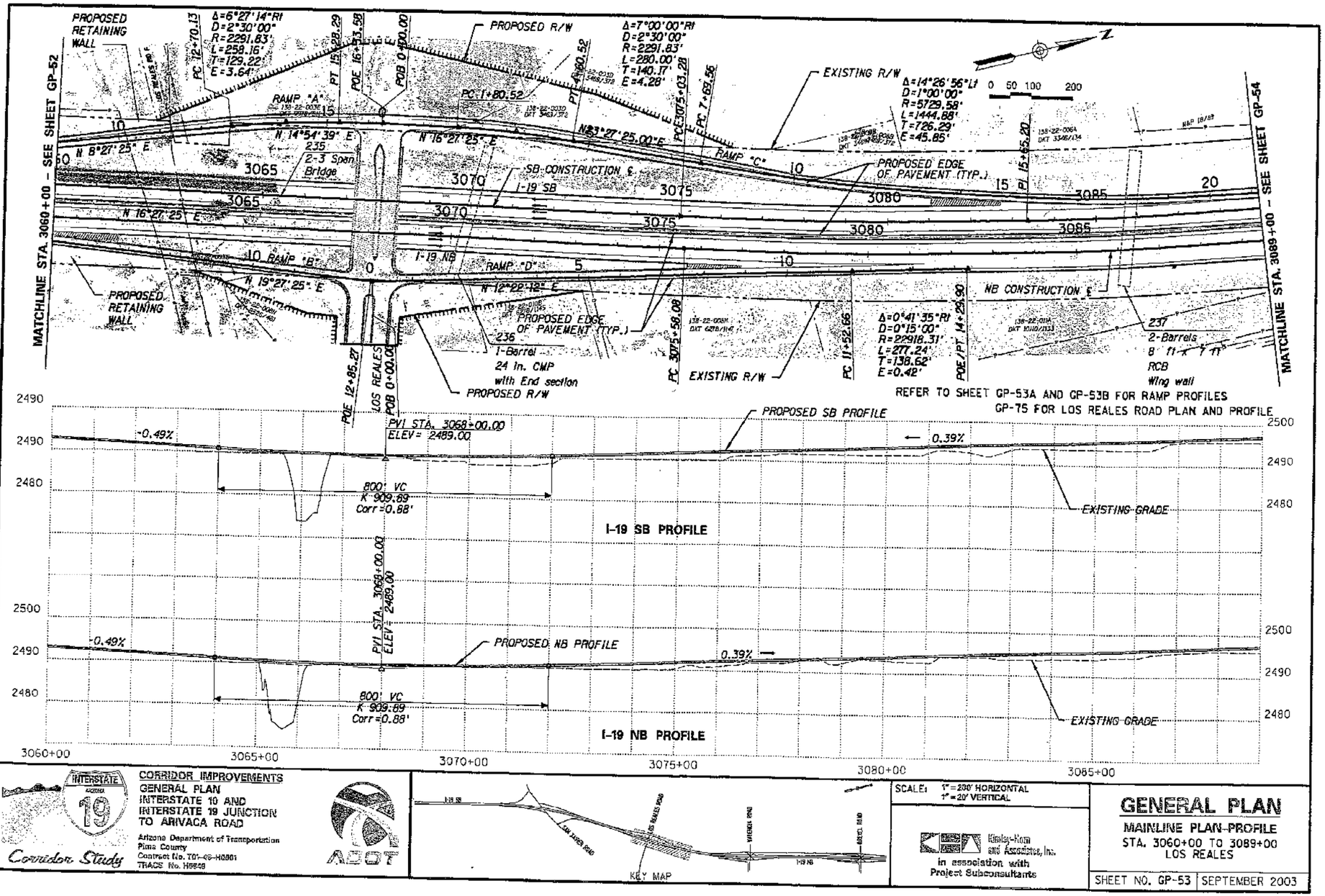
Arizona Department of Transportation
Pima County
Contract No. 101-49-H0601
TRACS No. H5949

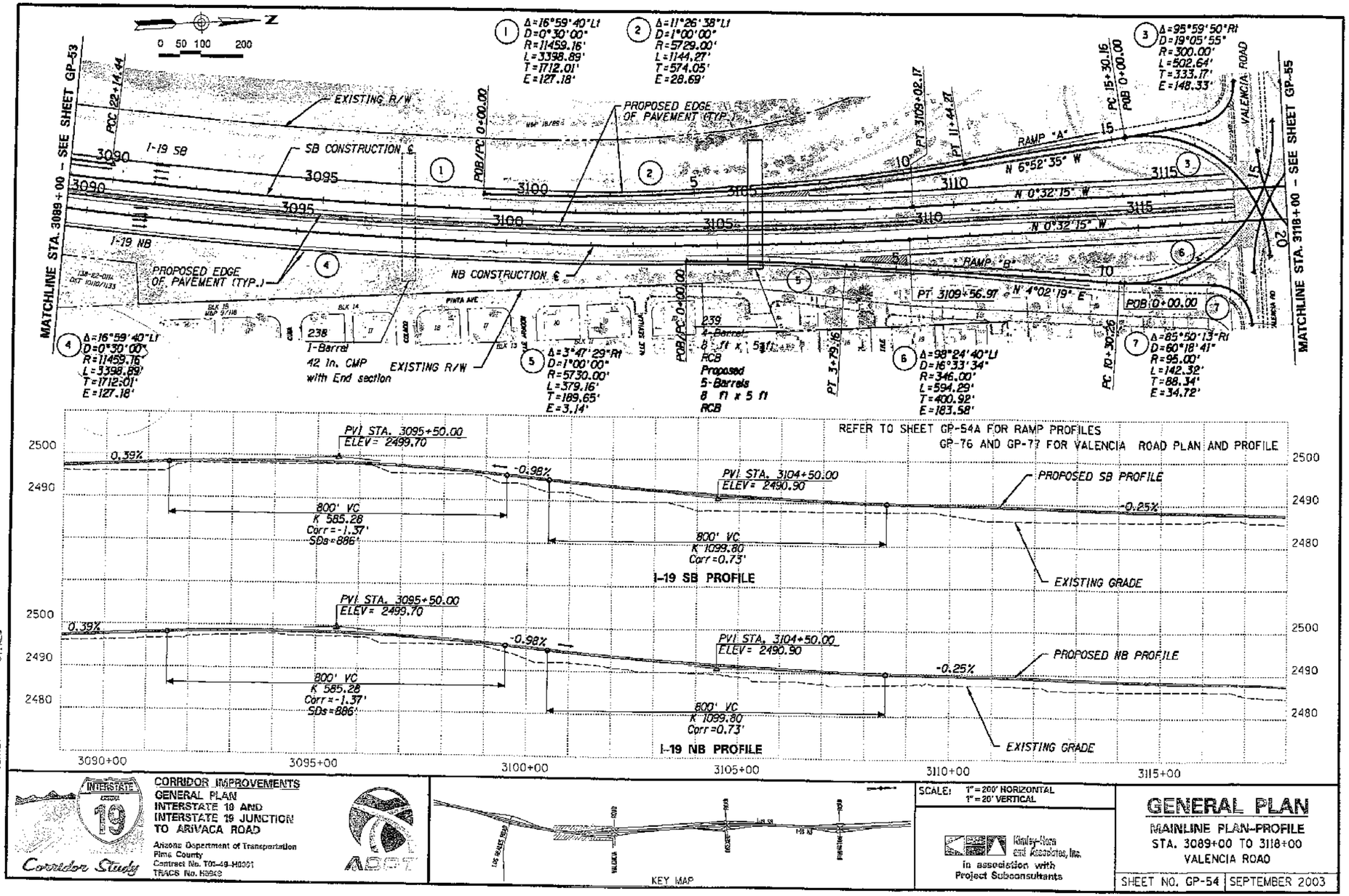
SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL

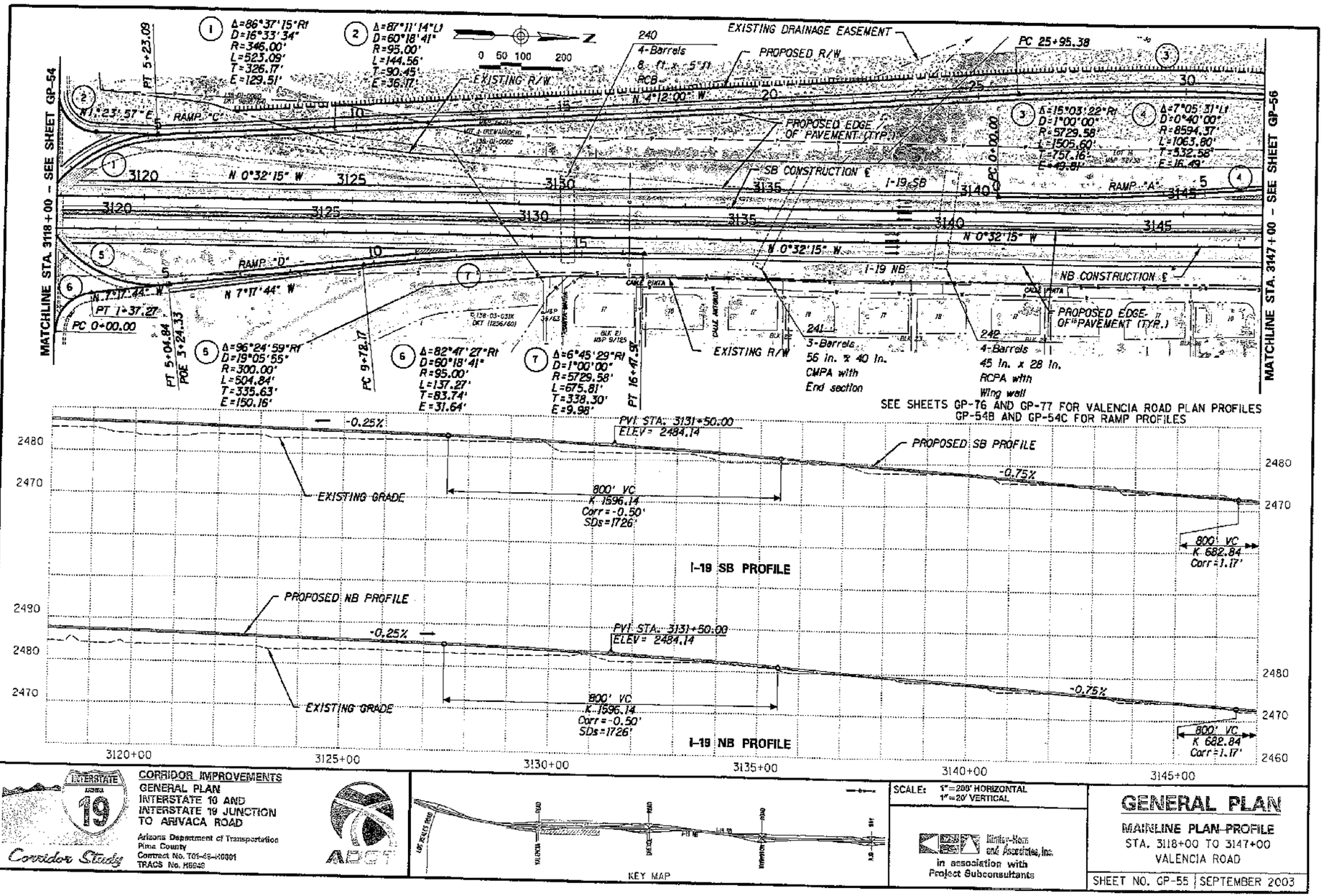
Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants

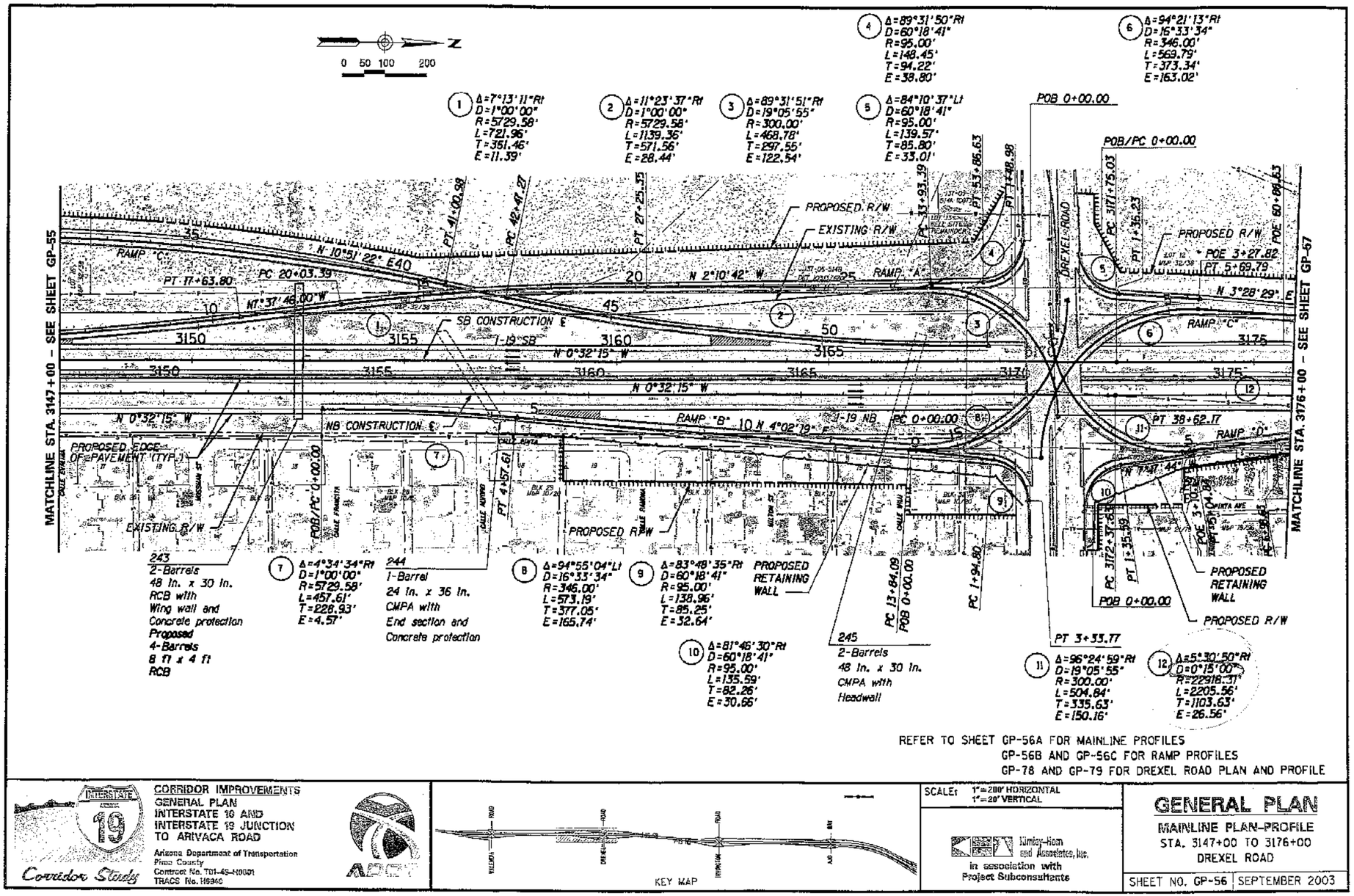
GENERAL PLAN
MAINLINE PLAN-PROFILE
STA. 3031+00 TO 3060+00

SHEET NO. GP-52 | SEPTEMBER 2003


PROPOSED RETAINING WALL
Δ=6°27'14"Rt
D=2°30'00"
R=2291.83'
L=258.16'
T=129.22'
E=3.64'
PC 12+70.13
PT 15+28.29
POE 16+73.58
POB 0+00.00
PROPOSED R/W
Δ=7°00'00"Rt
D=2°30'00"
R=2291.83'
L=280.00'
T=140.17'
E=4.28'
PC 1+80.52
PT 4+60.52
PCE 3075+03.28
PC 7+69.56
EXISTING R/W
Δ=14°26'56"Lt
D=1°00'00"
R=5729.58'
L=1444.88'
T=726.29'
E=45.85'
RAMP "A"
RAMP "B"
RAMP "C"
RAMP "D"
N 14°54'39" E
N 8°27'25" E
N 16°27'25" E
N 19°27'25" E
N 83°27'25.00"E
N 12°22'12" E
235
2-3 Span Bridge
I-19 SB
I-19 NB
SB CONSTRUCTION ℄
NB CONSTRUCTION ℄
PROPOSED EDGE OF PAVEMENT (TYP.)
PROPOSED RETAINING WALL
236
1-Barrel 24 in. CMP with End section
237
2-Barrels 8' ft x 7' ft RCB Wing wall
PC 3075+56.08
PC 11+52.66
POE/PT 14+25.90
Δ=0°41'35"Rt
D=0°15'00"
R=22918.31'
L=277.24'
T=138.62'
E=0.42'
PI 15+65.20
LOS REALES
POB 0+00.00
POE 12+85.27
MATCHLINE STA. 3060+00 – SEE SHEET GP-52
MATCHLINE STA. 3089+00 – SEE SHEET GP-54
REFER TO SHEET GP-53A AND GP-53B FOR RAMP PROFILES
GP-75 FOR LOS REALES ROAD PLAN AND PROFILE
PROPOSED SB PROFILE
PVI STA. 3068+00.00
ELEV= 2489.00
-0.49%
0.39%
800' VC
K 909.89
Corr=0.88'
EXISTING GRADE
I-19 SB PROFILE
PROPOSED NB PROFILE
I-19 NB PROFILE
2490
2480
2500
3060+00
3065+00
3070+00
3075+00
3080+00
3085+00
CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD
Arizona Department of Transportation
Pima County
Contract No. T01-46-H0861
TRACS No. H9648
Corridor Study
KEY MAP
SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL
Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants
GENERAL PLAN
MAINLINE PLAN-PROFILE
STA. 3060+00 TO 3089+00
LOS REALES
SHEET NO. GP-53
SEPTEMBER 2003
$TIME$
$DATE$
$FILE$
$USERNAME$


N
0 50 100 200
MATCHLINE STA. 3089+00 - SEE SHEET GP-53
MATCHLINE STA. 3118+00 - SEE SHEET GP-55
EXISTING R/W
PROPOSED EDGE OF PAVEMENT (TYP.)
SB CONSTRUCTION ℄
NB CONSTRUCTION ℄
I-19 SB
I-19 NB
RAMP "A"
RAMP "B"
VALENCIA ROAD
PINTA AVE
POB/PC 0+00.00
PC 22+14.44
PC 15+30.16
PT 3109+02.17
PT 11+44.27
PT 3+79.16
PT 3109+56.97
PC 10+30.26
N 6°52'35" W
N 0°32'15" W
N 4°02'19" E
1 Δ=16°59'40"LT D=0°30'00" R=11459.16' L=3398.89' T=1712.01' E=127.18'
2 Δ=11°26'38"LT D=1°00'00" R=5729.00' L=1144.27' T=574.05' E=28.69'
3 Δ=95°59'50"RT D=19°05'55" R=300.00' L=502.64' T=333.17' E=148.33'
4 Δ=16°59'40"LT D=0°30'00" R=11459.16' L=3398.89' T=1712.01' E=127.18'
5 Δ=3°47'29"RT D=1°00'00" R=5730.00' L=379.16' T=189.65' E=3.14'
6 Δ=98°24'40"LT D=16°33'34" R=346.00' L=594.29' T=400.92' E=183.58'
7 Δ=85°50'13"RT D=60°18'41" R=95.00' L=142.32' T=88.34' E=34.72'
238 T-Barrel 42 in. CMP with End section
239 4-Barrel 8 ft x 5 ft RCB
Proposed 5-Barrels 8 ft x 5 ft RCB
PVI STA. 3095+50.00 ELEV= 2499.70
PVI STA. 3104+50.00 ELEV= 2490.90
0.39%
-0.98%
-0.25%
800' VC K 585.28 Corr=-1.37' SDs=886'
800' VC K 1099.80 Corr=0.73'
PROPOSED SB PROFILE
PROPOSED NB PROFILE
EXISTING GRADE
I-19 SB PROFILE
I-19 NB PROFILE
2500
2490
2480
3090+00
3095+00
3100+00
3105+00
3110+00
3115+00
REFER TO SHEET GP-54A FOR RAMP PROFILES
GP-76 AND GP-77 FOR VALENCIA ROAD PLAN AND PROFILE
CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD
Arizona Department of Transportation
Pima County
Contract No. T01-49-H8001
TRACS No. H8949
Corridor Study
KEY MAP
SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL
Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants
GENERAL PLAN
MAINLINE PLAN-PROFILE
STA. 3089+00 TO 3118+00
VALENCIA ROAD
SHEET NO. GP-54
SEPTEMBER 2003
$TIME$
$DATE$
$FILE$
$USERNAME$


MATCHLINE STA. 3118+00 – SEE SHEET GP-54
MATCHLINE STA. 3147+00 – SEE SHEET GP-56
① Δ=86°37'15"Rt D=16°33'34" R=346.00' L=523.09' T=326.17' E=129.51'
② Δ=87°11'14"Lt D=60°18'41" R=95.00' L=144.56' T=90.45' E=36.17'
③ Δ=15°03'22"Rt D=1°00'00" R=5729.58' L=1505.60' T=757.16' E=49.81'
④ Δ=7°05'31"Lt D=0°40'00" R=8594.37' L=1063.80' T=532.58' E=16.49'
⑤ Δ=96°24'59"Rt D=19°05'55" R=300.00' L=504.84' T=335.63' E=150.16'
⑥ Δ=82°41'27"Rt D=60°18'41" R=95.00' L=137.27' T=83.74' E=31.64'
⑦ Δ=6°45'29"Rt D=1°00'00" R=5729.58' L=675.81' T=338.30' E=9.98'
PC 0+00.00
PT 1+37.27
PT 5+04.84
POE 5+24.33
PT 5+23.09
PC 9+78.17
PT 16+47.98
PC 25+95.38
PC 0+00.00
N 23°57'E
N 7°17'44" W
N 0°32'15" W
N 4°12'00" W
RAMP "C"
RAMP "D"
RAMP "A"
EXISTING R/W
PROPOSED R/W
EXISTING DRAINAGE EASEMENT
PROPOSED EDGE OF PAVEMENT (TYP.)
SB CONSTRUCTION ℄
NB CONSTRUCTION ℄
I-19 SB
I-19 NB
CALLE PINTA
CALLE ANTONIA
240
4-Barrels
8 ft. x 5 ft.
RCB
241
3-Barrels
56 in. x 40 in.
CMPA with
End section
242
4-Barrels
45 in. x 28 in.
RCPA with
Wing wall
SEE SHEETS GP-76 AND GP-77 FOR VALENCIA ROAD PLAN PROFILES
GP-54B AND GP-54C FOR RAMP PROFILES
-0.25%
PVI STA. 3131+50.00
ELEV = 2484.14
PROPOSED SB PROFILE
-0.75%
EXISTING GRADE
800' VC
K 1596.14
Corr = -0.50'
SDs = 1726'
800' VC
K 682.84
Corr = 1.17'
I-19 SB PROFILE
PROPOSED NB PROFILE
I-19 NB PROFILE
3120+00
3125+00
3130+00
3135+00
3140+00
3145+00
2480
2470
2490
2460
CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD
Arizona Department of Transportation
Pima County
Contract No. T05-48-R0001
TRACS No. H6648
Corridor Study
KEY MAP
SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL
Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants
GENERAL PLAN
MAINLINE PLAN-PROFILE
STA. 3118+00 TO 3147+00
VALENCIA ROAD
SHEET NO. GP-55 | SEPTEMBER 2003
$TIME$
$DATE$
$FILE$
$USERNAME$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MATCHLINE STA. 3147+00 – SEE SHEET GP-55
MATCHLINE STA. 3176+00 – SEE SHEET GP-57
PROPOSED R/W
EXISTING R/W
SB CONSTRUCTION ℄
I-19 SB
NB CONSTRUCTION ℄
I-19 NB
RAMP "A"
RAMP "B"
RAMP "C"
RAMP "D"
DREXEL ROAD
PROPOSED EDGE OF PAVEMENT (TYP.)
EXISTING R/W
PROPOSED R/W
PROPOSED RETAINING WALL
POB 0+00.00
POB/PC 0+00.00
POE 3+27.82
PT 5+69.79
PT 38+62.17
PC 0+00.00
PT 11+63.80
PC 20+03.39
N 10°51' 22" E
N 1°37' 46.00" W
N 2°10' 42" W
N 0°32' 15" W
N 4°02' 19" E
N 3°28' 29" E
N 7°47' 44" W
PT 41+00.38
PC 42+41.27
PT 27+25.55
PC 33+93.39
PT 1+63.63
PT 1+48.98
PC 3171+75.03
PT 1+35.23
POE 80+66.63
PC 3172+37.63
PT 1+35.99
POE 3+04.88
PT 4+37.61
PC 13+84.09
POB 0+00.00
PC 1+94.60
PT 3+35.77
243
2-Barrels
48 in. x 30 in.
RCB with
Wing wall and
Concrete protection
Proposed
4-Barrels
8 ft x 4 ft
RCB
244
1-Barrel
24 in. x 36 in.
CMPA with
End section and
Concrete protection
245
2-Barrels
48 in. x 30 in.
CMPA with
Headwall
1 Δ=7°13'11"Rt D=1°00'00" R=5729.58' L=721.96' T=361.46' E=11.39'
2 Δ=11°23'37"Rt D=1°00'00" R=5729.58' L=1139.36' T=571.56' E=28.44'
3 Δ=89°31'51"Rt D=19°05'55" R=300.00' L=468.78' T=297.55' E=122.54'
4 Δ=89°31'50"Rt D=60°18'41" R=95.00' L=148.45' T=94.22' E=38.80'
5 Δ=84°10'37"Lt D=60°18'41" R=95.00' L=139.57' T=85.80' E=33.01'
6 Δ=94°21'13"Rt D=16°33'34" R=346.00' L=569.79' T=373.34' E=163.02'
7 Δ=4°34'34"Rt D=1°00'00" R=5729.58' L=457.61' T=228.93' E=4.57'
8 Δ=94°55'04"Lt D=16°33'34" R=346.00' L=573.19' T=377.05' E=165.74'
9 Δ=83°48'35"Rt D=60°18'41" R=95.00' L=138.96' T=85.25' E=32.64'
10 Δ=81°46'30"Rt D=60°18'41" R=95.00' L=135.59' T=82.26' E=30.55'
11 Δ=96°24'59"Rt D=19°05'55" R=300.00' L=504.84' T=335.63' E=150.16'
12 Δ=5°30'50"Rt D=0°15'00" R=22918.31' L=2205.56' T=1103.63' E=26.56'
REFER TO SHEET GP-56A FOR MAINLINE PROFILES
GP-56B AND GP-56C FOR RAMP PROFILES
GP-78 AND GP-79 FOR DREXEL ROAD PLAN AND PROFILE
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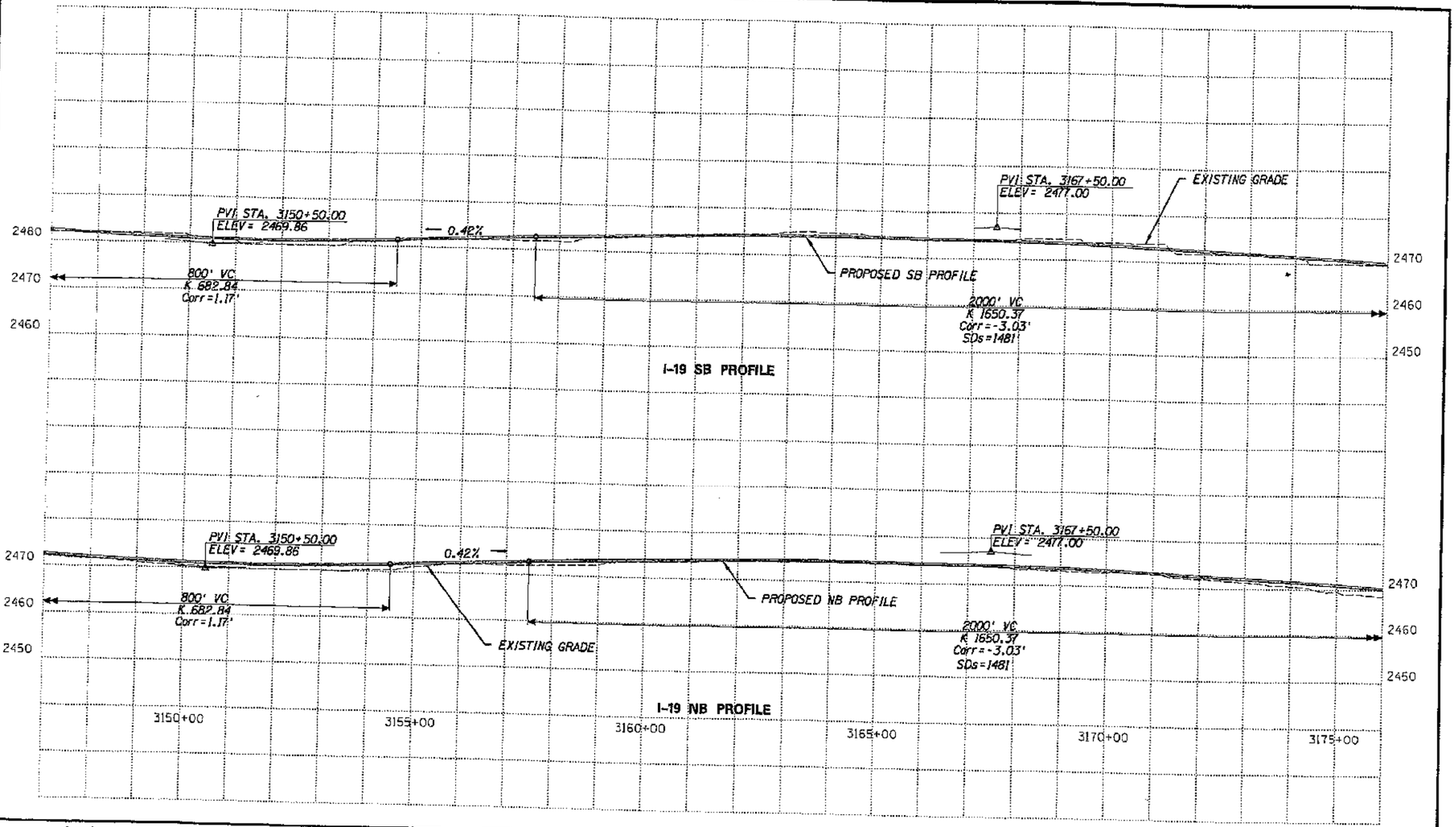
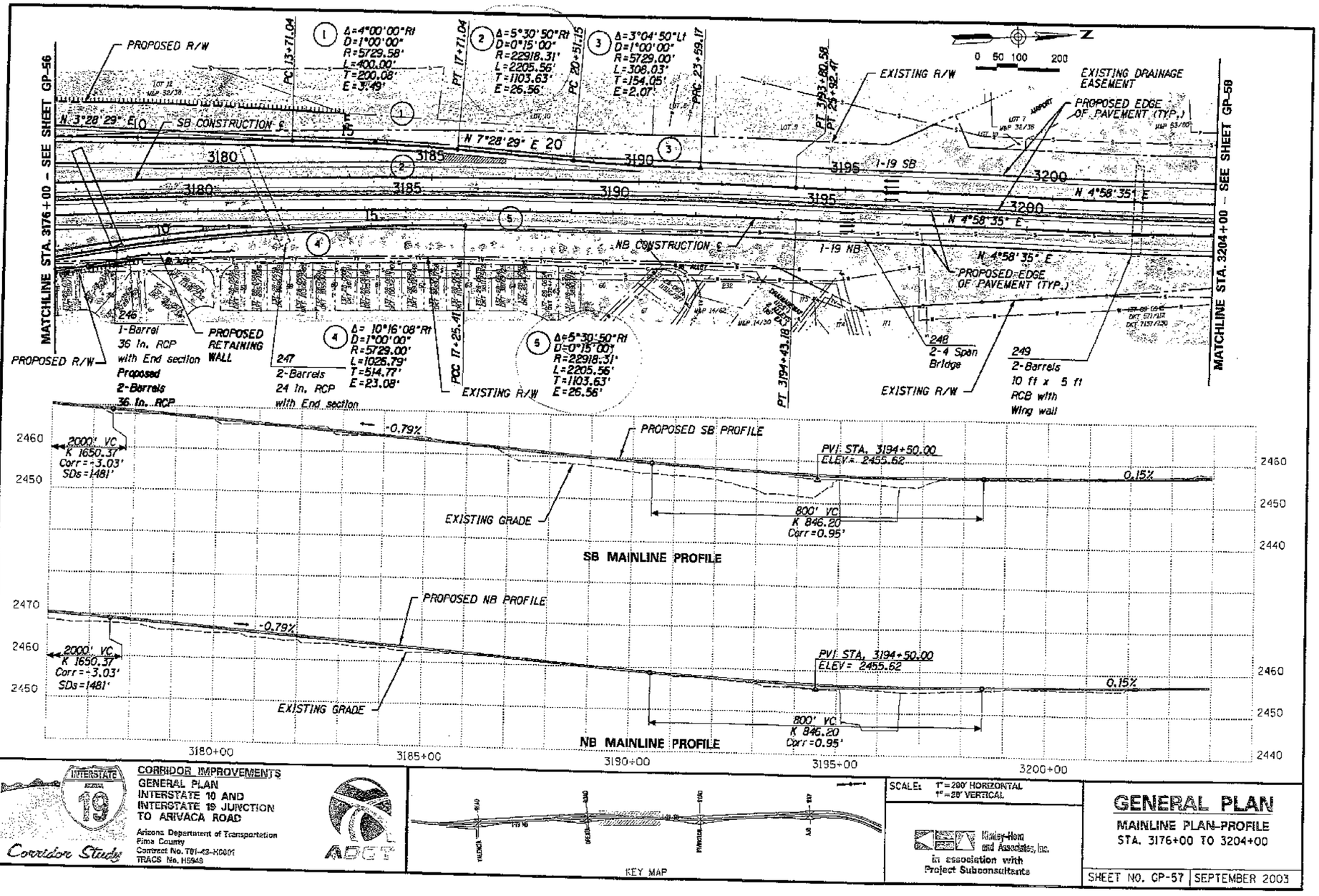
09/11/2003
1:1:35 AM
CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 19 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD
Arizona Department of Transportation
Pima County
Contract No. T01-49-M0001
TRACS No. H5940
Corridor Study
KEY MAP
SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL
Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants
GENERAL PLAN
MAINLINE PLAN-PROFILE
STA. 3147+00 TO 3176+00
DREXEL ROAD
SHEET NO. GP-56
SEPTEMBER 2003


PVI STA. 3150+50.00
ELEV = 2469.86
0.42%
PVI STA. 3167+50.00
ELEV = 2477.00
EXISTING GRADE
PROPOSED SB PROFILE
800' VC
K 682.84
Corr = 1.17'
2000' VC
K 1650.37
Corr = -3.03'
SDs = 1481'
2480
2470
2460
2450
I-19 SB PROFILE
PVI STA. 3150+50.00
ELEV = 2469.86
0.42%
PVI STA. 3167+50.00
ELEV = 2477.00
PROPOSED NB PROFILE
EXISTING GRADE
800' VC
K 682.84
Corr = 1.17'
2000' VC
K 1650.37
Corr = -3.03'
SDs = 1481'
3150+00
3155+00
3160+00
3165+00
3170+00
3175+00
I-19 NB PROFILE
$TIME$
$DATE$
$FILE$
$USERNAME$
INTERSTATE 19
Corridor Study
CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD
Arizona Department of Transportation
Pima County
Contract No. T01-46-H0001
TRACS No. H5543
ADOT
KEY MAP
SCALE: 1" = 200' HORIZONTAL
1" = 20' VERTICAL
Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants
GENERAL PLAN
MAINLINE PLAN-PROFILE
STA. 3147+00 TO 3176+00
DREXEL ROAD
SHEET NO. GP-56A
SEPTEMBER 2003


MATCHLINE STA. 3176+00 – SEE SHEET GP-56
MATCHLINE STA. 3204+00 – SEE SHEET GP-58
PROPOSED R/W
SB CONSTRUCTION ℄
NB CONSTRUCTION ℄
EXISTING R/W
EXISTING DRAINAGE EASEMENT
PROPOSED EDGE OF PAVEMENT (TYP.)
I-19 SB
I-19 NB
N 3°28'29" E
N 7°28'29" E
N 4°58'35" E
1 Δ=4°00'00"Rt D=1°00'00" R=5729.58' L=400.00' T=200.08' E=3.49'
2 Δ=5°30'50"Rt D=0°15'00" R=22918.31' L=2205.56' T=1103.63' E=26.56'
3 Δ=3°04'50"Lt D=1°00'00" R=5729.00' L=308.03' T=154.05' E=2.07'
4 Δ=10°16'08"Rt D=1°00'00" R=5729.00' L=1026.79' T=514.77' E=23.09'
5 Δ=5°30'50"Rt D=0°15'00" R=22918.31' L=2205.56' T=1103.63' E=26.56'
PC 13+71.04
PT 17+71.04
PC 20+51.15
PRC 23+59.17
PT 3193+80.58
PT 23+92.47
PCC 17+25.41
PT 3194+43.18
246 1-Barrel 36 in. RCP with End section Proposed 2-Barrels 36 in. RCP
247 2-Barrels 24 in. RCP with End section
PROPOSED RETAINING WALL
248 2-4 Span Bridge
249 2-Barrels 10 ft x 5 ft RCB with Wing wall
0 50 100 200
PROPOSED SB PROFILE
EXISTING GRADE
-0.79%
0.15%
2000' VC K 1650.37 Corr=-3.03' SDs=1481'
800' VC K 846.20 Corr=0.95'
PVI STA. 3194+50.00 ELEV.= 2455.62
SB MAINLINE PROFILE
PROPOSED NB PROFILE
NB MAINLINE PROFILE
3180+00
3185+00
3190+00
3195+00
3200+00
2460
2450
2470
2440
CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND INTERSTATE 19 JUNCTION TO ARIVACA ROAD
Arizona Department of Transportation
Pima County
Contract No. T01-43-KC001
TRACS No. H5948
Corridor Study
KEY MAP
SCALE: 1"=200' HORIZONTAL 1"=20' VERTICAL
Kimley-Horn and Associates, Inc.
in association with Project Subconsultants
GENERAL PLAN
MAINLINE PLAN-PROFILE
STA. 3176+00 TO 3204+00
SHEET NO. GP-57
SEPTEMBER 2003
$TIME$
$DATE$
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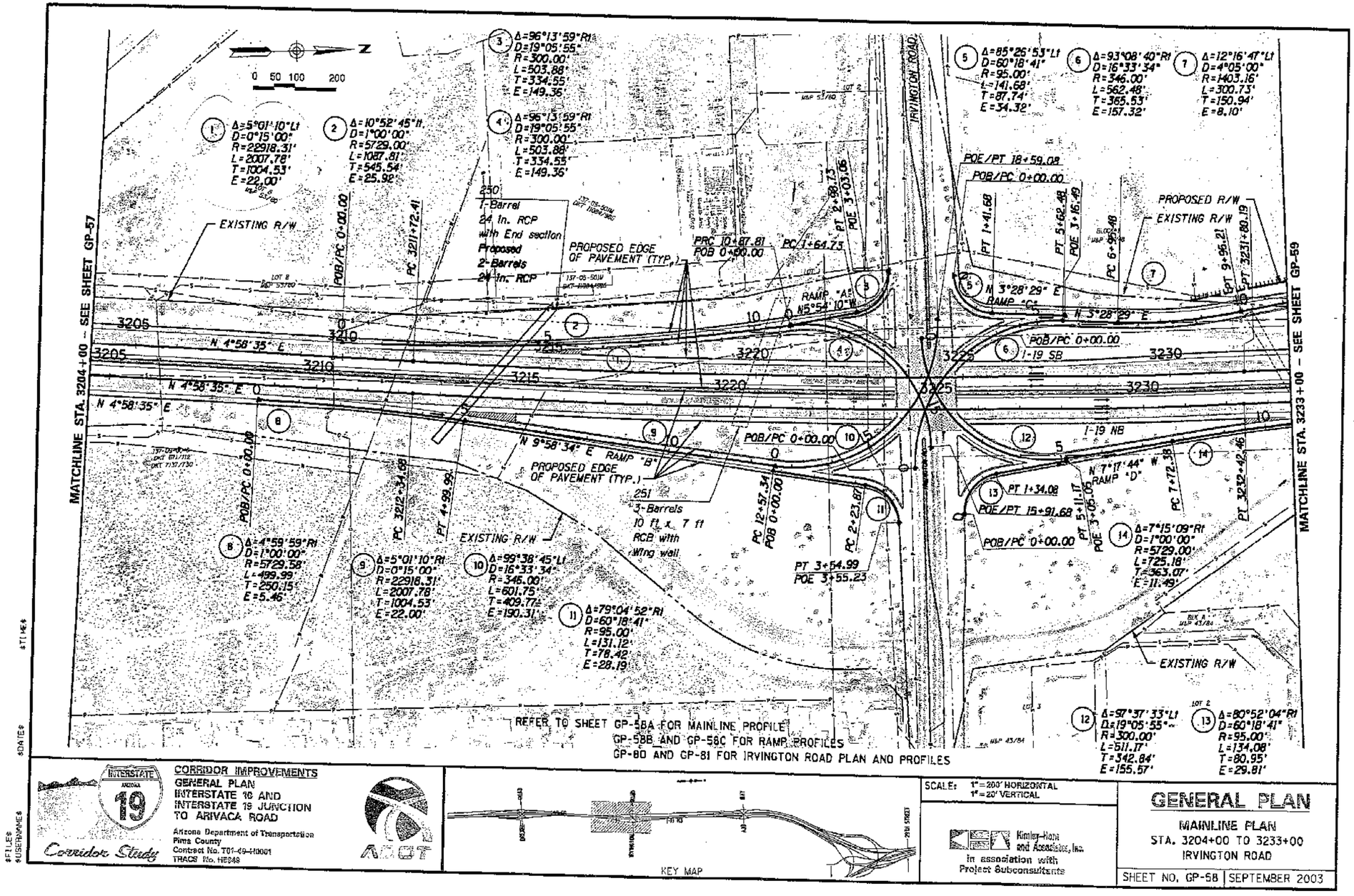
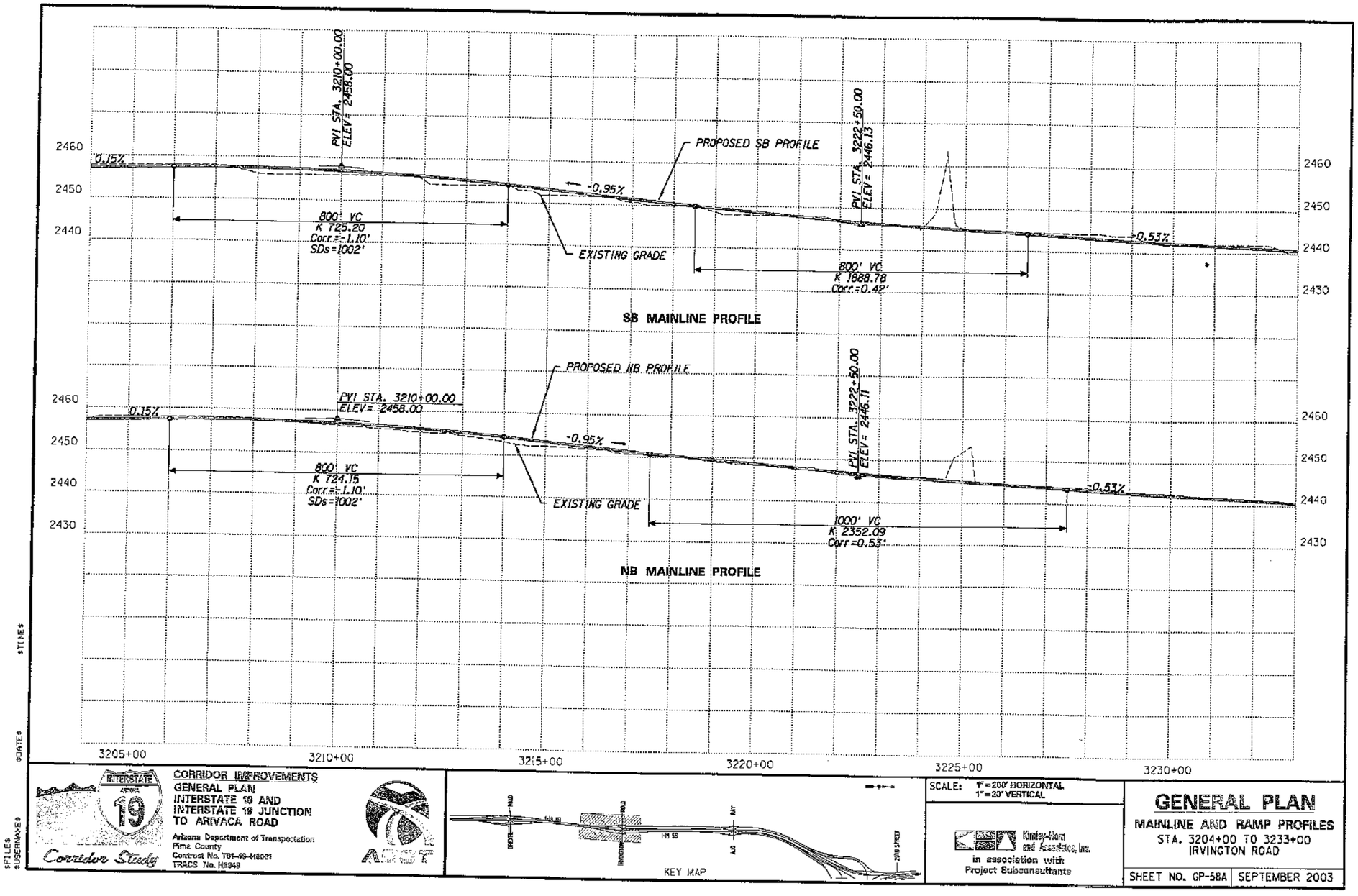

0 50 100 200
EXISTING R/W
PROPOSED EDGE OF PAVEMENT (TYP.)
1-Barrel 24 in. RCP with End section Proposed 2-Barrels 24 in. RCP
3-Barrels 10 ft x 7 ft RCB with Wing wall
IRVINGTON ROAD
RAMP "A"
RAMP "B"
RAMP "C"
RAMP "D"
I-19 SB
I-19 NB
PROPOSED R/W
EXISTING R/W
MATCHLINE STA. 3204+00 – SEE SHEET GP-57
MATCHLINE STA. 3233+00 – SEE SHEET GP-59
REFER TO SHEET GP-58A FOR MAINLINE PROFILE
GP-58B AND GP-58C FOR RAMP PROFILES
GP-80 AND GP-81 FOR IRVINGTON ROAD PLAN AND PROFILES
CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD
Arizona Department of Transportation
Pima County
Contract No. T01-49-H0001
TRACS No. HE48
Corridor Study
KEY MAP
SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL
Kimley-Horn and Associates, Inc.
In association with
Project Subconsultants
GENERAL PLAN
MAINLINE PLAN
STA. 3204+00 TO 3233+00
IRVINGTON ROAD
SHEET NO. GP-58 | SEPTEMBER 2003


PVI STA. 3210+00.00
ELEV= 2458.00
PROPOSED SB PROFILE
PVI STA. 3222+50.00
ELEV= 2446.13
0.15%
-0.95%
-0.53%
800' VC
K 725.20
Corr.=-1.10'
SDs=1002'
EXISTING GRADE
800' VC
K 1888.78
Corr.=0.42'
SB MAINLINE PROFILE
PROPOSED NB PROFILE
PVI STA. 3210+00.00
ELEV= 2458.00
PVI STA. 3222+50.00
ELEV= 2446.11
0.15%
-0.95%
-0.53%
800' VC
K 724.15
Corr.=-1.10'
SDs=1002'
EXISTING GRADE
1000' VC
K 2352.09
Corr.=0.53'
NB MAINLINE PROFILE
2460
2450
2440
2430
3205+00
3210+00
3215+00
3220+00
3225+00
3230+00
$TIME$
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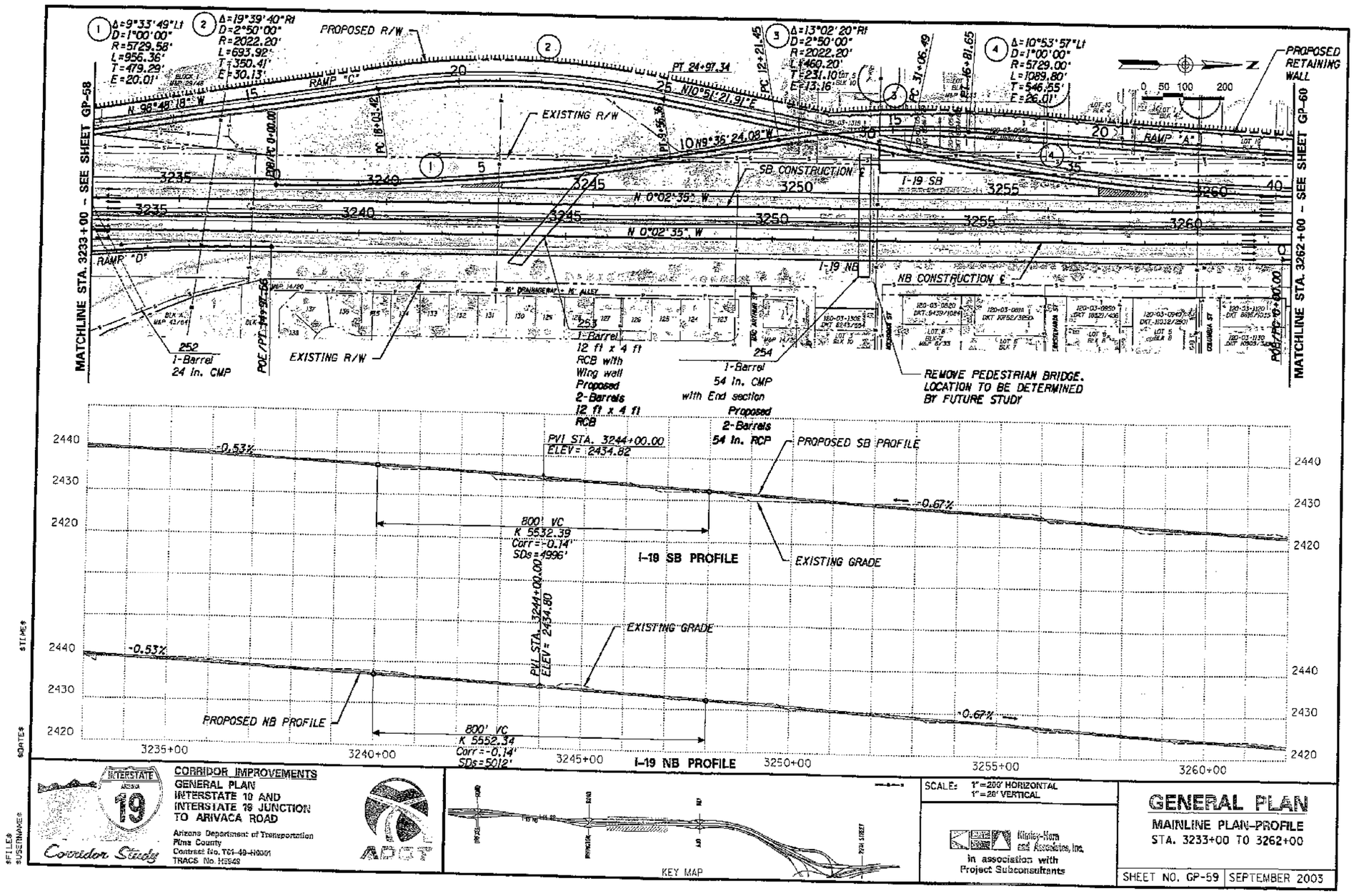
INTERSTATE
ARIZONA
19
Corridor Study
CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 19 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD
Arizona Department of Transportation
Pima County
Contract No. 701-49-H8021
TRACS No. H8948
ADOT
KEY MAP
SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL
Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants
GENERAL PLAN
MAINLINE AND RAMP PROFILES
STA. 3204+00 TO 3233+00
IRVINGTON ROAD
SHEET NO. GP-58A
SEPTEMBER 2003


MATCHLINE STA. 3233+00 - SEE SHEET GP-58
MATCHLINE STA. 3262+00 - SEE SHEET GP-60
PROPOSED R/W
EXISTING R/W
RAMP "C"
RAMP "D"
RAMP "A"
N 98°48'18" W
N10°51'21.91"E
N10°36'24.08"W
N 0°02'35" W
SB CONSTRUCTION ℄
NB CONSTRUCTION ℄
I-19 SB
I-19 NB
PROPOSED RETAINING WALL
REMOVE PEDESTRIAN BRIDGE. LOCATION TO BE DETERMINED BY FUTURE STUDY
252
1-Barrel
24 in. CMP
253
1-Barrel
12 ft x 4 ft
RCB with
Wing wall
Proposed
2-Barrels
12 ft x 4 ft
RCB
254
1-Barrel
54 in. CMP
with End section
Proposed
2-Barrels
54 in. RCP
PVI STA. 3244+00.00
ELEV = 2434.82
800' VC
K 5532.39
Corr=-0.14'
SDs=4996'
800' VC
K 5532.34
Corr=-0.14'
SDs=5012'
PVI STA. 3244+00.00
ELEV = 2434.80
-0.53%
-0.67%
PROPOSED SB PROFILE
EXISTING GRADE
I-19 SB PROFILE
PROPOSED NB PROFILE
EXISTING GRADE
I-19 NB PROFILE
3235+00
3240+00
3245+00
3250+00
3255+00
3260+00
2440
2430
2420
CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD
Arizona Department of Transportation
Pima County
Contract No. TCI-49-H0501
TRACS No. H594
Corridor Study
ADOT
KEY MAP
SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL
Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants
GENERAL PLAN
MAINLINE PLAN-PROFILE
STA. 3233+00 TO 3262+00
SHEET NO. GP-59
SEPTEMBER 2003
$TIME$
$DATE$
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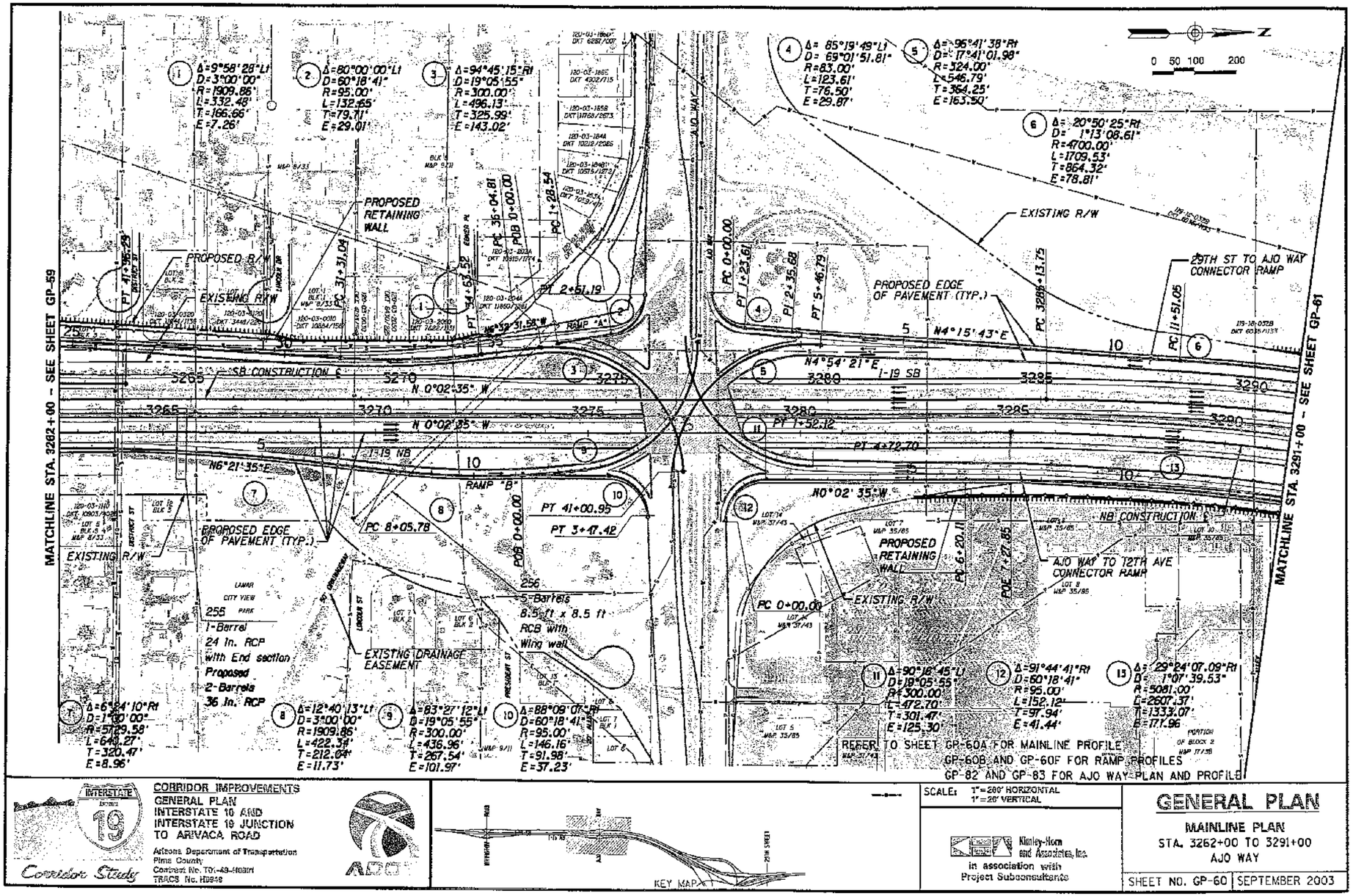
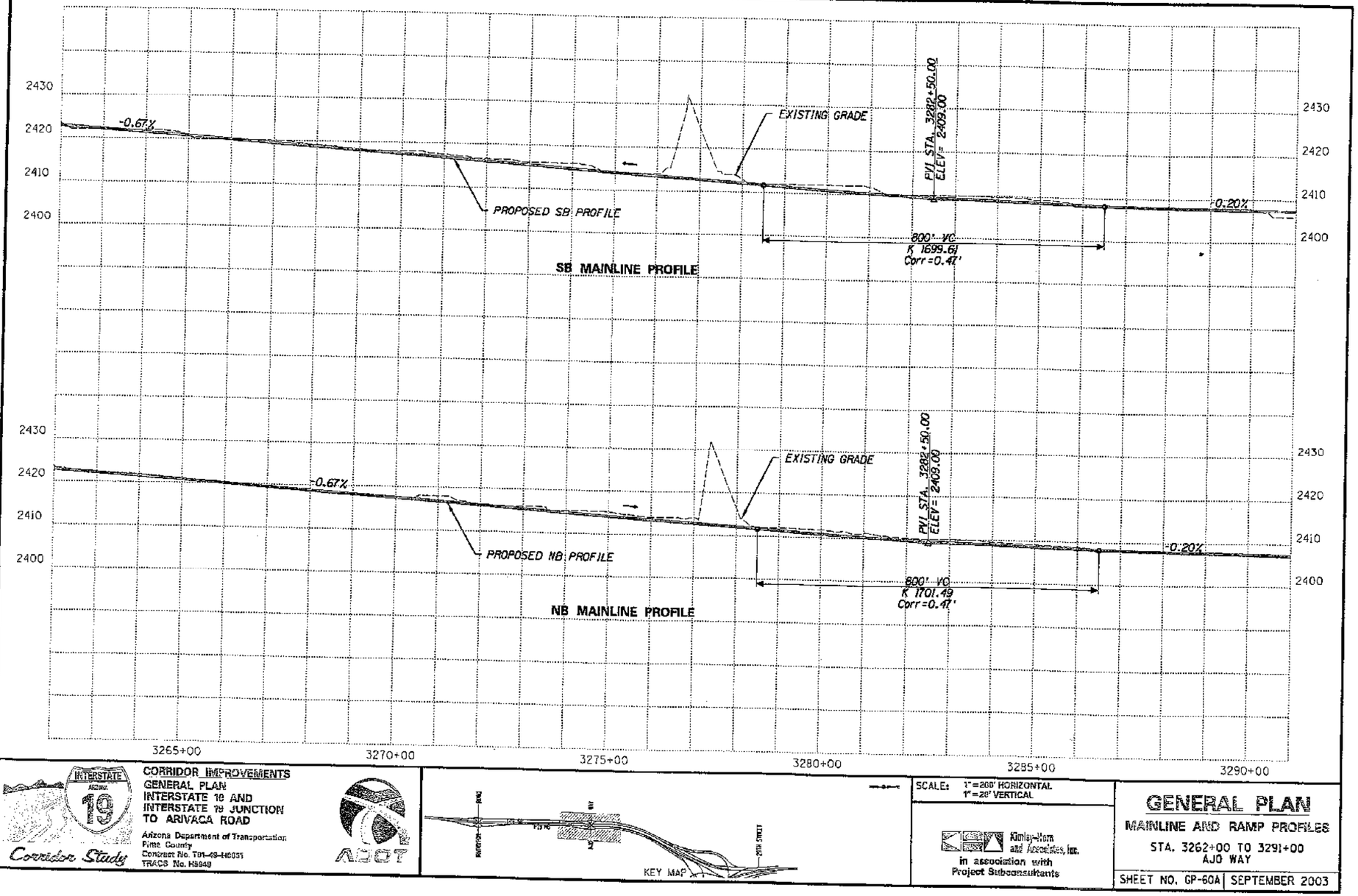
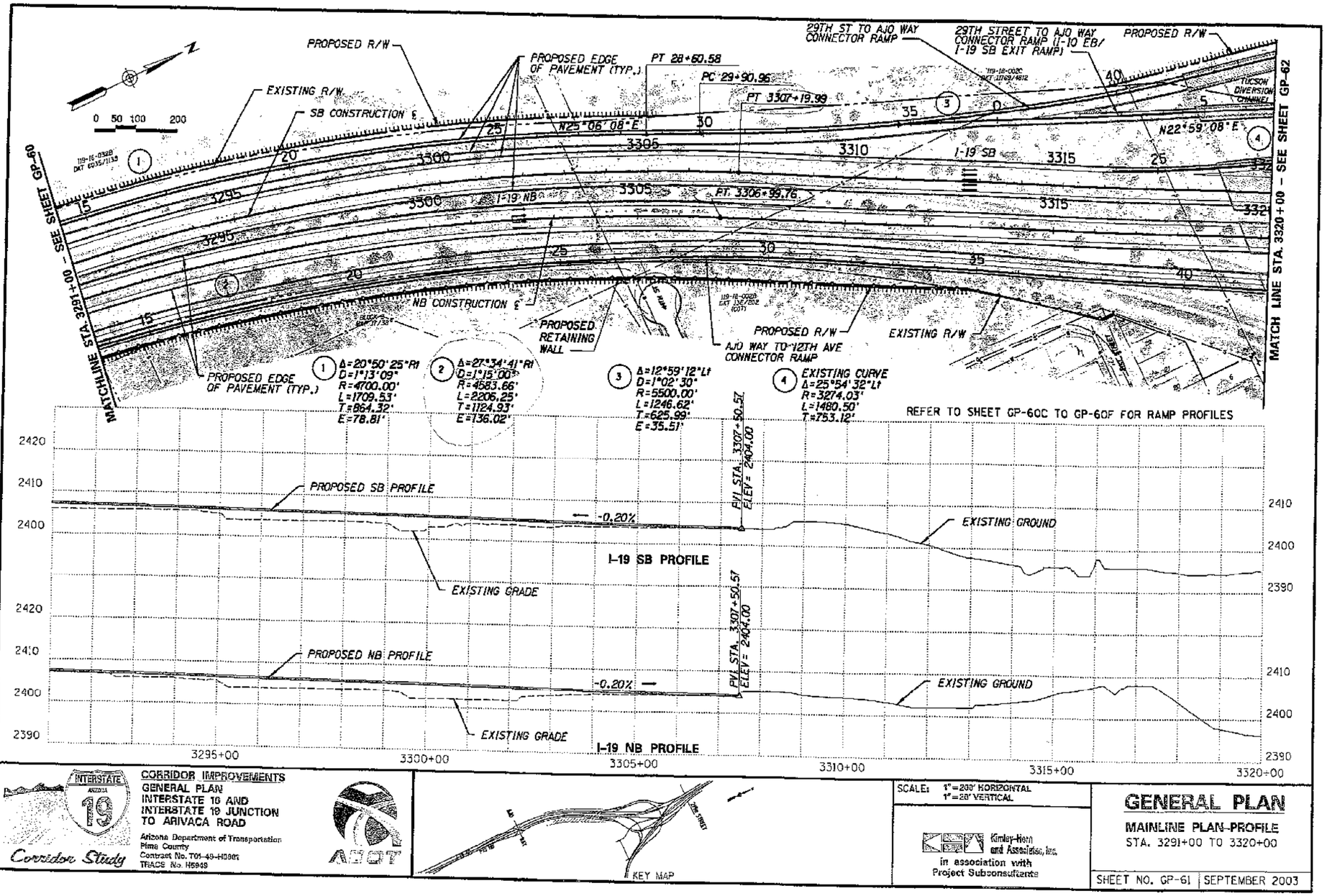

MATCHLINE STA. 3262+00 - SEE SHEET GP-59
MATCHLINE STA. 3291+00 - SEE SHEET GP-61
0 50 100 200
PROPOSED RETAINING WALL
PROPOSED R/W
EXISTING R/W
PROPOSED EDGE OF PAVEMENT (TYP.)
29TH ST TO AJO WAY CONNECTOR RAMP
AJO WAY TO 12TH AVE CONNECTOR RAMP
SB CONSTRUCTION ℄
NB CONSTRUCTION ℄
I-19 SB
I-19 NB
RAMP "A"
RAMP "B"
AJO WAY
EXISTING DRAINAGE EASEMENT
5-Barrels 8.5 ft x 8.5 ft RCB with Wing wall
1-Barrel 24 in. RCP with End section
Proposed 2-Barrels 36 in. RCP
REFER TO SHEET GP-60A FOR MAINLINE PROFILE
GP-60B AND GP-60F FOR RAMP PROFILES
GP-82 AND GP-83 FOR AJO WAY PLAN AND PROFILE
CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD
Arizona Department of Transportation
Pima County
Contract No. 101-49-XXXX
TRACS No. H5949
Corridor Study
KEY MAP
SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL
Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants
GENERAL PLAN
MAINLINE PLAN
STA. 3262+00 TO 3291+00
AJO WAY
SHEET NO. GP-60
SEPTEMBER 2003


2430
2420
2410
2400
-0.67%
PROPOSED SB PROFILE
EXISTING GRADE
PVI STA. 3282+50.00
ELEV= 2409.00
-0.20%
800' VC
K 1699.61
Corr=0.47'
SB MAINLINE PROFILE
PROPOSED NB PROFILE
EXISTING GRADE
PVI STA. 3282+50.00
ELEV= 2409.00
800' VC
K 1701.49
Corr=0.47'
NB MAINLINE PROFILE
3265+00
3270+00
3275+00
3280+00
3285+00
3290+00
$FILE$
$USERNAME$
$TIME$
$DATE$
INTERSTATE
ARIZONA
19
Corridor Study
CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD
Arizona Department of Transportation
Pima County
Contract No. T01-49-H8031
TRACS No. H8949
ADOT
KEY MAP
SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL
Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants
GENERAL PLAN
MAINLINE AND RAMP PROFILES
STA. 3262+00 TO 3291+00
AJO WAY
SHEET NO. GP-60A
SEPTEMBER 2003



$FILE$
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INTERSTATE ARIZONA 19
Corridor Study

CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND INTERSTATE 19 JUNCTION TO ARIVACA ROAD

Arizona Department of Transportation
Pima County
Contract No. T05-49-H5901
TRACS No. H5949

ADOT

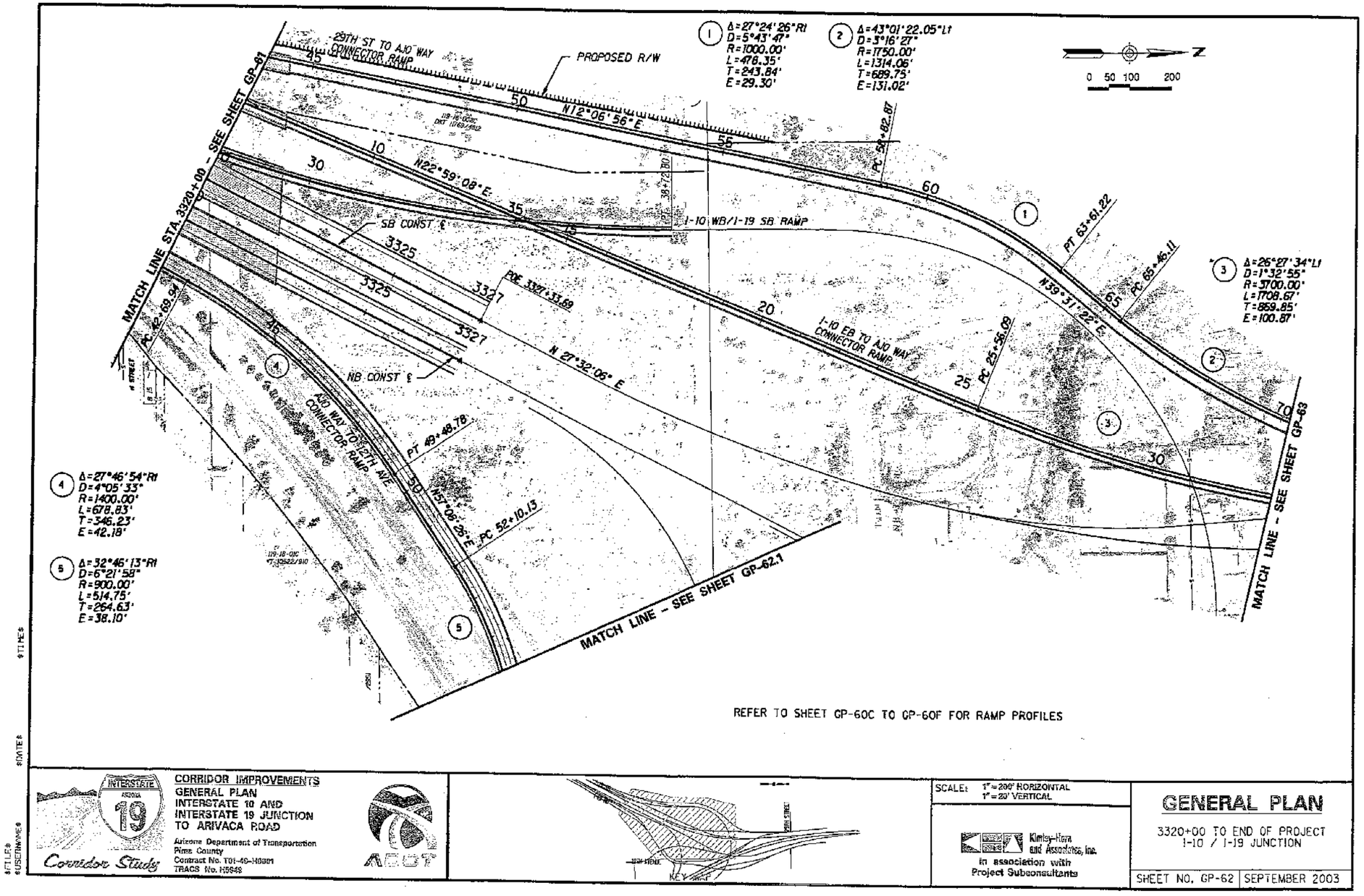
KEY MAP

SCALE: 1"=200' HORIZONTAL
1"=20' VERTICAL

Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants

GENERAL PLAN
MAINLINE PLAN-PROFILE
STA. 3291+00 TO 3320+00

SHEET NO. GP-61 | SEPTEMBER 2003



REFER TO SHEET GP-60C TO GP-60F FOR RAMP PROFILES

CORRIDOR IMPROVEMENTS
GENERAL PLAN
INTERSTATE 10 AND
INTERSTATE 19 JUNCTION
TO ARIVACA ROAD

Arizona Department of Transportation
Pima County
Contract No. T01-46-H8801
TRACS No. H5946

Corridor Study

SCALE: 1" = 200' HORIZONTAL
1" = 20' VERTICAL

Kimley-Horn and Associates, Inc.
in association with
Project Subconsultants

GENERAL PLAN

3320+00 TO END OF PROJECT
I-10 / I-19 JUNCTION

SHEET NO. GP-62 | SEPTEMBER 2003

$TIME$
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$FILE$
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Appendix D: Drainage Report

Nogales – Tucson Highway
I-19 San Xavier Road to I-10
DCR and EA

019 PM 057 H5105 01D
Federal Aid Reference No. 019-A(014)

FINAL DRAINAGE REPORT

Prepared For:

ARIZONA DEPARTMENT OF TRANSPORTATION

Prepared By:

1860 East River Rd.
Suite 300
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JANUARY 2012

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1.0 EXECUTIVE SUMMARY

This drainage report is prepared in support of the *Design Concept Report, I-19 San Xavier Road to I-10*, and addresses the existing hydrologic and hydraulic conditions for the existing cross drainage facilities that will be affected by the proposed reconstruction of I-19 between San Xavier Road (Milepost 56.3) and Interstate 10 (Milepost 63.0). This report contains the analysis of the existing culverts as well as provides recommendations on proposed improvements.

Most of the existing pipe culverts within the project study area will need to be replaced due to the revised I-19 profile and the proposed pavement structural section. At some locations, pipe culverts will be removed with flow directed to alternate locations, and other locations will have new pipe culverts to replace undersized facilities.

In general, the existing box culverts at wash crossing were found to be adequately sized and could remain or be extended as needed. The existing box culverts for Irvington Wash and Wyoming Wash are proposed to be removed and new box culverts constructed. Additionally, new box culverts are proposed to help reduce flooding, decrease headwater elevations, to replace existing open channels, and provide cross drainage relief for new roadways. Open channels will be needed downstream of new culverts where there is not adequate capacity to convey flows to the Santa Cruz River.

Hydraulic analysis for bridge widening as well as new bridge construction on I-19 will be performed as part of future design and included in a separate report.

2.0 INTRODUCTION

The Arizona Department of Transportation (ADOT) is proposing the widening of Interstate 19 (I-19) in Tucson, Arizona from south of San Xavier Road (Milepost 56.3) to Interstate 10 (I-10) (Milepost 63.0). The purpose of the widening is to provide additional capacity and improve the operational characteristics of I-19. The project includes the widening of I-19 to four travel lanes in each direction and new traffic interchanges at Los Reales Road and Drexel Road. Additionally, the project includes interchange improvements at San Xavier Road, Valencia Road, Irvington Road, Ajo Way, and the I-19/I-10 system interchange.

The objective of this drainage report is to determine the hydrologic and hydraulic characteristics for the design of cross drainage facilities within the project limits. This drainage report analyzes the hydrologic and hydraulic conditions for existing cross drainage structures, determine whether the existing structures have sufficient capacity for the design flows, and provide design recommendations. All designs will meet the criteria contained in Section 600 of the ADOT Roadway Design Guidelines (RDG).

3.0 AREA DESCRIPTION

ADOT"s Arizona Major Drainage Basin map identifies the I-19 corridor to be within the Santa Cruz drainage basin. Rainfall runoff in the I-19 corridor is conveyed from east to west as sheet flow in a braided network of washes and drainage facilities. The I-19 corridor within the study area is located on the east side of the Santa Cruz River, and runs predominately parallel to the river. Cross drainage structures convey flows under I-19 to the Santa Cruz River. The studied watersheds consist of mild sloped topography, averaging 1.5%.

3.1 Topography

The project area is located at elevations from 2,400 feet to 2,530 feet above mean sea level. Topography in the project area is relatively flat to gently sloping. Nearby topographic features include Martinez Hill, an igneous mountain that is just east of I-19 near the project area"s southern terminus, and the Santa Cruz River. The normally dry channel of the Santa Cruz River passes under I-19 from the east near the southern project limit, parallels I-19 on the west side as it continues north, and passes under Ajo Way near the northern project limit, west of I-19.

The project is located within the Arizona Upland subdivision of the Sonoran Desert Scrub biotic community. Vegetation along I-19 is predominately native, consisting of large Mesquite and Palo Verde trees within the median and along the edges of the right-of-way. Creosote bush, Prickly pear, Cholla cacti, and Acacia shrubs are also present between the roadway and the right-of-way fence lines.

3.2 Land Use

Land use in the project area is largely rural in character on both sides of the freeway between San Xavier Road and Los Reales Road. This area is within the San Xavier District of the Tohono O"odham Nation.

The east side of I-19 is bounded by largely residential uses from Los Reales Road north to the I-19/I-10 interchange with some commercial uses occurring at the Valencia Road, Irvington Road, and Ajo Way interchanges.

The west side of I-19 has various land uses. Between Los Reales Road and Valencia Road there is a major sand and gravel operation. A Central Arizona Project electrical substation lies north of Valencia Road and west of I-19. The Desert Vista Campus of Pima Community College is located west of I-19 and south of Drexel Road. A 68-acre parcel of vacant state land carrying Park Industrial (P-1) zoning is located between the two.

West of I-19 and north of Drexel Road there is a 60,000+ square foot manufacturing facility. The 145-acre Spectrum retail center is located between the facility and Irvington Road. The City of Tucson owns all the land west of I-19 between Irvington Road and the I-19/I-10 interchange except for a subdivision south of Ajo Way. The City land is vacant. However, Tucson Water operates several potable water wells in this area known as the Santa Cruz field.

Land owners include ADOT, the Central Arizona Project, the Arizona State Land Department, the Tohono O"odham Nation, the Pascua Yaqui Tribe, the City of Tucson and private entities.

3.3 Soils

The Natural Resource Conservation Service (NRCS) compiles soil survey data and maintains soils data for the United States. A review of the data shows the predominate soil is considered to be mixed type. Soils in the project area are hyperthermic arid soils of the Torrifluvents association. This association consists of well-drained soils formed on recent mixed alluvium on the floodplains of the Santa Cruz, Upper Gila, and San Pedro rivers and their tributaries. The Torrifluvents Association is characterized by deep, moderately coarse to moderately fine-textured, nearly level to gently sloping soils on floodplains and alluvial fans (Hendricks 1985).

4.0 PREVIOUS STUDIES

This project is covered by drainage studies performed by both ADOT and the City of Tucson. In April 2003, ADOT completed the *I-19 Corridor Study I-10 to Pima/ Santa Cruz County Line Drainage Report* determining 100-yr flows at the major washes. The City of Tucson completed a comprehensive stormwater management program for the Tucson metropolitan area with a study called the Tucson Stormwater Management Study (TSMS). A subcomponent of that study was the Stormwater Master Plan; a comprehensive, long-term framework for managing the city"s storm water system. Based on the hydrologic watershed modeling (HEC-1) performed as part of the TSMS study, the City has established concentration points throughout the city. Each node has an associated watershed name, watershed identification letter, node identification number and flow (Q) data. One of the watersheds delineated is the “Rodeo Wash Watershed” which crosses the I-19 corridor at its downstream segment.

Several drainage studies have been conducted for ADOT, City of Tucson and Pima County Regional Flood Control District offices. Table 4.1 lists the drainage reports that exist for this corridor.

Table 4.1: Existing Drainage Reports

Report	Agency	Report Date
I-19 Corridor Study: Initial Drainage Report Junction I-10 to Pima/Santa Cruz County Line, Kimley-Horn & Associates, Inc	ADOT	March 2003
I-10 / I-19 Traffic Interchange: Final Hydrologic and Hydraulic Report, Johnson-Brittain & Associates, Inc	ADOT	August 2000
Interstate I-19- Valencia Road TI Drainage Report, Entranco	ADOT	March 1999
Final Report Tucson Stormwater Management Study, Phase II, Stormwater Master Plan (Task11), Simons, Li & Associates, Inc.	City of Tucson	December 1995
Existing-Conditions Hydrologic Modeling for the Tucson Stormwater Master Plan	City of Tucson	November 1995
Final Drainage Report: I-19/Valencia TI .Contract No. 93-26. TRACS # 019 PM 058 H 2609 01C, Federal Reference No. NH-19-1 (111), BRW Inc.	ADOT	October 1995
Santa Cruz River at I-19, ADOT Design Services	ADOT	July 1985

5.0 EXISTING CONDITIONS

5.1 FEMA Floodplain Issues

The Federal Emergency Management Agency (FEMA) produces Flood Insurance Rate Maps (FIRM) according to various levels of flood risk. Zone designations B, C, and X indicate low to moderate risk areas; whereas zones A, AH and AO indicate high risk areas. Zone D indicates an undetermined risk area. A review of FEMA FIRM maps shows this project falling within the following map panels:

- 04019C2830K
- 04019C2238K
- 04019C2236K

This project has zone designations AE, A, and X (shaded and unshaded) within its boundaries. Zone A denotes that no base flood elevation has been determined. Zone AE denotes that a floodplain study has been performed and a 100-year base flood elevation (BFE) has been determined by FEMA. Shaded zone X denotes areas of 100-year flood with average depths of less than 1 foot or drainage areas less than 1 square mile, and areas protected by levees from the 100-year flood. Unshaded zone X denotes areas outside the 500-year floodplain. Table 5.1 lists FEMA regulated washes.

Table 5.1: FEMA Regulated Floodplains

Wash	TSMS Q100 (cfs)	FEMA Q100 (cfs)	Zone	FEMA Base Flood Elevation
Santa Clara Wash	376	705	A	No
Airport Wash	5,100	8,100	A	No
Rodeo Wash	3,437*	2,922	AE	Yes

* Unverified TSMS flow

5.2 Clean Water Act (CWA)

Sections 401 and 404: The I-19 corridor has ephemeral washes that have defined channels that might be considered waters of the United States and thus requires coordination with the US Army Corps of Engineers (Corps). Activities associated with improvements to I-19 that would require coordination include placement of fill material, bridge supports, culverts, and rip-rap within the boundaries of waters of the United States. In many areas along the I-19 corridor, the washes have culverts that extend from the outside edge of the northbound lanes to the outside edge of the southbound lanes, including interior open space between lanes. Work within these areas may require Corps authorization.

Section 402: The National Pollutant Discharge Elimination System (NPDES) stormwater program created under Section 402 of the CWA, requires that any construction project that will disturb one or more acres of land area will require a permit for stormwater discharge. Arizona has its own program called the Arizona Pollution Discharge Elimination System (AZPDES) that is administered by the Arizona Department of Environmental Quality (ADEQ). Improvements to I-19 will require authorization under the Construction General Permit and preparation of a Stormwater Pollution Prevention Plan (SWPPP).

5.3 Rivers, Channels, and Washes

There are multiple named and unnamed natural washes within the project corridor. The major system adjacent to the project limits is the Santa Cruz River that runs parallel to the corridor. Airport Wash, Hughes Wash and Tucson Diversion Channel are the largest systems that cross the corridor with flows designated between 5000-10000 cfs. Rodeo Wash, a system with smaller flows, also crosses the corridor with flows ranging from 2000-5000 cfs.

5.4 Existing Cross Drainage Structures

Data for existing structures were obtained from as-built plans and aerial imagery. The corridor has multiple culverts that cross I-19, both at natural washes and sheet flow “non-wash” segments. The wash locations and associated cross culverts are listed in Table 5.2. Table 5.3 lists the culverts at non-wash locations.

Table 5.2: Existing Project Washes & Associated Cross Culverts

No	Station	Wash Name	Structure Type	Structure Size
1	3065+00	Hughes Wash	*Bridge*	-
2	3084+25	Santa Clara Wash	RCBC	2-8"X7"
3	3104+80	El Vado Wash	RCBC	4-10"X5"
4	3129+77	Valencia Wash	RCBC	4-10"X5"
5	3152+00	Mission Park Wash	RCBC	2-10"X4"
6	3195+00	Airport Wash	*Bridge*	-
7	3201+70	Nebraska Wash	RCBC	2-10"X5"
8	3219+85	Wyoming Wash	RCBC	3-10"X7"
9	3243+50	Irvington Wash	RCBC	10"X4"
10	3271+00	Rodeo Wash	RCBC	5-9"X4"
11	485+40	Wyoming Wash at Irvington Rd	RCBC	3-10"X7"
12	3315+00	16th Street Wash	RCBC	4-10"X6"

Table 5.3: Existing Non-Wash Cross Culverts

No	Alignment	Station	Structure Size
1	I-19 SB	3034+35	24” RCP
2	I-19	3048+40	24” CMP
3	I-19	3070+75	24” CMP
4	I-19	3074+50	24” CMP
5	I-19	3078+40	24” CMP
6	I-19	3096+50	42” RCP
7	I-19	3135+60	3-57”X38” CMPA
8	I-19	3138+66	4-45”X29” ERCP
9	I-19	3156+00	2-59”X37” CMPA
10	I-19	3165+80	2-52”X29” CMPA
11	I-19	3175+70	36” RCP
12	I-19	3178+95	2-24” RCP
13	I-19 NB & SB	3211+70	24” RCP
14	I-19	3219+70	24” RCP
15	I-19 NB & SB	3232+18	2-50”X34” CMPA
16	I-19	3249+37	54” RCP

5.5 Existing Pavement Drainage, Ditches, and Area Inlets

The existing I-19 mainline has no storm drain system and drains via drainage ditches. The northbound and southbound roadways are crowned sections which drain into v-ditches paralleling the road on the outside. The v-ditches discharge to existing cross culverts and natural channels. Precipitation falling in the median is collected in median ditches which are drained with a series of area inlets that connect into cross culverts discharging into adjacent natural channels.

5.6 Existing Bridges

There are 15 structures listed in the ADOT Bridge Record; 14 highway structures and a pedestrian overpass. A summary of the existing bridge structures within the study area is provided in Table 5.4.

Table 5.4: Existing Bridge Structures

Structure Number	Milepost	Structure Name	Bridge Type
1243(NB), 1244(SB)	56.8	Santa Cruz River Br	Steel Plate Girders
1245(NB), 1246(SB)	56.95	San Xavier TI OP	Steel Plate Girders
1247(NB), 1248(SB)	57.82	Bridge	CIP T-Girder
1943	58.82	Valencia Road TI UP	AASHTO Type V
1120	59.9	Drexel Road UP	Steel Plate Girders
1121(NB), 1122(SB)	60.32	Airport Wash Br	Concrete Slab
1123	60.95	Irvington Road TI UP	Steel Plate Girders
1124	61.4	Pedestrian UP	Steel Rigid Frame w/ hinged suspension
1125	61.9	Ajo Way UP	Steel Girder
2531	62.67	I-19 Ramp W-S	CIP PT
528	SR86 171.07	Santa Cruz River Br	AASHTO Type V

5.7 Existing Cross Drainage Hydrology

The Arizona Department of Transportation (ADOT) approved methodology within the *Highway Drainage Design Manual – Hydrology* (Drainage Manual) was used to analyze the existing hydrologic conditions within the project area. Per the Roadway Design Guidelines (RDG), cross drainage structures must be designed for the 50-year event and checked at the 100-year event for increased water surface elevation. The *I-19 Corridor Study I-10 to Pima/Santa Cruz County Line Initial Drainage Report (April 2003)* contains 100-year peak flow information for the major wash crossings. In addition, the Tucson Stormwater Management Study (TSMS) was referenced to obtain the 100-year discharge values for El Vado Wash and Valencia Wash. These flows were used for this drainage analysis and the discharge values summarized in Table 5.5.

Table 5.5: Documented Wash Discharge Rates (Existing Conditions)

Wash Name	50-Year	100-Year
	(cfs)**	(cfs)
Hughes	2,943	3,462
Santa Clara	458	539
El Vado*	1,324	1,558
Valencia*	984	1,158
Mission Park	588	691
Airport	5,862	6,897
Nebraska	824	969
Wyoming	901	1042
Irvington	441	519
Rodeo	2,484	2,922*
16th Street	1129	1328

Note: All values are from the I-19 Corridor Study I-10 to Pima/Santa Cruz County Line Initial Drainage Report (April 2003) unless otherwise noted.
* FEMA Discharge Value
** Factor Of 0.85 applied to Q100 (Source: Pima County)

Watershed sub-basin delineation was performed for all remaining cross drainage locations to obtain peak flows. Pima Association of Governments orthophotography and associated digital elevation model (DEM) point files were used to develop a digital terrain model for determining sub basin boundaries. Points of concentration were defined generally by the location of the existing drainage structures.

Peak discharge flow rates for watershed sub-basins less than 160 acres were developed using the Rational Method defined by the following equation:

$$Q = CiA$$

Where: Q = peak discharge of a selected return period (cfs)

C = runoff coefficient

i = rainfall intensity of the calculated rainfall duration for the selected rainfall return period (in/hr)

A = drainage area (acre)

The runoff coefficient (C) was estimated using “Rational „C" Coefficient Developed Watersheds”, Figure 2.3 in the Drainage Manual. Watershed type as defined within the figure was determined using available aerial photography and survey information.

The rainfall intensity (i) was calculated using a derived equation describing precipitation frequency estimates with respect to rainfall duration as shown in “Generalized I-D-F Graph for Zone 8 of Arizona” (I-D-F Graph), Figure 2-2 in the Drainage Manual. This equation is used in the iterative process for determining the time of concentration (Tc). Precipitation frequency estimates were acquired from the NOAA “Point Precipitation Frequency Estimates” data server referencing Atlas 14, Volume 1, Version 4. The point precipitation frequency estimates are located within Appendix B.

The time of concentration (Tc) for each watershed is equal to the rainfall duration value within the I-D-F graph. It is defined by the following equation within the ADOT Drainage Manual:

$$T_c = 11.4\, L^{0.5} K_b^{0.52} S^{-0.31} i^{-0.38}$$

Where: T_c = time of concentration (hr)

L = length of longest flow path (mi)

K_b = watershed resistance factor (Table 2-1)

S = slope of longest flow path (ft/mi)

i = average rainfall intensity (in/hr) for a rainfall duration equal to T_c (10 minute minimum)

Table 5.6 identifies the sub-basin area, 50-year and 100-year discharge flow rates for the Rational Method calculations. The culvert locations are shown on the exhibits contained in Appendix A.

Table 5.6: Rational Method Results Summary (Existing Cross Culverts)

Alignment	Culvert Station	Area (Acres)	Q50 (cfs)	Q100 (cfs
I-19	3070+75	2.85	12	14
I-19	3074+50	2.38	10	12
I-19	3078+40	6.28	29	34
I-19	3096+50	11.14	66	76
I-19	3135+60	33.49	187	219
I-19	3138+66	20.94	124	143
I-19	3156+00	10.06	60	69
I-19	3165+80	34.36	202	234
I-19	3175+70	19.07	113	130
I-19	3178+95	2.9	18	20
I-19	3211+70	4.43	18	22
I-19	3232+18	7.32	30	36
I-19	3249+37	15.21	90	104

5.8 Existing Cross Drainage Hydraulics

Hydraulic analyses have been performed for all the existing cross drainage structures listed in Tables 5.7 and 5.8, excluding bridge structures. Watersheds and wash flow paths that cross I-19 through bridge structures, such as Hughes and Airport Wash, have not been analyzed. The software program HY-8 Version 7.2, developed by the Federal Highway Administration, was used to analyze the other structures.

Wash structure analysis utilized the 50-year and 100-year storm discharge rates as illustrated in Table 5.7 to ascertain if deficiencies exist. To determine the 50-year discharge rate, a factor of 0.85 has been applied to the 100-year storm event discharge based on the Pima County *Hydrology Manual for Engineering Design and Flood Plain Management Within Pima County, Arizona (September 1979).* Also, where applicable, initial comparisons were performed with the 100-year water surface elevations for the major washes and the datum adjusted Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) and any associated Letter of Map Revisions (LOMR).

The following assumptions and cross culvert criteria were used to evaluate existing hydraulic performance based on ADOT RDG, Chapter 600:

- Pipe culvert minimum diameter of 24-inch.
- Box culvert minimum dimensions of 6-foot in width by 4-foot in height. Existing box culverts that perform adequately, but do not meet the minimum size requirements will not be replaced.
- The headwater elevation for the 50-year design event should be 3-inches lower than the roadway pavement elevation.
- Manning “n” values of 0.012 for concrete pipe, 0.024 or 0.028 for CMP”s, and 0.014 for cast-in-place concrete used in the calculations.
- When a culvert is unable to convey the 100-year event, the existing bypass and headwater elevation were determined. Proposed improvements should approximate the estimated existing flow and bypass, and maintain or reduce the headwater elevation.

The results of the analysis are included in Appendix B, and summarized in Table 5.7 for the wash box culverts, and Table 5.8 for non-wash cross culverts.

Table 5.7: Existing Conditions Flow and Headwater: Washes

WASH CROSS CULVERT SUMMARY

Wash Name / Location	Approx. Station	Existing RCBC Size	Q50 (cfs)	Q100 (cfs)	Headwater Elev. (ft) (50 yr)	Headwater Elev. (ft) (100 yr)	Bypass for 100 yr (cfs)
Santa Clara	3084+25	2-8'X7'	458	539	2490.13	2490.66	No
El Vado	3104+80	4-10'X5'	1324	1558	2485.82	2486.58'	No
Valencia	3129+77	4-10'X5'	984	1158	2479.34	2479.87	No
Mission Park	3152+00	2-10'X4'	587	691	2469.66	2470.65	No
Nebraska	3201+70	2-10'X5'	824	969	2452.26	2452.50	303
Wyoming	3219+85	3-10'X7'	901	1042	2445.09	2445.57	No
Irvington	3243+50	1-10'X4'	441	519	2434.41	2434.58	223
Rodeo	3271+00	5-9'X4'	2484	2922	2421.70	2422.09	536
Irvington Road 485+40	485+40	3-10'X7'	680	789	2418.76	2419.17	No
16th Street	3315+00	4-10'X6'	1129	1328	2397.13	2397.69	No

Table 5.8: Existing Conditions Flow and Headwater: Pipe Culverts

NON- WASH CROSS CULVERT SUMMARY

Approx. Station	Existing Culvert Size	Q50 (cfs)	Q100 (cfs)	Headwater Elev. (ft) (50 yr)	Headwater Elev. (ft) (100 yr)	Bypass for 100 yr (cfs)
3070+75	1-24" CMP	12	14	2490.54	2490.72	1
3074+50	1-24" CMP	10	12	2491.53	2491.74	No
3078+40	1-24" CMP	29	34	2493.56	2493.62	22
3096+50	1-42" RCP	66	76	2494.98	2495.10	13
3135+60	3-57"X38" CMPA	187	219	2479.20	2479.41	35
3138+66	4-45"X29" ERCP	124	143	2475.32	2475.58	No
3156+00	1-59"X37" CMPA	60	69	2470.57	2470.90	No
3165+80	2-52"X29" CMPA	202	234	2473.76	2473.94	119
3175+70	1-36" RCP	113	130	2468.64	2468.83	65
3178+95	2-24" RCP	18	20	2464.44	2464.48	No
3211+70	1-24" RCP	18	22	2455.24	2456.31	No
3232+18	2-50"X34" CMPA	30	36	2440.82	2441.06	No
3249+37	1-54" RCP	90	104	2431.55	2432.00	No

6.0 PROPOSED IMPROVEMENTS

6.1 Design Criteria

The following assumptions and cross culvert criteria were used to evaluate proposed hydraulic performance based on ADOT RDG, chapter 600:

- The design storm is the 50-year event.
- The headwater elevation for the 50-year design event should be 3-inches lower than the roadway pavement elevation.
- The headwater elevation for the proposed 100-year design event should not exceed the existing headwater elevation for the same event.
- New pipe culvert minimum diameter of 24-inch.
- If existing structures are to remain, but include additional barrels, the proposed structure shall retain same material type, shape, size, and invert elevation characteristics.
- Extended culverts should maintain the existing profile slope when possible.
- One foot of cover over new pipes or extended pipes. Pipes with less than the desired cover shall have protective measures taken.
- Box culverts may encroach into the pavement structural section in special cases, but should be below the pavement section when possible.
- Box culvert minimum dimensions of 6-foot in width by 4-foot in height, with a desired minimum height of 6-foot. Existing box culverts that perform adequately but do not meet the minimum size requirements will not be replaced.
- Drainage structure extensions are assumed to extend to the roadway cut/fill.
- Manning “n” values of 0.012 for concrete pipe, 0.024 or 0.028 for CMP"s, and 0.014 for cast-in-place concrete used in the calculations.
- When an existing culvert is unable to convey the 100-year event, the proposed improvements should approximate the estimated existing flow and bypass, and maintain or reduce the headwater elevation.

6.2 Proposed Cross Drainage Hydrology

The 50-year and 100-year flows for the proposed condition are the same as the calculated existing 50-year and 100-year values for most culverts. Some of the existing culverts are to be removed, in which case the new proposed flow is a combination of two existing drainage basins. The existing pipe at 3074+50 is to be removed, and the flow diverted by channelization to 3070+75. The existing pipe at 3211+70 will be removed and a channel graded to the inlet of the new box culvert for Wyoming Wash at 3249+60. The existing RCBC for Valencia Wash will be removed, and a channel graded to 3249+60. Here a new RCBC will be installed that will also take the flow from the existing culvert at 3249+37 proposed to be removed.

Additional drainage basins are delineated north of Ajo Way on the east side of I-19. These basins are at key locations where culverts may be proposed during final design, and to aid in modeling the proposed 100-year floodplain based on the proposed ramp embankments and retaining walls. Several new basins on the crossroad were identified and proposed 50-year and 100-year flows were calculated.

The drainage areas for proposed cross drainage facilities and the corresponding flows are shown in Table 6.1.

Table 6.1: Rational Method Results Summary

(Proposed Conditions)

Alignment	Culvert Station	Area (Acres)	Q50 (cfs)	Q100 (cfs)	Remarks
I-19	3070+21	5.21	22	26	Remove 3074+50 and grade back to 3070+75
I-19	3218+85	-	904	1064	Add 3211+70 and Wyoming Wash, new RCBC
I-19	3249+60	-	531	623	Add 3249+37 and Valencia Wash, new RCBC
I-19	3281+00	9.84	58	67	Between Ajo Ramp D and existing private wall
I-19	3291+47	76.30	463	543	New 2-6"x6" RCBC & channel to Santa Cruz
I-19	3294+35	8.06	48	55	New concrete lined channel at face of wall
I-19	3304+50	35.21	207	239	Continue concrete lined channel to 16th St Wash
San Xavier Road	529+14	92.05	339	408	Replace existing at-grade crossing
San Xavier Road Ditch	-	52.83	214	253	Concrete lined roadway cut ditch to Santa Cruz. Profile and ditch width revisions would help here.
San Xavier Road Ramp B	14+77	17.47	65	78	Infield area for new ramp location.
I-19	3035+60	15.17	56	68	Add flow from San Xavier Road Ramp B for total Q"s
Los Reales Road	513+54	50.25	219	269	Geometric revisions would reduce channelization
Los Reales Road	503+45	11.36	52	61	New pipe under Los Reales Road near the ramps
10W19S	18+81	11.22	51	60	Add to flows in channel of 421 cfs (50 year) and 477 cfs (100 year), from JBA report.
Irvington Road	485+40	35.51	90	270	Add to Irvington Wash Q"s for downstream RCBC

6.3 Cross Drainage Hydraulics

Hydraulic analyses have been performed for all the proposed cross drainage structures listed in Table 6.1 using the software program HY-8 Version 7.2, developed by the Federal Highway Administration. Watersheds and wash flow paths that cross I-19 through bridge structures, such as Hughes and Airport Wash, have not been analyzed. Bridged locations will be analyzed as part of the Bridge Hydraulic Report for each location.

The results of the analysis are included in Appendix B, and compared to the existing conditions and summarized in Table 6.2.

Table 6.2: Existing / Proposed Culverts and Headwater

	Existing Culvert			Proposed Culvert		
Approx. Station	Culvert Size & Material	Headwater Elev. (ft) (50 yr)	Headwater Elev. (ft) (100 yr)	Culvert Size & Material	Headwater Elev. (ft) (50 yr)	Headwater Elev. (ft) (100 yr)
San Xavier Road 529+14	-	-	-	2-78" CMP	2517.31	2517.57
San Xavier Road B 14+77	-	-	-	2-36" RCP	2502.77	2503.16
Los Reales Road 513+80	-	-	-	7-36"X23" RCPA	2499.40	2500.90
Los Reales Road 503+45	-	-	-	2-36" RCP	2495.58	2495.84
3070+75	1-24" CMP	2490.54	2490.72	1-36" CMP	2491.55*	2491.67*
3074+50	1-24" CMP	2491.53	2491.74	Remove	-	-
3078+40	1-24" CMP	2493.56	2493.62	3-24" CMP	2490.00	2490.97
3084+25	2-8'X7' RCBC	2490.13	2490.66	2-8'X7' RCBC	2490.13	2490.66
3096+50	1-42" RCP	2494.98	2495.10	1-42" RCP	2493.95	2494.54
3104+80	4-10'X5' RCBC	2485.82	2486.58	4-10'X5' RCBC	2485.82	2486.58
3129+77	4-10'X5' RCBC	2479.34	2479.87	4-10'X5' RCBC	2479.34	2479.87
3135+60	3-57"X38" CMPA	2479.20	2479.41	3-57"X38" CMPA	2478.50	2478.75
3138+66	4-45"X29" ERCP	2475.32	2475.58	4-45"X29" ERCP	2475.32	2475.58
Mission Wash 3152+00	2-10'X4' RCBC	2469.66	2470.65	2-10'X4' RCBC	2469.58	2470.16
3156+00	1-59"X37" CMPA	2470.57	2470.90	2-59"X37" CMPA	2469.86	2470.06
3165+80	2-52"X29" CMPA	2473.76	2473.94	Move to 3166+65	-	-
3166+65	-	-	-	4-36" RCP	2470.70	2471.41
3175+70	1-36" RCP	2468.64	2468.83	3-36" RCP	2468.04	2468.41
3178+95	2-24" RCP	2464.44	2464.48	2-24" RCP	2464.20	2464.31
3201+70	2-10'X5' RCBC	2452.26	2452.50	2-10'X5' RCBC	2452.24	2452.47
3211+70	1-24" RCP	2455.24	2456.31	Remove	-	-
3219+85	3-10'X7' RCBC	2445.09	2445.57	4-10'X6' RCBC	2445.09	2445.53
Irvington Road 485+40	3-10'X7' RCBC	2418.76	2419.17	3-10'X7' RCBC	2418.76	2419.17
3232+18	2-50"X34" CMPA	2440.82	2441.06	2-24" RCP	2440.92	2441.23
3243+50	1-10'X4' RCBC	2434.41	2434.58	Move to 3249+35	-	-
3249+37	1-54" RCP	2431.55	2432.00	Move to 3249+35	-	-
3249+35	-	-	-	2-6'X6' RCBC	2429.50	2430.33
Rodeo Wash 3271+00	5-9'X4' RCBC	2421.70	2422.09	5-9'X4' RCBC 1-9'X5' RCBC	2420.23	2421.99
Parallel to Ajo Way	-	-	-	4-8'X8' RCBC	2408.50	2410.29
3280+98	1-24" RCP	-	-	Remove	-	-
3291+47	-	-	-	2-6'X6' RCBC	2401.39	2402.02
3315+00	4-10'X6' RCBC	2397.13	2397.69	4-10'X6' RCBC	2396.28	2396.54
19W10S 18+81	-	-	-	1-10'X6' RCBC	2391.61	2392.24

* New headwater elevation below existing grade. Therefore, no impacts to adjacent properties are anticipated.

New pipes are proposed for the new San Xavier Road alignment, as well as on the San Xavier Road Ramp B and downstream on I-19 at Sta. 3035+60. New pipe arches are proposed to carry the flow under Los Reales Road, and a new pipe is proposed under Los Reales Road near the new I-19 embankment.

Just south of Drexel Road, the existing pipes under I-19 are in conflict with the new pavement section and need to be replaced. The existing pipes are not adequate to pass the 50-year event without bypass occurring. As the water level rises, the water breaks out into the I-19 roadside v-ditch and goes north to the next culvert. The current design allows all flow including existing break out flow to pass under I-19 at this location. This approach should be reviewed with more detailed survey data and refined during final design.

The existing box culvert for Wyoming Wash is proposed to be removed due to a lowered mainline profile, the need for an additional barrel to reduce the headwater due to an inlet extension required for Irvington Road Ramp B, and the new fill height for Irvington Road Ramp A would likely cause over-stress on the existing structure. The pipe at 3211+70 could then be removed and a channel graded to the new box culvert inlet.

The existing Irvington Wash crossing is proposed to be removed and a channel on the east side of I-19 constructed to approximately 3249+60 where a new 2-6"X6" RCBC will be constructed. The existing pipe at 3249+37 will be removed, and the flow directed to the new box culvert. Preliminary modeling shows the proposed channel does not extend beyond the existing right-of-way on the east. The proposed channel will need to be coordinated with any sound walls that may be required in the area.

The existing open channel/culvert system for the Rodeo Wash will need to be modified to accommodate roadway improvements. The modifications include an additional cell on the existing 5-9"X4" RCBC, and a new box culvert running parallel to Ajo Way to replace the existing channel that extends from I-19 to the Santa Cruz River. The new box culvert is needed since the proposed roadway prism of Ajo Way encroaches into the existing channel. Lamar Avenue will be reconstructed on top of the new 4-8"X8" RCBC. The new box culvert will have an approximate length of 700 ft and will be proceed by a channel to discharge into the Santa Cruz River.

A new 2-6"X6" box culvert is proposed at 3291+47 to take a portion of the flow currently going to the 16th Street Wash RCBC. The new box will require a new channel to the Santa Cruz River, and the corresponding new drainage easement from the City of Tucson. The area on the east side of I-19 currently experiences flooding, and the new Ajo Way Ramp and I-19 / I-10 Connector encroach into the existing flow path. This new box culvert will reduce the 100-year flood limits, and also eliminates the need to add an additional barrel on the existing 16th Street Wash box culvert.

A new box culvert is also proposed under the new connector from I-10 to South I-19.

Pipe penetration through new or existing concrete box culverts, retaining walls, and sound barriers will need to be addressed during the final design process.

6.4 Sedimentation and Erosion Control

A number of the existing culverts are partially restricted due to sediment at the outlet. From visual observation it appears the downstream channel conditions are causing the sedimentation at the outlet. The HY8 analysis of the existing culverts included the sediment blockage at the outlet. If the downstream condition was improved, the velocities in the culverts would rise to self-cleaning levels and a lowering of the headwater elevation may occur. Downstream improvements should be addressed during final design, and sedimentation calculations performed to ensure sedimentation will not occur in the culverts.

Other existing culverts are experiencing scour downstream of the outlet. The existing channel velocity should be calculated during final design, and compared to the new outlet velocity. Typically, if the outlet velocity is less than 1.5 times the natural stream velocity then no protection is required. Dumped riprap is generally sufficient for ratios between 1.5 and 2.0 with an outlet velocity less than 10 feet per second (fps). Wire-tied riprap should generally be used where the ratio is 1.5 to 2.5 with an outlet velocity between 10 and 15 fps. Energy dissipaters are required when the ratio between outlet and natural stream velocities is greater than 2.5 or when the outlet velocity is greater than 15 fps. Guidance for erosion control can be found in Section 612 of the RDG, as well as the ADOT Hydraulics Manual.

6.5 Pavement Drainage

The existing I-19 mainline has no storm drain system and drains via drainage ditches. The proposed I-19 mainline typical section generally drains away from the median barrier to v-ditches paralleling the edge of shoulder. The proposed v-ditches will discharge at approximately the same location as the existing v-ditches.

Median drainage will be addressed during final design for the area north of Ajo Way where a series of ramps and diverging roadways will allow for graded areas between roadways. The areas will be graded to advantageous locations where the water will be collected in catch basins and carried via a storm drain system to an existing culvert or channel.

Drainage of the infield area of the individual interchanges will also be addressed during the final design for each interchange. Area drains will collect the water and the storm drains will outlet into cross culverts discharging into adjacent natural channels.

The crossroads and the new ramps will have curb and gutter installed. The final designers should analyze the proposed ramps and crossroads and meet the criteria in section 600 of the RDG, or meet the local criteria for the crossroads.

6.6 Project Bridges

A total of seven bridges over washes or rivers are proposed to be widened. The two existing I-19 bridges at the Santa Cruz River will be widened and the decks replaced. The NB and SB bridges at Hughes Wash and Airport Wash will be widened, and the Ajo Way (SR 86) bridge over the Santa Cruz River will also be widened. Bridge hydraulics will be investigated at each location and will be included as part of the Preliminary Structure Selection Reports.

Two new bridges are also proposed for the two Los Reales Road ramps over Hughes Wash. Channel improvements may be required for the downstream bridge (ramp A), and will be addressed in the Preliminary Structure Selection Report.

7.0 CONCLUSIONS

Most of the existing pipe culverts within the project study area will need to be modified or replaced due to the revised I-19 profile and the proposed pavement structural section. Modifications include extensions and/or augmentations. Several of the existing pipe culverts are proposed to be removed and replaced with new pipe culverts at a lower elevation, or removed entirely and channelization used to direct the flow to an alternate location. Additionally, new pipe culverts are proposed to provide cross drainage under new roadways.

The existing box culverts at the wash crossing were generally found to be adequately sized and could remain or be extended as needed. The existing box culvert for Irvington Wash is proposed to be removed and a new box culvert placed at an alternate location. Channelization will be required on the east side of I-19 within the new right-of-way to eliminate the need for the existing channel on the west side of I-19.

The existing box culvert at Wyoming Wash is proposed to be removed and replaced near its existing location. The new box culvert will have a better alignment with the existing channel, will not have angle breaks, will have adequate cover to the pavement structural section, and will be designed for the Irvington Road Ramps A and B.

Three of the existing box culverts are proposed to remain with no revisions. Five of the existing box culverts are proposed to be extended on their existing horizontal alignment.

Four new box culverts are proposed to help reduce flooding, decrease headwater elevations, to replace existing open channels, and on new roadways.

A new open channel is proposed on the west side of I-19, north of Ajo Way at Station 3291+47. The proposed channel will discharge flow from a new 2-6"X6" RCBC into the Santa Cruz River and will extend across a land owned by the City of Tucson. Currently, the Pima County Regional Flood Control District (PCFCD) is conducting a planning study for the area where the proposed channel will discharge into the Santa Cruz River. The project is called Paseo de las Iglesias and might be impacted by the new channel. As a result, coordination has been conducted between the two projects. Note that additional coordination will be required during subsequent stages of these projects.

During final design, the cross drainage for each segment should be thoroughly investigated and the design refined. Pavement drainage and on-site drainage will also be addressed for each segment during final design.

8.0 REFERENCES

1. *Highway Drainage Design Manual - Hydrology,* Arizona Department of Transportation, March 1993.
2. *Highway Drainage Design Manual - Hydraulics,* Arizona Department of Transportation, January 2008.
3. *Roadway Design Guidelines,* Arizona Department of Transportation, January 2007.
4. *Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona,* City of Tucson Department of Transportation, Revised July, 1998.
5. *Flood Insurance Rate Map (FIRM) 04019C2830 K,* Federal Emergency Management Agency (FEMA), February 8, 1999. *Letter of Map Revision (LOMR) 99-09-1303P,* March 24, 2000.
6. *Flood Insurance Rate Map (FIRM) 04019C2238 K,* Federal Emergency Management Agency (FEMA), February 8, 1999. *Letter of Map Revision (LOMR) 99-09-1303P,* March 24, 2000. *Letter of Map Revision (LOMR) 01-09-423P,* June 8, 2001.
7. *Flood Insurance Rate Map (FIRM) 04019C2236 K,* Federal Emergency Management Agency (FEMA), February 8, 1999. *Letter of Map Revision (LOMR) 99-09-1305P,* July 24, 2000.
8. *HEC-RAS v. 4.0.0,* U.S. Army Corps of Engineers, Hydrologic Engineering Center, March 2008.
9. *CulvertMaster v. 3.1,* Bentley Systems, Inc., Haestad Methods Solution Center, December 2005.
10. *HY-8 v.7.2,* Federal Highway Administration, July, 2009.
11. *FlowMaster v. 8.1,* Bentley Systems, Inc., Haestad Methods Solution Center, March 2007.
12. *Hydraulic Design of Highway Culverts,* U.S. Department of Transportation and the Federal Highway Administration, September 1985.
13. *Hydraulic Design of Energy Dissipators for Culverts and Channels,* U.S. Department of Transportation and Federal Highway Administration, July 2006.
14. *Drainage and Channel Design Standards for Local Drainage,* Pima County Department of Transportation and Flood Control District, June 1, 1984.
15. *Arizona Soils,* David M. Hendricks, the University of Arizona Press, 1985.

Appendix E: Public Involvement

Arizona Department of Transportation

Interstate 19 (I-19) Nogales – Tucson Highway

San Xavier Road to Ajo Way

Public Involvement Plan

TRACS No. 019 PM 057 H5105 01D

Contract No. 04-34

Presented by
Gordley Design Group, Inc.
In association with
DMJM+HARRIS
Logan Simpson Design, Inc.
January 19, 2005

Introduction

Purpose

This Public Involvement Plan (PIP) is designed to support the planning effort to evaluate the need and alternatives for additional traffic lanes to improve capacity on Interstate 19 (I-19) from San Xavier Road to the recently completed Interstate 10 (I-10)/I-19 Traffic Interchange north of Ajo Way in Tucson, Arizona (see project map in Attachment 4).

The PIP identifies the public outreach strategy and the means through which the public will be notified and participate in the planning process. The goal of this PIP is to assist the Arizona Department of Transportation (ADOT) with identifying the interested public, responding to their questions and concerns and addressing the public comments when developing the Design Concept Report (DCR) and Environmental Assessment (EA). The overall goal is to achieve a public consensus for the best alternative and commitment of these federal highway funds.

Compliance Statement

This PIP is in compliance with the Council for Environmental Quality regulations for implementing the procedural provisions of the National Environmental Policy Act (NEPA) (40 CFR Parts 1500-1508), Department of Transportation Order 5610.1C [23 CFR 771.111 (h)], and the ADOT Action Plan for state-funded highway projects. The Federal Highway Administration (FHWA) is the lead federal agency for the NEPA document.

Agency Scoping Meeting

One Agency Scoping Meeting is scheduled for the I-19 San Xavier Road to Ajo Way project.

Purpose
The purpose of the Agency Scoping Meeting is to solicit comments, concerns and issues related to providing additional traffic lanes on I-19 from San Xavier Road to Ajo Way from the affected agencies in this project. The team will then address these concerns in the DCR and EA.

Schedule
This meeting is scheduled for Tuesday, January 25, 2005 from 1 to 3 p.m. This meeting will take place just before the Public Scoping Meeting at the Valencia Branch of the Tucson-Pima Public Library. Letters will be prepared and mailed to invite agency representatives to the Agency Scoping Meeting, and to request written comments if the representatives cannot attend the meeting.

Format
The agenda for the Agency Scoping Meeting will include introducing the key agency, ADOT and consultant team members. The project team will make a presentation about the I-19 San Xavier Road to Ajo Way project, including the project purpose and need, opportunities, constraints and the project schedule. It will be followed by a roundtable workshop with the agency representatives.

Arizona Department of Transportation
I-19 San Xavier Road to Ajo Way
Public Involvement Plan

Public Scoping Meeting

One Public Scoping Meeting is scheduled for the I-19 San Xavier Road to Ajo Way project.

Purpose
The purpose of the Public Scoping Meeting is to generate public comments and identify concerns and issues related to providing additional traffic lanes on I-19 from San Xavier Road to Ajo Way, and to address these concerns in the DCR and EA.

Schedule
This meeting is scheduled for Tuesday, January 25, 2005 from 4 to 7 p.m. at the Valencia Branch of the Tucson-Pima Public Library. Letters will be prepared and mailed to adjacent property owners, inviting them to attend the meeting or provide written comments if they are unable to attend.

Format
The format of the meeting will be informal open house. An informational handout with general information and project background will be provided in English and Spanish. Sign-in sheets will be provided to record attendance. People who attend the meeting will be able to fill out comment sheets, in English and Spanish versions, recording their concerns and questions. Comments will be documented and summarized for the project team, and questions will receive a response. A Spanish/English language interpreter will be available to translate verbal comments, questions and answers as needed. Displays depicting the project will be prepared for the meeting.

The team will record public concerns and questions expressed during the meeting and respond with additional, follow-up information as

needed. About two weeks before the scoping meeting, the project team will meet to review the meeting format, displays, handouts and other materials. The team will discuss who will have what role at the meeting.

Public Information Meeting

Purpose
The purpose of the public information meeting is to present the initial alternatives from the DCR and EA in response to public concerns that were raised at the public scoping meeting and to elicit public feedback.

Schedule
This meeting will be scheduled for later in 2005. The exact date and time of the public information meeting will be determined, with consideration given to the convenience of the public.

Format
The format of the public information meeting will be an informal open house. ADOT's team will address public concerns from the previous meeting and then present alternatives and study findings. A question-and-answer session may be held following the presentation.

The team will provide visual displays of the study area, design alternatives and the current project schedule. An informational handout in English and Spanish with general information and project background will be distributed. A comment sheet will be provided to people for them to record their opinions and concerns about the project alternatives and any other issues.

Arizona Department of Transportation
I-19 San Xavier Road to Ajo Way
Public Involvement Plan

The team will record public concerns and questions expressed during the meeting and respond with additional, follow-up information as needed. About two weeks before the public information meeting, the project team will meet to review the meeting format, displays, handouts and other materials. The team will discuss who will have what role at the meeting.

Public Notification

The public will be notified for all public meetings by mail, using the contact database developed for the project. Advertisements will be published in the *Arizona Daily Star*, the *Tucson Citizen* and *La Estrella*. Public notices will be posted in libraries and other public facilities and online calendars. The notices will be written in both English and Spanish. News releases will also be distributed to local newspapers, radio stations and television stations. The public will receive the notices two weeks in advance of the public meetings. The notices will be mailed to businesses, residents and post office boxes within about one block of the project area. The advertisements will run a minimum of 15 days before the public meetings.

Local Officials/Other Stakeholders Notification

The team will provide regular updates and send timely notifications of public meetings to local agencies and stakeholders, including the Tucson police and fire departments, emergency services, the Sunnyside School District, the Tucson Unified School District, Pueblo High School, Pima Community College Desert View Campus, area neighborhood associations including Elvira, Sunnyside, Midvale, Rose, Drexel, Fairgrounds, National Cities, Wakefield and Sunset Villa, the Tohono O'Odham Nation's San Xavier District, the Pima Association of Governments, elected officials from Pima County Dis-

tricts 3 and 5, the City of Tucson's Ward 1 and Ward 5, the City of South Tucson and the Town of Sahuarita.

The team will maintain strong communications with these stakeholders and will meet individually with key stakeholders as needed.

State Notification

The team will provide brief memos and copies of the public notices to the State Transportation Board Chairman and Members, the ADOT Director, State Engineer, District Engineer, Transportation Planning Group, Statewide/Valley Project Management Section, Design Section, Right-of-Way Section, Equal Employment Office and Community Relations Office a minimum of seven days prior to public mailing. The team will make appropriate changes to the public notices if notified by these officials.

Public Concerns

The team will document questions and concerns from each public open house and respond to written or emailed comments as appropriate. The team will document all public contact in a public involvement summary.

Public Hearing

After the FHWA signs the draft EA, a notice will be submitted to the local paper identifying where the draft EA can be reviewed. This notice will establish the beginning of the 30-day comment period. The notice will also extend the opportunity for a public hearing if desired by the public. The public hearing can be scheduled no sooner than 15 days after the placement of the notice.

If a public hearing is requested, it will inform the public of the preferred alternative, provide information about the issues leading to the recommendation and give the public an opportunity to comment on the recommendations and issues. A certified court reporter will attend and record this meeting in order to fulfill NEPA requirements.

Attachments

1. Project Team Directory
2. ADOT Public Meeting Checklist
3. Census Data
4. Project Map

Public Open House Meeting Summaries
Interstate 19: San Xavier Road to Interstate 10
Arizona Department of Transportation

Public Scoping Meeting
Tuesday, Jan. 25, 2005
4 to 7 p.m.
Valencia Library, Large Meeting Room
202 W. Valencia Road

PUBLIC NOTIFICATION
- Government official letter e-mailed Jan. 6, 2005
- Postcard invitations mailed Jan. 7, 2005
- Arizona Daily Star advertisement Jan. 9, 2005
- News release sent to area media Jan. 11, 2005
- La Estrella advertisement Jan. 12, 2005
- Notices posted on public boards Jan. 18, 2005

ATTENDANCE/PUBLIC
- Approximately 104

WRITTEN COMMENTS RECEIVED
- 45

MATERIALS
- Fact sheet
- Comment form
- Project location map
- Sign-in sheets

DISPLAY BOARDS
- Welcome
- Open House/Purpose
  - Tell Us
  - Issues/Concerns
  - Thank You
  - Two sets of three boards showing aerial photos of the project site

Public Open House
Thursday, March 15, 2007
5 to 7 p.m.
Valencia Library, Large Meeting Room
202 W. Valencia Road

PUBLIC NOTIFICATION
- Government official letter e-mailed March 6, 2007
- Postcard invitations mailed March 1, 2007
- Tucson Citizen advertisement to run March 1, 2007
- Arizona Daily Star advertisement to run March 1, 2007
- La Estrella advertisement to run Feb. 28, 2007
- News release to be sent to area media Feb. 28, 2007
- Notices distributed and posted on public boards March 7, 2007

ATTENDANCE/PUBLIC
- Approximately 30

WRITTEN COMMENTS RECEIVED
- 26

MATERIALS
- Comment form
- Fact sheet
- Project location map
- Sign-in sheets

DISPLAY BOARDS
- Interim
- Ultimate
- Objectives
- Typical Sections
- Areas to be evaluated for noise mitigation
- Environmental

Public Open House
Thursday, March 31, 2009
5 to 7 p.m.
Valencia Library, Large Meeting Room
202 W. Valencia Road

PUBLIC NOTIFICATION
- Government official notification e-mailed March 12, 2009
- La Estrella advertisement ran March 13, 2009
- News release sent to area media March 13, 2009 – ADOT Communications and Community Partnerships (CCP) distributed; Gordley Design Group drafted
- Postcard invitations mailed March 16, 2009
- Tucson Citizen advertisement ran March 16, 2009
- Arizona Daily Star advertisement ran March 16, 2009
- Notices distributed and posted on public boards March 16, 2009

ATTENDANCE/PUBLIC
- Approximately 42

WRITTEN COMMENTS RECEIVED
- 12

MATERIALS
- Comment form
- Fact sheet
- Project location map
- Sign-in sheets
- Copies of PowerPoint presentation
- Question cards

DISPLAY BOARDS
- Ultimate
- Objectives
- Typical Sections
- Areas to be evaluated for noise mitigation
- Environmental

Is the overpass currently used?			Should it be replaced?			Why?
yes	no	unsure	yes	no	unsure	
x				x		Due to the closing of Ajo I see a lot of children using the overpass. I don't think it's a problem leaving it up, but put a screen so the kids don't throw
x				x		I see people and children using the overpass. That is a waste of money to be taken down. Just put mesh so nobody can throw things down on cars and also for safety of children.
		x			x	I don't use it and rarely see it used.
x			x			No comment.
x			x			Some residents use this bridge to walk to the river walk.
x			x			No comment.
x			x			Many people from Sunnyside NA use the Irvington pedestrian overpass to shop at Home Depot, etc., located on the side of their neighborhood. Same thing for the Ajo pedestrian overpass, people use it to go to Fry's, etc.
x			x			It is necessary for students especially, but as well for the residents.
x			x			TRANSLATED: The access from one side to the other is important for pedestrians. Note: secure the bridge because kids throw rocks at the cars
	x		x			I am not sure if this overpass is utilized?
x			x			It still keeps the neighborhoods connected. The youth use it to come over to Mission Manor park.
x				x		I think the bridge is still a useful advantage for the communities. The issue is to bring it up to code and to also kid proof it.
x			x			For safety issues concerning the pedestrians and also the traffic below.
x			x			The structure needs improvement and would be less costly to replace it to fit the needs of Interstate 19. And school reps should be on committees (TUSD & Sunnyside). I have never had a problem with this bridge. If there is a concern of rocks, could a clear plexiglass be used to enclose it instead of the fence
x			x			This is the only way to send children to elementary school (C.E. Rose)
x			x			This is the only safe passageway for children who attend C.E. Rose.
x				x		TRANSLATED: Because it is more comfortable and easier to cross.
x			x			Foot traffic is necessary only if necessary if widening done.
	x		x			It mostly attracts the younger kids in the neighborhood. And would like to see Drexel extended all the way to Midvale area.
x			x			For safety reasons for when the pedestrian should be able to walk without being interfaced with traffic.
x				x		For safety reason don't do away with this pedestrian overpass. You will have bicyclists and those who walk to the neighboring shopping and medical facilities at risk will all the traffic congestion.
x			x-kept			People need to be able to walk, rather than forced to drive everywhere.
x						So don't have to use I-19 to get across the freeway.
			x			This is the only place where there are homes on both sides of I-19 - therefore, the link should remain to keep the community from being divided. Keep the netting "close" to prevent vandalism.
x				x		There is a tunnel under I-10 to connect neighborhoods. We still need some sort of access.
x				x		It is important that other modes of transportation receive equal consideration. Build a better bridge, build more bridges to accommodate pedestrians and
x			x			No comment.
		x	x			Since I do not live near the walkway, I am unaware of the amount of use it gets. However, due to the age and possible future expansion, the walkway needs replacement. A more "eye-friendly" walkway would improve the overall

Interstate 19: San Xavier to Ajo Way, January 25, 2005, Public Open House, Pedestrian Bridge Comment Tally

Is the overpass currently used?			Should it be replaced?			Why?
yes	no	unsure	yes	no	unsure	
	x			x		Kids drop rocks on to cars below. This happened to my daughter. Kids encourage truck drivers to honk repeatedly. Very disturbing noise.
	x					Remove overpass - or secure it.
	x			x		I don't see people using the OP - except for the ones that love to vandalize/put graffiti all over. I think before the children from the west side of the I-19 would use it to walk to C.E. Rose elementary. Now with Lynn Urquides Elementary on Ajo Way, I don't feel that there is a need to rebuild.
		x		x		A house-to-house canvass should be made to determine who and how many people use this overpass. If use is minimal - REMOVE THE OVERPASS.
	x					No comment.
	x			x		Walkways are on both Irvington and Ajo. The current pedestrian crosswalk is underused and does not need to be replaced.
	x					I live farther south, near I-19/Irvington Road.
	x			x		If you want to make improvements here - take the pedestrian bridge out and vehicle bridge there or an exit at Drexel.
	x			x		It would be too costly to fix a really old bridge that is used as a graffiti target and endangerment as kids are caught repeatedly throwing rocks from the center
		x		x		Either leave as is or eliminate depending on whether it's being used or not.
	x			x		Very little to no traffic.
	x				x	I have lived in Tucson for 37 yrs and I hardly ever see people walking over the bridge - more kids playing than anything.
		x				If that neighborhood want it. Other neighborhoods don't have a need to use it.
		x			x	This pedestrian bridge should be replaced only and if a study is made of the neighborhoods that would be impacted.
						Have no concerns - don't live near it - very seldom seen it used.
x			x			Because people who have depended on the bridge should still be able to have one. Children crossing over makes it safer than trying to cross the freeway. It does need to be enclosed so people can't drop or throw things off of it.
		x			x	Just as a small incident that occurred before this meeting, a man to my door from the freeway. He needed water for his vehicle (Broke down). I don't mind helping people, but he could have easily been someone "dangerous." Not to mention all the trash from the freeway.
24	13	7	20	15	4	TOTALS

Comment Summary
Interstate 19: San Xavier Road to Ajo Way
Open House
Valencia Library
March 15, 2007

Name	Address	Phone	E-mail	List?	What community and personal benefits do you hope to gain from this project?	General Comments
Comments Received at the Open House						
Anonymous					It would be nice to have the entrance and exit ramps on Drexel Road done as soon as possible because current traffic won't see the benefits. If it takes 20 to 30 years, maybe my grandkids will.	On and off ramps on Drexel Road need to be done ASAP. A new shopping center is being built there, and traffic is bad now and will become worse. Also, a bridge across the river at Drexel Road is needed due to traffic. A retention wall down the freeway is needed because of traffic noises and crashes. It would help.
Anonymous					Relieve congestion in the vicinity through the traffic bypass at Drexel Road.	Thank you for your input.
Anonymous					A smooth drive home from work or to work	I think the idea of a bridge across the Santa Cruz River from Drexel Road to Midvale Park Road is a must with the new store going up soon. The pedestrian bridge is also a great idea. Love it!
Begay, Velma	792 W. Martinez Hill Drive Tucson, AZ 85746		vbegay@ waknet.org		Traffic flow should ease up and become less congested	Does improvements to I-19 also include road improvements near the proposed developments? Road improvements to Irvington Road, San Xavier Road, Los Reales Road? Improvements should be done to existing roads. Will these improvements effect mesquite trees? The San Xavier District should be offered these resources for tribal member use for any development near the reservation.
Byrd, Angela		631-7587	angela _e _byrd@ hotmail.com	Yes	Maintain access for railroad personnel to the tracks east of project area.	Glad to see advance planning for traffic volumes.
Franks, Arnold	716 Calle Rita Tucson, AZ 85706	294-9783	kissy2@ cox.net		A more even flow of north to south traffic especially concerning the growth to the south of the San Xavier Reservation.	Plan ahead, well beyond the immediate future. Open up a roadway over the Santa Cruz River to help ease traffic on Valencia and Irvington Roads. On- and off-ramps at Irvington. Valencia Roads could widen and lengthen the ramps to accommodate future growth. Irvington Road now backs up on to I-19 causing an obstruction of main lanes. Why not add an additional pedestrian bridge across the highway further south? Look well beyond the 30 year span. Growth will continue.

Comment Summary
Interstate 19: San Xavier Road to Ajo Way
Open House
Valencia Library
March 15, 2007

Name	Address	Phone	E-mail	List?	What community and personal benefits do you hope to gain from this project?	General Comments
Gonzalez, Julio	918 W. Calle Colado Tucson, AZ 85706	807-6375			Translated from Spanish to English: Concerns about the project include the following: In my case it seems a perfect project (illegible text) between Ajo Way and San Xavier to improve traffic and ease congestion on Drexel Road.	Translated from Spanish to English: My comment is that if this project is going to succeed – and will one day be necessary anyway owing to to Tucson's rapid growth – better to do it now rather than wait until we have even more vehicles on I-19 and traffic congestion at the I-19/Irvington Road exits. Another comment pertains specifically to my area – Valencia Road and Ajo Way west of I-19: This area and its residents are in need of a hospital. The closest hospitals are St. Mary's and Kino but the wait is too long and necessitates going to Tucson Medical Center.
Mutchler, Jack	942 W. Calle Francita Tucson, AZ 85706	889-2500	j.mutchler@co x.net		Better flow of traffic	The Drexel Road overpass-exchange should be completed first. The Irvington Road-Ajo Way exchange should be second. Sound retention walls and a bridge over the Santa Cruz River for Drexel Road.
Stites, Mary D.	965 W. Milton Road Tucson, AZ 85706	294-0369			In the Sunnyside area, a wall along the east side of the road which, is heavily populated, is needed. The noise at 5 a.m. is not okay! We need a sound barrier that does not need to be 15-feet high!	More bridges are needed over the Santa Cruz River.
Willis, Contrad Jr.	4326 S. Lamar Avenue Tucson, AZ 85714	573-7753			We are looking for a buffer wall before freeway work begins.	We hope the Ajo Way on and off ramps will help traffic to get onto Ajo Way.
Willis, Molly	4326 S. Lamar Avenue Tucson, AZ 85714	573-7753			More traffic control and to keep everybody safe.	There needs to be buffer walls put up on both sides where residents live. Not only for noise, but for protection from car accidents. Ajo Way is getting very heavy with traffic that gets on and off of the freeway. It needs to be expanded.

Comment Summary
Interstate 19: San Xavier Road to Ajo Way
Open House
Valencia Library
March 15, 2007

Name	Address	Phone	E-mail	List?	What community and personal benefits do you hope to gain from this project?	General Comments
Comments Received after the Open House						
Ambrose, Jim	841 W. District St. Tucson, AZ 85714	889-7513		Yes	A noise barrier (wall) to muffle the sound of traffic; Improved on-ramps on to I-19 heading south from Ajo Way; Continued access to the west via the pedestrian bridge.	There was an open house on this project several years ago, which was adequately advertised (unlike the one this year). I will repeat the comments I made then: 1) A wall to baffle noise is essential for this neighborhood, and should be constructed before the balance of the construction work. 2) The ramps from Ajo Way onto I-19 South are so bad I avoid them by driving to Irvington. Please fix them.
Bedoya, Jenniferlynn	1024 W. Lincoln Street	396-3553	jenniferlynnbedoya@hotmail.com	Yes	I'm hoping to gain peace and quiet while and during construction, and less dust during the process. I hope you build a sound barrier wall.	I have three children, the youngest being two years old. She is an asthmatic. The dust is so bad for her as it is. The construction will only increase the dust and worsen her asthma. She's already on a nebulizer one to two times per day. Please build a wall while under construction; it would be greatly appreciated.
Celaya, Delores	919 W. Michigan Tucson, AZ 85714	294-2773			I personally would not be affected, except for the possibility of higher property taxes.	Before starting this project, please put a sound barrier, like one of the walls I see all along the freeways in other neighborhoods. I live two houses from the pedestrian bridge on the eastside of the freeway on Michigan. The noise gets pretty bad at certain hours of the day. The bridges we can do without. During the summer, late at night, gangs or young adults spend the nights drinking, breaking bottles, and they urinate on the bridge. 4th of July they go there with fire works. We don't call the police anymore. It takes too long for them to come, because it's not an emergency. We also get a lot of transients that sleep down in the Santa Cruz River area during the summer. Thank you
Chavez, Martina	931 W. Michigan Tucson, AZ 85714	807-9684	mchavez03@cox.net	yes	I, as many Tucsonans, will experience less traffic jams. However, weighing the options, I have mixed feelings because my home may very well not exist in the near future due to this.	I believe I will directly be affected since my house is the first house east of I-19. Will the value of my home plummet as a result of this expansion? Due to the high volume of traffic, it has become very difficult to enter our own neighborhood. Will signs be posted at intersections near stop lights to allow our entrance into our homes? Do not block the intersection signs. I want to be informed of the next meeting. We'd like to have a wall put up to minimize the noise we already experience which will obviously increase significantly once this change is made.

Comment Summary
Interstate 19: San Xavier Road to Ajo Way
Open House
Valencia Library
March 15, 2007

Name	Address	Phone	E-mail	List?	What community and personal benefits do you hope to gain from this project?	General Comments
Clark, H.J.	1020 W. Columbia St. Tucson, AZ 85714	741-1320	dehaseth@netzero.net	Yes	Reduced noise, dust, erosion and pollution	I live near I-19. Increasing from four to six lanes will increase noise and dust by 50 percent. A sound barrier installed before construction is needed to protect my neighborhood.
Clark, Mary G.	1031 W. Columbia St. Tucson, AZ 85714	889-0763		Yes	We have been waiting since 1963 for another exit/entrance ramp in Lamar City Acres. If widening is going to happen on I 19, we would definitely need a sound barrier wall from the river to Michigan Street. And, yes, the cat-walk needs to be wheel chair accessible.	The noise from the freeway has gotten worse, with the flow of traffic. Changes need to be made to lessen the noise. An extra exit is necessary because during monsoons and river flow, the Ajo entrance/exit is impossible to get in and out of. There have been numerous accidents at that Kostka/Ajo area. People use that as a place to make U-turns, which causes accidents also. By all means expand the freeway, make us safe and accessible, and build us a barrier wall, to cut down on noise! Thank you!
Coronado, Barbara and Gilbert		294-9157			Less traffic in the Rose area, and less pollution and noise.	Please build sound barrier walls before you start construction in this area as the noise and smell of pollution are horrible. Thank you!
Federico, Mary	4671 S. Camino Paso Doble Tucson, AZ 85714	741-9455	cfederi@msn.com			My mom now lives in Lamar Subdivision. Before my Dad passed, they lived at 916 W. District for over 50 years. Please take into consideration placing a wall along I-19 from Ajo to Irvington. My mom's passion for her garden has become a sad situation instead of a joy, due to the traffic she doesn't hear anything or anyone arriving. Also, the fumes have become a hazard to everyone's health in the area. Thank you in advance
Gomez, Elias F.	904 W. District Street Tucson, AZ 85714				My suggestion is to build a wall even before road construction is started.	We have lived at 904 W. District since 1952. When I-19 was built they planted oleander bushes as a barrier which did no good at all. My wishes are 100 percent for a wall. Respectfully yours, Elias F. Gomez - 87 years old!
Martinez, Arturo B.	1010 W. Lincoln St. Tucson, AZ 85714				None. Widening I-19 will not benefit us in any way. We need more help on the Ajo Highway due to the traffic problem.	We live in the Lamar Acres subdivision off of I-19 and Ajo Highway. We are blocked in completely on all sides -- East of us is I-19, South the City of Tucson installed a Water Plant, West is the Santa Cruz water, North is Ajo Way. That is our main problem with the traffic, we cannot make a left turn or a right turn. We have a hard time trying to reach our homes until some good people let us in. Thank you.

Comment Summary
Interstate 19: San Xavier Road to Ajo Way
Open House
Valencia Library
March 15, 2007

Name	Address	Phone	E-mail	List?	What community and personal benefits do you hope to gain from this project?	General Comments
Payne, Charles	1020 W District Tucson, AZ 85714			Yes	Sound barrier walls should be built as part of the I-19 project to separate adjacent neighborhoods (such as Lamar Acres) from the I-19 freeway.	The sound barrier walls should be added to the I-19 project objectives. Thank you!
Spencer, Robert and Mary	925 W. District St. Tucson, AZ 85714	807-3140	katz_21@ msn.com	Yes		Would like to see the wall go up before construction begins.
Tapia, Darri and Felix, Jeremiah	3315 E. Flower Street Tucson, AZ 85716	780-9106			A more quiet neighborhood and less pollution.	I would like you to build the wall before construction begins on the extension of the freeway.
Tapia, Robert L.	1007 W. Pennsylvania Tucson, AZ 85714			Yes	To obtain a solid barrier wall to reduce noise from freeway traffic and safety.	I would like more information and details on the I-19 improvements. Also, it is probably necessary to put in place a barrier wall structure for noise and safety concerns because there has been a few accidents near my home where the vehicles have come through the fence line and on to Lemar Street.
Villa, David	916 W District St. Tucson, AZ 85714	808-7562	dvilla54@ yahoo.com	Yes	We hope to prevent the air pollution and the noise level.	We need a wall to be placed alongside of freeway before construction takes place. The oleanders (bushes) placed are now dried and does not help. The noise level is so loud we feel deaf, or that it might be causing hearing loss. The wall will also cause a decrease in the pollution caused by vehicles on freeway.
Villa, Frances	916 W District St., Tucson AZ 85714	746-3516		Yes	With this project, we hope to gain a decrease in the noise level and hopefully prevent an increase in the pollution.	We need a wall placed alongside of the freeway before the construction takes place. The noise level now is overbearing. We cannot hear one another talk. We also feel the pollution is more noticeable than a neighborhood away from the freeway. A wall now is what we need.

Comment Summary
Interstate 19: San Xavier Road to Interstate 10
Open House
Valencia Library
March 31, 2009

Name	Address	Phone	E-mail	List?	What community and personal benefits do you hope to gain from this project?	General Comments
Comments Received at the Open House						
Chavez, Martina	931 W. Michigan St. Tucson, AZ 85714	850-8976	michavez03@gmail.com	Yes	1. Hopefully less traffic congestion on major streets near my home. 2. Spending less time in traffic.	I have two concerns: 1. I have lived at 931 W. Michigan Street for two years and have seen several problems in my area with the open area between me and the bridge, and at the bridge between Ajo Way and Irvington Road. Some problems are drug activity, dumping stolen cars, kids hangout out at the bridge and drinking. 2. We will need a noise barrier to diminish noise as traffic will increase and my house is next to Interstate 19.
Donogue, Christine	3016 W. Royal Copeland Drive Tucson, AZ 85745	205-0222	cjdonoghue@mac.com		Improve function of existing traffic exchanges. My parents live in MidVale Park.	Encourage use of rubberized asphalt throughout project for noise benefits. Would like to see trail connections in conjunction with washes at interstate bridges. Would like to see a trail improvement plan integrated with project (Houghton Road, Santa Cruz River). Original I-19 construction divided the neighborhood - this would help improve neighborhood connectivity. Federal Highway Administration (FHWA) has mentioned this before. Walls and additional pavement may create tunnel affect on I-19. Maximize available landscaping, incorporate art into walls. I like the new configuration at San Xavier Road.
Giffin, Eric	7034 S. Lundy Drive Tucson, AZ 85758	294-5839	eg4586@gmail.com	Yes	Flooding has become a problem for the Elvira Neighborhood. The Drachman Institute at the University of Arizona is currently working on a master plan for the Elvira Neighborhood Association. In November 2008, a meeting with County Supervisors and City Council people over flooding problem was going to be sent to the Army Corps of Engineers for possible assistance. Perhaps a collaboration between City, County, State and Federal government could be established.	Since the County channelized the east end of the El Vado Wash, the lower end has experienced considerable flooding. The flooded area is west Medina Road, between Santa Clara Avenue and the culvert at I-19. Hope United Methodist Church and a number of homes on West Medina Road have been flooded numerous times. Any relief would be greatly appreciated.
Hargrove, Michael	3176 W. Avenida Isabel Tucson, AZ 85746	235-9506	hargrov@arizona.edu		Easier flow of traffic with safer ramps and interchanges.	1. Better signs for off-bound left-hand turns onto Valencia Road. I have seen two different occurrences where someone exited I-19 and turned into on-coming traffic. 2. There is considerable backup at certain times of the morning getting onto northbound I-19 from eastbound Valencia Road where bottle necking happens and collisions have occurred.
Meisenheimer, Sharon	1001 W. Columbia St. Tucson, AZ 85714	240-4680		Yes		Lamar City Acres subdivision has only one access and that is at Ajo Way at Kostka Street. Too difficult to get onto Ajo Way during rush hours.

Comment Summary
Interstate 19: San Xavier Road to Interstate 10
Open House
Valencia Library
March 31, 2009

Name	Address	Phone	E-mail	List?	What community and personal benefits do you hope to gain from this project?	General Comments
Comments Received outside of the Open House						
Basurto, Gus	5427 S. Wellby Road Tucson, AZ 85746		gbasurto@cox.net			Concerned about land and house being taken. Getting ready to retire and planning on handing down the land and house to children or perhaps selling it to son. At one time, family owned a very large ranch and the land was taken for I-19 development and some of it was sold. The house and land now owned is what is left of that large ranch. Concerned that if he tries to sell his home/land now, need to disclose the study and upcoming "take" and no one will want to buy it. Wants a better idea as to when land may actually be taken and would like project team to keep in touch as study progresses. I am the owner of the family land at 1010 Los Reales. According to the map, it looks like I will be forced to sell this land for the project. I need additional information. I have several improvements I have planned for the house like connecting to city water that I am unsure now if I should complete. I also board horses there, and need more information on the timeline in order to prepare for the transfer of the horses. Any additional information you can provide will be greatly appreciated.
Jacobs, Philip	1464 W. Waterford Drive Tucson, AZ 85746		thepaj@msn.com	Yes	No one can deny the need to expand the capacity of this Freeway and update the roadway and adjacent areas to current safety and design standards. The urban interchange at I-19 and Valencia Road is a great example of how design can enhance both traffic flow and safety while improving the lives of people in the surrounding area.	Moving traffic through the area and providing easy, safe access to I-19 for the local residents is important. Additional attention must be paid to the design to have minimal impact on the aesthetic aspects of the area and local comfort and land use for the local residents as well. One area of concern for me is the area bounded by Ajo Highway, Silverlake Road, 10th Avenue, 12th Avenue and Mission Road. This area contains the I-19/I-10 exchange and a mile or two of I-19 as well as the Santa Cruz River, Santa Cruz River Park and starts up again at Ajo Highway. As part of your project completing this part of the trail will provide a complete path from Drexel Road to Grant Road as well as access to Downtown Tucson without a motor vehicle further improving traffic conditions on I-19/I-10. Additionally, the proposed Drexel Road/I-19 interchange would reduce congestion on Irvington Road and provide greater access to the new shopping at the Tucson Spectrum. However, connecting Drexel Road over the Santa Cruz River will bring an undue increase in traffic into the residential area immediately to the west side of the river. Drexel Road at that point is used as a childrens' school bus stop and walking path for school access. To make this a major thoroughfare to I-19 will have a large negative impact on the quality of life as well as property values to the residents of this area. I will be happy to meet with you to point out the specifics of my concerns and make recommendations.

Comment Summary
Interstate 19: San Xavier Road to Interstate 10
Open House
Valencia Library
March 31, 2009

Name	Address	Phone	E-mail	List?	What community and personal benefits do you hope to gain from this project?	General Comments
Koss, David	5851 S. Blucher Drive Tucson, AZ 85746	573-7618	dave.koss@tucsonaz.gov	Yes	Greater safety for travelers on I-19. Less congestion and less pollution.	I support these improvements and hope that the timeline can be accelerated. It would be better if an exit could be constructed at Drexel Road with a bridge over the Santa Cruz River to help alleviate traffic exiting and entering I-19 at Valencia Road and Irvington Road.
Olivas, Arthur	1015 W. Acadia Drive Tucson, AZ 85706				Zero - sum	The bottom line 1. Ecocatastrophe (noising) - cars, trucks 2. The Arizona Highway Patrol and Border Patrol. As soon as they pass the Papago Indian fence on the north side, they make a stop. People start running into my property 24 hours a day, and seven days a week.
Rosmaier, Scott	1571 W. Lama Drive Tucson, AZ 85746	889-0186	strosmaier@raytheon.com		Less congestion.	1. Raytheon employees contribute to much traffic. 2. New casino on Valencia Road could use better access. 3. Improve San Xavier Road to develop cut-off just east of JJ Stock Road towards Nogales Highway and improve traffic flow to both Raytheon and new Casino. Unfortunately, I will be out of the country and cannot attend the open house.
Toro, Pedro			aztoro@gmail.com			I read in the "La Estrella de Tucson" about the improvements on I-19. I wish you could improve the flow on I-10 and Irvington Road by building a bridge on Drexel Road crossing the Santa Cruz River. Thank you for listening.
Anonymous (phone call)						I read in the "La Estrella de Tucson" about the improvements on I-19. I wish you could improve the flow on I-10 and Irvington Road by building a bridge on Drexel Road crossing the Santa Cruz River.

Appendix F: AASHTO Controlling Design Criteria Report

PROJECT 019 PM 57 H5105 01D

SAN XAVIER ROAD TI – AJO WAY TI

INTERSTATE 19 (I-19) NOGALES – TUCSON HIGHWAY

I-19

AASHTO CONTROLLING DESIGN CRITERIA REPORT

January 2012

Prepared For:

ARIZONA DEPARTMENT OF TRANSPORTATION

Prepared By:

AECOM

1860 East River Road, Suite 300
Tucson, Arizona 85718

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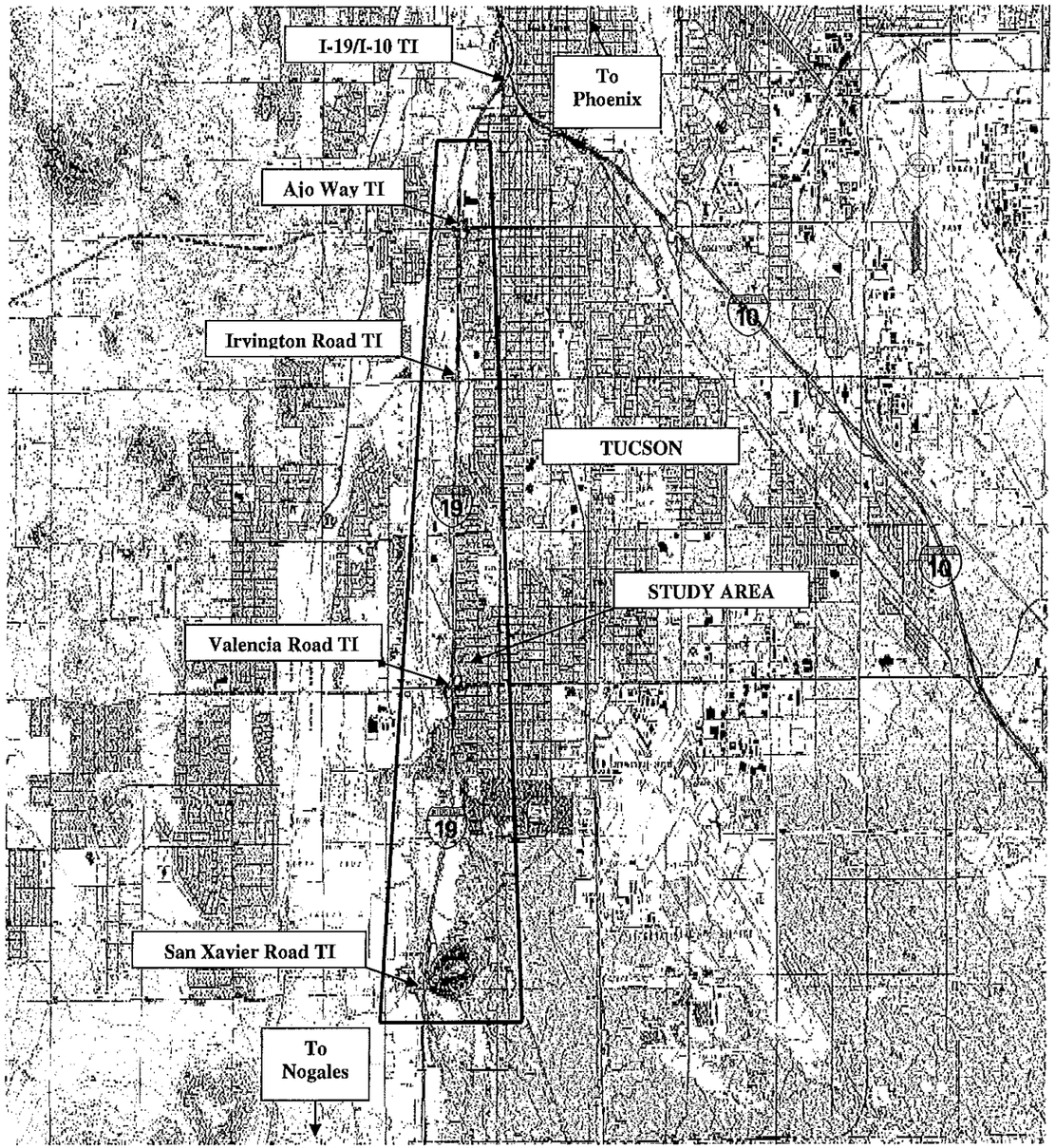

I-19 Nogales – Tucson Highway
San Xavier Road TI – Ajo Way TI
Location Map

SUMMARY OF NON-CONFORMING DESIGN FEATURES

The following is a list of the existing design features requiring design exceptions.

The analysis of all design features is based on the 2004 AASHTO Green Book.

I-19 MAINLINE NB:

The existing pavement cross slope is less than the recommended minimum of 1.5% as follows:

1. MP 58.68 to MP 61.97 - 0.50% less than the recommended minimum.

The existing horizontal curve superelevation rate is less than the recommended minimum as follows:

1. MP 59.99 to MP 60.29 HPI STA 3182+29.81 - 0.005 ft/ft less than the minimum.

I-19 MAINLINE SB:

The existing pavement cross slope is less than the recommended minimum of 1.5% as follows:

1. MP 58.68 to MP 61.97 – 0.50% less than the recommended minimum.

The existing horizontal curve superelevation rate is less than the recommended minimum as follows:

1. MP 59.99 to MP 60.29 HPI STA 3182+24.61 - 0.005 ft/ft less than the minimum.

The existing vertical clearance is less than the recommended 16'-0" as follows:

1. MP 61.91 Ajo Way TI UP (#01125) – 0.02" less than recommended.

SAN XAVIER ROAD TI:

Ramp 92 S-3 (Northbound Exit Ramp)

The ramp pavement width is less than the recommended 23' as follows:

1. STA 1+54.81 to STA 8+17.72 – 2' less than recommended.

The existing shoulder width is less than the recommended minimum 8' (outside) as follows:

1. STA 1+54.81 to STA 8+17.72 – 4' less than recommended minimum.

Ramp 92 S-2 (Northbound Entrance Ramp)

The ramp pavement width is less than the recommended 20' as follows:

1. STA 2+24.81 to STA 11+44.21 – 2' less than recommended.

The existing shoulder width is less than the recommended minimum 8' (outside) as follows:

1. STA 2+24.81 to STA 11+44.21 – 4' less than recommended minimum.

Ramp 92 S-1 (Southbound Exit Ramp)

The ramp pavement width is less than the recommended 20' as follows:

1. STA 1+69.88 to STA 17+94.45 – 2' less than recommended.

The existing shoulder width is less than the recommended minimum 8' (outside) as follows:

1. STA 1+68.88 to STA 17+94.45 – 4' less than recommended minimum.

The existing horizontal curve superelevation rate is less than the recommended minimum as follows:

1. HPI STA 4+68.74 – 0.002 ft/ft less than the minimum.

Ramp 92 S-4 (Southbound Entrance Ramp)

The ramp pavement width is less than the recommended 20' as follows:

1. STA 3+00.62 to STA 14+34.88 – 2' less than recommended.

The existing shoulder width is less than the recommended minimum 8' (outside) as follows:

1. STA 3+00.62 to STA 14+34.88 – 4' less than recommended minimum.

The existing bridge width is less than the recommended 44' as follows:

1. MP 56.94 Santa Cruz (#1547) – 18.0' less than recommended.

Crossroad

The existing vertical clearance is less than the recommended 16'-0" as follows:

1. MP 56.95 San Xavier OP NB (#01245) – 6.5" less than recommended.
2. MP 56.95 San Xavier OP SB (#01246) – 5.2" less than recommended.

VALENCIA ROAD TI:

Ramp B_1 (Northbound Exit Ramp)

The ramp pavement width is less than the recommended 25' as follows:

1. STA to STA – 5' less than recommended.

Ramp D_1 (Northbound Entrance Ramp)

The ramp pavement width is less than the recommended 25' as follows:

1. STA to STA – 5' less than recommended.

Ramp C_1 (Southbound Exit Ramp)

The ramp pavement width is less than the recommended 25' as follows:

1. STA 3+00.00 to STA 6+39.42 – 5' less than recommended.

Ramp A_1 (Southbound Entrance Ramp)

The ramp pavement width is less than the recommended 25' as follows:

1. STA 1+78.03 to STA 4+23.14 – 5' less than recommended.

IRVINGTON ROAD TI:

AJO WAY TI:

Ramp 99Q (Northbound Exit Ramp)

The ramp pavement width is less than the recommended 21' as follows:

1. STA 0+00 to STA 19+42.79 – 1' less than recommended.

The existing shoulder width is less than the recommended minimum 8' (outside) as follows:

1. STA 0+00 to STA 19+42.79 – 2' less than recommended minimum.

The existing horizontal curve superelevation rate is less than the recommended minimum as follows:

1. HPI STA 16+00.75 - Existing superelevation rate = 0.015 ft/ft. The existing degree of curve (36°02'06") exceeds the AASHTO maximum allowable (16°51'06"). Therefore, the minimum superelevation rate could not be calculated.

Ramp 99N (Northbound Entrance Loop Ramp)

The ramp pavement width is less than the recommended 23' as follows:

1. STA 0+00 to STA 11+51.22 – 3' less than recommended.

The existing shoulder width is less than the recommended minimum 8' (outside) as follows:

1. STA 0+00 to STA 11+51.22 – 2' less than recommended minimum.

Ramp 99J (Southbound Exit Ramp)

The ramp pavement width is less than the recommended 21' as follows:

1. STA 0+00 to STA 19+45.97 – 1' less than recommended.

The existing shoulder width is less than the recommended minimum 8' (outside) as follows:

1. STA 0+00 to STA 23+25.35 – 2' less than recommended minimum.

The existing horizontal curve superelevation rate is less than the recommended minimum as follows:

1. HPI STA 1+21.98 – 0.043 ft/ft less than the minimum.

Ramp 99L (Southbound Entrance Loop Ramp)

The ramp pavement width is less than the recommended 23' as follows:

1. STA 0+00.00 to STA 11+51.22 – 3' less than recommended.

The existing shoulder width is less than the recommended minimum 8' (outside) as follows:

1. STA 0+00 to STA 11+51.22 – 2' less than recommended minimum.

Ramp 99H (Southbound Entrance Ramp)

The ramp pavement width is less than the recommended 21' as follows:

1. STA 0+00 to STA 23+25.35 – 1' less than recommended.

The existing shoulder width is less than the recommended minimum 8' (outside) as follows:

1. STA 0+00 to STA 23+25.35 – 2' less than recommended minimum.

The existing horizontal curve superelevation rate is less than the recommended minimum as follows:

1. HPI STA 7+51.02 - 0.041 ft/ft less than the minimum.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
I-19 MAIN LINE SUMMARY (DIVIDED)

PROJECT NUMBER: 019 PM 057 H5105 01D — ROUTE: I-19 NB & SB
PROJECT LOCATION: SAN XAVIER ROAD - AJO WAY (JCT SR 86) — BEGINNING MP: 56.80±
HIGHWAY SECTION: NOGALES - TUCSON HIGHWAY — ENDING MP: 61.97±
FUNCTIONAL CLASSIFICATION: URBAN FREEWY

LANE AND SHOULDER WIDTH

	EXISTING (Feet)	PROPOSED (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)
LANE WIDTH:	12		12
Exst. (LT) SHOULDER WIDTH:	4		4
Exst. (RT) SHOULDER WIDTH:	10		10

DESIGN SPEED
THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS:
70 MPH EXISTING DESIGN SPEED SOUTH OF AJO WAY
65 MPH EXISTING DESIGN SPEED NORTH OF AJO WAY
THE POSTED SPEED LIMIT IS: 55 MPH
TERRAIN IS: LEVEL

GRADES
EXISTING MAXIMUM GRADE IS: 2.1100%
AASHTO RECOMMENDED MAXIMUM GRADE IS: 3.0000%

CROSS SLOPE
EXISTING CROSS SLOPE IS: 1.50% (MP 56.80 to MP 58.68)
1.00% (MP 58.68 to MP 61.97)*
AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

Existing 2005	Design Year 2030	TRAFFIC FACTORS
ADT (VPD)	ADT (VPD)	K= 8%
64,900 NB & SB	69,800 NB	D= 55%
	62,800 SB	T= 9%

REMARKS
* Design Exception Required

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
I-19 MAINLINE CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE NB	PRECONSTRUCTION CLEARANCE SB	POST CONSTRUCTION CLEARANCE NB	POST CONSTRUCTION CLEARANCE SB		AASHTO Minimum Allowable Clearance
San Xavier OP NB (#01245)	56.95	N/A	N/A	15.46' *		(Over Crossroad)	16'-0"
San Xavier OP SB (#01246)	56.95	N/A	N/A		15.54' *	(Over Crossroad)	16'-0"
Valencia Road TI UP (#01943)	58.85	N/A	N/A	18'-6"	17'-9"		16'-0"
Drexel Road TI UP (#01120)	59.90	N/A	N/A	17.70'	16.56'		16'-0"
Irvington Road TI UP (#01123)	60.95	N/A	N/A	16.70'	16.18'		16'-0"
Pedestrian UP (#01124)	61.40	N/A	N/A	17.20' [1]	17.10' [1]		17'-0"
Ajo Way TI UP (#01125)	61.91	N/A	N/A	16.70'	15.98' *		16'-0"

STRUCTURES

STRUCTURE	MILEPOST	Existing Bridge Length	Existing Bridge Width	Recommended Bridge Width	Bridge Rail Geometry Adequate?	Bridge Rail Structure Adequate?	Existing Structural Capacity	Recommended Structural Capacity
San Xavier OP NB (#01245)	56.95	197'	38'	38'	Yes	Yes	HS-20+	HS-20
San Xavier OP SB (#01246)	56.95	195'	38'	38'	Yes	Yes	HS-20+	HS-20
Bridge SB (#01248)	57.82	109'	38.2'	38'	Yes	Yes	HS-20+	HS-20
Bridge NB (#01247)	57.85	109'	38.2'	38'	Yes	Yes	HS-20+	HS-20
Airport Wash Bridge (#01121)	60.32	147'	38.0'	38'	Yes	Yes	HS-20+	HS-20
Airport Wash Bridge (#01122)	60.32	147'	38.0'	38'	Yes	Yes	HS-20+	HS-20
MINOR STRUCTURES		Existing Culvert Length	Existing Culvert Width					
El Vado 4-10'x5' RCB NB & SB (#05828)	58.59	42'	326'	N/A	N/A	N/A	N/A	N/A
4-10'x5' RCB NB & SB (#05830)	59.08	42'	280'	N/A	N/A	N/A	N/A	N/A
2-10'x4' RCB NB & SB (305832)	59.48	21'	195'	N/A	N/A	N/A	N/A	N/A
2-10'x5' RCB NB & SB (#06511)	60.47	21'	199'	N/A	N/A	N/A	N/A	N/A
3-10'x7' RCB NB & SB (#06075)	60.65	37'	338'	N/A	N/A	N/A	N/A	N/A
3-10'x7' RCB NB & SB (#06823)	60.85	32'	78'	N/A	N/A	N/A	N/A	N/A
5-9'x4' Rodeo Wash RCB	61.80	55'	555'	N/A	N/A	N/A	N/A	N/A

REMARKS

* Design Exception Required

[1] The pedestrian bridge will be replaced

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
I-19 MAINLINE -CONTINUED

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	Approach Grade (%)	Departure Grade (%)	Length of Curve (Feet)	Existing Sight Distance (Feet)	AASHTO Recommended Sight Distance (Feet)	Existing Speed (MPH)	Recommended Design Speed (MPH)

See Attachment 1-1 for NB and SB roadways

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

Median Centerline Station HPI STATION	SUPERELEVATION Minimum [1] (Ft/Ft)	SUPERELEVATION Existing (Ft/Ft)	SUPERELEVATION Maximum [1] (Ft/Ft)	EXISTING DESIGN SPEED (MPH)	DEGREE OF CURVE Maximum	DEGREE OF CURVE Existing
SB						
Sta. 3015+04.70	NC	0.015	0.060	70	2°-48'	0° - 17.95'
Sta. 3091+51.32	NC	0.015	0.060	70	2°-48'	0° - 30.14'
Sta. 3182+29.81	NC	0.010 [2]	0.060	70	2°-48'	0° - 14.96'
Sta. 3221+22.96	NC	0.015	0.060	70	2°-48'	0° - 15.04'
Sta. 84+70.08 (I-10/119 TI)	0.036	0.0345 [2]	0.060	65	3° -27'	1° - 15'
NB						
Sta. 3014+88.52	NC	0.015	0.060	70	2°-48'	0° - 18.05'
Sta. 3091+67.46	NC	0.015	0.060	70	2°-48'	0° - 29.86'
Sta. 3182+24.61	NC	0.010 [2]	0.060	70	2°-48'	0° - 15.04'
Sta. 3221+27.70	NC	0.015	0.060	70	2°-48'	0° - 14.96'
Sta. 84+43.59 (I-10/I-19 TI)	0.036	0.0345 [2]	0.06	65	3° -27'	1° - 15'

[1] Minimum superelevation rate is based on AASHTO (2004) Exhibit 3-26 with e_{max} = 6% or ADOT RDG Table 202.3B e_{max} = 6% dated 12-02-04

[2] Less than the recommended minimum superelevation.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
SAN XAVIER ROAD RAMP 92 S-3

PROJECT NUMBER:	019 PM 057 H5105 01D
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY
INTERCHANGE:	SAN XAVIER ROAD TI
RAMP DESIGNATION:	RAMP 92 S-3
DESCRIPTION:	NB EXIT RAMP (LOOP)

MAINLINE MILEPOST: 57

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
21*	23	24	159

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 25 mph minimum for loop ramps

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	4.0800	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 1.5%

AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 39%
ADT (VPD)	ADT (VPD)	D= N/A
310	6,100	T= Not Available

REMARKS

* Design Exception Required

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
SAN XAVIER ROAD RAMP 92 S-3 CONTINUED

VERTICAL CLEARANCE

		PRE-CONSTRUCTION CLEARANCE		POST-CONSTRUCTION CLEARANCE		AASHTO MINIMUM
STRUCTURE	MILEPOST	NB	SB	NB	SB	CLEARANCE
NB Exit Ramp - San Xavier Guide Sign (Cantilever)				>17'-6"		17' (Min. for Signs)

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

	SUPERELEVATION			EXISTING		
	MAXIMUM	EXISTING	MINIMUM	DESIGN SPEED	DEGREE OF CURVE	
HPI STATION	(Ft/Ft)	(Ft/Ft)	(Ft/Ft)	(MPH)	MAXIMUM	EXISTING
7+44.05	0.080	0.080	0.079	25	42°38'00"	35°48'35.5"

REMARKS

Note:
1. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
SAN XAVIER ROAD RAMP 92 S-2

PROJECT NUMBER:	019 PM 057 H5105 01D
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY
INTERCHANGE:	SAN XAVIER ROAD TI
RAMP DESIGNATION:	RAMP 92 S-2
DESCRIPTION:	NB ENTRANCE RAMP

MAINLINE MILEPOST: 57

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
18*	20	21	694

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	1.0020	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 1.5% AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 10%
ADT (VPD)	ADT (VPD)	D= N/A
4,000	4,600	T= Not available

REMARKS

* Design Exception Required

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
SAN XAVIER ROAD RAMP 92 S-2 CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE
Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline						

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY
Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)
See Attachment No. 1-2							

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION MAXIMUM (Ft/Ft)	SUPERELEVATION EXISTING (Ft/Ft)	SUPERELEVATION MINIMUM (Ft/Ft)	EXISTING DESIGN SPEED (MPH)	DEGREE OF CURVE MAXIMUM	DEGREE OF CURVE EXISTING
8+35.64	0.080	0.080	0.077	50	7°34'00"	6°00'00"

REMARKS

Note:
1. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
SAN XAVIER ROAD RAMP 92 S-1

PROJECT NUMBER:	019 PM 057 H5105 01D
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY
INTERCHANGE:	SAN XAVIER ROAD TI
RAMP DESIGNATION:	RAMP 92 S-1
DESCRIPTION:	SB EXIT RAMP

MAINLINE MILEPOST: 57

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
18*	20	21	694

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	2.4164	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 1.5% AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 20%
ADT (VPD)	ADT (VPD)	D= N/A
1,800	710	T= Not available

REMARKS

* Design Exception Required

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
SAN XAVIER ROAD RAMP 92 S-1 CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

	SUPERELEVATION			EXISTING		
	MAXIMUM	EXISTING	MINIMUM	DESIGN SPEED	DEGREE OF CURVE	
HPI STATION	(Ft/Ft)	(Ft/Ft)	(Ft/Ft)	(MPH)	MAXIMUM	EXISTING
4+68.74	0.080	0.075*	0.077	50	7°34'00"	6°00'00"

REMARKS

* Design Exception Required

Note:
1. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
SAN XAVIER ROAD RAMP 92 S-4

PROJECT NUMBER:	019 PM 057 H5105 01D
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY
INTERCHANGE:	SAN XAVIER ROAD TI
RAMP DESIGNATION:	RAMP 92 S-4
DESCRIPTION:	SB ENTRANCE RAMP

MAINLINE MILEPOST: 57

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
18*	20	21	694

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	3.3761	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 2.0% AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 12%
ADT (VPD)	ADT (VPD)	D= N/A
780	3,700	T= Not available

REMARKS

* Design Exception Required

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
SAN XAVIER ROAD RAMP 92 S-4 CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY
San Xavier Road RCB (#6788)	56.93	43.7'	40	Yes	Yes	HS-20.0	HS-20.0
Santa Cruz SB On Ramp (#1547)	56.94	26*	44'	Yes	Yes	HS-20.0	HS-20.0

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION MAXIMUM (Ft/Ft)	SUPERELEVATION EXISTING (Ft/Ft)	SUPERELEVATION MINIMUM (Ft/Ft)	EXISTING DESIGN SPEED (MPH)	DEGREE OF CURVE MAXIMUM	DEGREE OF CURVE EXISTING
8+29.81	0.080	0.080	0.077	50	7°34'00"	6°00'00"

REMARKS

Note:
1. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
SAN XAVIER ROAD

PROJECT NUMBER:	019 PM 057 H5105 01D	**MAINLINE MILEPOST:** 55.78
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)	
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY	
CROSS ROAD:	SAN XAVIER ROAD, MP 55.78	
FUNCTIONAL CLASSIFICATION:	URBAN MINOR ARTERIAL	

PAVEMENT AND SHOULDER WIDTH

	EXISTING (FEET)	AASHTO RECOMMENDED MINIMUM (FEET)
WIDTH OF TRAVELED WAY:	24'*	48'
WIDTH OF USABLE SHOULDER:	10'	8' (where warranted)

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 45 mph

THE POSTED SPEED LIMIT IS: 45 mph
TERRAIN IS: Level

GRADES

EXISTING MAXIMUM GRADE IS: + 1.2900%

AASHTO ALLOWABLE MAXIMUM GRADE IS: 6%

CROSS SLOPE

EXISTING CROSS SLOPE IS: Varies

AASHTO ALLOWABLE RANGE IS: 1.5 - 3.0%

TRAFFIC VOLUMES AND FACTORS

	PROGRAM YEAR 2001	DESIGN YEAR 2030	TRAFFIC FACTORS
			K=15%
			D=0.59
	ADT (VPD)	ADT (VPD)	T=2.8% (EB) & 3.0 (WB)
San Xavier Road	6,300	12,700	

REMARKS

* Design Exception Required

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
SAN XAVIER ROAD CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POSTCONSTRUCTION CLEARANCE	AASHTO MINIMUM ALLOWABLE CLEARANCE

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMEND. BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	MILE POST	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)
100+00.00	55.78	+0.6800	-1.2400	400	546	360	55	45
104+00.00	55.78	-1.2400	-0.3200	200	+9999	360	+100	45
108+00.00	55.78	-0.3200	+1.2900	100	+9999	360	+100	45
111+00.00	55.78	+1.2900	0.0000	200	615	360	59	45
116+50.00	55.78	0.0000	+0.5000	100	+9999	360	+100	45

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

		SUPERELEVATION			EXISTING	DEGREE OF CURVE	
		MAXIMUM	EXISTING	MINIMUM	SPEED	MAXIMUM	EXISTING
HPI STATION	MILE POST	(Ft/Ft)	(Ft/Ft)	(Ft/Ft)	(MPH)	(FEET)	(FEET)
103+80.01	55.78	0.040	0.015	RC	65	8°04'00"	1°00'00"
118+28.15	55.78	0.040	0.040	0.038	50	8°04'00"	6°00'00"

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP B

PROJECT NUMBER:	019 PM 057 H5105 01D	**MAINLINE MILEPOST:** 58
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)	
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY	
INTERCHANGE:	VALENCIA ROAD TI	
RAMP DESIGNATION:	RAMP B	
DESCRIPTION:	NB EXIT RAMP	

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 3
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
32	29	30	330 (SPUI Turning Movement)

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	3.2200	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 2.0% AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 9%
ADT (VPD)	ADT (VPD)	D= N/A
2,576	5,880	T= Not available

REMARKS

Notes:
1. Traffic volumes adjusted based on Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003; traffic factors obtained from same report.
2. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP B CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE
Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline						

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY
Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)
See Attachment No. 1-2							

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION MAXIMUM (Ft/Ft)	SUPERELEVATION EXISTING (Ft/Ft)	SUPERELEVATION MINIMUM (Ft/Ft)	EXISTING DESIGN SPEED (MPH)	DEGREE OF CURVE MAXIMUM	DEGREE OF CURVE EXISTING
203+57.34	0.060	0.020	NC	60	4°18'00"	0°32'50"
217+87.41	0.020	0.020	0.020 [1]	SPUI [2]	N/A	16°33'34"

REMARKS

[1] Assumed Design Speed 10 - 20 mph in SPUI turning movements.

[2] SPUI recommended Design Speed 20-30 mph. Using Low Speed Urban Street Design Exhibit 3-16 and Exhibit 3-17 AASHTO 2004 page 151 & 152

Note:
1. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP B_1

PROJECT NUMBER:	019 PM 057 H5105 01D	**MAINLINE MILEPOST:** 58
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)	
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY	
INTERCHANGE:	VALENCIA ROAD TI	
RAMP DESIGNATION:	RAMP B_1	
DESCRIPTION:	NB EXIT RAMP	

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
20*	25	26	95 (SPUI Turning Movement)

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	2.5000	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 2.0% AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 9%
ADT (VPD)	ADT (VPD)	D= N/A
2,024	4,620	T= Not available

REMARKS

* Design Exception Required

Notes:
1. Traffic volumes adjusted based on Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003; traffic factors obtained from same report.
2. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP B_1 CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION MAXIMUM (Ft/Ft)	SUPERELEVATION EXISTING (Ft/Ft)	SUPERELEVATION MINIMUM (Ft/Ft)	EXISTING DESIGN SPEED (MPH)	DEGREE OF CURVE MAXIMUM	DEGREE OF CURVE EXISTING
5+01.27	0.020	0.020	0.020 [1]	SPUI [2]	N/A	60°18'41"

REMARKS

[1] Assumed Design Speed 10 - 20 mph in SPUI turning movements.

[2] SPUI recommended Design Speed 20-30 mph. Using Low Speed Urban Street Design Exhibit 3-16 and Exhibit 3-17 AASHTO 2004 page 151 & 152

Note:
1. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP D

PROJECT NUMBER:	019 PM 057 H5105 01D
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY
INTERCHANGE:	VALENCIA ROAD TI
RAMP DESIGNATION:	RAMP D
DESCRIPTION:	NB ENTRANCE RAMP

MAINLINE MILEPOST: 58

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 3
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
32	29	30	284 (SPUI Turning Movement)

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	-5.5000	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 2.0% AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 9%
ADT (VPD)	ADT (VPD)	D= N/A
5,656	9,072	T= Not available

REMARKS

Notes:
1. Traffic volumes adjusted based on Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003; traffic factors obtained from same report.
2. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP D CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION MAXIMUM (Ft/Ft)	SUPERELEVATION EXISTING (Ft/Ft)	SUPERELEVATION MINIMUM (Ft/Ft)	EXISTING DESIGN SPEED (MPH)	DEGREE OF CURVE MAXIMUM	DEGREE OF CURVE EXISTING
403+35.63	0.020	0.020	0.020 [1]	SPUI [2]	N/A	19°05'55"
410+75.12	0.060	0.020	NC	50	6°53'00"	1°00'00"

REMARKS

[1] Assumed Design Speed 10 - 20 mph in SPUI turning movements.

[2] SPUI recommended Design Speed 20-30 mph. Using Low Speed Urban Street Design Exhibit 3-16 and Exhibit 3-17 AASHTO 2004 page 151 & 152

Note:
1. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP D_1

PROJECT NUMBER: 019 PM 057 H5105 01D — **MAINLINE MILEPOST:** 58
PROJECT LOCATION: SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION: NOGALES - TUCSON HIGHWAY
INTERCHANGE: VALENCIA ROAD TI
RAMP DESIGNATION: RAMP D_1
DESCRIPTION: NB ENTRANCE RAMP

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
20*	25	26	95 (SPUI Turning Movement)

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	-2.9940	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 2.0% — AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 9%
ADT (VPD)	ADT (VPD)	D= N/A
4,444	7,128	T= Not available

REMARKS

* Design Exception Required

Notes:
1. Traffic volumes adjusted based on Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003; traffic factors obtained from same report.
2. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP D_1 CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION MAXIMUM (Ft/Ft)	SUPERELEVATION EXISTING (Ft/Ft)	SUPERELEVATION MINIMUM (Ft/Ft)	EXISTING DESIGN SPEED (MPH)	DEGREE OF CURVE MAXIMUM	DEGREE OF CURVE EXISTING
4+83.74	0.020	0.020	0.020 [1]	SPUI [2]	N/A	60°18'41"

REMARKS

[1] Assumed Design Speed 10 - 20 mph in SPUI turning movements.

[2] SPUI recommended Design Speed 20-30 mph. Using Low Speed Urban Street Design Exhibit 3-16 and Exhibit 3-17 AASHTO 2004 page 151 & 152

Note:
1. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP C

PROJECT NUMBER: 019 PM 057 H5105 01D — **MAINLINE MILEPOST:** 58
PROJECT LOCATION: SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION: NOGALES - TUCSON HIGHWAY
INTERCHANGE: VALENCIA ROAD TI
RAMP DESIGNATION: RAMP C
DESCRIPTION: SB EXIT RAMP

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 3
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
32	29	30	330 (SPUI Turning Movement)

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	-3.6400	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 2.0% — AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 9%
ADT (VPD)	ADT (VPD)	D= N/A
4,796	8,008	T= Not available

REMARKS

Notes:
1. Traffic volumes adjusted based on Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003; traffic factors obtained from same report.
2. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP C CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE
Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline						

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY
Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)
See Attachment No. 1-2							

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION MAXIMUM (Ft/Ft)	SUPERELEVATION EXISTING (Ft/Ft)	SUPERELEVATION MINIMUM (Ft/Ft)	EXISTING DESIGN SPEED (MPH)	DEGREE OF CURVE MAXIMUM	DEGREE OF CURVE EXISTING
303+73.01	0.020	0.020	0.020 [1]	SPUI [2]	N/A	16°33'34"

REMARKS

[1] Assumed Design Speed 10 - 20 mph in SPUI turning movements.

[2] SPUI recommended Design Speed 20-30 mph. Using Low Speed Urban Street Design Exhibit 3-16 and Exhibit 3-17 AASHTO 2004 page 151 & 152

Note:
1. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP C_1

PROJECT NUMBER:	019 PM 057 H5105 01D
MAINLINE MILEPOST:	58
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY
INTERCHANGE:	VALENCIA ROAD TI
RAMP DESIGNATION:	RAMP C_1
DESCRIPTION:	SB EXIT RAMP

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIOTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
20*	25	26	95 (SPUI Turning Movement)

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	-3.1980	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 2.0% AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 9%
ADT (VPD)	ADT (VPD)	D= N/A
6,104	10,192	T= Not available

REMARKS

* Design Exception Required

Notes:
1. Traffic volumes adjusted based on Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003; traffic factors obtained from same report.
2. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP C_1 CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

	SUPERELEVATION			EXISTING		
	MAXIMUM	EXISTING	MINIMUM	DESIGN SPEED	DEGREE OF CURVE	
HPI STATION	(Ft/Ft)	(Ft/Ft)	(Ft/Ft)	(MPH)	MAXIMUM	EXISTING
3+87.22	0.020	0.020	0.020 [1]	SPUI [2]	N/A	60°18'41"

REMARKS

[1] Assumed Design Speed 10 - 20 mph in SPUI turning movements.

[2] SPUI recommended Design Speed 20-30 mph. Using Low Speed Urban Street Design Exhibit 3-16 and Exhibit 3-17 AASHTO 2004 page 151 & 152

Note:
1. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP A

PROJECT NUMBER:	019 PM 057 H5105 01D
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY
INTERCHANGE:	VALENCIA ROAD TI
RAMP DESIGNATION:	RAMP A
DESCRIPTION:	SB ENTRANCE RAMP

MAINLINE MILEPOST: 58

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 3
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
32	29	30	284 (SPUI Turning Movement)

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE IS (%):	3.4600	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 2.0% AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 9%
ADT (VPD)	ADT (VPD)	D= N/A
1,980	3,388	T= Not Available

REMARKS

Notes:
1. Traffic volumes adjusted based on Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003; traffic factors obtained from same report.
2. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP A CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

	SUPERELEVATION			EXISTING		
	MAXIMUM	EXISTING	MINIMUM	DESIGN SPEED	DEGREE OF CURVE	
HPI STATION	(Ft/Ft)	(Ft/Ft)	(Ft/Ft)	(MPH)	MAXIMUM	EXISTING
107+46.44	0.06	0.020	NC	60	4°18'00"	0°30'10"
118+95.28	0.06	0.020	NC	50	6°53'00"	1°00'00"
128+33.29	0.020	0.020	0.020 [1]	SPUI [2]	N/A	19°05'55"

REMARKS

[1] Assumed Design Speed 10 - 20 mph in SPUI turning movements.

[2] SPUI recommended Design Speed 20-30 mph. Using Low Speed Urban Street Design Exhibit 3-16 and Exhibit 3-17 AASHTO 2004 page 151 & 152

Note:
1. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP A_1

PROJECT NUMBER:	019 PM 057 H5105 01D	**MAINLINE MILEPOST:** 58
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)	
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY	
INTERCHANGE:	VALENCIA ROAD TI	
RAMP DESIGNATION:	RAMP A_1	
DESCRIPTION:	SB ENTRANCE RAMP	

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
20*	25	26	95 (SPUI Turning Movement)

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	3.5000	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 2.0% AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 9%
ADT (VPD)	ADT (VPD)	D= N/A
2,520	4,312	T= Not Available

REMARKS

* Design Exception Required

Notes:
1. Traffic volumes adjusted based on Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003; traffic factors obtained from same report.
2. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VALENCIA ROAD RAMP A_1 CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION MAXIMUM (Ft/Ft)	SUPERELEVATION EXISTING (Ft/Ft)	SUPERELEVATION MINIMUM (Ft/Ft)	EXISTING DESIGN SPEED (MPH)	DEGREE OF CURVE MAXIMUM	DEGREE OF CURVE EXISTING
3+52.98	0.020	0.020	0.020 [1]	SPUI [2]	N/A	60°18'41"

REMARKS

[1] Assumed Design Speed 10 - 20 mph in SPUI turning movements.

[2] SPUI recommended Design Speed 20-30 mph. Using Low Speed Urban Street Design Exhibit 3-16 and Exhibit 3-17 AASHTO 2004 page 151 & 152

Note:
1. Geometric data acquired from Entranco 100% Design Plans for Valencia TI dated June 1999.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
IRVINGTON ROAD RAMP 98C

PROJECT NUMBER: 019 PM 057 H5105 01D — **MAINLINE MILEPOST:** 60
PROJECT LOCATION: SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION: NOGALES - TUCSON HIGHWAY
INTERCHANGE: IRVINGTON ROAD TI
RAMP DESIGNATION: RAMP 98C
DESCRIPTION: NB EXIT RAMP

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
22	21	22	521

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	1.2889	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 2.0% — AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 6%
ADT (VPD)	ADT (VPD)	D= N/A
1,700	3,500	T= Not Available

REMARKS

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
IRVINGTON ROAD RAMP 98C CONTINUED

VERTICAL CLEARANCE

		PRE-CONSTRUCTION CLEARANCE		POST-CONSTRUCTION CLEARANCE		AASHTO MINIMUM
STRUCTURE	MILEPOST	NB	SB	NB	SB	CLEARANCE
Irvington Guide Sign (Cantilever)				>17'-6 "		17' Min. for signs)

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

	SUPERELEVATION			EXISTING		
	MAXIMUM	EXISTING	MINIMUM	DESIGN SPEED	DEGREE OF CURVE	
HPI STATION	(Ft/Ft)	(Ft/Ft)	(Ft/Ft)	(MPH)	MAXIMUM	EXISTING
9+49.29	0.100	0.100	0.092	50	8°15'00"	6°00'00"
17+05.01	0.100	0.085	0.083	35	19°39'00"	11°00'00"

REMARKS

Note:
1. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
IRVINGTON ROAD RAMP 98D

PROJECT NUMBER:	019 PM 057 H5105 01D
MAINLINE MILEPOST:	60
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY
INTERCHANGE:	IRVINGTON ROAD TI
RAMP DESIGNATION:	RAMP 98D
DESCRIPTION:	NB ENTRANCE RAMP

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
22	21	22	573

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	-1.5867	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 2.0% AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 8%
ADT (VPD)	ADT (VPD)	D= N/A
9,700	16,000	T= Not Available

REMARKS

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
IRVINGTON ROAD RAMP 98D CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

	SUPERELEVATION			EXISTING		
	MAXIMUM	EXISTING	MINIMUM	DESIGN SPEED	DEGREE OF CURVE	
HPI STATION	(Ft/Ft)	(Ft/Ft)	(Ft/Ft)	(MPH)	MAXIMUM	EXISTING
3+98.61	0.100	0.085	0.079	35	19°39'00"	10°00'00"
11+91.11	0.100	0.100	0.092	50	8°15'00"	6°00'00"

REMARKS

Note:
1. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
IRVINGTON ROAD RAMP 98B

PROJECT NUMBER:	019 PM 057 H5105 01D
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY
INTERCHANGE:	IRVINGTON ROAD TI
RAMP DESIGNATION:	RAMP 98B
DESCRIPTION:	SB EXIT RAMP

MAINLINE MILEPOST: 60

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
22	20	21	11459

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	3.7854	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 2.0% AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 16%
ADT (VPD)	ADT (VPD)	D= N/A
9,800	17,800	T= Not Available

REMARKS

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
IRVINGTON ROAD RAMP 98B CONTINUED

VERTICAL CLEARANCE

		PRE-CONSTRUCTION CLEARANCE		POST-CONSTRUCTION CLEARANCE		AASHTO MINIMUM
STRUCTURE	MILEPOST	NB	SB	NB	SB	CLEARANCE
Irvington Guide Sign (Cantilever)					>17'-6 "	17' Min. for signs)

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

	SUPERELEVATION			EXISTING		
	MAXIMUM	EXISTING	MINIMUM	DESIGN SPEED	DEGREE OF CURVE	
HPI STATION	(Ft/Ft)	(Ft/Ft)	(Ft/Ft)	(MPH)	MAXIMUM	EXISTING
7+75.77	0.100	NC	NC	50	8°15'00"	0°30'00"

REMARKS

Note:
1. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
IRVINGTON ROAD RAMP 98A

PROJECT NUMBER: 019 PM 057 H5105 01D — **MAINLINE MILEPOST:** 60
PROJECT LOCATION: SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION: NOGALES - TUCSON HIGHWAY
INTERCHANGE: IRVINGTON ROAD TI
RAMP DESIGNATION: RAMP 98A
DESCRIPTION: SB ENTRANCE RAMP

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
22	20	21	2865

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	-3.7975	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 2.0% — AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 6%
ADT (VPD)	ADT (VPD)	D= N/A
1,800	4,900	T= Not Available

REMARKS

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
IRVINGTON ROAD RAMP 98A CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE
Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline						

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY
Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline							

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	AASHTO RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)
See Attachment No. 1-2							

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION MAXIMUM (Ft/Ft)	SUPERELEVATION EXISTING (Ft/Ft)	SUPERELEVATION MINIMUM (Ft/Ft)	EXISTING DESIGN SPEED (MPH)	DEGREE OF CURVE MAXIMUM	DEGREE OF CURVE EXISTING
3+37.98	0.100	0.058	0.055	60	5°15'00"	2°00'00"

REMARKS

Note:
1. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
IRVINGTON ROAD

PROJECT NUMBER:	019 PM 057 H5105 01D	**MAINLINE MILEPOST:** 60.95
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)	
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY	
CROSS ROAD:	IRVINGTON ROAD, MP 60.95	
FUNCTIONAL CLASSIFICATION:	URBAN MINOR ARTERIAL	

PAVEMENT AND SHOULDER WIDTH

	EXISTING (FEET)	AASHTO RECOMMENDED MINIMUM (FEET)
WIDTH OF TRAVELED WAY:	72'	48'
WIDTH OF USABLE SHOULDER:	N/A	8' (where warranted)

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 40 mph

THE POSTED SPEED LIMIT IS: 40 mph
TERRAIN IS: Level

GRADES

EXISTING MAXIMUM GRADE IS: + 5.000%

AASHTO ALLOWABLE MAXIMUM GRADE IS: 6%

CROSS SLOPE

EXISTING CROSS SLOPE IS: 1.50%

AASHTO ALLOWABLE RANGE IS: 1.5 - 3.0%

TRAFFIC VOLUMES AND FACTORS

	PROGRAM YEAR	DESIGN YEAR	TRAFFIC FACTORS
	2001	2030	K=11%
			D=0.54
	ADT (VPD)	ADT (VPD)	T=9.1% (EB) & 6.4 (WB)
Irvington Road	28,500	46,400	

REMARKS

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
IRVINGTON ROAD CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POSTCONSTRUCTION CLEARANCE	AASHTO MINIMUM ALLOWABLE CLEARANCE

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMEND. BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	MILE POST	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)
12+00.00	60.95	+1.4750	+5.0000	300	411	305	46	40
20+00.00	60.95	+5.0000	-3.8000	700	414	305	46	40
26+00.00	60.95	-3.8000	+0.4200	300	337	305	41	40

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

		SUPERELEVATION			EXISTING	DEGREE OF CURVE	
		MAXIMUM	EXISTING	MINIMUM	SPEED	MAXIMUM	EXISTING
HPI STATION	MILE POST	(Ft/Ft)	(Ft/Ft)	(Ft/Ft)	(MPH)	(FEET)	(FEET)
23+16.75	60.95	0.040	0.042	0.028	40	11°49'00"	2°17'35"

REMARKS

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
AJO WAY RAMP 99Q

PROJECT NUMBER:	019 PM 057 H5105 01D
MAINLINE MILEPOST:	61
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY
INTERCHANGE:	AJO WAY TI
RAMP DESIGNATION:	RAMP 99Q
DESCRIPTION:	NB EXIT RAMP

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
20-22*	21	22	159

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	3.6890	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 1.5% AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 8%
ADT (VPD)	ADT (VPD)	D= N/A
3,400	13,300	T= Not Available

REMARKS

* Design Exception Required

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
AJO WAY RAMP 99Q CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	SIGHT DISTANCE (FEET)	SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

	SUPERELEVATION			EXISTING		
	MAXIMUM	EXISTING	MINIMUM	DESIGN SPEED	DEGREE OF CURVE	
HPI STATION	(Ft/Ft)	(Ft/Ft)	(Ft/Ft)	(MPH)	MAXIMUM	EXISTING
7+73.20	0.040	0.040	0.040	50	6°11'00"	6°00'00"
16+00.75		0.015 [1]		35	16°51'06"	36°02'06"

REMARKS

[1] Existing degree of curve exceeds AASHTO maximum allowable, minimum superelevation not calculated.

Note:
1. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
AJO WAY RAMP 99N

PROJECT NUMBER: 019 PM 057 H5105 01D — **MAINLINE MILEPOST:** 61
PROJECT LOCATION: SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION: NOGALES - TUCSON HIGHWAY
INTERCHANGE: AJO WAY TI
RAMP DESIGNATION: RAMP 99N
DESCRIPTION: NB ENTRANCE LOOP RAMP

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
20*	23	24	159

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 25 mph minimum for loop ramps

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	-2.4197	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 1.5% — AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 9%
ADT (VPD)	ADT (VPD)	D= N/A
7,300	8,900	T= Not Available

REMARKS

* Design Exception Required

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
AJO WAY RAMP 99N CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	SIGHT DISTANCE (FEET)	SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

	SUPERELEVATION			EXISTING		
	MAXIMUM	EXISTING	MINIMUM	DESIGN SPEED	DEGREE OF CURVE	
HPI STATION	(Ft/Ft)	(Ft/Ft)	(Ft/Ft)	(MPH)	MAXIMUM	EXISTING
4+96.42	0.060	0.060	0.060	25	45°23'00"	32°44'25.6"

REMARKS

HPI Station is located at mid-point of curve.

Note:
1. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
AJO WAY RAMP 99M

PROJECT NUMBER:	019 PM 057 H5105 01D
PROJECT LOCATION:	SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION:	NOGALES - TUCSON HIGHWAY
INTERCHANGE:	AJO WAY TI
RAMP DESIGNATION:	RAMP 99M
DESCRIPTION:	NB ENTRANCE RAMP

MAINLINE MILEPOST: 61

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
22	21	22	382

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	-3.4206	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 1.5%

AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 7%
ADT (VPD)	ADT (VPD)	D= N/A
2,800	2,700	T= Not Available

REMARKS

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
AJO WAY RAMP 99M CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	SIGHT DISTANCE (FEET)	SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

	SUPERELEVATION			EXISTING		
	MAXIMUM	EXISTING	MINIMUM	DESIGN SPEED	DEGREE OF CURVE	
HPI STATION	(Ft/Ft)	(Ft/Ft)	(Ft/Ft)	(MPH)	MAXIMUM	EXISTING
3+90.76	0.060	0.060	0.060	35	16°50'00"	15°00'00"
8+80.18	0.060	0.060	0.037	50	8°15'00"	1°30'00"

REMARKS

Note:
1. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
AJO WAY RAMP 99J CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	SIGHT DISTANCE (FEET)	SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION MAXIMUM (Ft/Ft)	SUPERELEVATION EXISTING (Ft/Ft)	SUPERELEVATION MINIMUM (Ft/Ft)	EXISTING DESIGN SPEED (MPH)	DEGREE OF CURVE MAXIMUM	DEGREE OF CURVE EXISTING
17+79.73	0.060	0.060	0.056	50	6°53'00"	5°00'00"
1+21.98	0.060	0.015*	0.058	35	17°45'00"	15°00'00"

REMARKS

* Design Exception Required

Note:

1. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
AJO WAY RAMP 99J

PROJECT NUMBER: 019 PM 057 H5105 01D
MAINLINE MILEPOST: 61
PROJECT LOCATION: SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION: NOGALES - TUCSON HIGHWAY
INTERCHANGE: AJO WAY TI
RAMP DESIGNATION: RAMP 99J
DESCRIPTION: SB EXIT RAMP

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH EXISTING (Feet)	TOTAL PAVEMENT WIDTH AASHTO RECOMMENDED MINIMUM (Feet)	TOTAL PAVEMENT WIDTH AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
20-22*	21	22	318

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%) ASCENDING	AASHTO ALLOWABLE MAXIMUM GRADE (%) DESCENDING
EXISTING MAXIMUM GRADE (%):	-2.2979	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 2.0%
AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	TRAFFIC FACTORS
2001	2030	K= 12%
ADT (VPD)	ADT (VPD)	D= N/A
7,300	14,700	T= Not Available

REMARKS

* Design Exception Required

Notes:

1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
AJO WAY RAMP 99L

PROJECT NUMBER: 019 PM 057 H5105 01D — **MAINLINE MILEPOST:** 61
PROJECT LOCATION: SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION: NOGALES - TUCSON HIGHWAY
INTERCHANGE: AJO WAY TI
RAMP DESIGNATION: RAMP 99L
DESCRIPTION: SB ENTRANCE LOOP RAMP

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
20-22*	23	24	159

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 25 mph minimum for loop ramps

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	-5.4054	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 1.5% — AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 3%
ADT (VPD)	ADT (VPD)	D= N/A
4,300	11,100	T= Not Available

REMARKS

* Design Exception Required

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
AJO WAY RAMP 99L CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	SIGHT DISTANCE (FEET)	SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	DESIGN SPEED (MPH)

See Attachment No. 1-2

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION MAXIMUM (Ft/Ft)	SUPERELEVATION EXISTING (Ft/Ft)	SUPERELEVATION MINIMUM (Ft/Ft)	EXISTING DESIGN SPEED (MPH)	DEGREE OF CURVE MAXIMUM	DEGREE OF CURVE EXISTING
4+96.42	0.060	0.060	0.060	25	39°53'00"	32°44'25.6"

REMARKS

HPI Station is located at mid-point of curve.

Note:
1. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
AJO WAY RAMP 99H

PROJECT NUMBER: 019 PM 057 H5105 01D **MAINLINE MILEPOST:** 61
PROJECT LOCATION: SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION: NOGALES - TUCSON HIGHWAY
INTERCHANGE: AJO WAY TI
RAMP DESIGNATION: RAMP 99H
DESCRIPTION: SB ENTRANCE RAMP

PAVEMENT WIDTH

CASE (1 OR 2 OR 3): 2
TRAFFIC CONDITIONS (A OR B OR C): C

TOTAL PAVEMENT WIDTH			
EXISTING (Feet)	AASHTO RECOMMENDED MINIMUM (Feet)	AASHTO MAXIMUM (Feet)	MINIMUM RAMP INSIDE RADIUS (Feet)
20*	21	22	380

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: Ramp Terminal = 35 mph; Ramp Body = 50 mph; Ramp Gore Area = 60 mph

GRADES

		AASHTO ALLOWABLE MAXIMUM GRADE (%)	
		ASCENDING	DESCENDING
EXISTING MAXIMUM GRADE (%):	4.0426	8.0000	8.0000

CROSS SLOPE

EXISTING CROSS SLOPE IS: 1.5% AASHTO RECOMMENDED RANGE IS: 1.5% - 2%

TRAFFIC VOLUMES AND FACTORS

EXISTING YEAR	DESIGN YEAR	
2001	2030	TRAFFIC FACTORS
		K= 11%
ADT (VPD)	ADT (VPD)	D= N/A
1,700	5,700	T= Not Available

REMARKS

* Design Exception Required

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
AJO WAY RAMP 99H CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRE-CONSTRUCTION CLEARANCE NB	PRE-CONSTRUCTION CLEARANCE SB	POST-CONSTRUCTION CLEARANCE NB	POST-CONSTRUCTION CLEARANCE SB	AASHTO MINIMUM CLEARANCE
Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline						

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMENDED BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY
Refer to summary of AASHTO Controlling Design Criteria for I-19 Mainline							

VPI STATION	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	SIGHT DISTANCE (FEET)	SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	DESIGN SPEED (MPH)
See Attachment No. 1-2							

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	SUPERELEVATION MAXIMUM (Ft/Ft)	SUPERELEVATION EXISTING (Ft/Ft)	SUPERELEVATION MINIMUM (Ft/Ft)	EXISTING DESIGN SPEED (MPH)	DEGREE OF CURVE MAXIMUM	DEGREE OF CURVE EXISTING
3+39.71	0.060	0.060	0.060	35	16°50'00"	15°00'00"
7+51.02	0.060	0.015*	0.056	50	8°15'00"	5°00'00"

REMARKS

* Design Exception Required

Note:
1. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
AJO WAY

PROJECT NUMBER: 019 PM 057 H5105 01D
MAINLINE MILEPOST: 61.9
PROJECT LOCATION: SAN XAVIER ROAD - AJO WAY (JCT SR 86)
HIGHWAY SECTION: NOGALES - TUCSON HIGHWAY
CROSS ROAD: AJO WAY, MP 61.90
FUNCTIONAL CLASSIFICATION: URBAN MINOR ARTERIAL

PAVEMENT AND SHOULDER WIDTH

	EXISTING (FEET)	AASHTO RECOMMENDED MINIMUM (FEET)
WIDTH OF TRAVELED WAY:	56'	48'
WIDTH OF USABLE SHOULDER:	N/A	8' (where warranted)

DESIGN SPEED

THE AASHTO RECOMMENDED MINIMUM DESIGN SPEED OF THE HIGHWAY IS: 30 mph
THE POSTED SPEED LIMIT IS: 40 mph
TERRAIN IS: Level

GRADES

EXISTING MAXIMUM GRADE IS: +4.9883%
AASHTO ALLOWABLE MAXIMUM GRADE IS: 6%

CROSS SLOPE

EXISTING CROSS SLOPE IS: 1.50%
AASHTO ALLOWABLE RANGE IS: 1.5 - 3.0%

TRAFFIC VOLUMES AND FACTORS

	PROGRAM YEAR 2001	DESIGN YEAR 2030	TRAFFIC FACTORS
			K=11%
			D=0.54
	ADT (VPD)	ADT (VPD)	T=17.6% (EB) & 5.3 (WB)
Ajo Way	28,500	56,300	

REMARKS

Notes:
1. Traffic volumes and factors obtained from Kimley-Horn I-19 Corridor Study "Traffic Report" dated April 2003.
2. Geometric data taken from Kimley-Horn I-19 Corridor Study "AASHTO Controlling Design Criteria" dated April 2003 and verified by as-built plans.

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
AJO WAY CONTINUED

VERTICAL CLEARANCE

STRUCTURE	MILEPOST	PRECONSTRUCTION CLEARANCE	POSTCONSTRUCTION CLEARANCE	AASHTO MINIMUM ALLOWABLE CLEARANCE

STRUCTURES

STRUCTURE	MILEPOST	EXISTING BRIDGE WIDTH	RECOMMEND. BRIDGE WIDTH	BRIDGE RAIL GEOMETRY ADEQUATE?	BRIDGE RAIL STRUCTURE ADEQUATE?	EXISTING STRUCTURAL CAPACITY	RECOMMEND. STRUCTURAL CAPACITY

VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI STATION	MILE POST	APPROACH GRADE (%)	DEPARTURE GRADE (%)	LENGTH OF CURVE (FEET)	EXISTING SIGHT DISTANCE (FEET)	RECOMMEND. SIGHT DISTANCE (FEET)	EXISTING SPEED (MPH)	RECOMMEND. DESIGN SPEED (MPH)
5+00.00	61.9	0.0000	+4.9883	400	368	305	44	40
11+00.00	61.9	+4.9883	-1.2214	500	427	305	46	40
18+50.00	61.9	-1.2214	+0.3630	400	+9999	305	+100	40

HORIZONTAL ALIGNMENT, SUPERELEVATION, AND STOPPING SIGHT DISTANCE

HPI STATION	MILE POST	SUPERELEVATION MAXIMUM (Ft/Ft)	SUPERELEVATION EXISTING (Ft/Ft)	SUPERELEVATION MINIMUM (Ft/Ft)	EXISTING SPEED (MPH)	DEGREE OF CURVE MAXIMUM (FEET)	DEGREE OF CURVE EXISTING (FEET)
No Curves							

REMARKS

ATTACHMENT NO. 1-1

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI Station	Curve Length (Ft)	Grades (%)		Existing SDs (Ft)	AASHTO Minimum SDs (Ft)	Existing Speed (mph)	Design Speed (mph)
		Approach	Departure				
Direction: I-19 Northbound (One Way With Stationing)							
2999+00.00	800	-0.4658%	0.2000%	>1500	730	>90	70
3022+00.00	800	0.2000%	-2.1133%	866	730	76	70
3031+00.00	800	-2.1133%	-0.4125%	>1500	730	>90	70
3051+00.00	0	-0.4125%	-0.5038%	11,818	730	>90	70
3067+00.00	800	-0.5038%	0.3200%	>1500	730	>90	70
3095+00.00	700	0.3200%	-1.1300%	1,094	730	88	70
3104+00.00	800	-1.1300%	-0.2000%	>1500	730	>90	70
3131+00.00	1,000	-0.2000%	-0.7000%	2,658	730	>90	70
3150+00.00	600	-0.7000%	0.3750%	>1500	730	>90	70
3166+00.00	1,200	0.3750%	-0.7500%	1,559	730	>90	70
3194+00.00	600	-0.7500%	0.3500%	>1500	730	>90	70
3207+00.00	800	0.3500%	-0.8369%	1,309	730	>90	70
3220+00.00	600	-0.8369%	-0.5081%	>1500	730	>90	70
3240+50.00	800	-0.5081%	-0.6668%	7,199	730	>90	70
3280+40.46	481	-0.6668%	-0.4823%	>1500	730	>90	70
96+50.00	0	0.3647%	0.4823%	>1500	645	>90	65
79+50.00	800	-0.2859%	0.3647%	>1500	645	>90	65
Direction: I-19 Southbound (One Way Against Stationing)							
3000+00.00	800	-0.4744%	0.2000%	>1500	730	>90	70
3021+00.00	800	0.2000%	-2.0056%	889	730	79	70
3030+00.00	800	-2.0056%	-0.4534%	>1500	730	>90	70
3069+00.00	800	-0.4534%	0.3805%	>1500	730	>90	70
3095+00.00	700	0.3805%	-1.1300%	1,064	730	88	70
3104+00.00	800	-1.1300%	-0.2000%	>1500	730	>90	70
3131+00.00	1,000	-0.2000%	-0.7000%	2,658	730	>90	70
3150+00.00	600	-0.7000%	0.3750%	>1500	730	>90	70
3166+00.00	1,200	0.3750%	-0.7500%	1,559	730	>90	70
3194+00.00	600	-0.7500%	0.3500%	>1500	730	>90	70
3207+00.00	800	0.3500%	-0.8369%	1,309	730	>90	70
3220+00.00	600	-0.8369%	-0.5065%	>1500	730	>90	70
3240+50.00	800	-0.5065%	-0.6668%	7,131	730	>90	70
3280+79.46	359	-0.6668%	-0.5024%	>1500	730	>90	70
97+25.00	0	0.3957%	0.5024%	>1500	645	>90	65
81+00.00	800	-0.2000%	0.3957%	>1500	645	>90	65

DESIGN STOPPING SIGHT DISTANCE
AASHTO - 2001

PI Station	Design Speed (mph)	Roadway Type (2w,1ww,1wa)	Grade #1 (%)	Grade #2 (%)	Length of Curve (ft)	Algebraic Difference (%)	Effective Grade (%)	C-Crest S-Sag	ADOT Slope Adjusted Required Stopping Sight Distance (ft)	Stopping Sight Distance Provided (ft)	Min Length for Sag Comfort (ft)	Design Speed Provided (mph)
I-19 NB Mainline Vertical Curves (One-Way with Stationing)												
2999+00.00	70	1ww	-0.4658	0.2000	800	.6658	-.4658	S	733	>1500	70	>90
3022+00.00	70	1ww	0.2000	-2.1133	800	2.3133	-2.1133	C	757	866	n/a	75.9
3031+00.00	70	1ww	-2.1133	-0.4125	800	1.7008	-2.1133	S	757	>1500	179	>90
3051+00.00	70	1ww	-0.4125	-0.5038	0	.0913	-.5038	C	733	11,818	n/a	>90
3067+00.00	70	1ww	-0.5038	0.3200	800	.8238	-.5038	S	733	>1500	87	>90
3095+00.00	70	1ww	0.3200	-1.1300	700	1.4500	-1.1300	C	742	1,094	n/a	88.2
3104+00.00	70	1ww	-1.1300	-0.2000	800	.9300	-1.1300	S	742	>1500	98	>90
3131+00.00	70	1ww	-0.2000	-0.7000	1000	.5000	-.7000	C	736	2,658	n/a	>90
3150+00.00	70	1ww	-0.7000	0.3750	600	1.0750	-.7000	S	736	>1500	113	>90
3166+00.00	70	1ww	0.3750	-0.7500	1200	1.1250	-.7500	C	737	1,559	n/a	>90
3194+00.00	70	1ww	-0.7500	0.3500	600	1.1000	-.7500	S	737	>1500	116	>90
3207+00.00	70	1ww	0.3500	-0.8369	800	1.1869	-.8369	C	738	1,309	n/a	>90
3220+00.00	70	1ww	-0.8369	-0.5081	600	.3288	-.8369	S	738	>1500	35	>90
3240+50.00	70	1ww	-0.5081	-0.6668	800	.1587	-.6668	C	735	7,199	n/a	>90
3280+40.46	70	1ww	-0.6668	-0.4823	480.9	.1845	-.6668	S	735	>1500	19	>90
96+50.00	65	1ww	0.3647	0.4823	0	.1176	.3647	S	639	>1500	11	>90
79+50.00	65	1ww	-0.2859	0.3647	800	.6506	-.2859	S	647	>1500	59	>90
I-19 SB Mainline Vertical Curves (One-Way against Stationing)												
3000+00.00	70	1wa	-0.4744	0.2000	800	.6744	-.2000	S	729	>1500	71	>90
3021+00.00	70	1wa	0.2000	-2.0056	800	2.2056	-2.0056	C	729	889	n/a	78.9
3030+00.00	70	1wa	-2.0056	-0.4534	800	1.5522	.4534	S	720	>1500	164	>90
3069+00.00	70	1wa	-0.4534	0.3805	800	.8339	-.3805	S	731	>1500	88	>90
3095+00.00	70	1wa	0.3805	-1.1300	700	1.5105	-.3805	C	731	1,064	n/a	87.6
3104+00.00	70	1wa	-1.1300	-0.2000	800	.9300	.2000	S	724	>1500	98	>90
3131+00.00	70	1wa	-0.2000	-0.7000	1000	.5000	.2000	C	724	2,658	n/a	>90
3150+00.00	70	1wa	-0.7000	0.3750	600	1.0750	-.3750	S	731	>1500	113	>90
3166+00.00	70	1wa	0.3750	-0.7500	1200	1.1250	-.3750	C	731	1,559	n/a	>90
3194+00.00	70	1wa	-0.7500	0.3500	600	1.1000	-.3500	S	731	>1500	116	>90
3207+00.00	70	1wa	0.3500	-0.8369	800	1.1869	-.3500	C	731	1,309	n/a	>90
3220+00.00	70	1wa	-0.8369	-0.5065	600	.3304	.5065	S	720	>1500	35	>90
3240+50.00	70	1wa	-0.5065	-0.6668	800	.1603	.5065	C	720	7,131	n/a	>90
3280+79.46	70	1wa	-0.6668	-0.5024	358.91	.1644	.5024	S	720	>1500	17	>90
97+25.00	65	1wa	0.3957	0.5024	0	.1067	-.5024	S	649	>1500	10	>90
81+00.00	65	1wa	-0.2000	0.3957	800	.5957	-.3957	S	648	>1500	54	>90

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ATTACHMENT NO. 1-2

SUMMARY OF AASHTO CONTROLLING DESIGN CRITERIA
VERTICAL ALIGNMENT AND STOPPING SIGHT DISTANCE

VPI Station	Curve Length (Ft)	Grades (%)		Existing SDs (Ft)	AASHTO Minimum SDs (Ft)	Existing Speed (mph)	Design Speed (mph)
		Approach	Departure				
San Xavier Road TI Ramps							
(Ramp 92 S-2) 7+50.00	400	0.3655%	-1.0020%	989	425	83	50
(Ramp 92 S-2) 11+44.21	200	-1.0020%	-0.1600%	>1500	425	>90	50
(Ramp 92 S-3) 4+00.00	200	0.1591%	4.0800%	273	155	38	25
(Ramp 92 S-3) 7+00.00	200	4.0800%	1.5120%	520	155	58	25
(Ramp 92 S-4) 13+00.00	300	3.3761%	0.0500%	474	425	52	50
(Ramp 92 S-4) 9+00.00	400	0.0500%	0.9600%	>1500	425	>90	50
(Ramp 92 S-1) 17+00.00	200	0.8300%	-0.2300%	1,118	425	90	50
(Ramp 92 S-1) 11+00.00	400	-0.2300%	0.1480%	>1500	425	>90	50
(Ramp 92 S-1) 3+50.00	400	0.1480%	-2.4164%	621	425	63	50
Valencia Road TI Ramps							
(Ramp A) 117+00	800	-0.6500%	3.4600%	781	425	73	50
(Ramp A) 125+75	250	3.4600%	2.5532%	1,315	250	>90	35
(Ramp A1) 2+00	140	3.5000%	-1.1444%	302	250	40	35
(Ramp B) 204+50	700	-0.7200%	3.2200%	721	570	69	60
(Ramp B) 213+50	300	3.2200%	1.2471%	697	425	69	50
(Ramp B1) 3+30	100	2.5000%	1.0521%	795	425	75	50
(Ramp C) 303+50	300	-2.5666%	-3.6400%	1,155	250	>90	35
(Ramp C) 308+50	600	-3.6400%	-0.3600%	774	425	73	50
(Ramp C1) 3+55	190	1.4274%	-3.1980%	328	250	42	35
(Ramp D) 402+70	360	-1.1489%	-5.5000%	428	250	51	35
(Ramp D) 406+30	620	-5.5000%	-0.2263%	505	425	56	50
(Ramp D1) 4+80	140	-0.8600%	-2.9940%	576	250	61	35
Irvington Road TI Ramps							
(Ramp 98D) 4+00.00	400	-1.5867%	-0.3410%	>1500	250	>90	35
(Ramp 98D) 9+00.00	400	-0.3410%	-1.5244%	1,112	425	89	50
(Ramp 98D) 13+50.00	400	-1.5244%	-0.5400%	>1500	425	>90	50
(Ramp 98C) 8+50.00	300	-0.0800%	-1.1250%	1,183	425	>90	50
(Ramp 98C) 12+50.00	400	-1.1250%	1.2889%	1,028	425	85	50
(Ramp 98C) 17+00.00	400	1.2889%	-1.1356%	645	250	64	35
(Ramp 98A) 8+00.00	600	-3.7975%	0.8044%	551	425	59	50
(Ramp 98B) 6+00.00	600	0.3920%	3.7854%	741	425	68	50
Ajo Way Ramps							
(Ramp 99M) 3+00.00	400	0.2467%	-3.6050%	480	250	52	35
(Ramp 99M) 9+00.00	550	-3.6050%	-0.3030%	714	360	66	45
(Ramp 99N) 1+00.00	200	-0.8597%	-2.4197%	792	155	72	25
(Ramp 99N) 8+60.00	300	-2.4197%	-0.5701%	4,794	155	>90	25
(Ramp 99Q) 6+00.00	300	-0.7514%	0.6300%	>1500	425	>90	50
(Ramp 99Q) 1+50.00	100	0.6186%	3.6890%	268	250	37	35
(Ramp 99Q) 2+50.00	100	3.6890%	1.5000%	543	250	59	35
(Ramp 99H) 3+00.00	200	4.0426%	-1.5620%	293	250	38	35
(Ramp 99H) 8+00.00	200	-1.5620%	0.6867%	852	360	76	45
(Ramp 99L) 1+00.00	200	-2.1428%	-5.4054%	431	155	52	25
(Ramp 99L) 5+25.00	500	-5.4054%	0.7670%	371	155	46	25
(Ramp 99J) 15+75.00	350	0.1824%	-0.3629%	2,154	250	>90	50
(Ramp 99J) 19+25.00	350	-0.3629%	0.6000%	>1500	360	>90	35
(Ramp 99J) 11+00.00	200	0.1824%	-0.3629%	2,154	360	>90	35

* Design Exception Required

DESIGN STOPPING SIGHT DISTANCE
AASHTO - 2001

PI Station	Design Speed (mph)	Roadway Type (2w,1ww,1wa)	Grade #1 (%)	Grade #2 (%)	Length of Curve (ft)	Algebraic Difference (%)	Effective Grade (%)	C-Crest S-Sag	ADOT Slope Adjusted Required Stopping Sight Distance (ft)	Stopping Sight Distance Provided (ft)	Min Length for Sag Comfort (ft)	Design Speed Provided (mph)
San Xavier Road TI Ramps												
(Ramp 92 S-2) 7+50.00	50	1ww	0.3655	-1.0020	400	1.3675	-1.0020	C	430	989	n/a	83.2
(Ramp 92 S-2) 11+44.21	50	1ww	-1.0020	-0.1600	200	.8420	-1.0020	S	430	>1500	45	>90
(Ramp 92 S-3) 4+00.00	25	1ww	0.1591	4.0800	200	3.9209	.1591	S	151	273	53	37.6
(Ramp 92 S-3) 7+00.00	25	1ww	4.0800	1.5120	200	2.5680	1.5120	C	149	520	n/a	57.9
(Ramp 92 S-4) 13+00.00	50	1wa	3.3761	0.0500	300	3.3261	-3.3761	C	449	474	n/a	51.8
(Ramp 92 S-4) 9+00.00	50	1wa	0.0500	0.9600	400	.9100	-.9600	S	430	>1500	49	>90
(Ramp 92 S-1) 17+00.00	50	1wa	0.8300	-0.2300	400	1.0600	-.8300	C	429	1,118	n/a	89.7
(Ramp 92 S-1) 11+00.00	50	1wa	-0.2300	0.1480	400	.3780	-.1480	S	424	>1500	20	>90
(Ramp 92 S-1) 3+50.00	50	1wa	0.1480	-2.4164	400	2.5644	-.1480	C	424	621	n/a	63.5
Valencia Road TI Ramps												
(Ramp A) 117+00	50	1ww	-0.6500	3.4600	800	4.1100	-.6500	S	427	781	221	72.6
(Ramp A) 125+75	35	1ww	3.4600	2.5532	250	.9068	2.5532	C	238	1,315	n/a	>90
(Ramp A1) 2+00	35	1ww	3.5000	-1.1444	140	4.6444	-1.1444	C	250	302	n/a	39.7
(Ramp B) 204+50	60	1ww	-0.7200	3.2200	700	3.9400	-.7200	S	572	721	305	69.1
(Ramp B) 213+50	50	1ww	3.2200	1.2471	300	1.9729	1.2471	C	415	697	n/a	69.2
(Ramp B1) 3+30	50	1ww	2.5000	1.0521	100	1.4479	1.0521	C	416	795	n/a	74.8
(Ramp C) 303+50	35	1wa	-2.5666	-3.6400	300	1.0734	2.5666	C	238	1,155	n/a	>90
(Ramp C) 308+50	50	1wa	-3.6400	-0.3600	600	3.2800	.3600	S	420	774	176	73.0
(Ramp C1) 3+55	35	1wa	1.4274	-3.1980	190	4.6254	-1.4274	C	251	328	n/a	41.8
(Ramp D) 402+70	35	1wa	-1.1489	-5.5000	360	4.3511	1.1489	C	242	428	n/a	51.0
(Ramp D) 406+30	50	1wa	-5.5000	-0.2263	620	5.2737	.2263	S	421	505	284	56.1
(Ramp D1) 4+80	35	1wa	-0.8600	-2.9940	140	2.1340	.8600	C	243	576	n/a	61.3
Irvington Road TI Ramps												
(Ramp 98D) 4+00.00	35	1ww	-1.5867	-0.3410	400	1.2457	-1.5867	S	251	>1500	33	>90
(Ramp 98D) 9+00.00	50	1ww	-0.3410	-1.5244	400	1.1834	-1.5244	C	434	1,112	n/a	88.6
(Ramp 98D) 13+50.00	50	1ww	-1.5244	-0.5400	400	.9844	-1.5244	S	434	>1500	53	>90
(Ramp 98C) 8+50.00	50	1ww	-0.0800	-1.1250	300	1.0450	-1.1250	C	431	1,183	n/a	>90
(Ramp 98C) 12+50.00	50	1ww	-1.1250	1.2889	400	2.4139	-1.1250	S	431	1,028	130	85.1
(Ramp 98C) 17+00.00	35	1ww	1.2889	-1.1356	400	2.4245	-1.1356	C	250	645	n/a	64.3
(Ramp 98A) 8+00.00	50	1wa	-3.7975	0.8044	400	4.6019	-.8044	S	429	551	247	58.5
(Ramp 98B) 6+00.00	50	1wa	0.3920	3.7854	600	3.3934	-3.7854	S	452	741	182	67.7
Ajo Way TI Ramps												
(Ramp 99M) 3+00.00	35	1ww	0.2467	-3.6050	400	3.8517	-3.6050	C	259	480	n/a	52.0
(Ramp 99M) 9+00.00	45	1ww	-3.6050	-0.3030	550	3.3020	-3.6050	S	382	714	144	66.3
(Ramp 99N) 1+00.00	25	1ww	-0.8597	-2.4197	200	1.5600	-2.4197	C	156	792	n/a	71.7
(Ramp 99N) 8+60.00	25	1ww	-2.4197	-0.5701	300	1.8496	-2.4197	S	156	4,794	25	>90
(Ramp 99Q) 6+00.00	50	1ww	-0.7514	0.6300	300	1.3814	-.7514	S	428	>1500	74	>90
(Ramp 99Q) 1+50.00	35	1ww	0.6186	3.6890	100	3.0704	.6186	S	244	268	81	37.3
(Ramp 99Q) 2+50.00	35	1ww	3.6890	1.5000	100	2.1890	1.5000	C	241	543	n/a	59.5
(Ramp 99H) 3+00.00	35	1wa	4.0426	-1.5620	200	5.6046	-4.0426	C	261	293	n/a	37.7
(Ramp 99H) 8+00.00	45	1wa	-1.5620	0.6867	200	2.2487	-.6867	S	363	852	98	76.5
(Ramp 99L) 1+00.00	25	1wa	-2.1428	-5.4054	200	3.2626	2.1428	C	148	431	n/a	51.7
(Ramp 99L) 5+25.00	25	1wa	-5.4054	0.7670	500	6.1724	-.7670	S	153	371	83	45.6
(Ramp 99J) 15+75.00	50	1wa	0.1824	-0.3629	350	.5453	.1824	C	424	2,154	n/a	>90
(Ramp 99J) 19+25.00	35	1wa	-0.3629	0.6000	350	.9629	-.6000	S	248	>1500	25	>90
(Ramp 99J) 11+00.00	35	1wa	0.0586	1.5000	200	1.4414	-1.5000	S	251	>1500	38	>90

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