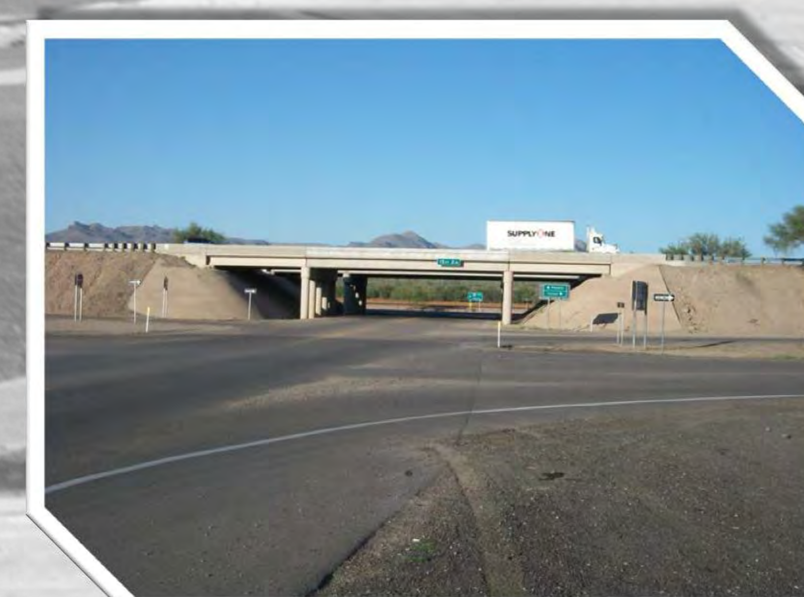
Interstate 10 Corridor Study, Tangerine Road to Ina Road

Final Design Concept Report

ADOT Project No.: 010 PM 240 H7960 01L
Federal Aid No.: 010-D(209)A

Volume 1 of 2

February 2014



ADOT

U.S. Department of Transportation
Federal Highway Administration

ADOT
Intermodal Transportation

MEMORANDUM

TO: RODERICK LANE, TUCSON DISTRICT ENGINEER
STEVE BEASLEY, ACTING URBAN PROJECT MANAGEMENT GROUP MANAGER
ANNETTE RILEY, ASSISTANT STATE ENGINEER, ROADWAY ENGINEERING GROUP

FROM: ROBIN RAINE, URBAN PROJECT MANAGEMENT GROUP

DATE: February 10, 2014

SUBJECT: FINAL DESIGN CONCEPT REPORT
I-10 TANGERINE ROAD TO INA ROAD
010 PM 240 H7960 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.

ROBIN RAINE, URBAN PROJECT MANAGMENT

Concurrence: RODERICK LANE, TUCSON DISTRICT ENGINEER — Date: 2-10-14

Concurrence: TRENT KELSO, URBAN PROJECT MANAGEMENT GROUP — Date: 2/14/14

Approved: Annette Riley — ANNETTE RILEY, ROADWAY ENGINEERING GROUP — Date: 3/4/14

Please see attached note.

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

William Lyons

From: William Lyons
Sent: Friday, February 28, 2014 12:35 PM
To: Annette Riley
Cc: Reed Henry
Subject: I-10, Tangerine Rd. To Ina Rd. Corridor Study: ADOT Project Number; 010 PM 240 H7960 01L, Federal Aid Number: 010-D(209)A - Final DCR Review Comments
Attachments: I-10 Comments.docx

Annette,
Your concurrence and approval of the Final DCR for this project is being requested. I reviewed the Final DCR document and find it to be very thorough and complete. This email is to inform you of some pending changes to the proposed work described in the document.

On 1/29/14, a telephone conference call meeting was held to discuss the Final DCR and three of my review comments (attached). Participating in the discussion were:
Robin Raine, ADOT Project Manager
William Lyons, ADOT Roadway Review Engineer
Charlene Robinson, AECOM Project Manager
Rodney 8ragg, AECOM Transportation Engineer

AECOM is currently preparing the Stage II Plans. All three review comments are being addressed and will be incorporated into the Stage II Plans. The comment topics / resolutions are briefly described below:

- Addition of the sidewalk/barrier along the EB frontage road approaching Avra Valley Rd shown in typical sections and plan view
- Wider Avra Valley lane widths in ADOT R/W shown in typical sections and plan view, and in the Bridge report
- Per discussion with Pete Mayne, an easement will not be shown for the UPRR spur crossing north (west) of Avra Valley, but the access control line will be shown to go up the embankment slope and across the bridge rather than crossing the RR spur track

The DCR, as written, meets RDG requirements. My three comments address the addition of desirable design features (not mandatory requirements). If left unaddressed, none of these three concerns would require a design exception or design variance.

The ADOT Project Manager advises that the Stage II plans along with the electronic files will be provided to the Final Design Team.

William J. Lyons, P.E., Design Review Engineer
Roadway Engineering Group, Support Section
205 S 17th Ave, Room 117 - Mail Drop 615E
Ph: 602 712 7404 Fax: 602 712 3335

Bill Lyons -
For your review & Then return to Reed.
Thanks -
Baljeet
2/18/14

Interstate 10 Corridor Study
Tangerine Road to Ina Road

Final Design Concept Report
ADOT Project No.: 010 PM 240
ADOT TRACS No.: H7960 01L

Prepared for:

ADOT

U.S. Department of Transportation
Federal Highway Administration

Prepared by:

AECOM

February 2014

Registered Professional Engineer (Civil)
CERTIFICATE NO. 33452
CHARLENE J. ROBINSON
DATE SIGNED 02/02/14
ARIZONA U.S.A.
Charlene J. Robinson
Expires: 03-31-14

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EX.0 EXECUTIVE SUMMARY

This Final Design Concept Report (DCR) describes the development, evaluation and recommendation of improvements to increase the capacity of Interstate 10 (I-10) between Tangerine Road (approximate milepost (MP) 240.5) and Ina Road (approximate MP 248.7), for a total length of approximately eight miles. The project limits, as designated by the Arizona Department of Transportation (ADOT), extend from MP 240.0 to MP 247.5. The proposed improvements shown in the DCR plans begin at existing I-10 Station 4553+98 (MP 239.9) and end at existing I-10 Station 4993+00 (MP 248.2). This project is located in ADOT's Tucson District within Pima County in south-central Arizona. Project location and vicinity maps are provided with Figures EX.1 and EX.2, respectively.

The goal of this project is to develop and objectively evaluate transportation alternatives in order to move ahead a long-term master plan for this segment of I-10 in accordance with the approved regional and local transportation plans, and other recently completed or on-going studies along I-10. This project will seek to optimize the traffic operations within the corridor for the projected design year 2040 traffic demand, and to minimize or mitigate impacts the improvements may have on the surrounding community. Other documents prepared to support this DCR include the following:

- Alternative Selection Report
- Final Traffic Report
- Preliminary Drainage Report
- Preliminary Geotechnical Report
- Preliminary Structure Selection Reports

EX.1 NEED FOR THE PROJECT

I-10 is an existing freeway traversing the northern and eastern areas of Pima County. It is a major commercial corridor for intrastate, interstate, and international commerce. I-10 is one of the major interstate highways crossing Arizona and is part of an intercontinental corridor connecting the east and west coasts of the United States (US). I-10 provides mobility for the communities along its route, and is a primary carrier of commerce and interstate travel across the US.

The improvements to the I-10 corridor are needed to address:

- Increased travel demand and traffic congestion
- Compromised efficiency of the Canada-America-Mexico (CANAMEX) Trade Corridor, a Congressionally-designated “High Priority Corridor”
- Lack of a continuous parallel route with direct connection to I-10 during major accidents or incidents
- Existing facility not meeting current design standards
- Vehicle-train conflicts

To meet the project objectives and address the elements of need, the proposed improvements in the Recommended Alternative include:

- Expanding I-10 to add two travel lanes in both directions between Tangerine Road and Ina Road (ten-lane freeway) with a closed median (concrete median barrier)
- Lowering the I-10 profile at Avra Valley Road and Cortaro Road
- Parallel entrance and exit ramps in both directions on I-10 at all traffic interchanges
- Continuous two-lane, one-way frontage roads
- Reconstructing the Avra Valley Road TI to:
    - Shift the alignment approximately 80 feet east of the existing alignment
    - Pass over I-10
    - Widen Avra Valley Road to include a raised curbed median, four travel lanes (two travel lanes in each direction) and left- and right-turn lanes as warranted
    - Accommodate the future extension of Avra Valley Road to the north over the UPRR by the Town of Marana or others
- Reconstructing the Cortaro Road TI to:
    - Shift the alignment approximately 100 feet east of the existing alignment
    - Pass over I-10 and the UPRR
    - Widen Cortaro Road to include a raised curbed median, six travel lanes (three travel lanes in each direction) and left- and right-turn lanes as warranted

The Recommended Alternative would:

- Operate at LOS ‘D’ or better during peak hours on all segments of the I-10 mainline and at the Avra Valley Road and Cortaro Road TIs based on the traffic analysis performed with the projected 2040 traffic volumes
- Support the designation of I-10 as part of the CANAMEX trade corridor by maintaining acceptable levels of service through the corridor
- Reconstruct the frontage roads to be continuous and one-way; thereby providing a parallel route to I-10
- Upgrade the existing facilities to current design standards and practices. The drainage facilities constructed with the Twin Peaks Road TI improvements would remain in place
- Eliminate vehicle-train conflicts on Cortaro Road. If the Town of Marana extends Avra Valley Road to the north, the proposed improvements at Avra Valley Road would allow the northward extension of this roadway with an overpass of the UPRR.
- Be compatible with ADOT, Town of Marana and Pima County long-range plans

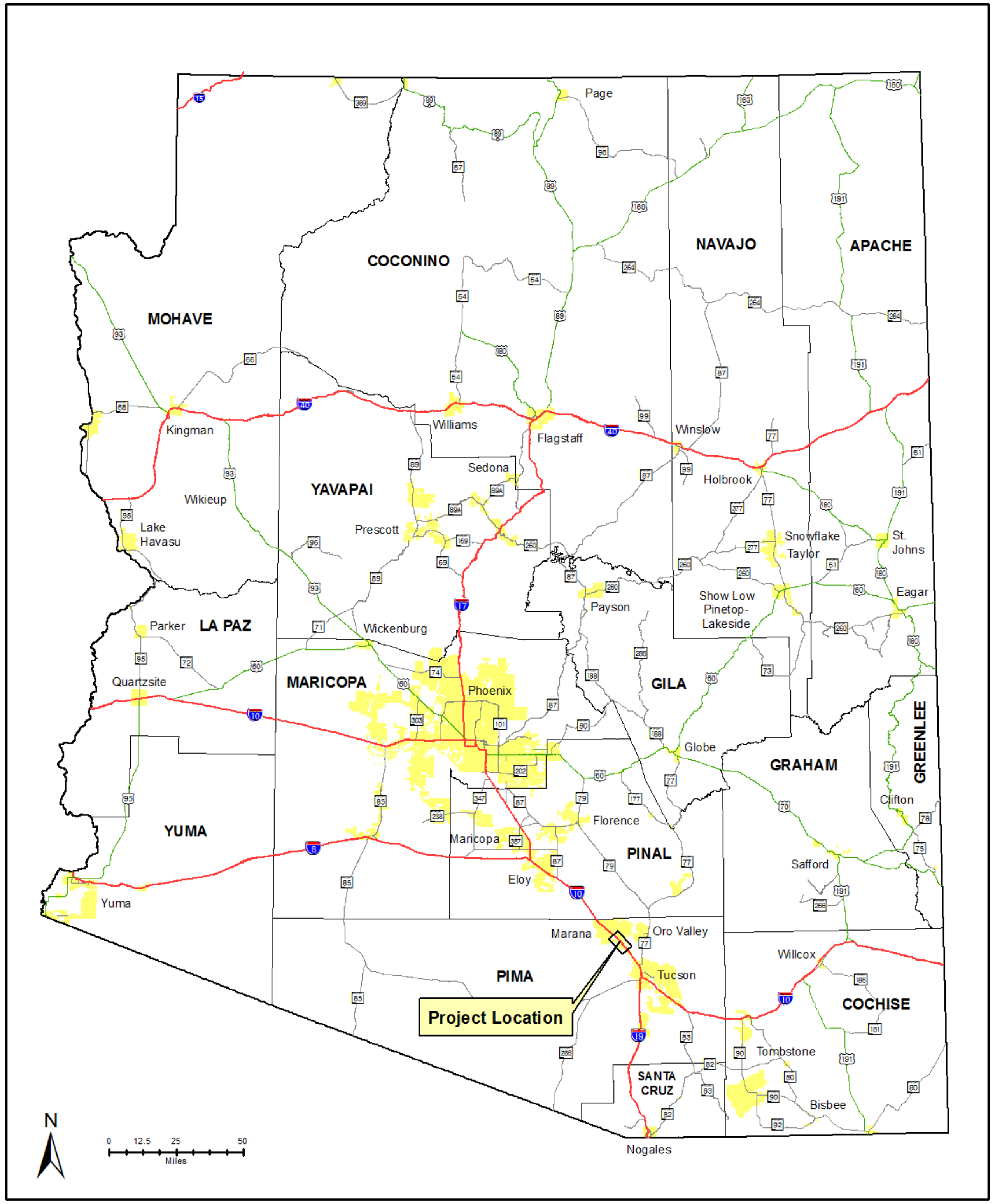


Figure EX.1 – Project Location Map

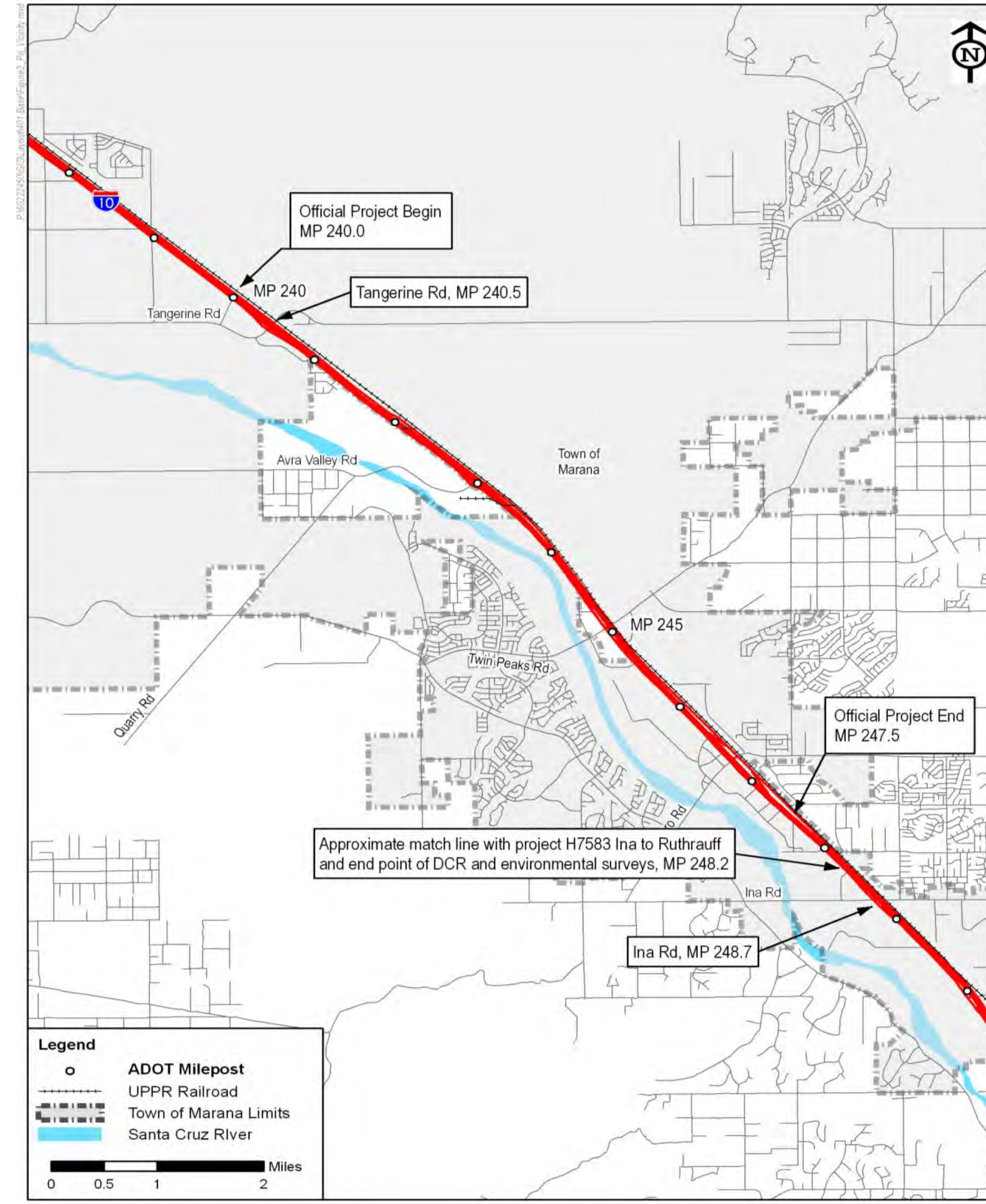


Figure EX.2 – Vicinity Map

EX.2 DESIGN CONCEPT ALTERNATIVES

The design concept alternative development and evaluation process was divided into three categories as follows:

- I-10 Typical Section – evaluated the number of lanes, median configuration, and frontage road configuration along I-10
- Traffic Interchange Location Options – evaluated the location of traffic interchanges along the corridor
- Crossroad Alignment Options – evaluated crossroad alignment options based on the traffic interchange location recommendations

Based on the findings documented in the *Final Alternative Selection Report* prepared for this project, the No-Build Alternative and one Build Alternative was carried forward for further study through the DCR and the Working Draft of the Environmental Assessment (EA).

Both the No-Build and Build Alternatives would include improvements at the Tangerine Road and Ina Road TIs, as planned by other projects. At Tangerine Road, a new diamond interchange would be constructed approximately 2,500 feet west of the existing Tangerine Road TI with one-way frontage roads. I-10 would remain at ground level and a realigned Tangerine Road would be constructed to pass over I-10 and the UPRR. The existing Tangerine Road crossing would remain and provide a grade-separated crossing of I-10 and an at-grade crossing of the UPRR. In addition, the Town of Marana intends to widen existing Tangerine Road to a five-lane section north of I-10.

Ina Road is being designed under ADOT Project No. 010 PM 248 H8479 01D. This project would reconstruct Ina Road to pass over I-10 and the UPRR. The I-10 mainline would be reconstructed to accommodate a ten-lane freeway section (five travel lanes in each direction) plus auxiliary lanes. The Ina Road TI would maintain the full diamond interchange configuration at its current location and include parallel entrance and exit ramps. The frontage roads between Cortaro Road and Ina Road are one-way, continuous, two-lane roads, but they would be reconstructed to be compatible with the I-10 mainline and interchange improvements.

No-Build Alternative

The No-Build Alternative would not construct any improvements to I-10 other than the Tangerine Road and Ina Road TI improvements described above. I-10 would continue to provide three travel lanes in each direction (six-lane freeway) with an open median. The frontage roads would remain in their current configuration and access to adjacent parcels would continue to be provided by the existing frontage roads.

The existing Avra Valley Road and Cortaro Road TIs would remain in their current configurations. The Town of Marana, or others, could extend Avra Valley Road to the north with an at-grade crossing of the UPRR. The existing at-grade crossing of the UPRR on Cortaro Road would remain.

Build Alternative

I-10 would be reconstructed to lower the profile and include five travel lanes in each direction (ten-lane freeway) with a closed median, and continuous one-way frontage roads. On I-10, each travel lane would be 12 feet wide along with 12-foot-wide inside and outside shoulders. The median would contain a 42-inch tall concrete barrier to separate two-way traffic. Parallel entrance and exit ramps would be included in both directions on I-10 at all interchanges. Portions of the eastbound entrance ramp and westbound exit ramp for the new Tangerine Road TI and the entrance and exit ramps at the Twin Peaks Road TI would be reconstructed.

The continuous one-way frontage roads would generally be parallel to the I-10 mainline and would connect to the ramps near the traffic interchanges. The frontage roads would contain two 12-foot-wide travel lanes with 8-foot-wide inside and outside shoulders. Access to adjacent parcels would be provided by the one-way frontage roads. The I-10 Build Alternative typical section is shown in Figure EX-3.

The Avra Valley Road TI would be reconstructed to:

- Shift the alignment approximately 80 feet east of the existing alignment
- Pass over I-10
- Widen Avra Valley Road to include a raised curbed median, four travel lanes (two travel lanes in each direction) and left- and right-turn lanes as warranted
- Accommodate the future extension of Avra Valley Road to the north over the UPRR by the Town of Marana or others

The Cortaro Road TI would be reconstructed to:

- Shift the alignment approximately 100 feet east of the existing alignment
- Pass over I-10 and the UPRR
- Widen Cortaro Road to include a raised curbed median, six travel lanes (three travel lanes in each direction) and left- and right-turn lanes as warranted

EX.3 MAJOR DESIGN FEATURES OF THE RECOMMENDED ALTERNATIVE

The preliminary plans for the Recommended Alternative are presented in Appendix D. In order to accommodate 2040 projected traffic volumes in the study corridor the following improvements are recommended:

I-10 mainline:

- Expand I-10 to a ten-lane freeway consisting of five travel lanes in each direction with a closed median. The mainline expansion and other improvements would require approximately 26 acres of new right-of-way from properties adjacent to the roadway improvements

- Shift the proposed I-10 median centerline north or south (depending on the location) of the existing median centerline to improve the geometry and optimize the available space between the frontage roads and the ADOT right-of-way

- Lower the I-10 profile to go under Avra Valley Road and Cortaro Road. The I-10 profile would continue to pass over Tangerine Road and the UPRR spur track (APC RR OP) west of the Avra Valley Road TI. This UPRR spur track will remain active; therefore, the existing structure would be demolished and reconstructed to meet the railroad's minimum vertical clearance requirements. The abandoned railroad spur east of the Avra Valley Road TI would be demolished; so the profile would be lowered in this area

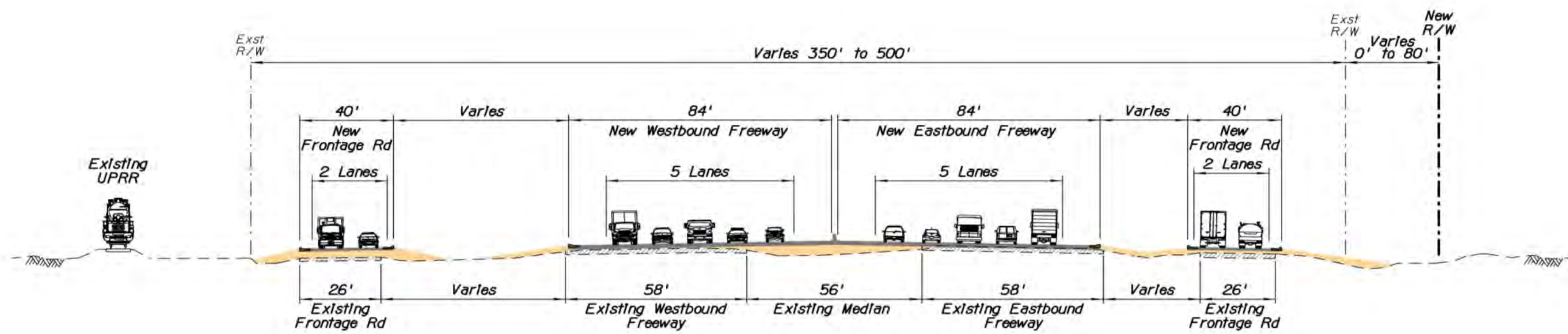


Figure EX-3 – I-10 Build Alternative Typical Section

- Continue to restrict access to and from the interstate to interchange location
- Reconfigure the frontage roads to be continuous and one-way throughout the study corridor. Widen the frontage roads to accommodate two 12-foot-wide travel lanes and 8-foot-wide shoulders for a total width of 40 feet. The proposed alignment for the frontage roads would generally parallel the proposed I-10 alignment

Traffic Interchanges:

- Maintain full diamond interchanges at Avra Valley Road, Twin Peaks Road and Cortaro Road
- Reconstruct Avra Valley Road and Cortaro Road TIs to be grade-separated over I-10
- Provide parallel entrance ramps at all interchanges that have two lanes in the body of the ramps with one lane being dropped near the mainline gore and one lane connecting to I-10
- Provide one-lane exit ramps eastbound and westbound on I-10 at all traffic interchanges, except that the westbound exit ramps at the Cortaro Road and Twin Peaks Road TIs would continue to have two lanes
- Shift the Avra Valley Road alignment approximately 80 feet east of the existing alignment and widen it to include a raised curbed median and four travel lanes (two lanes in each direction). One left-turn lane would be provided for the northbound to westbound movement and another for southbound to eastbound. One right-turn lane would be provided for the northbound to eastbound movement and another for southbound to westbound. A four-lane approach to Avra Valley Road would be provided for both the eastbound and westbound I-10 exit ramps/frontage roads
- The improvements on Avra Valley Road would terminate just north of I-10 at the ADOT right-of-way. The Town of Marana or others could extend Avra Valley Road to the north over the UPRR
- Shift the Cortaro Road alignment approximately 100 feet east of the existing alignment and widen it to include a raised curbed median and six travel lanes (three lanes in each direction). Two left-turn lanes would be provided for the northbound to westbound movement and the southbound to eastbound movement. Two right-turn lanes would be provided for the northbound to eastbound movement. One right-turn lane would be provided for the southbound to westbound movement. A four-lane approach to Cortaro Road would be provided for the eastbound I-10 exit ramp/frontage road. The westbound approach to Cortaro Road would have five lanes
- Reconstruct the mainline gores at the Twin Peaks Road TI to accommodate the expansion of I-10
- The reconstruction of the Tangerine Road TI is being planned under ADOT Project No. 010 PM 239 H7467 01X. This project would construct a new full diamond interchange approximately 2,500 feet west of the existing Tangerine Road TI and would realign portions of the eastbound frontage road. I-10 would remain at ground level and the crossroad would be constructed to pass over I-10 and the UPRR. This design concept would include eliminating the ramps connecting to I-10 at the existing Tangerine Road TI. Assuming that the interchange is constructed prior to this project, the eastbound entrance ramp and westbound exit ramp would be reconstructed at the gores to accommodate the expansion of I-10
- South of I-10, Tangerine Road is a four-lane divided roadway and the Town of Marana intends to widen it to a five-lane section north of I-10. The I-10 overpass would be reconstructed to accommodate a widened section of Tangerine Road
- The Ina Road TI is being designed under ADOT Project No. 010 PM 248 H8479 01D. This project will reconstruct Ina Road to pass over I-10 and the UPRR. The I-10 mainline will be reconstructed to accommodate a ten-lane freeway section (five travel lanes in each direction) plus auxiliary lanes. The Ina Road TI will maintain the full diamond interchange configuration at its current location and include parallel entrance and exit ramps. The frontage roads between Cortaro Road and Ina Road are one-way, continuous, two-lane roads; however, they would be reconstructed to be compatible with the I-10 mainline and interchange improvements

Other Roadways:

- Near the Rillito Community, Benta Vista Street would be extended to the west to cross the Cortaro-Marana Irrigation District (CMID) canal. A new roadway would be constructed to connect Benta Vista Street to Rillito Village Trail, along the Portland Avenue alignment. These roadways would provide a two-way connection between the Rillito community and Tangerine Road once the eastbound frontage road is converted to one-way operation
- The Joplin Lane connection to Cortaro Road would be removed with the Recommended Alternative. However, several parcels located north of I-10 and west of Cortaro Road use Joplin Lane for access. The Town of Marana intends to have a future development construct a new access to these parcels. However, the timing of this development is unknown and it may not be in place when the Cortaro Road TI is reconstructed. Therefore, the Cortaro Road TI project may need to include the construction of the alternate access to these parcels, or the connection of Joplin Lane to Cortaro Road may need to be restored to provide right-in/right-out access

The reconstruction of this corridor would have impacts to numerous utilities. Major utilities in the study area, anticipated conflicts due to the proposed improvements, and possible mitigation measures are discussed in Section 4.9.

EX.4 PUBLIC INVOLVEMENT

To ensure that the community had an opportunity to provide comments and be involved in the development, evaluation and recommendation of the Recommended Alternative, this study included a public involvement process with public and agency meetings and a project website.

An Agency Scoping meeting was held on December 7th, 2011 at the Wheeler Taft Abbett Sr. Branch Library in Marana, Arizona. The agency scoping meeting was attended by representatives of ADOT, FHWA, Arizona Game and Fish Department, Central Arizona Project, Pima Association of Governments, Pima County, Town of Marana, and Tucson Electric Power Company (Unisource Energy Corporation).

The public scoping meeting was held on December 14th, 2011 at Coyote Trail Elementary School in Marana, Arizona. The purpose of this meeting was to obtain input from the public on the scope of the project, identify issues, and express concerns. A total of 50 people attended the meeting which included a presentation, question and answer session, and an open house format.

A public information meeting was held on May 2nd, 2012 at Coyote Trail Elementary School in Marana, Arizona. The purpose of this meeting was to present proposed alternatives for the mainline and interchange improvements and obtain comments and concerns about the possible solutions. A total of 92 people attended the meeting. Attendees were requested to write their questions on a question card, which were read and addressed during the question and comment session at the end of the presentation. Attendees were also encouraged to visit the displays, provide input on the various alternatives, and ask questions.

The general public has been encouraged during the course of the study to use the project website to access study information and provide feedback to the project team. This project is included on the ADOT website: www.azdot.gov/tangerine2ina.

A complete set of agency and public meeting materials can be found in Appendix A and agency co-ordination letters in Appendix F.

EX.5 IMPLEMENTATION PLAN

The Implementation Plan was developed to propose a logical sequence of construction phasing that would systematically build the ultimate I-10 corridor improvements as future traffic demands warrant and funding becomes available. The plan considers the need for improvements based on traffic demand, construction staging to maintain traffic during construction, and minimizing duplication or repetition of effort over short- and long-term periods. The following project construction phasing is recommended:

PHASE I – RECONSTRUCT THE CORTARO ROAD TI, I-10 AND FRONTAGE ROADS

The Cortaro Road TI is currently operating at an unacceptable LOS 'E'. The I-10 mainline between the Cortaro Road and Ina Road TIs is projected to operate at capacity by 2020 for a six-lane freeway. The segment of the I-10 mainline between the Twin Peaks Road and Cortaro Road TIs would experience unacceptable LOS by Year 2025.

Therefore, the recommendation is to reconstruct the Cortaro Road TI in Phase I. Since the reconstruction of the interchange includes realigning and lowering I-10 and elevating Cortaro Road, this project would include reconstructing the I-10 mainline to the configuration for the Recommended Alternative.

Phase I should:

- Reconstruct the Cortaro Road TI to:
  - Shift the alignment approximately 100 feet east of the existing alignment
  - Pass over I-10 and the UPRR
  - Widen Cortaro Road to include a raised curbed median, six travel lanes (three travel lanes in each direction) and left- and right-turn lanes as warranted

- Reconstruct the eastbound frontage road between Station 4852+11± and Station 4992+14± and the westbound frontage road between Station 4835+33± and Station 4991+95± to widen the roadway to accommodate two-12-foot-wide travel lanes and 8-foot-wide shoulders for a total width of 40 feet

- Reconstruct I-10 from the Twin Peaks Road TI to the Ina Road TI (Station 4820+00± to Station 4981+80±) to:
  - Lower the profile to go under Cortaro Road
  - Widen the mainline to an eight-lane freeway with a closed median (concrete median barrier) and provisions for expanding to a ten-lane freeway

Reconstructing I-10 to an eight-lane freeway with a closed median would be compatible with the proposed improvements for the mainline included in the scope of the Ina Road TI project. The Cortaro Road Bridge underpass would be designed to accommodate the future expansion of I-10 to a ten-lane freeway by making provisions for the fifth lane to the outside of the I-10 pavement edge. This phase also includes modifications to the eastbound entrance and westbound exit ramps at the Twin Peaks Road TI.

This phase assumes that the proposed improvements for the I-10, Ina Road TI to Ruthrauff Road TI segment would be completed as identified in the ADOT Five-Year Transportation Facilities Construction Program (2014 - 2018) approved in June 2013. The Ina Road TI is planned to be under construction in FY 2016 and the Ruthrauff Road TI in FY 2018. The design and construction of the Orange Grove Road and Sunset Road TIs have not been programmed. The Orange Grove Road and Sunset Road TIs would need to be completed prior to striping the I-10 mainline to accommodate four travel lanes in each direction west of the Ina Road TI.

PHASE II - RECONSTRUCT THE AVRA VALLEY ROAD TI, I-10 AND FRONTAGE ROADS

Based on the traffic analysis, the operation of the existing configuration at the Avra Valley Road TI is forecasted to operate at an unacceptable LOS 'F' by Year 2030. However, if significant development occurs to the south of I-10 and/or if Avra Valley Road is extended to the north, this would create the need to implement this phase before 2030. The I-10 mainline from Tangerine Road to the Twin Peaks Road TI is projected to operate at capacity by 2030 for a six-lane freeway.

Therefore, the recommendation is to reconstruct the Avra Valley Road TI in Phase II. Since the reconstruction of the interchange includes realigning and lowering I-10 and elevating Avra Valley Road, this project would include reconstructing the I-10 mainline to the configuration for the Recommended Alternative. The Avra Valley Road Bridge underpass would be designed to accommodate the future expansion of I-10 to a ten-lane freeway by making provisions for the fifth lane to the outside of the 1-10 pavement edge.

Phase II should:

- Reconstruct the Avra Valley Road TI to:
  - Shift the alignment approximately 80 feet east of the existing alignment
  - Pass over I-10 and make provisions for the future extension of Avra Valley Road to the north over the UPRR by the Town of Marana or others
  - Widen Avra Valley Road to include a raised curbed median, four travel lanes (two travel lanes in each direction) and left- and right-turn lanes as warranted

- Reconstruct the eastbound frontage road between Station 4580+50± and Station 4796+54± and the westbound frontage road between Station 4576+25± and Station 4794+60± to:
  - Be continuous and one-way
  - Widen the roadway to accommodate two 12-foot-wide travel lanes and 8-foot-wide shoulders for a total width of 40 feet

- Reconstruct I-10 from Tangerine Road to the Twin Peaks Road TI (Station 4554+00± to Station 4820+00±) to:
    - Lower the profile to go under Avra Valley Road
    - Widen the mainline to an eight-lane freeway with a closed median (concrete median barrier) and provisions for expanding to a ten-lane freeway

The proposed improvements would also include:

- Modifications to the eastbound exit and westbound entrance ramps at the Twin Peaks Road TI
- Extending Benta Vista Street to the west to cross over the CMID irrigation canal. A new roadway would be constructed to connect Benta Vista Street to Rillito Village Trail, along the Portland Avenue alignment. Portland Avenue would be stop controlled

The following assumptions were made for this phase:

- The new Tangerine Road TI, approximately 2,500 feet west of the existing Tangerine Road TI, and the conversion of the existing interchange to a grade-separated crossing without ramp connections to I-10 is completed
- The Town of Marana improvements to widen Tangerine Road to a five-lane section, north of I-10, would be completed

PHASE III - EXPAND I-10 TO A TEN-LANE FREEWAY

I-10 would be reconstructed in Phase I and II to an eight-lane freeway with provisions for expanding to a ten-lane freeway. Expansion to a ten-lane facility would be accomplished by adding 12 feet of pavement width to the outside pavement edge of the eight-lane I-10 facility and restriping the mainline. The improvements would also involve removing and replacing the curb or barrier and reconstructing the catch basins along the outside shoulder, and relocating the freeway guide signs. The five-lane section would consist of five 12-foot-wide travel lanes and 12-foot-wide inside and outside shoulders. Based on the traffic analysis, traffic operations would warrant expanding I-10 to five travel lanes in each direction between the Twin Peaks Road and Ina Road TIs by 2035 and Tangerine Road and the Twin Peaks Road TI after 2035.

EX.6 ITEMIZED ESTIMATE OF PROBABLE COSTS

The estimate of probable cost to construct the Recommended Alternative as a single project is $391,200,000, including right-of-way costs provided by ADOT Right-of-Way. It is anticipated that this project would be constructed in phases as described above; therefore, Table EX-1 provides a breakdown of the estimated costs by project as determined by the implementation process. The total estimate of probable cost to construct the project according to the implementation plan is $412,100,000. The following assumptions were made in the development of the cost estimates:

- All bridges would be constructed to their ultimate configuration in Phases I and II, and would not be widened in Phase III
- All retaining walls would be constructed to their ultimate configuration in Phases I and II, and would not be reconstructed in Phase III
- All concrete box culverts would be constructed to their ultimate configuration in Phases I and II, and would not be lengthened in Phase III
- Catch basins along I-10 constructed in Phases I and II would be reconstructed in Phase III
- Curb and gutter and barrier along I-10 constructed in Phases I and II would be reconstructed in Phase III
- Freeway guide signs installed in Phases I and II would be reconstructed in Phase III
- Phase III would include paving a new overlay and restriping I-10

The estimates of probable costs for the phases of implementation are as follows:

Table EX-1 - Summary of Estimated Cost

Phase	Construction Cost	Design Cost	Right-of-Way	Utilities Mitigation	Environmental Mitigation	Total Cost
Phase I	$142,099,870	$9,208,000	$4,335,200	$6,856,000	-	$162,499,070
Phase II	$189,301,800	$12,267,000	$2,128,000	$6,807,410	-	$210,504,210
Phase III	$35,852,500	$2,324,000	-	$872,000	-	$39,048,500
Total	$367,254,170	$23,799,000	$6,463,200	$14,535,410	-	$412,051,780

There is currently $2.3 million allocated in the ADOT Five-Year Transportation Facilities Construction Program (2014 - 2018) for the design of the Cortaro Road TI in FY 2017 (Phase I) and $2.7 million in FY 2018 for right-of-way acquisition.

EX.7 ENVIRONMENTAL ASSESSMENT

The Working Draft EA, dated December 2013, was developed in accordance with the National Environmental Policy Act (NEPA) of 1969 and the policies of the FHWA as the lead federal agency. ADOT is participating as a joint lead agency in the planning, preparation, and review of all technical and environmental documents. The Working Draft EA is currently on file with ADOT's Environmental Planning Group (EPG). When projects are programmed and meets FHWA criteria for fiscal constraint, the NEPA process may resume. At that time, the Working Draft EA and supporting technical studies will be reviewed for consistency with conditions within the project area, applicable regulations and requirements, and required mitigations. Re-evaluation may be required based on changed conditions or regulations. It is anticipated that, at a minimum, the following information will be updated or re-evaluated: socioeconomic data, Title VI and Environmental Justice, cultural resources, Section 4(f) resources, air quality impacts, noise analysis, biological resources, and hazardous materials assessment. The Working Draft EA would then be revised for ADOT and FHWA review and comment. Once approved by ADOT and FHWA, the Draft EA would be made available for public comment. Pertinent comments received on the Draft EA would be reflected in the Final EA. If FHWA, as the lead agency, determines that the project would not result in significant impacts, then a Finding of No Significant Impact (FONSI) will be issued for the project. The EA will need to be completed during the final design phase.

An Environmental Overview is provided in Appendix E.

1.0 INTRODUCTION

1.1 FORWARD

This Final Design Concept Report (DCR) describes the development, evaluation and recommendation of improvements to increase the capacity of Interstate 10 (I-10) between Tangerine Road (approximate milepost (MP) 240.5) and Ina Road (approximate MP 248.7), for a total length of approximately eight miles. The project limits, as designated by the Arizona Department of Transportation (ADOT), extend from MP 240.0 to MP 247.5. The proposed improvements shown in the DCR plans begin at existing I-10 Station 4553+98 (MP 239.9) and end at existing I-10 Station 4993+00 (MP 248.2). This project is located in ADOT's Tucson District within Pima County in south-central Arizona. Project location and vicinity maps are provided with Figures 1.1 and 1.2, respectively.

The goal of this project is to develop and objectively evaluate transportation alternatives in order to move ahead a long-term master plan for this segment of I-10 in accordance with the approved regional and local transportation plans, and other recently completed or on-going studies along I-10. This project will seek to optimize the traffic operations within the corridor for the projected design year 2040 traffic demand, and to minimize or mitigate impacts the improvements may have on the surrounding community. Other documents prepared to support this DCR include the following:

- Alternative Selection Report
- Final Traffic Report
- Preliminary Drainage Report
- Preliminary Geotechnical Report
- Preliminary Structure Selection Reports

I-10 is a major component of the National Highway System (NHS). Several planning documents have identified the need for transportation improvements along the study corridor, including:

- *ADOT I-10 General Plan Tangerine Road to Ruthrauff Road.* The 1993 ADOT I-10 General Plan outlined the necessary improvements on and along I-10. The proposed improvements on I-10 included widening I-10 to accommodate three travel lanes in each direction between the Tangerine Road TI and Twin Peaks Road TI and four travel lanes in each direction between the Twin Peaks Road TI and Ruthrauff Road TI. The improvements along the interstate included continuous two-lane, one-way frontage roads along both sides of the mainline, and reconstructing traffic interchanges, constructing new traffic interchanges, crossroad widening at the frontage road intersections, drainage, traffic and utility improvements.
- *Building a Quality Arizona (bqAZ) (ADOT 2010).* This study established a 40-year vision for future transportation investments in Arizona. The study recognized the need for roadway capacity improvements between Pinal and Pima Counties, and recommendations included widening I-10 to a maximum of ten lanes (five lanes in each direction).
- *Regional Transportation Authority (RTA).* In 2006, Pima County voters approved a ½ cent county-wide sales tax to fund a 20-year transportation program to be administered by the RTA. The RTA plan included the construction of a new traffic interchange in Marana, Arizona at Twin Peaks Road on I-10, completed in November 2010, and roadway improvement projects in the project vicinity including the Tangerine Road and Ina Road TI improvements.
- *Regional Transportation Plan (RTP).* The 2040 Pima Association of Governments (PAG) RTP includes widening I-10 from I-19 to the Pinal County line and building new or reconstructing existing traffic interchanges at Tangerine Road, Avra Valley Road, Twin Peaks Road (already completed), and Ina Road. New or reconstructed grade separations at the Union Pacific Railroad (UPRR) crossings are noted at Cortaro Road and Ina Road.
- *Town of Marana General Plan (2010).* Project recommendations in the General Plan included traffic interchange improvements and UPRR grade separations at Tangerine Road, Avra Valley Road, Cortaro Road, and Ina Road.

In addition, ADOT has prepared planning documents for the segments adjacent to the study corridor including:

- *I-10 Corridor Study; Junction I-8 to Tangerine Road.* A DCR prepared for ADOT recommended widening I-10 to five travel lanes in each direction with a closed median and continuous one-way frontage roads
- *I-10; Ina Road TI to Ruthrauff Road TI.* ADOT completed a study that includes a DCR and EA for this segment of I-10. Preliminary recommendations would implement a similar ten-lane cross-section with continuous two-lane, one-way frontage roads along both sides of I-10, and reconstructing the Ina Road TI
- *Tangerine Road Interchange.* A DCR prepared in 2008 recommended constructing a new interchange approximately 2,500 feet west of the existing Tangerine Road TI and converting the existing interchange to a grade-separated crossing without ramp connections to I-10

The current ADOT Five-Year Transportation Facilities Construction Program (2014-2018) (adopted June 25, 2013) contains the reconstruction of the Ina Road TI in Fiscal Year (FY) 2016 and the Cortaro Road TI design in FY 2017.

1.2 NEED FOR THE PROJECT

I-10 is an existing freeway traversing the northern and eastern areas of Pima County. It is a major commercial corridor for intrastate, interstate, and international commerce. I-10 is one of the major interstate highways crossing Arizona and is part of an intercontinental corridor connecting the east and west coasts of the United States (US). I-10 provides mobility for the communities along its route, and is a primary carrier of commerce and interstate travel across the US.

The improvements to the I-10 corridor are needed to address:

- Increased travel demand and traffic congestion
- Compromised efficiency of the Canada-America-Mexico (CANAMEX) Trade Corridor, a Congressionally-designated "High Priority Corridor"
- Lack of a continuous parallel route with direct connection to I-10 during major accidents or incidents
- Existing facility not meeting current design standards
- Vehicle-train conflicts

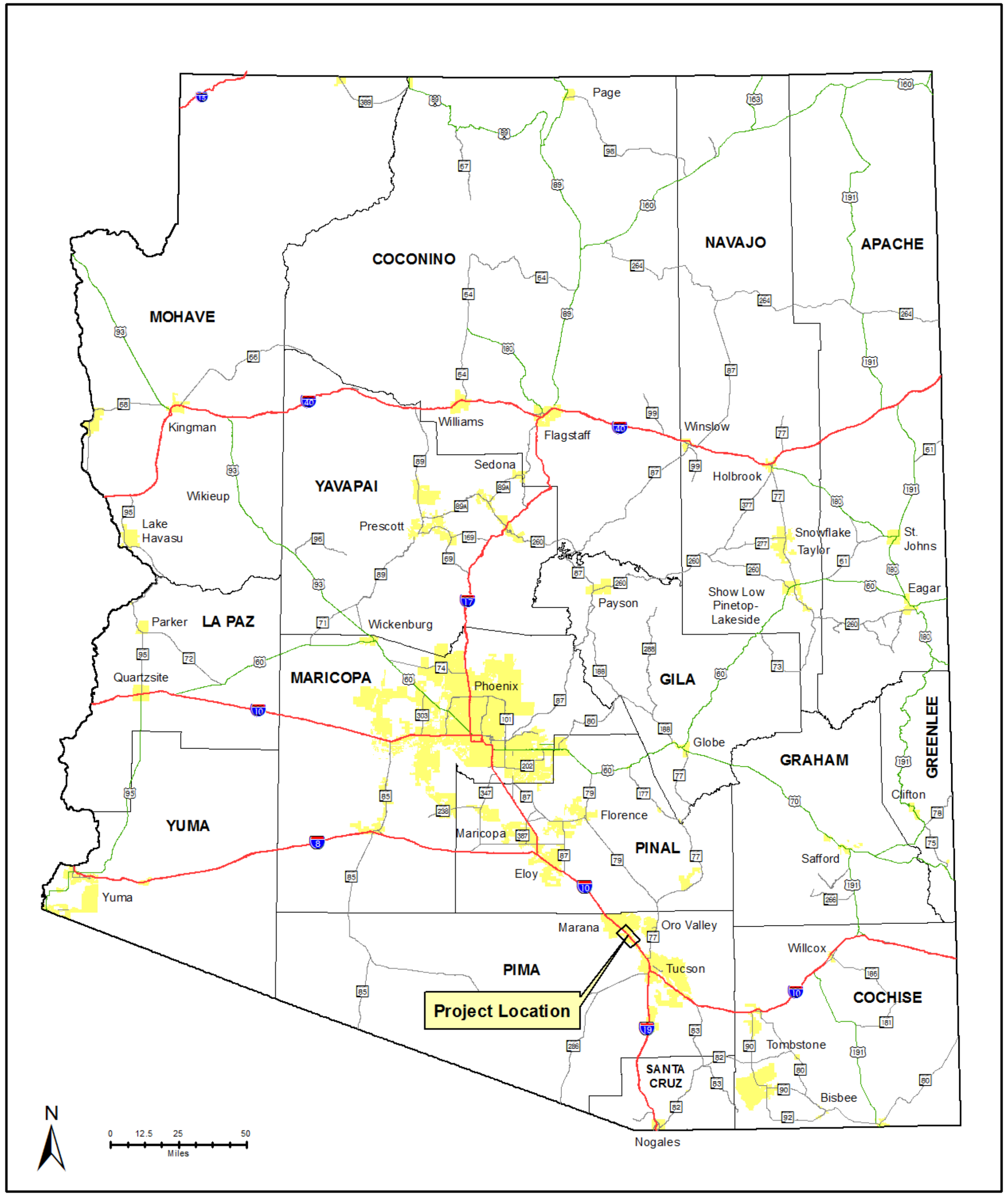


Figure 1.1 – Project Location Map

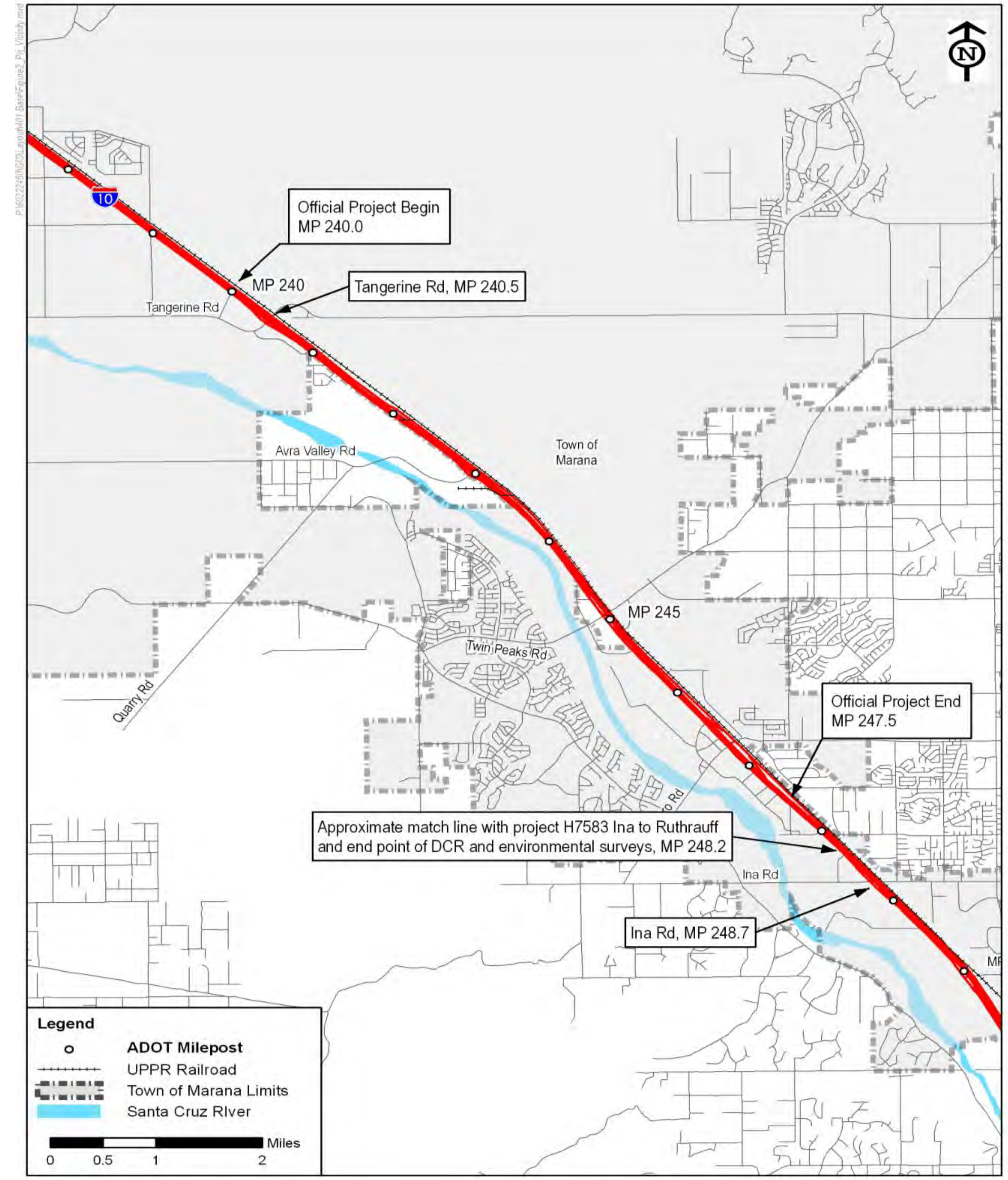


Figure 1.2 – Vicinity Map

Each of these project needs is discussed in detail in the following sections.

Increased Travel Demand and Traffic Congestion

The sustained growth over the last three decades in the Town of Marana and Northern Pima County has placed increased demands upon the roadway network, especially on I-10. As shown in Table 1.1, between 2010 and 2040, the population within Pima County is expected to increase by approximately 93%, from 982,008 to 1,897,713.

Table 1.1 – Projected Population Growth

Jurisdiction	2010 Population	2040 Population	Percent Change
City of Tucson (1)	594,725	995,276	67%
Town of Marana (2)	56,466	210,469	273%
Pima County (3)	982,008	1,897,713	93%

Source: PAG Traffic Analysis Zones (TAZ) data
Notes:
For the purposes of existing and future population projections, the geographies for the above-captioned jurisdictions were defined as the following:
(1) All TAZs that intersect the City of Tucson incorporated limits.
(2) All TAZs that intersect the Town of Marana incorporated limits.
(3) Areas within the PAG travel modeling area, which covers eastern Pima County and parts of southern Pinal County.

The economic changes that have occurred since late 2008 have affected the growth rate in Arizona, including the I-10 corridor between Phoenix and Tucson. However, the slowdown in growth is expected to be temporary, and the future populations shown in Table 1.1 are predicted to be reached following economic recovery. As the economy improves, growth rates are anticipated to trend back toward the rates experienced in the 1990's and early 2000's. Population growth in the Phoenix and Tucson metropolitan areas will increase the use of the highway by local commuters and overall traffic volumes.

Existing traffic volumes were collected in October 2011 to analyze existing conditions in the study area. The traffic volume data collected included counts on I-10, all ramps, Avra Valley Road, Cortaro Road, and principal intersections surrounding the Avra Valley Road and Cortaro Road TIs.

Currently, I-10 carries an average of nearly 69,500 vehicles per day (vpd) through the project corridor with the heaviest volumes experienced in the eastern end of the study area, between Cortaro Road and Ina Road, with an average of 91,000 vpd. Because I-10 is a major corridor for freight movement, truck traffic accounts for approximately 22% of the total vehicles on the roadway.

The overall quality of the service provided by a given transportation facility is described using a Level-of-Service (LOS) report card method. Freeway LOS is graded using six letter grades, 'A' through 'F', with 'A' being the best and 'F' being the worst. These LOS qualitative measures characterize operational conditions using factors such as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. Based on predicted traffic volumes and population trends from PAG, the project corridor is expected to exceed traffic capacity by the year 2040. The projected traffic volumes indicate that I-10 travel demand would experience an increase of approximately 186% by year 2040. Congestion on the existing I-10 facility and at intersections would severely worsen resulting in a majority of the corridor operating at LOS 'E' or 'F'.

CANAMEX Corridor

I-10 is a major corridor for intrastate, interstate, and international commerce. I-10 is a segment of a critical highway link between I-19 and I-8, connecting central and western Arizona with the southern and southeastern portions of the state. I-10 is the main highway corridor connecting the Phoenix and Tucson metropolitan areas, and is an important facility to the local communities along the corridor as well.

I-10 is part of the National Highway System (NHS), and within the study area it is a designated section of the CANAMEX Trade Corridor. The CANAMEX corridor serves as the main route between Canada and Mexico through the US and serves as a major north-south cargo trade corridor for large, load-bearing trucks. The US Congress designated this as a "High Priority Corridor" in the NHS Designation Act of 1995. The US Congress reauthorized that designation through two subsequent bills: the Transportation Equity Act for the 21st Century of 1998 and the Safe, Accountable, Flexible, and Efficient Transportation Equity Act of 2005 – A Legacy for Users (SAFETEA-LU). The original designation followed the signing of the North American Free Trade Agreement in 1994, which is an agreement supporting trade between Canada, the US, and Mexico. In the US, the CANAMEX Trade Corridor begins in Nogales, Arizona, at the US-Mexico border and traverses Arizona, Nevada, Utah, Idaho, and Montana. The US segment of the CANAMEX Trade Corridor ends in Sweetgrass, Montana at the US-Canadian border.

The urban areas of the I-10 corridor near Tucson represent a major segment of the CANAMEX corridor in Arizona, and the ability to travel through these areas is an important component of the CANAMEX objectives. Traffic studies conducted for the CANAMEX corridor planning indicated that the urban locations of Phoenix and Tucson would experience severe congestion by 2020 (CANAMEX 2001). The efficiency of the CANAMEX Trade Corridor would be compromised by the projected increase in traffic volumes and associated decrease in LOS.

Parallel Route to I-10

In some locations in the study area, the existing frontage roads are discontinuous, accommodate two-way traffic, or accommodate a single lane of traffic. In the event that a major accident or other incident results in a closure of several or all of the travel lanes on I-10, there are no effective alternative routes for the freeway traffic. Traffic backups that occur during these incidents often block or severely delay movement of emergency response vehicles. The lack of a continuous frontage road or parallel route to I-10 with connections to the interstate restricts local access and connectivity. Therefore, frontage road improvements are needed to provide a continuous parallel route that can be utilized during incidents on the I-10 mainline.

Existing Facility Not Meeting Current Design Standards

I-10 was originally constructed in the 1960s. Design standards have been refined since that time and existing elements do not meet the current American Association of State Highway Transportation Officials (AASHTO) standards and ADOT Roadway Design Guidelines. These elements include vertical clearances at the Cortaro Road and Avra Valley Road bridges; undersized drainage culverts; minimum drainage culvert height for maintenance; and frontage road widths. Therefore, improvements are needed to bring the roadways and bridges up to current standards.

Vehicle-Train Conflicts

Currently, Cortaro Road crosses the railroad at-grade. If a future extension of Avra Valley Road is implemented (as shown in the Town of Marana's Transportation Plan), a new at-grade crossing of the UPRR tracks would be created. At-grade railroad crossings:

- Have a higher potential for serious collisions between vehicles and trains
- Cause traffic delays for motorists, emergency responders, pedestrians, and other modes of transportation
- Interrupt nearby traffic signal operations when trains pass-by, resulting in even more delays
- Generate higher noise levels due to the train horns

According to ADOT Utility and Railroad, approximately 30 to 40 UPRR trains pass through the area per day. UPRR is almost complete with installing new tracks (double tracking) to the north of the existing tracks in the study corridor, which will result in an increase in the number of trains passing through this area.

In a statewide, comprehensive assessment of Arizona's rail needs conducted for *The 2011 Arizona State Rail Plan*, at-grade rail crossings were identified as a critical issue due to the potential conflicts between vehicles and trains. Specific rail investment opportunities were outlined, including the strategic opportunity to pursue a reduction in the number of conflict points between vehicles and trains. The Rail Plan identified implementation of a grade-separation program as a potential action that could be taken in this pursuit.

1.3 PROJECT DESCRIPTION

The project vicinity map (Figure 1.2) illustrates the limits of the corridor study. The project limits, as designated by ADOT, extend from MP 240.0 to MP 247.5. The proposed improvements shown in the DCR plans begin at existing I-10 Station 4553+98 (MP 239.9) and end at existing I-10 Station 4993+00 (MP 248.2) for a total length of approximately eight miles.

This project is located in ADOT's Tucson District in Pima County in south-central Arizona.

This project is recommending a long-range plan to the I-10 Corridor that would guide implementation over the next 30 years. The recommended alternative includes the expansion of the I-10 mainline, reconstruction of the Avra Valley Road and Cortaro Road TIs, and continuous one-way frontage roads.

1.3.1 Proposed Roadway Improvements

I-10 would be reconstructed to lower the profile and include five travel lanes in each direction (ten-lane freeway) with a closed median. The travel lanes would be 12 feet wide along with 12-foot-wide inside and outside shoulders. The median would contain a 42-inch concrete barrier to separate two-way traffic.

The frontage roads would be reconstructed to operate as continuous one-way frontage roads that would generally be parallel to the I-10 mainline and would connect to the ramps near the traffic interchanges. The frontage roads would contain two 12-foot-wide travel lanes with 8-foot-wide inside and outside shoulders for a total width of 40 feet. Access to adjacent parcels would be provided by the one-way frontage roads. South of Avra Valley Road, the mainline, frontage roads, and ramps would include curb/curb and gutter. Curb and gutter is proposed at each interchange, beginning at the location where the exit ramp and frontage road joins, and ending where the entrance ramp and frontage road split.

Both the Avra Valley Road TI and Cortaro Road TI would require full reconstruction generally in their current locations to accommodate the I-10 expansion, grade-separation of the roadways and the UPRR, provide the number of travel lanes shown in the Town of Marana's Transportation Plan, and meet the projected 2040 travel demand. Both roadways are planned to be elevated over the I-10 mainline and the UPRR. Avra Valley Road would not extend beyond the westbound frontage road as a component of this project. The project would provide one-lane exit ramps eastbound at Avra Valley Road, Twin Peaks Road and Cortaro Road and westbound at Avra Valley Road. Two-lane exit ramps would be provided westbound at Cortaro Road and Twin Peaks Road. Two-lanes would be provided on all entrance ramps that would merge into one-lane entering the freeway. Portions of the eastbound entrance ramp and westbound exit ramp for the new Tangerine Road TI would also be reconstructed.

1.3.2 Right-of-Way

New right-of-way would be required for the project. Approximately 26 acres is estimated to be acquired for the Recommended Alternative. Most of the properties impacted by either full or partial acquisitions are privately owned. There would also be partial acquisitions of several Pima County parcels and one State of Arizona parcel.

1.3.3 Structures

There are five locations where existing bridge structures would be reconstructed or demolished and new bridge structures constructed. The overpasses at Tangerine Road and the active railroad spur that serves CTI (west of Avra Valley Road) would be demolished and reconstructed as overpasses accommodating the I-10 widening. At the Avra Valley Road and Cortaro Road TIs, the existing structures would be demolished to accommodate lowering the I-10 mainline and elevating the crossroads over I-10 and the UPRR, with the Avra Valley Road extension over the railroad being completed by the Town of Marana or others. The abandoned railroad spur overpass (east of Avra Valley Road) would be demolished and a new box culvert constructed to maintain flows under I-10.

1.3.4 Drainage

There are 16 reinforced concrete box culverts (RCBC) and at least 14 corrugated metal pipe (CMP) culverts for local site drainage along the mainline that would be replaced, extended or eliminated. The CMP culverts would be replaced as needed to convey site drainage to existing outfall locations.

The proposed cross drainage improvements include the following new culverts: 10 RCBC's (various sizes), reinforced concrete pipes (RCP's) in various sizes, and two 42-inch smooth steel pipes. Four existing culverts at the Twin Peaks Road TI will remain.

A new channel (Massingale Channel) would be constructed between the eastbound frontage road and the Santa Cruz River to convey flows from north of I-10 to the Santa Cruz River. The Massingale Channel would generally follow the alignment of Massingale Road to Hartman Lane, where it would curve to the south for about 500 feet and then curve to the west to outfall into the Santa Cruz River. The channel between the eastbound frontage road and Hartman Lane would be fully concrete lined with a bottom width of 12 feet and 2:1 side slopes. Between Hartman Lane and the Santa Cruz River, the channel would have a 30-foot-wide earthen bottom with 2:1 concrete lined side slopes. The depth of the channel would be approximately five feet. Concrete box culverts would be installed at the access to the Northwest Fire Station near the intersection of Massingale Road and the eastbound frontage road, at Hartman Lane, and under the internal access road on the Fairfax Companies property. The channel is approximately 2,400 linear feet.

1.3.5 Utilities

The reconstruction of this corridor would have impacts to numerous utilities. The Cortaro-Marana Irrigation District (CMID) owns an irrigation canal that parallels I-10 for the entire project limit and this facility would be relocated and most of the alignment converted to an irrigation pipeline. Three CMID wells are impacted by the proposed improvements and would also be relocated.

The Central Arizona Project (CAP) Canal moves Colorado River water from Lake Havasu to southwest of Tucson. The CAP Canal crosses I-10 in a 10-foot siphon just east of Tangerine Road near MP 240.

Other major utilities in the study area and anticipated conflicts due the proposed improvements are listed in Table 4.9 (see Section 4.9). A comprehensive inventory of all utilities was not completed as part of this study. More detailed design would be completed as individual projects move forward.

1.4 PROJECT OBJECTIVE

The primary objective of this project is to develop a long-range master plan for the I-10 corridor to optimize the traffic operations for the Design Year 2040, in accordance with the approved regional and local transportation plans. These plans include:

- ADOT I-10 General Plan Tangerine Road to Ruthrauff Road, 1993
- RTA Transportation Program, approved by Pima County voters in 2006
- PAG 2040 RTP
- Town of Marana's General Plan, 2010

Secondary objectives include minimizing vehicle-train conflicts, supporting the CANAMEX Trade Corridor, and providing a continuous parallel route to I-10 which can be used during incidents on the I-10 mainline.

1.4.1 Public Involvement

To ensure that the community had an opportunity to provide comments and be involved in the development, evaluation and recommendation of the Recommended Alternative, this study included a public involvement process with public and agency meetings and a project website.

An Agency Scoping meeting was held on December 7th, 2011 at the Wheeler Taft Abbett Sr. Branch Library in Marana, Arizona. The agency scoping meeting was attended by representatives of ADOT, FHWA, Arizona Game and Fish Department (AGFD), CAP, PAG, Pima County, Town of Marana, and Tucson Electric Power Company (TEP).

The public scoping meeting was held on December 14th, 2011 at Coyote Trail Elementary School in Marana, Arizona. The purpose of this meeting was to obtain input from the public on the scope of the project, identify issues, and express concerns. A total of 50 people attended the meeting which included a presentation, question and answer session, and an open house format.

A public information meeting was held on May 2nd, 2012 at Coyote Trail Elementary School in Marana, Arizona. The purpose of this meeting was to present proposed alternatives for the mainline and interchange improvements and obtain comments and concerns about the possible solutions. A total of 92 people attended the meeting. Attendees were requested to write their questions on a question card, which were read and addressed during the question and comment session at the end of the presentation. Attendees were also encouraged to visit the displays, provide input on the various alternatives, and ask questions.

A complete set of agency and public meeting materials can be found in Appendix A and agency co-ordination letters in Appendix F.

1.4.2 Project Website

The general public has been encouraged during the course of the study to use the project website to access study information and provide feedback to the project team. This project is included on the ADOT website: www.azdot.gov/tangerine2ina.

1.5 CHARACTERISTICS OF THE CORRIDOR

I-10 was originally constructed in the 1960's. Since that time, numerous improvements and maintenance projects have been completed in the study area. Table 1.2 lists the previous projects based on the ADOT Milepost Strip Map.

Table 1.2 – Previous Projects

Freeway Corridor	Project Number and/or TRACS Number	Milepost	As-Built Date	Description
I-10	I-10-4(32)	233.36 – 235.83	1965	Orange Grove Rd. to Ina Rd. - Construct Orange Grove Rd. and Ina Rd. TI and I-10 EB and WB Mainline and Frontage Roads
I-10	I-10-4(34)	229.03 – 233.36	1966	Ina Rd. to Avra Valley Rd. - Construct Cortaro Rd. TI and I-10 EB and WB Mainline and Frontage Roads
I-10	I-IG-10-4(33)	224.94 – 229.03	1967	Avra Valley Rd. to Tangerine Rd.- Construct Tangerine Rd. and Avra Valley Rd. TI and I-10 EB and WB Mainline and Frontage Roads
I-10	I-10-4(42)	199.77 – 244.24	1972	I-8 to Avra Valley Rd. - Signs and Delineators
I-10	I-10-4(44)	229.03 – 245.54	1978	Avra Valley Rd. to I-19 - Signs and Delineators
I-10	LSI-10-4(52)	244.3 – 253.7	1966	Avra Valley Rd. to Prince Rd. - Landscaping
I-10	I-10-4(56)	212.62 - 244.24	1970	I-8 to Avra Valley Rd. - Landscaping
I-10	IR-I-10-4(67)	231.8 – 244.0	1980	Marana Airbase to Avra Valley Rd. - Resurface and Safety
I-10	IR-I-10-4(68)	244.0 – 255.75	1981	Avra Valley Rd. to Grant Rd. - Resurface and Safety
I-10	ER-10-4(76)	244	1981	Santa Cruz River Bridge Repair
I-10	ER-10-4(89)	244	1987	Santa Cruz River Flood Damage Repair

Table 1.2 – Continued

Freeway Corridor	Project Number and/or TRACS Number	Milepost	As-Built Date	Description
I-10	ACNH-10-4(169) H3038 01C	248.45 – 251.19	2002	Ina Rd. to Sunset Rd. - Construct EB and WB Frontage Road
I-10	IR-10-4(104) 010 PM 248 H0152 04C	248.4 – 248.8	1990	Ina Rd. TI - Reconstruct Ina Rd. TI, Ramp and Signals
I-10	ACIR-10-4(98) 010 PM 244 H0156 04C	244.00 – 250.00	1990	Avra Valley Rd. to Orange Grove Rd. - Mill, Resurface and Safety
I-10	IR-10-4(118) 010 PM 237 H2376 01C	237.00 – 244.00	1994	Marana Rd. to Avra Valley Rd. - Mill, Replace, ACFC and Safety
I-10	AC-NH-10-4(122) 010 PM 248 H2379 01C	248.82 – 254.88	1996	Ina Rd. to Prince Rd. - Mainline Widening
I-10	NH-10-4(160) 010 PM 246 H4156 01C	247.33	1999	Cortaro Rd. TI - Build Frontage Roads, Ramps and Reconstruct Cortaro Rd. TI
I-10	NH-010-D-(006)B 010 PM 246 H4347 01C	247.07 – 248.98	2004	Cortaro Rd. to Ina Rd. - Mainline Widening
I-10	NH-010-D(007)N 010 PM 236 H4582 01C	236.32 – 247.36	2010	Marana Rd. to Cortaro Rd. - Widen Mainline and Structures
I-10	010-D-NFA 010 PM 231 H4582 03C	231.37 – 239.33	2009	Pinal Air Park to Tangerine Rd. - Widen Mainline and Structures
I-10	IM-10-4(166) 010 PM 244 H4823 01C	244.00 – 248.70	2000	Railroad Overpass to Ina Rd. - Mill and Replace AR-ACFC
I-10	I-010-D-501 010 PM 236 H5977 01C	236.42 – 250.66	2001	Marana Rd. to Orange Grove Rd. - I-10 Bridge Repair at 236.42 - 250.66
I-10	I-010-D-507 010 PM 239 H6130 01C	239.10 – 248.72	2009	Marana Rd. to Ina Rd. - WB Frontage Road Pavement Preservation
I-10	I-010-D-505 010 PM 246 H6131 01C	246.90 – 248.50	2009	Cortaro Rd. to Ina Rd. - EB Frontage Road Pavement Preservation
I-10	I-010-D-508 010 PM 240 H6600 01C	240.45 & 242.95	2006	Tangerine Rd. and Avra Valley Rd. - Bridge Girder Replacement
I-10	I-010-D-509 010 PM 236 H6605 01C	236.9 – 244.0	2006	Marana Rd. to Cortaro Rd. - Mill and Replace ½” ACFC

1.5.1 Roadway Characteristics

The functional classification for I-10 is Urban Interstate throughout the study area. The posted speed limit is 75 miles per hour (mph) west of Cortaro Road and 65 mph east of Cortaro Road. I-10 consists of three travel lanes in each direction with an open median. The eastbound and westbound median shoulder is 12 feet wide and the outside shoulder is 10 feet wide. All I-10 travel lanes are 12 feet wide. The median, including the inside shoulder, is 56 feet wide. One-lane exit ramps exist eastbound at Tangerine Road, Avra Valley Road, Twin Peaks Road and Cortaro Road and westbound at Tangerine Road and Avra Valley Road. Two-lane exit ramps exist westbound at Cortaro Road and Twin Peaks Road. One-lane entrance ramps exist eastbound at Tangerine Road and Avra Valley Road and westbound at Tangerine Road, Avra Valley Road and Cortaro Road. At Cortaro Road, there is an eastbound two-lane entrance ramp that merges into one lane entering the freeway. The eastbound and westbound entrance ramps at Twin Peaks Road are striped for one lane; however, the ramp widths were constructed to accommodate two-lanes that would merge into one-lane entering the freeway. Existing condition plan sheets are included in Appendix B.

Cable barrier is installed along I-10 adjacent to the inside edge of pavement through the project limits with most of the barrier being adjacent to the westbound median shoulder. Between Tangerine Road and approximately 1,800 feet west of the active UPRR spur track, and between the abandoned UPRR spur track and the Twin Peaks Road TI, cable barrier is adjacent to the eastbound inside shoulder edge of pavement. Guardrail is installed along both sides of I-10 at the Tangerine Road, Avra Valley Road, Cortaro Road, and Ina Road TIs and the overpasses at the active and abandoned spur tracks.

I-10 is elevated over Tangerine Road, Avra Valley Road, Cortaro Road, the active UPRR spur track, and the abandoned UPRR spur track. Along the remaining portions of the corridor, including at Twin Peaks Road, I-10 is at-grade.

Between the Tangerine Road and Ina Road TIs, the westbound frontage road accommodates one-way travel. Between the Avra Valley Road and Ina Road TIs, the westbound frontage road is approximately 26 feet wide and provides two 12-foot-wide travel lanes and 1-foot-wide shoulders. North of Avra Valley Road, the westbound frontage road is approximately 14 feet wide and provides one 12-foot-wide travel lane and a 2-foot-wide outside shoulder. There are approximately five defined access points along the westbound frontage road which provide access to the adjacent land uses and one public street (Massingale Road).

Between the Tangerine Road and Avra Valley Road TIs, the eastbound frontage road accommodates two-way travel. At Tangerine Road, a portion of the eastbound frontage road has been abandoned and the movement is accommodated by Rillito Village Trail. Between the Avra Valley Road and Ina Road TIs, the eastbound frontage road accommodates one-way travel. The eastbound frontage road is approximately 26 feet wide and provides two 12-foot-wide travel lanes and 1-foot-wide shoulders. There are approximately 36 defined access points along the eastbound frontage road which provide access to the adjacent land uses and the following public streets:

- Benta Vista Street
- Water Street
- Tiffany Loop North
- Tiffany Loop South
- Norway Spruce Road
- Arizona Pavilions Drive
- Burlingame Road
- Coca Cola Place
- Gillette Road
- Hartman Lane
- Massingale Road
- Starcommerce Way

Local arterial street traffic interchanges along I-10 provide full freeway access at Tangerine Road (MP 240.5), Avra Valley Road (MP 243), Twin Peaks Road (MP 244.9), Cortaro Road (MP 246.7), and Ina Road (MP 248.7). The existing traffic interchanges are spaced between 1¾ and 2½ miles apart, with the closest interchange spacing between Twin Peaks Road and Cortaro Road.

The reconstruction of the Tangerine Road TI was planned under ADOT Project No. 010 PM 239 H7467 01X. According to the *Final Design Concept Report I-10/Replacement Tangerine Traffic Interchange*, December 2008, a new diamond interchange would be constructed approximately 2,500 feet west of the existing Tangerine Road TI with one-way frontage roads. I-10 would remain at ground level and a realigned Tangerine Road would be constructed to pass over I-10 and the UPRR. The existing Tangerine Road crossing would remain and provide a grade separated crossing of I-10 and an at-grade crossing of the UPRR. UPRR does reserve the right to require that the proposed improvements for the new Tangerine Road TI include removing the existing at-grade crossing. New traffic signals would be installed at the new (realigned) Tangerine Road TI. The existing Tangerine Road (Tangerine Farms Road)/frontage road intersections are signal controlled. The Town of Marana has interim plans to widen existing Tangerine Road, north of I-10, to a five-lane section.

Avra Valley Road is a two-lane rural roadway south of I-10. At the Avra Valley Road TI, the street section contains one travel lane in each direction. Avra Valley Road currently terminates just north of I-10 and there is no at-grade crossing of the UPRR facilities. The ramp terminal and frontage road intersections are currently stop-controlled. Avra Valley Road is at ground level and I-10 is elevated over Avra Valley Road. Avra Valley Road provides access to the Marana Regional Airport, Saguaro National Park and Asarco Silver Bell mine.

ADOT Project No. 010 PM 240 H5838 01C constructed the Twin Peaks Road TI in 2010. Twin Peaks Road is a four-lane arterial street. At the Twin Peak Road TI, the street section contains three travel lanes in both the northbound and southbound directions, two left-turn lanes for the northbound Twin Peaks Road to westbound I-10 movement, two-left turn lanes for the southbound Twin Peaks Road to eastbound I-10 movement, two right-turn lanes for the northbound Twin Peaks Road to eastbound I-10 movement, and one right-turn lane for the southbound Twin Peaks Road to westbound I-10 movement. North of I-10, Twin Peaks Road transitions from a six-lane roadway near I-10 to a four-lane roadway north of Linda Vista Boulevard. South of I-10, Twin Peaks Road transitions from a six-lane roadway near I-10 to a four-lane roadway south of Tiffany Loop. The ramp terminal intersections are currently signal-controlled. I-10 is at ground level and Twin Peaks Road is elevated over I-10 and the UPRR.

Cortaro Road is a four-lane arterial street. At the Cortaro Road TI, the street section contains two northbound and southbound through lanes, one left-turn lane for the northbound Cortaro Road to westbound I-10 movement, one left-turn lane for the southbound Cortaro Road to eastbound I-10 movement, a shared through/left-turn lane for southbound Cortaro Road, and two northbound Cortaro Road to eastbound I-10 right-turn lanes. Bridge piers are currently located between the two outside through lanes in each direction of travel on Cortaro Road. Immediately north of I-10, Cortaro Road crosses the UPRR at-grade. The ramp terminal intersections are currently signal-controlled. Cortaro Road is at ground level and I-10 is elevated over Cortaro Road.

The Ina Road TI is being designed under ADOT Project No. 010 PM 248 H8479 01D. This project will reconstruct Ina Road to pass over I-10 and the UPRR.

The Town of Marana's Transportation Plan (Marana 2010 General Plan) shows the relocated Tangerine Road TI and the extension of Avra Valley Road to the east of I-10 connecting to Lambert Lane. No new traffic interchanges are shown along this segment of I-10.

1.5.2 Transit Facilities and Routes/Park-and-Ride Lots

The Arizona Pavilions park-and-ride lot is located on the southwest corner of the Cortaro Road/Arizona Pavilions Drive intersection. Sun Tran, a regional public transportation system, operates Route 104X in the study area. Route 104X, or Marana-Downtown Express, is an express route that operates three times in the morning and three times in the afternoon. This express route uses I-10 to provide service every 30 minutes from the Arizona Pavilions park-and-ride lot to the Ronstadt Transit Center, located in downtown Tucson. The service is provided Monday through Friday. Sun Shuttle, a neighborhood transit service, operates two routes (Route 411 (Cortaro/Silverbell) and Route 413 Marana/I-10)) in the study area. The routes operate with 60 minutes headways, Monday through Saturday. Both routes utilize Cortaro Road, I-10 and the frontage roads. The Arizona Pavilions park-and-ride lot also serves as a transit point between Sun Shuttle and Sun Tran.

In addition, ADOT allows (by permit) park and ride use of vacant land in their right-of-way just east of the McDonalds restaurant on Cortaro Road, which is adjacent to the Cortaro Road TI.

1.5.3 Land Use

The project area is located within portions of the Town of Marana and unincorporated Pima County. No tribal or federal lands exist in the project limits. With the exception of a quarter-square mile parcel of Arizona State Land Department (ASLD) State Trust Land centered on I-10 near MP 244 (between Avra Valley and Twin Peaks Roads) and several parcels owned by Pima County, most of the land in the corridor is privately owned.

Most of the existing industrial and commercial development is concentrated on the south side of I-10 between Arizona Pavilions Drive and Ina Road, with the highest concentration of development located near Cortaro Road. The Arizona Pavilions development and Continental Ranch Business Park and Retail Center, located on both sides of Cortaro Road between I-10 and Courtney Page Way, is a retail and hospitality area, serving as a key revenue generator and the leading source of high-wage jobs for the Town of Marana. Currently, the areas in the vicinity of the Tangerine Road, Avra Valley Road and Twin Peaks Road TIs, and segments of the eastbound and westbound frontage roads, are sparsely developed with commercial, industrial, and residential uses. The remainder of the land adjacent to the project area is undeveloped. West of Avra Valley Road, portions of the land adjacent to the frontage roads is agriculture.

The future land use scenario (Town of Marana's General Plan, 2010) retains the open space associated with the Santa Cruz River. Continued growth and development is anticipated throughout the Town of Marana, building out the remainder of the adjacent land along the I-10 corridor, resulting in the conversion of undeveloped and farmland to other uses. Land use changes would be determined and controlled by Marana land use codes. The General Plan notes the areas around the Tangerine Road, Twin Peaks Road, and Ina Road TIs as economic activity centers and high growth areas.

1.5.4 Utilities and Railroad

Utilities

Numerous utilities exist in the corridor, either along I-10, in the UPRR right-of-way or within the crossroad right-of-way.

Within the UPRR right-of-way, there are fiber-optic lines owned by Level 3 Communications, AT&T and MCI. Also in the railroad's right-of-way are petroleum pipelines owned by Kinder Morgan. The Kinder Morgan pipelines are along the southern side of the railroad's right-of-way, very close to the ADOT right-of-way.

The major existing public utilities that are located in the project corridor are summarized in Table 1.3. This inventory of major utilities was compiled from quarter section maps, existing facility plans and as-built drawings that have been provided by the local agencies and utility companies.

Table 1.3 – Preliminary Utility and Facility Inventory

Utility Service Provider	Facility Type & Description (1)
Central Arizona Project (CAP)	CAP has a single crossing in the project limits which consists of an underground water siphon pipe constructed as part of the Tucson Aqueduct Santa Cruz River Siphon project. *I-10 Crossings:* • 132" Diameter Pipe at Tangerine Rd. – I-10 Sta 4589+50 *Crossroad Crossings:* • 156" Diameter Pipe – Tangerine Rd. Sta 33+97
Cortaro-Marana Irrigation District (CMID)	CMID has a wide range of facilities in the project limits including, but are not limited to, groundwater wells, main canals, and main canal pipelines. CMID facilities have multiple crossings with the I-10 mainline, frontage roads, and crossroads. *Active Groundwater Wells (in project corridor limits):* • I-10 Sta 4586+29, 455' Rt • I-10 Sta 4860+74, 95' Lt (Well Site #22P) • I-10 Sta 4897+20, 100' Lt (Well Site #26E) • I-10 Sta 4929+70, 113' Lt (Well Site #26J3) • Cortaro Rd. Sta 4+98, 111' Lt (Well Site #26J2) *I-10 Irrigation Line Crossings:* • I-10 Sta 4745+00 • I-10 Sta 4791+43 • I-10 Sta 4844+47 • I-10 Sta 4897+16 • I-10 Sta 4922+36 • I-10 Sta 4957+97 • I-10 Sta 4977+54 *Crossroad Irrigation Crossings:* • Tangerine Rd. Sta 16+77

Utility Service Provider	Facility Type & Description (1)
	• Avra Valley Rd. Sta 27+95 • Twin Peaks Rd. Sta 94+88 • Twin Peaks Rd. Sta 95+69 • Cortaro Rd. Sta 17+94 Main Canals – Approximately 3.3 linear miles (various locations) Main Canal Pipelines – Approximately 1.6 linear miles (various locations)
Kinder Morgan Energy	Kinder Morgan has 3 underground petroleum pipelines running parallel to I-10 in the UPRR right-of-way. The underground facilities include 12", 8", and 6" pipelines. *Crossroad Petroleum Pipeline Crossings:* • Tangerine Rd. Sta 22+42 • Avra Valley Rd. Sta 17+33 • Twin Peaks Rd. Sta 103+23 • Cortaro Rd. Sta 16+65
Level 3 Communications, LLC/Wiltel	Level 3 Communications has underground cable and fiber-optic facilities running parallel to the UPRR tracks in UPRR right-of-way along the eastern right-of-way boundary. The underground facilities include two banks of conduit, including 12-1¼" conduits and 3-1¾" conduits. *Crossroad Fiber-Optic Line Crossings:* • Tangerine Rd. Sta 24+16 • Avra Valley Rd. Sta 15+74 • Twin Peaks Rd. Sta 101+98 • Cortaro Rd. Sta 15+11
Pima County Regional Wastewater Reclamation Department (PCRWRD)	PCRWRD has numerous sanitary sewer facilities located in the project corridor limits. Facilities are predominately located outside of ADOT right-of-way in adjacent easements or Pima County and Marana right-of-way. *I-10 Sewer Line Crossings:* • 18" SS – I-10 Sta 4757+12 • 18" SS – I-10 Sta 4915+04 *Crossroad Sewer Line Crossings:* • 10" SS – Twin Peaks Rd. Sta 111+09 • 18" SS – Cortaro Rd. Sta 3+88, 57' Lt to Sta 12+37, 159' Lt • 24" SS – Cortaro Rd. Sta 12+37, 159' Lt to Sta 18+86, 110' Lt • 18" SS – Cortaro Rd. Sta 18+86, 110' Rt to Sta 30+05, 45' Lt • 12" SS – Cortaro Rd. Sta 12+54
Trico Electric	Trico Electric's facilities are predominately located around the I-10/Tangerine Rd. TI. Facilities include both overhead and underground power lines. *I-10 Overhead Power Line Crossing:* • I-10 Sta 4583+00 *Crossroad Overhead Power Line Crossings:* • Tangerine Rd. Sta 24+21

Table 1.3 – Continued

Utility Service Provider	Facility Type & Description (1)
Unisource Energy Corporation - Tucson Electric Power (TEP)	TEP has numerous facilities in the project corridor limits including, overhead transmission and distribution power lines and underground power lines. In addition, a large power generation facility is located just south of Avra Valley Rd. on the east side of the UPRR tracks. On the east side of the UPRR rights-of-way, large overhead transmission lines extend south from the power generation facility through the southernmost limits of the project corridor. *I-10 Overhead Power Line Crossings:* • I-10 Sta 4621+24 • I-10 Sta 4631+63 • I-10 Sta 4647+54 • I-10 Sta 4683+97 • I-10 Sta 4718+40 • I-10 Sta 4724+38 • I-10 Sta 4744+89 • I-10 Sta 4747+43 • I-10 Sta 4834+52 • I-10 Sta 4859+27 • I-10 Sta 4957+74 *Crossroad Overhead Power Line Crossings:* • Tangerine Rd. Sta 16+95 • Avra Valley Rd. Sta 26+52 • Avra Valley Rd. Sta 27+68 • Twin Peaks Rd. Sta 103+23 • Cortaro Rd. Sta 14+32 • Cortaro Rd. Sta 17+08 • Cortaro Rd. Sta 17+25
Verizon/MCI	Verizon has underground fiber-optic and communication facilities in the corridor. Verizon also has an above-ground communication tower facility located between the I-10 mainline and the WB frontage road just south of Cortaro Rd. (I-10 Sta 4937+40).

Note:
(1)All stations taken from existing/as-built plans.

In addition to the utility and agency facilities identified in Table 1.3 above, other utility service providers located in the project corridor study limits include Tucson Water, Marana Water, Rillito Water Users Inc., Southwest Gas, AT&T, CenturyLink, Sprint/Nextel, and Xspedias/Time Warner. A comprehensive inventory of all utilities was not completed as part of this study. More detailed design would be completed as individual projects move forward.

Railroad

The UPRR tracks located parallel to and north of I-10 (adjacent to the ADOT right-of-way) currently have both single and double tracks along the corridor. The UPRR is implementing improvements to increase rail capacity with double tracks throughout the area, which they designated as the Sunset Route Acceleration Project within the UPRR Gila Subdivision. According to ADOT Utility and Railroad, the current rail traffic averages 30 to 40 trains per day, but the UPRR is projecting future growth up to 100 trains per day or more through Tucson. The increased frequency will add significant delay to vehicles using the at-grade crossings.

The UPRR tracks have seven existing crossings with crossroads, local streets, and driveways in the project corridor. The crossings are summarized in Table 1.4.

The UPRR and the Arizona Corporation Commission (ACC) will not allow new at-grade crossings unless two equivalent crossings are closed. UPRR will contribute funds to a project if the existing crossing is replaced with a grade-separated crossing.

Table 1.4 – Existing UPRR Crossings

Crossing Location	Description	Crossing Type
Tangerine Rd.	Tangerine Rd. is an arterial roadway. The existing UPRR crossing is an at-grade crossing with advance warning signs, flashers and gates.	At-Grade
Driveway on WB Frontage Road	An unpaved driveway providing access to the WB frontage road for an existing residential/agricultural property located east (true direction) of the UPRR tracks. The existing UPRR crossing is an at-grade crossing with passive warning signs.	At-Grade
Driveway on WB Frontage Road	An unpaved driveway providing access to the WB frontage road for an existing Unisource Energy Corporation site located east (true direction) of the UPRR tracks. The existing UPRR crossing is an at-grade crossing with passive warning signs.	At-Grade
Twin Peaks Rd.	Twin Peaks Rd. is an arterial roadway. The existing crossing is grade separated with Twin Peaks Rd. crossing over the UPRR tracks.	Grade Separation
Cortaro Rd.	Cortaro Rd. is an arterial roadway. The existing UPRR crossing is an at-grade crossing with advance warning signs, flashers and gates.	At-Grade
Massingale Rd.	Massingale Rd. is a local street providing access from the neighborhoods north of the UPRR tracks to the WB frontage road. The existing UPRR crossing is an at-grade crossing with advance warning signs, flashers, and gates.	At-Grade
I-10	This UPRR crossing with I-10 is an active railroad spur utilized by the Arizona Portland Cement Company, which is located on the south side of I-10. The existing UPRR crossing with I-10 is grade separated with the UPRR tracks crossing under I-10. In addition, the existing UPRR spur is an at-grade crossing with flashers with both the EB and WB frontage roads.	Grade Separation at I-10; At-Grade with frontage roads
I-10	This UPRR crossing is an abandoned railroad spur. The tracks have been removed and all advance warning signage has been removed.	Abandoned Grade Separation

1.5.5 Drainage

Within the study area, the I-10 corridor is generally bounded by the UPRR tracks on the northeast and the Santa Cruz River on the southwest. The UPRR tracks are immediately adjacent to the I-10 corridor, and continue on this alignment for several miles west and east of the study area. The Santa Cruz River parallels I-10 south of the Avra Valley Road TI, but turns to the west near the Avra Valley Road TI while I-10 and the UPRR continue in a northwesterly direction. The drainage characteristics of the corridor change at this location leaving two distinct areas with differing drainage patterns.

Flows impacting both areas originate in the Tortolita Mountains northeast of the study area. The upper portions of the watersheds consist of steep slopes with more incised channels to convey flow. In the lower reaches, the slopes decrease and runoff is conveyed as sheet flow in a braided network of washes, or at the west end of the corridor as totally dispersed sheet flow across flat areas with no channel definition. The alluvial fan originating from the Tortolita Mountains extends to I-10.

The soils in the area consist of alluvial deposits from the Tortolita Mountains. The Natural Resource Conservation Service soil survey data was used to determine soil types within the watersheds. In areas outside the limits of the detailed study, the Soils Conservation Service (SCS) General Soil Map for Pima County was used to determine soil types. Data obtained from the soils maps indicate that the area soils are generally sandy loams and sandy clay loams.

The distinct drainage characteristics of the two areas are discussed in more detail below.

Tangerine Road to Avra Valley Road

While regional drainage patterns flow from the northeast to the southwest, the flows adjacent to I-10 in this segment are from southeast to northwest. Runoff from the Tortolita Mountains reaches the existing farmland adjacent to the UPRR, and continues through the farmland to the railroad embankment. The railroad embankment is higher than the adjacent farmland and directs flow to the northwest. Because I-10 is higher than the adjacent land, it acts as a watershed boundary with on-site runoff flowing either southwest toward the Santa Cruz River, or northeast under the UPRR tracks. There are no cross drainage culverts under I-10 or the eastbound frontage road between Tangerine Road and Avra Valley Road. Small culverts under the westbound frontage road convey on-site runoff from I-10 to culvert crossings under the UPRR tracks. As-built drawings for I-10 show that in this section the cross culverts under the UPRR tracks are flowing from southwest to northeast, away from I-10. UPRR has recently improved existing culverts as part of their construction of a second track. The new culverts are larger in size and are embedded below the flowline. The intent of this approach is to match existing culvert capacity once sediment deposits in the pipe to the flowline elevation. Design information provided by the Town of Marana indicates that the new culvert slopes are actually designed to flow into the open space between the westbound frontage road and the UPRR tracks. Because the elevation in this open space is generally higher than the elevation northeast of the tracks, these culverts act as equalizer pipes despite the reverse slope on the pipe.

A 132-inch underground pipe (siphon) for the CAP Canal crosses the study area just east of Tangerine Road. The main canal facility extends north from the siphon crossing and does not impede stormwater flows in the study area.

Avra Valley Road to Ina Road

Drainage patterns within this segment of the corridor are from northeast to southwest. Runoff from the Tortolita Mountains to the Santa Cruz River is impeded by the UPRR, the I-10 westbound frontage road, and the I-10 mainline. Existing cross drainage structures under the UPRR are undersized, causing flow from the upstream watersheds to pond at the structures. Excess flows not conveyed by cross drainage structures continue to the northwest along the upstream side of the UPRR to the next cross drainage structure. This pattern is consistent throughout this section of the corridor. Flows that are conveyed in the UPRR cross culverts are in turn conveyed under I-10 facilities in culverts that are also undersized. With the exception of the Twin Peaks Road TI, culverts occur in series under the westbound frontage road, the I-10 mainline, and the eastbound frontage road. The culverts constructed as part of the Twin Peaks Road TI are continuous under the frontage roads and the I-10 mainline.

Previous Studies and Federal Emergency Management Agency (FEMA) Floodplain

The drainage conditions of the Tortolita fan has been studied over many years dating back to the original FEMA studies in the 1980's. The most recent reports are listed below:

- Town of Marana Stormwater Master Plan Phase I Report (Town of Marana, September 1999)
- Twin Peaks Traffic Interchange Final Drainage Report (ADOT, March 2007)
- Hydrologic Analysis for Tortolita Mountain Watersheds Above Alluvial Fan Apexes (Town of Marana, October 2008)

A large portion of the area upstream of the UPRR tracks is within a FEMA 100-year floodplain. The FEMA maps show floodplains created by two separate conditions, specifically the Tortolita alluvial fan and the railroad embankment. The flat slopes approaching the railroad create an alluvial fan floodplain that extends easterly toward the base of the Tortolita Mountains, and the UPRR embankment - with undersized cross culverts - creates an overlapping floodplain that parallels the railroad embankment. Flooding along the railroad impacts the crossroads at interchanges, and any commercial or residential development in the vicinity of the traffic interchanges.

Existing On-Site Conditions

Pavement drainage facilities along the corridor are limited. The existing I-10 mainline and frontage roads generally do not have curb or curb and gutter except at the Twin Peaks Road TI. The Twin Peaks Road TI is the only location where a storm drain system is used to collect pavement drainage, which outfall directly into the cross culverts near the traffic interchange. All other locations convey flow with roadside drainage in the area between the I-10 mainline and frontage road to the next downstream box culvert. As previously mentioned, the culverts are in series under the I-10 mainline and frontage roads, thereby providing an outfall location at the culvert inlets for the roadside drainage. Median drainage is generally collected by median catch basins located immediately upstream of cross culverts, and drain directly into the culvert.

Cortaro Road has extensive drainage facilities on the south side of I-10, and a box culvert crossing on the north side of I-10. On the south, a series of grates across Cortaro Road capture local pavement drainage as well as sheet flow that makes its way from the north side of I-10 through the traffic interchange. The grates discharge at a double-cell box culvert inlet at the intersection of the eastbound frontage road and Cortaro Road. This box culvert extends from the intersection to the Santa Cruz River approximately ½ mile away. On the north side, an existing box culvert approximately 400 feet north of the railroad conveys flows running adjacent to the railroad to the northwest.

Per ADOT's direction, the Twin Peaks Road TI cross drainage improvements were designed based on a series of new culverts being constructed in the future under the I-10 mainline and frontage roads between I-10 Station 4868+50 and 4880+50. Therefore, the existing Twin Peaks Road TI culverts do not currently have capacity of the 50-year design event. The proposed new culverts to be constructed as part of the improvements for this project would need to convey the design flow within these station limits. The existing golf course and subdivision development downstream of this location has been designed to accommodate the additional flow.

1.5.6 Right-of-Way

The existing ADOT right-of-way width varies between approximately 350 feet and 500 feet along the corridor as shown in Table 1.5.

A park and ride lot is located in ADOT right-of-way by permit on the south side of I-10, adjacent to the Cortaro Road TI. Three CMID well sites and a Verizon communications tower are located between the westbound frontage road and the I-10 mainline.

Table 1.5 – Existing ADOT Right-of-Way

Location	Existing ADOT Right-of-Way Width (Ft.)		
	EB	WB	Total
Tangerine Rd. to Avra Valley Rd.	150' – 205'	190' – 300'	340' – 505'
Avra Valley Rd. TI	369'	400'	769'
Avra Valley Rd. to Twin Peaks Rd.	150'	200' – 268'	350' – 418'
Twin Peaks Rd. TI	357'	200'	557'
Twin Peaks Rd. to Cortaro Rd.	150'	200' – 300'	350' – 450'
Cortaro Rd. TI	334'	387'	721'
Cortaro Rd. to Ina Rd.	150'	196' – 383'	346' – 533'

Notes:
1. Right-of-way widths shown are approximate and are intended to be representative of location. Actual widths may vary from values shown in table.
2. Dimensions shown are from existing I-10 median centerline.

1.5.7 Structures

When the interstate highway program constructed I-10 during the 1960's, bridge structures were included for I-10 to pass over Tangerine Road, Avra Valley Road, Cortaro Road, and two UPRR spur tracks. Table 1.6 shows the existing bridge dimensions, structural capacity ratings, vertical clearances, and superstructure and substructure types. The structures over Tangerine Road, Avra Valley Road, and Cortaro Road do not meet the current AASHTO minimum vertical clearance requirement of 16 feet.

The Cortaro Road bridge was originally constructed in 1964 as a three-span structure. The middle span provided a 60-foot-wide clear opening for Cortaro Road. In 2006, the slope paving in the two outside spans was removed and retaining walls were constructed so that travel lanes could be placed between the pier and the new retaining wall in the outside spans. Figure 1.3 shows the north approach of the Cortaro Road TI.

ADOT Project No. 010 PM 240 H5838 01C constructed the Twin Peaks Road TI in 2010.

Figure 1.3 – Cortaro Road TI Looking South

Table 1.6 – Existing Structure Inventory

Structure Name	Str. No.	Milepost	Structure Type	Foundation Type	Existing Clearance (Ft.)	AASHTO/Railroad Minimum Required Clearance	Existing Bridge Length (Ft.)	No. Of Spans	Existing Bridge Width (Ft.)	Bridge Rail Geometry Adequate?	Bridge Rail Structures Adequate?	Existing Structural Capacity
Tangerine TI OP EB	960	240.45	Prestressed Girders	Abutments and piers on driven piles (original construction) and drilled shafts (recent widening)	15.63	16'-0"	127	3	59.2	Yes	Yes	HS-18.33
Tangerine TI OP WB	961	240.45	Prestressed Girders	Abutments and piers on driven piles (original construction) and drilled shafts (recent widening)	15.12	16'-0"	127	3	59.2	Yes	Yes	HS-20
APC RR OP EB	973	242.09	Steel Girders	Abutments and piers on driven piles (original construction) and drilled shafts (recent widening)	23.38	23'-4"	160	3	59.2	Yes	Yes	HS-20
APC RR OP WB	974	242.09	Steel Girders	Abutments and piers on driven piles (original construction) and drilled shafts (recent widening)	23.61	23'-4"	160	3	59.2	Yes	Yes	HS-20
Avra Valley TI OP EB	975	242.95	Prestressed Girders	Abutments and piers on driven piles (original construction) and drilled shafts (recent widening)	15.53	16'-0"	127	3	59.2	Yes	Yes	HS-20+
Avra Valley TI OP WB	976	242.95	Prestressed Girders	Abutments and piers on driven piles (original construction) and drilled shafts (recent widening)	15.42	16'-0"	127	3	59.2	Yes	Yes	HS-20+
AS&R RR OP EB	977	243.33	Steel Girders	Abutments and piers on driven piles (original construction) and drilled shafts (recent widening)	23(1)	N/A(2)	160	3	59.2	Yes	Yes	HS-20+
AS&R RR OP WB	978	243.33	Steel Girders	Abutments and piers on driven piles (original construction) and drilled shafts (recent widening)	23(1)	N/A(2)	160	3	59.2	Yes	Yes	HS-20+
Cortaro Road TI OP EB	864	246.60	Prestressed Girders	Abutments and piers on driven piles (original construction) and drilled shafts (recent widening)	14.69	16'-0"	127	3	59.2	Yes	Yes	HS-20+
Cortaro Road TI OP WB	865	246.60	Prestressed Girders	Abutments and piers on driven piles (original construction) and drilled shafts (recent widening)	14.36	16'-0"	127	3	59.2	Yes	Yes	HS-20+

Notes:
(1) Existing vertical clearance based on 1967 as-builts for clearance over railroad spur. Railroad spur location has been abandoned.
(2) To be removed with Recommended Alternative

1.5.8 Signing and Lighting

Guide Signs

The existing freeway guide signs are supported with cantilever sign supports, and tubular sign bridges. The existing guide signs vary in size, age and legend design since they were designed and installed with numerous projects. Table 1.7 summarizes the existing sign structures in the study area.

Table 1.7 – Existing Sign Structures

Location	Direction of Travel	Existing Stationing(1)	Sign Support Type	Span Length
I-10	EB	4565+15	Cantilever	30'
	WB	4602+28	Cantilever	43'
	WB	4628+68	Cantilever	33'
	EB	4652+08	Cantilever	29'
	WB	4657+35	Cantilever	29'
	EB	4678+49	Cantilever	33'
	EB	4704+68	Cantilever	30'
	WB	4732+00	Cantilever	29'
	EB	4737+94	Cantilever	33'
	WB	4758+40	Cantilever	33'
	EB	4768+76	Cantilever	33'
	WB	4783+85	Cantilever	33'
	EB	4790+74	Cantilever	33'
	WB	4841+06	Cantilever	43'
	EB	4855+79	Cantilever	33'
	WB	4863+49	Cantilever	43'
	WB	4880+66	Cantilever	33'
	EB	4882+19	Cantilever	33'
	EB	4897+09	Cantilever	33'
	WB	4907+06	Cantilever	33'
	WB	4945+60	Cantilever	43'
	WB	4958+82	Cantilever	43'
	WB	4970+32	Cantilever	33'
	EB	4953+22	Cantilever	33'
	EB	4979+43	Cantilever	33'
	EB	4992+64	Cantilever	33'
	WB	4993+09	Cantilever	33'
	EB	5009+46	Cantilever	33'
	WB	5048+50	Cantilever	33'
EB Frontage Road	EB	4816+35	Sign Bridge	80'
WB Frontage Road	WB	4825+15	Sign Bridge	80'
	WB	4918+63	Sign Bridge	90'
Twin Peaks Rd.	EB	91+99	Sign Bridge	186'
	WB	103+14	Sign Bridge	169'
Ina Rd.	WB	42+45	Sign Bridge	95'

Note:
(1)Sign Structure locations and stations taken from as-built plans.

Lighting and Freeway Management System (FMS)

Currently, there is no continuous mainline lighting along I-10 between the Tangerine Road and Ina Road TIs. There are existing 250-Watt high pressure sodium fixtures along the entrance/exit ramps at Twin Peaks Road, Cortaro Road and Ina Road.

There is an existing dynamic message sign (DMS) supported on a U-Pole, designated as Number 412 in the ADOT *Statewide Dynamic Message Sign Masterplan*, on westbound I-10 at Station 4770+50 (MP 245.3).

Conduit and pullboxes were installed for future ramp metering on the Twin Peaks Road TI eastbound and westbound entrance ramps as part of the Twin Peaks Road TI improvements.

1.5.9 Geotechnical

The subsurface conditions were determined based on a review of as-built plans of the various projects completed along I-10 in or adjacent to the study limits and available geologic maps. Geotechnical reports and geotechnical data from within the project limits were utilized in the development of this report.

The project site is located in the Basin and Range Geologic Province of the southwestern US. 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 depositions of the sediments in the newly-formed basins.

The generalized soils encountered in the vicinity of the project site are typically identified as weakly to moderately cemented with lime, low to medium plasticity, interbedded layers of sand containing varying amounts of silt and clay with occasional lenses of gravel and clay. The site soils are generally soft to firm in the upper five feet and moderately firm to very dense at depths greater than five feet. Limited areas with very loose soil at the surface were identified in borings performed at the various structures.

Soils subject to hydro-compaction (i.e. collapse upon wetting) were noted in the Interstate 10 Traffic Interchange at Twin Peaks/Linda Vista Final Geotechnical Report, Golder Associates (June 2008), but were present throughout the project limits. The soils subject to hydro-compaction were identified along Twin Peaks Road and the eastbound and westbound frontage roads, between Avra Valley Road and Cortaro Road generally to a depth of approximately five feet below ground surface. Treatment of these soft hydro-collapsible soils generally consisted of overexcavation and replacement.

No earth fissures are known to have been mapped in the project limits upon review of the fissure maps produced by the Arizona Geological Survey (AZGS) (AZGS, 2012). However, earth fissures have been observed and documented in Avra Valley, particularly near the northwest intersection of Trico Road and Avra Valley Road. Additionally, sporadic earth fissures have been documented along Sandario Road between Avra Valley Road and Ajo Highway.

The local groundwater table is estimated to be at least 100 feet or more below the ground surface based on review of Tucson Basin and Avra Valley depth to water maps (City of Tucson, 2005). However, perched groundwater was encountered in boreholes for elements of the Twin Peaks Road bridges over the Santa Cruz River and the westbound Cortaro Road Bridge. The depth to perched water would vary throughout the year and would be highly influenced by: water in the Santa Cruz River, the frequency of precipitation events, and the rate of discharge from the Ina Road Wastewater Treatment Facility. It is possible that perched groundwater would be encountered at every bridge element near the Santa Cruz River.

Four piezometers were installed by AGRA Engineering and Global Solutions (2000) between the access roads to the eastbound frontage road and the sand and gravel pit located immediately south of I-10 between Ina Road and Sunset Road. Groundwater was encountered in all piezometers at depths ranging from approximately 74 to 85 feet below ground surface or between the elevations of 2,100 feet and 2,109 feet above mean sea level.

1.5.10 Existing Pavement Structural Sections

As-built plans were reviewed to inventory the I-10 mainline, ramps and crossroad pavement sections. The typical I-10 mainline, ramp, and crossroad pavement sections consist of asphalt rubber asphaltic concrete friction course (AR-ACFC) over asphalt concrete (AC) over aggregate base (AB) (Class 2) over asphalt cement base (ACB) over select base material. The existing pavement sections are summarized in Appendix C.

2.0 CRASH AND TRAFFIC ANALYSIS

A separate Traffic Report was prepared as part of this project. The following sections summarize the results of the crash analysis, and the existing and future traffic conditions and analysis.

2.1 CRASH ANALYSIS

Crash data was obtained from ADOT's Traffic Safety Section for the five-year period between March 1, 2006 and February 28, 2011 for I-10, from the Tangerine Road TI to just west of the Ina Road TI (between MP 240 and MP 248), and all ramps, crossroads, and frontage roads in this segment.

A total of 748 crashes were recorded along the I-10 mainline, ramps, frontage roads, and intersections for the five-year period. From the 748 crashes reported, 467 crashes (62.4%) occurred on the mainline, 44 crashes (5.9%) happened on the ramps, and 237 crashes (31.7%) took place on the frontage roads. In terms of injury severity, a total of six fatal crashes (four on the mainline and two on the frontage roads) were recorded. The fatal crashes represent 0.8% of the crashes reported. Crashes involving an injury, possible injury, non-incapacitating injury correspond to 23.5% of the total crashes. Lastly, property damage only (PDO) crashes represent 75.7% of the 748 crashes. Table 2.1 summarizes the mainline, ramp, and frontage road related crashes by location and severity.

Table 2.1 – Crash Summary by Location and Severity

Road Segment		Number of Crashes					
		Fatal	Injury			PDO	Total
			Incapacitating	Non-Incapacitating	Possible		
I-10	Tangerine Rd. to Avra Valley Rd.	1	0	8	2	72	83
	Avra Valley Rd. to Twin Peaks Rd.	0	5	20	7	104	136
	Twin Peaks Rd. to Cortaro Rd.	1	4	13	11	87	116
	Cortaro Rd. to Ina Rd.	2	1	11	7	111	132
	Subtotal	**4**	**10**	**52**	**27**	**374**	**467**
Ramps	Tangerine Rd.	0	0	1	2	4	7
	Avra Valley Rd.	0	0	0	0	6	6
	Twin Peaks Rd.(1)	0	0	0	0	0	0
	Cortaro Rd.	0	0	2	2	13	17
	Ina Rd.	0	0	2	4	8	14
	Subtotal	**0**	**0**	**5**	**8**	**31**	**44**
Frontage Roads	Tangerine Rd.	0	0	9	8	40	57
	Benta Vista St.	0	0	0	0	3	3
	Avra Valley Rd.	1	4	9	14	38	66
	Twin Peaks Rd.(1)	0	0	0	0	0	0
	Cortaro Rd.	0	1	2	14	53	70
	Ina Rd.	1	0	5	5	25	36
	Arizona Pavilions Dr.	0	0	0	1	1	2
	Burlingame Rd.	0	1	0	0	1	2
	Hartman Ln.	0	1	0	0	0	1
	Subtotal	**2**	**7**	**25**	**42**	**161**	**237**
TOTAL CRASHES		**6**	**17**	**82**	**77**	**566**	**748**

Note:
(1) Crashes described for Twin Peaks Road only cover the time period from November 2010 through February 2011, as the TI opened in November 2010.

A detailed analysis of the crashes recorded on the I-10 mainline was conducted. Key findings of the analysis include the following:

- Single vehicle crashes accounted for 49.0% (229) of the mainline crashes
- After single vehicle crashes, the most common manner of collision was sideswipe (20.3% - 95 crashes), closely followed by rear-end collisions (18.6% - 87 crashes)
- Approximately 80% (592) of the crashes involved small vehicles (motorcycles, passenger cars and pick-up trucks)
- Most crashes occurred in the eastbound direction (57.4% - 268 crashes)
- Crashes that occurred during daylight hours represent 63.4% (296) of the mainline crashes
- Over 85% (405) of the crashes happened on dry pavement where weather conditions were either clear, or at worst, cloudy
- The first harmful occurrence cited most often was a collision with another motor vehicle (57.8% - 428 crashes)

Crash rates for a roadway segment are expressed in terms of crashes per million vehicle miles traveled (mvmt), and are calculated using the following equation:

$$Crash\ rate\,(crash/mvmt) = \frac{\#Crashes \times 1{,}000{,}000}{Segment \cdot Length \times AADT \times 365\dfrac{days}{year} \times 5years}$$

where AADT is the annual average daily traffic over the last five years. Note that the denominator of the equation represents five years' worth of vehicle miles traveled.

Crash rates for the I-10 mainline were calculated and are shown graphically in Figure 2.1. The average crash rate for the study segment is 0.46 crashes per movement with a standard deviation of 0.05 crashes per movement.

The highest crash rate was calculated on the I-10 segment between Avra Valley Road and Twin Peaks Road. However, the crash data was collected during the time period when the Twin Peaks Road TI was under construction.

To provide a basis for comparison, crash rates from the DCR's prepared for the segments of I-10 east and west of this study corridor were gathered. The crash rate on I-10, Junction I-8 to Tangerine Road, was 0.64 crashes per movement and the crash rate on I-10, Ina Road to Ruthrauff Road was 0.55 crashes per movement.

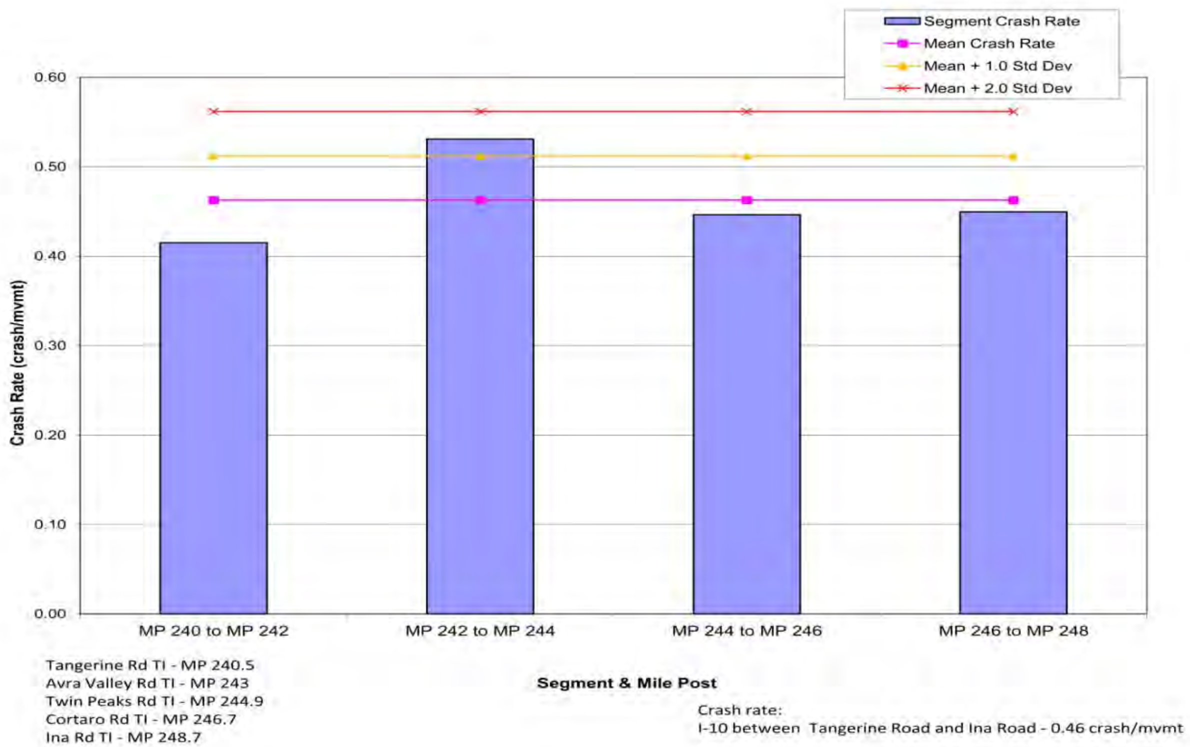


Figure 2.1 – Crash Rate by Mileposts

Ramp related crashes were also evaluated as part of the crash analysis. The highest number of crashes was reported at the Cortaro Road ramps where the highest traffic volumes were counted. A total of 17 crashes occurred at this location, of which 13 involved property damage only and 4 involved an injury, possible injury, non-incapacitating injury, or incapacitating injury. No fatal crashes were reported at the ramps located in the study limits. No ramp related crashes occurred at Twin Peaks Road within the five-year period analyzed as these ramps opened in November of 2010.

Likewise, intersection related crashes were analyzed and it was concluded that the highest number of crashes also occurred at the intersection of the frontage roads and Cortaro Road. A total of 70 crashes were reported at the Cortaro Road TI, of which 53 involved property damage only and 17 involved an injury, possible injury, non-incapacitating injury, or incapacitating injury. No fatal intersection related crashes were recorded on the ramps in the study limits.

Crash data related to the UPRR crossing at Cortaro Road was gathered from the Federal Railroad Administration Office of Safety Analysis. The vehicular-train collision data was collected for the last ten years from 2002 to 2011. During this period, four injury and property damage only crashes were reported. The crashes at the Cortaro Road/UPRR crossing are summarized in Table 2.2.

Table 2.2 – Crash Data at Cortaro Road/UPRR Crossing

Incident No.	Date	Time	Type of Vehicle	Injury Severity	Narrative Description (as summarized on report)
0410TS004	04/15/2010	08:28 AM	Pick-up Truck	PDO	Stopped on crossing before gates descended
0110TS003	01/09/2010	01:30 PM	Truck-trailer	PDO	Struck center of trailer of tractor trailer rig
0604TS028	06/06/2004	11:25 AM	Auto	PDO	Rolled forward under gate
0702TS021	07/24/2002	02:30 AM	Pick-up Truck	Injury	Drove around or thru gate

2.2 EXISTING TRAFFIC CONDITIONS

Historical traffic count data was obtained from ADOT Multimodal Planning Division (MPD) for years 2007 through 2010, as shown in Table 2.3. To evaluate existing traffic conditions in the project corridor, traffic volumes were collected from Monday, October 17, 2011 through Sunday, October 23, 2011. The traffic volumes collected include counts on the mainline, ramps, frontage roads, major crossroads, and principal intersections surrounding the traffic interchanges. Twenty-four hour volume data was recorded on all seven days for the mainline and frontage roads. Twenty-four hour volume data was recorded on the ramps and crossroads on October 19th and 20th. Turning movement counts were collected during a weekday AM and PM peak hour periods. The existing Average Daily Traffic (ADT) and peak hour volumes are shown in Figure 2.2.

Table 2.3 – Historic Traffic Volumes (Vehicles per Day)

Location	2007	2008	2009	2010
Tangerine Rd. to Avra Valley Rd.	54,500	55,500	57,000	58,000
Avra Valley Rd. to Cortaro Rd.	72,000	72,500	74,500	76,000
Cortaro Rd. to Ina Rd.	80,500	81,500	83,000	85,000

Based on the traffic counts collected for this study, the 2011 ADT on the I-10 mainline is approximately 69,500 vehicles per day (vpd). The traffic volumes vary in the study area from approximately 53,700 vpd at the west end (east of Tangerine Road) to approximately 91,000 vpd at the east end (west of Ina Road). The highest ramp traffic volume occurred on the Cortaro Road westbound exit ramp (14,000 vpd).

The traffic counts collected in October 2011 indicate that the portion of ADT occurring within the peak hour is approximately 6% to 8%, the directional distribution is approximately 55% to 65% in the peak direction of travel, and approximately 22% of the daily traffic is classified as commercial vehicles (trucks).

The traffic factors listed in the ADOT MPD Roadway Inventory Management System for 2010 show that 9% of the ADT occurs within the peak hour, the directional distribution is 55%, and 19% of the daily traffic is classified as commercial vehicles (trucks).

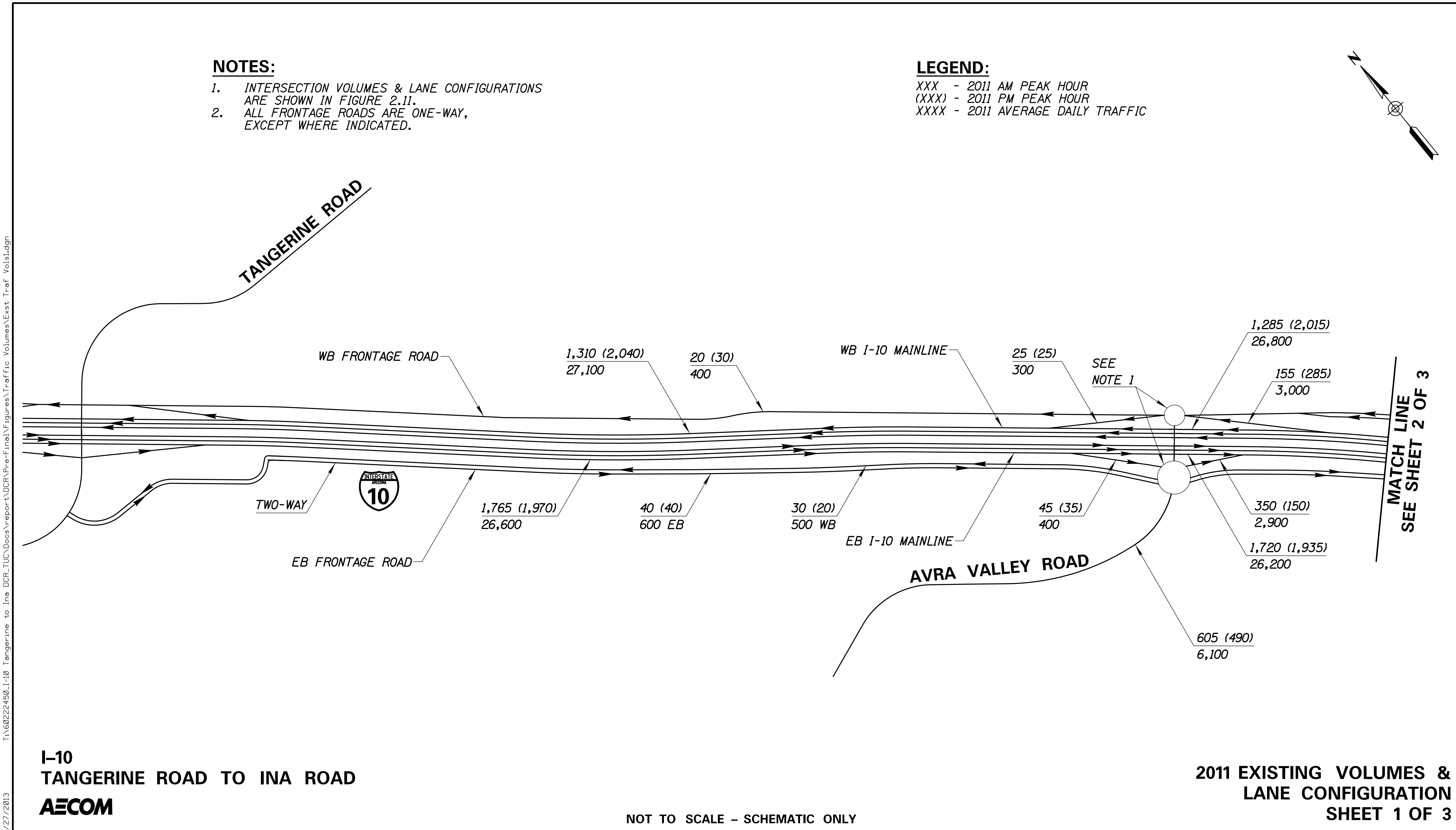


Figure 2.2 – 2011 Existing Volumes & Lane Configuration

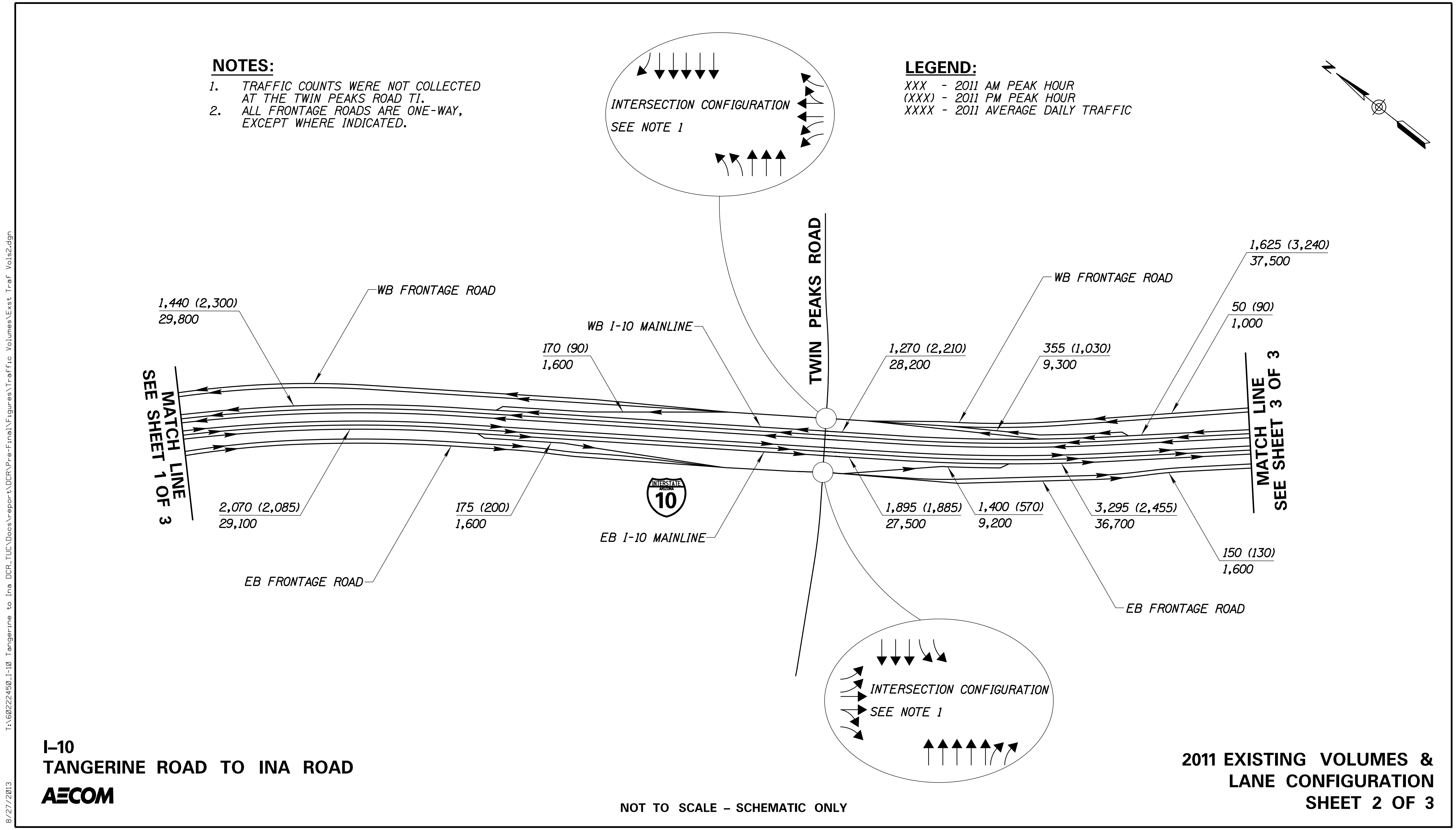


Figure 2.2 – Continued

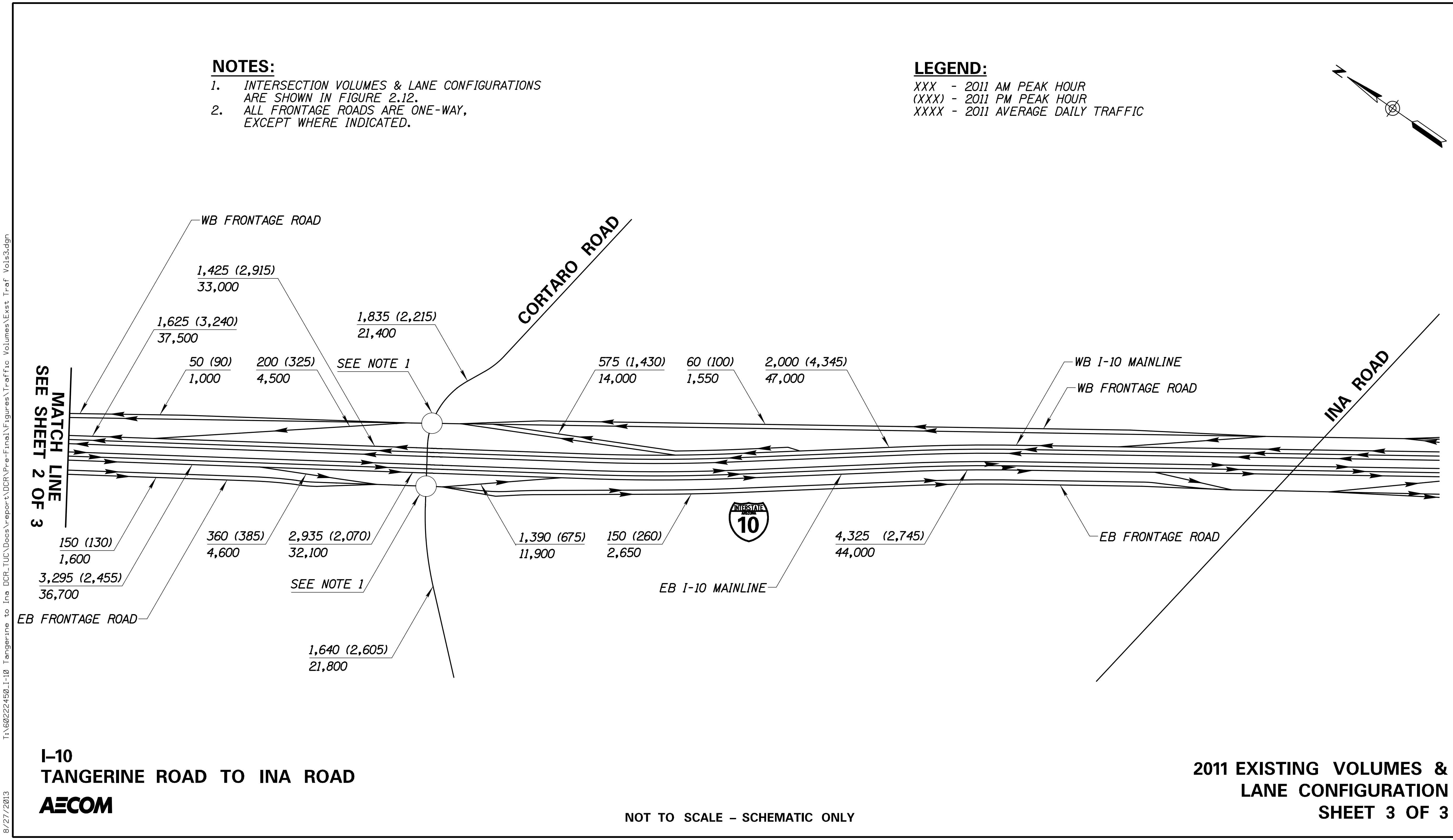


Figure 2.2 – Continued

2.3 FUTURE TRAFFIC CONDITIONS

2.3.1 Description of Alternatives

Two alternatives were developed and evaluated for 2040 traffic conditions: the No-Build Alternative and a Build Alternative. The No-Build Alternative would not include any improvements to this segment of the I-10 corridor.

The Build Alternative would include the following improvements:

- Expand I-10 to add two travel lanes in both directions between Tangerine Road and Ina Road (ten-lane freeway) with a closed median
- Include parallel entrance and exit ramps in both directions on I-10 at all traffic interchanges
- Provide continuous two-lane, one-way frontage roads
- Reconstruct the Avra Valley Road TI to:
    - Pass over I-10
    - Widen Avra Valley Road to include a raised curbed median, four travel lanes (two travel lanes in each direction) and left- and right-turn lanes as warranted
    - Accommodate the future extension of Avra Valley Road to the north over the UPRR by the Town of Marana or others
- Reconstruct the Cortaro Road TI to:
    - Pass over I-10 and the UPRR
    - Widen Cortaro Road to include a raised curbed median, six travel lanes (three travel lanes in each direction) and left- and right-turn lanes as warranted

2.3.2 Traffic Volume Projections

PAG provided traffic volume projections for Design Year 2040. PAG maintains a regional traffic forecasting model to develop future traffic volume projections based on projected socioeconomic, population, employment, origin-destination, and other regionally based data. The 2040 PAG travel demand model includes all transportation system improvements identified in the RTP through year 2040. Based on the review of the transportation plans, the study team recommended the following modifications to the 2040 standard RTP transportation network for traffic modeling purposes:

- Six lanes on Twin Peaks Road from Coachline Road to I-10
- Extension of Avra Valley Road/Lambert Lane (a four-lane roadway) from I-10 to Twin Peaks Road
- Five travel lanes in each direction on I-10 from Prince Road to the Pima/Pinal County line with three travel lanes in each direction on I-10 from Ina Road to Tangerine Road for the No-Build Alternative

The modifications to the 2040 PAG travel demand model were approved by ADOT, FHWA, PAG, Pima County DOT and the Town of Marana DOT.

Network travel demand output was provided by PAG for the No-Build and Build Alternatives. The output from the model includes daily and peak period traffic volumes. The 2040 traffic volume projections that were received from PAG were post-processed and balanced across the network.

The 2040 No-Build traffic projections along the corridor are expected to be, on average, approximately 160% higher than the 2011 traffic volumes as illustrated in Table 2.4. The 2040 Build traffic projections are anticipated to be, on average, approximately 195% higher than existing counts (2011 traffic volumes) and the 2040 Build traffic projections are approximately 13% higher than the 2040 No-Build traffic projections. The 2040 traffic volume projections and lane configuration for the No-Build Alternative are shown in Figure 2.3. The 2040 traffic volume projections and lane configuration for the Build Alternative are shown in Figure 2.4.

Table 2.4 – Existing and Future Traffic Volumes

Segment	Daily Traffic Volumes			Percent Increase	
	2011 Existing	2040 No-Build	2040 Build	2040 No-Build	2040 Build
Tangerine Rd. to Avra Valley Rd.	53,700	164,300	185,100	205.96%	244.69%
Avra Valley Rd. to Twin Peaks Rd.	58,900	168,300	190,700	185.74%	223.77%
Twin Peaks Rd. to Cortaro Rd.	74,200	177,200	203,500	138.81%	174.26%
Cortaro Rd. to Ina Rd.	91,000	193,400	215,800	112.53%	137.14%
Average	69,500	175,800	198,800	160.76%	194.97%

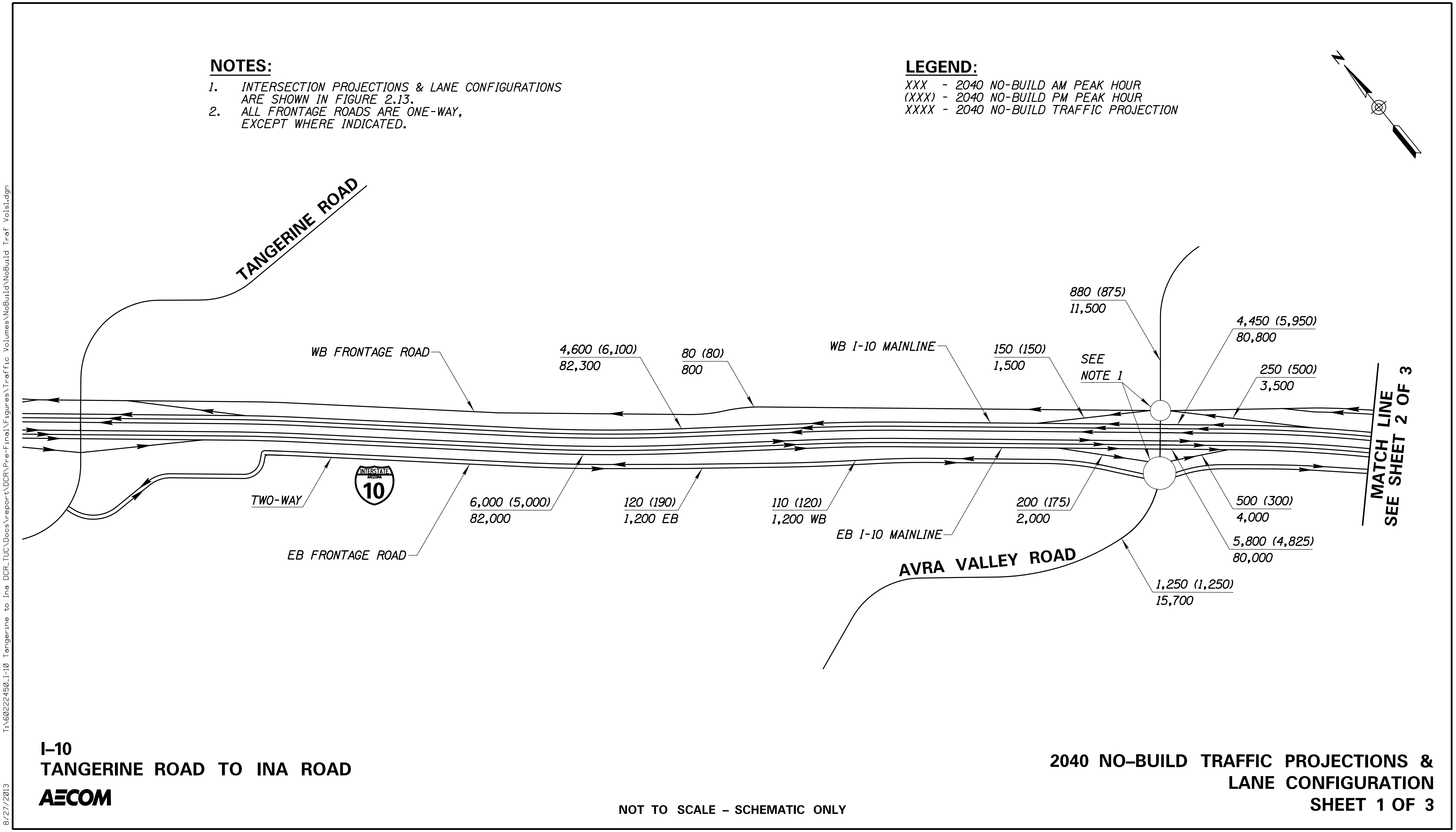


Figure 2.3 – 2040 No-Build Traffic Projections & Lane Configuration

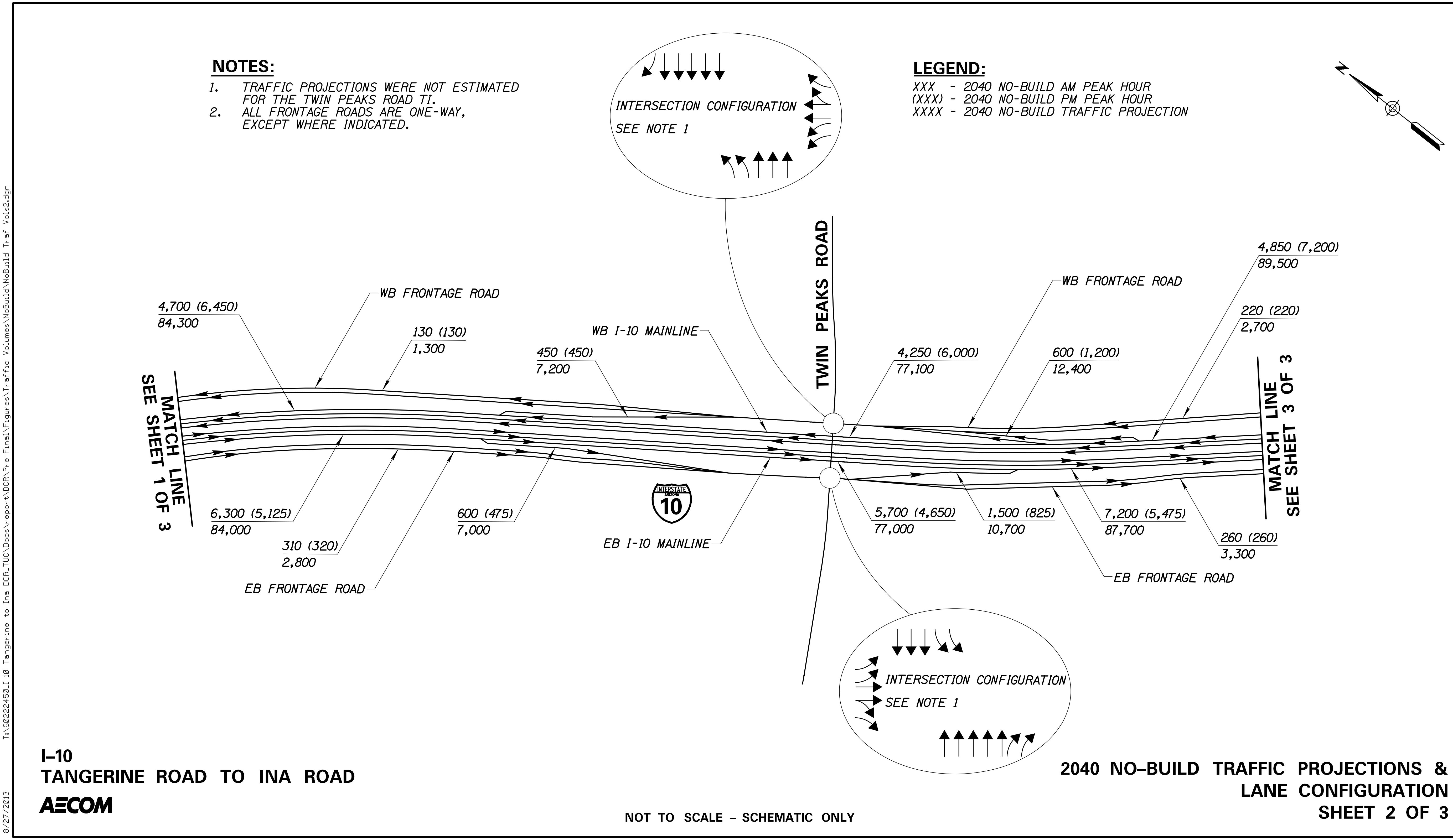
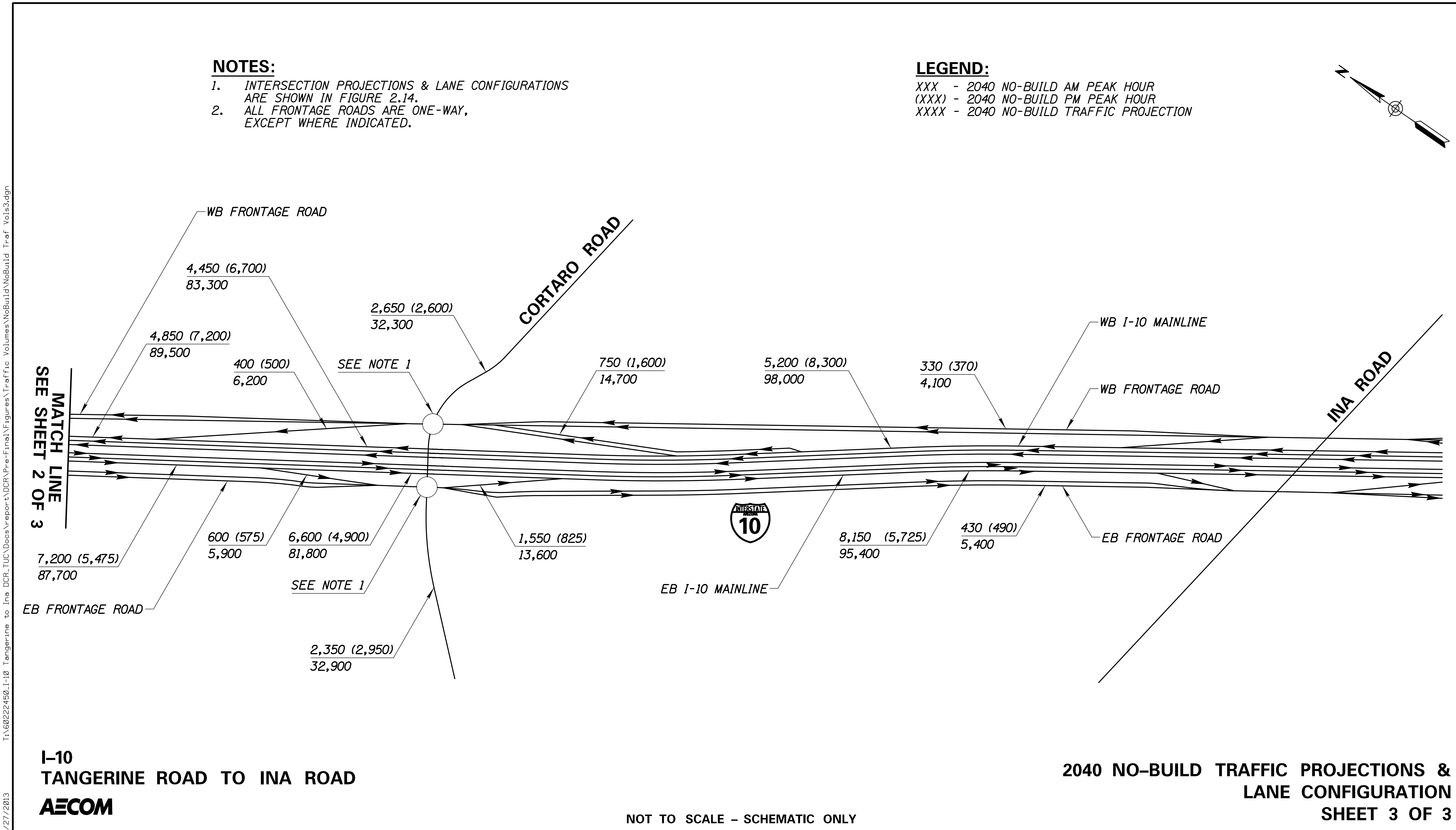


Figure 2.3 – Continued



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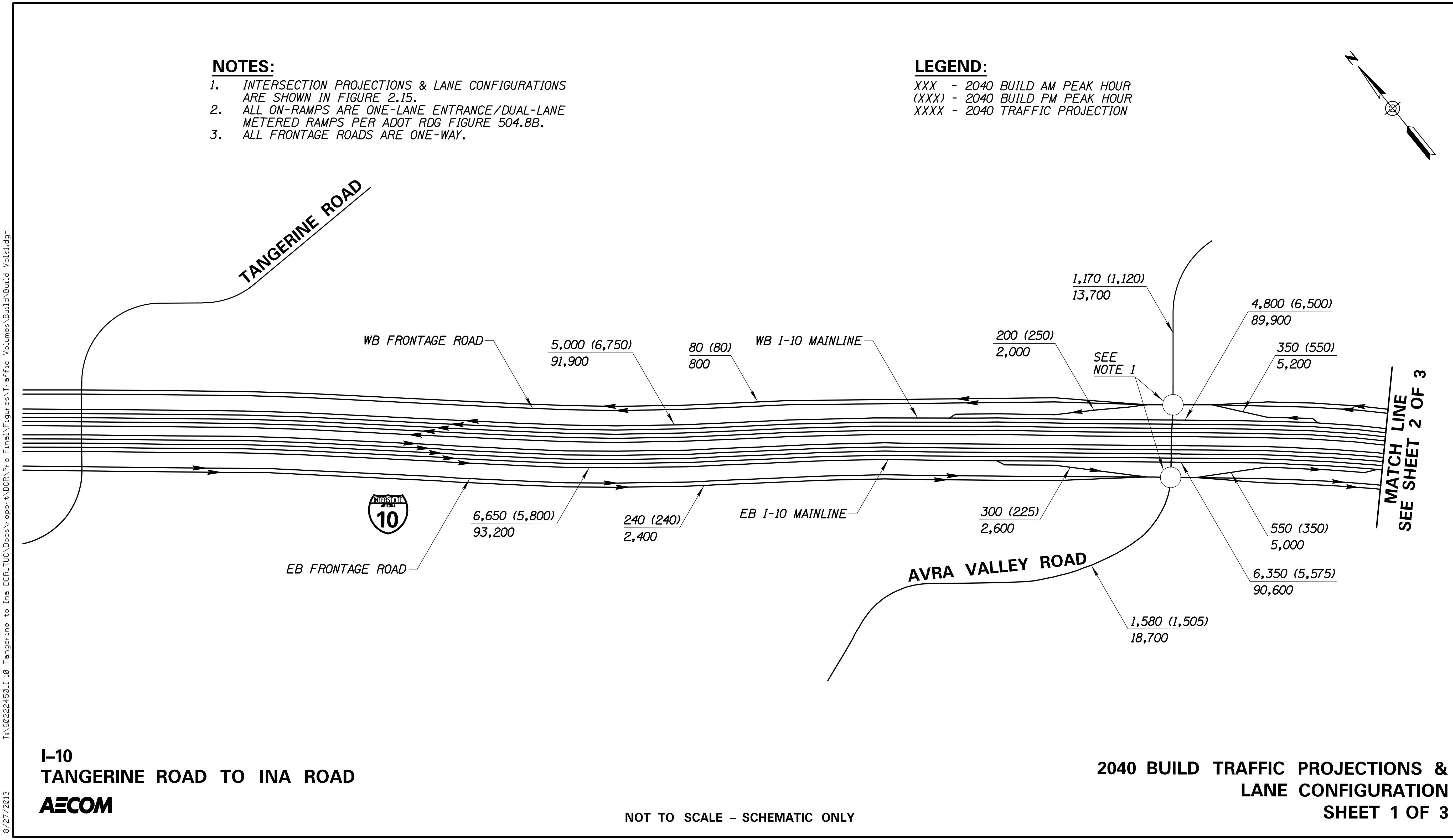
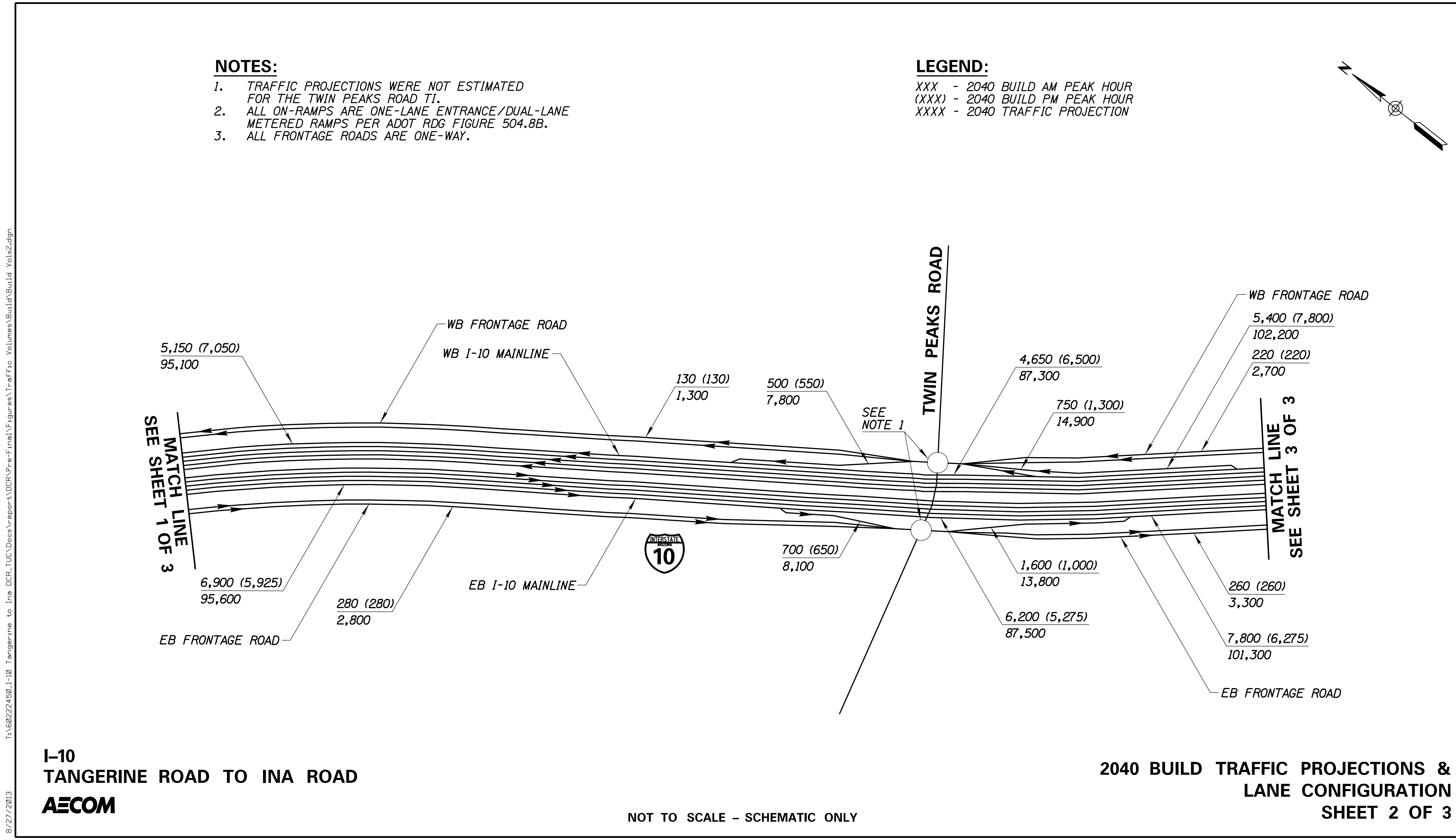


Figure 2.4 – 2040 Build Traffic Projections & Lane Configuration



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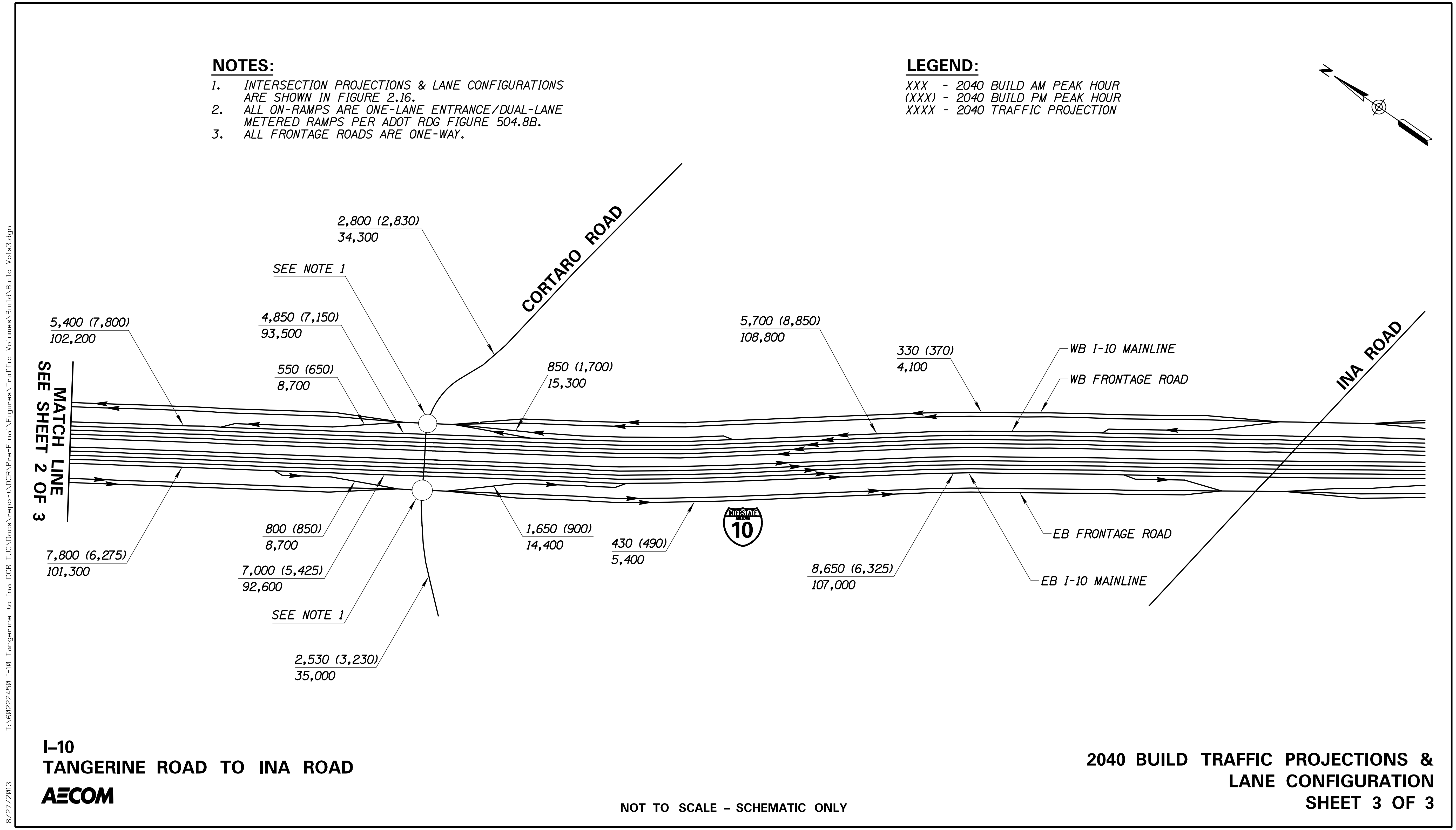


Figure 2.4 – Continued

2.4 OPERATIONAL ANALYSIS

Traffic operational analyses were conducted for the existing condition, and the No-Build and Build Alternatives. The following sections describe the analysis methodology and evaluation results.

2.4.1 Freeway Analysis Methodology

The CORSIM computer program was used to provide a simulation of the entire freeway system in the study area. CORSIM is a microscopic traffic simulation program that uses roadway geometry and traffic volume inputs to simulate operations of an entire freeway network.

CORSIM has the ability to provide various measures of effectiveness for each link in the system. The vehicle density and speed outputs from CORSIM were used as the measure of effectiveness to relate to a LOS as established by the Highway Capacity Manual (HCM).

Table 2.5 depicts the vehicle densities (passenger cars per mile per lane [pc/mi/ln]) and corresponding LOS established in the HCM.

Table 2.5 – Vehicle Densities and Corresponding Levels-of-Service

Level-of-Service	Density Range (pc/mi/ln)
A	0-11
B	>11-18
C	>18-26
D	>26-35
E	>35-45
F	>45

Source: 2010 HCM, pg. 10-9

In order to verify the CORSIM output, additional analyses were performed using the HCS for basic freeway segments, which uses the procedures from the HCM to provide the traffic operational characteristics in terms of LOS. HCS is generally not used to analyze a major freeway network as it has limited capability to address the cumulative effects of delay on an entire system. For example, a severe upstream bottleneck may limit the amount of traffic reaching a downstream location which may not be accurately accounted for in the HCS algorithm. Similarly, a severe downstream bottleneck may cause queuing to such an extent that it effects an upstream location. Therefore, CORSIM was used to evaluate the entire system and HCS was used to verify the CORSIM results.

The following CORSIM model input assumptions were used for the operational analysis:

- Free flow speed of 65 mph for the I-10 mainline general-purpose lanes
- Free flow speed of 50 mph for the service interchange ramps
- Commercial vehicle percentage was assumed to be 18% during the AM peak hour and 14% during the PM peak hour

Frontage roads were not included in the CORSIM modeling.

The existing conditions CORSIM model was calibrated following FHWA guidelines set forth in *Traffic Analysis Toolbox Volume IV: Guidelines for Applying CORSIM Microsimulation Modeling Software*.

2.4.2 Interchange Analysis Methodology

Intersection analyses were conducted for the existing conditions, No-Build, and the Build Alternatives. The analysis for the Build Alternative was conducted to optimize the lane configurations for the Avra Valley Road and Cortaro Road TIs. The peak hour traffic volumes for this analysis were based on the post-processed 2040 traffic volume projections described in the previous section. The ramp volumes and arterial street approach volumes were converted to intersection turning volumes based on the existing traffic patterns and future trends of the PAG model.

Intersection LOS analyses were conducted using Synchro 8.0 in accordance with procedures outlined in the 2000 HCM for signalized intersections. Table 2.6 shows the control delays and corresponding LOS established in the HCM for signalized intersections.

Table 2.6 – Intersection Delay and Corresponding Levels-of-Service

Level-of-Service	Signalized Intersection Control Delay (seconds/vehicle)	Two-Way Stop Controlled Intersection Control Delay (seconds/vehicle)
A	0-10.0	0-10.0
B	>10.0-20.0	>10.0-15.0
C	>20.0-35.0	>15.0-25.0
D	>35.0-55.0	>25.0-35.0
E	>55.0-80.0	>35.0-50.0
F	>80.0	>50.0

Source: 2000 HCM, pgs. 16-2 and 17-2

The following assumptions/input parameters were used in the intersection analysis:

- Peak Hour Factor (PHF): for existing conditions the PHF was calculated based on the traffic counts collected for this project. For the analysis of future conditions a PHF of 0.92 was assumed
- Vehicle travel speed: 45 mph
- Intersection spacing: based on existing or proposed roadway geometrics
- Lane widths: 12 feet
- Base saturation flow rate: 1,900 passenger-cars per hour per lane (pcphpl) for all movements
- Right-turn on red movements: these traffic movements were included in the analysis and modeled in the software
- Cycle length: between 90 and 140 seconds

The 2040 traffic volume projections were adjusted by utilizing a 0.92 peak hour factor to provide an appropriate “safety factor” for the analysis. The resulting control delays obtained from the Synchro software for each approach movement were used to develop a cumulative average control delay for the total interchange. In addition, truck percentages obtained from the classification counts taken on the crossroads in October 2011 and shown in Table 2.7 were used.

Table 2.7 – Existing Crossroads Truck Percentages

Roadway	Heavy Vehicle
Avra Valley Rd. south (west) of I-10	5.8%
Cortaro Rd. south (west) of I-10	3.5%
Cortaro Rd. north (east) of I-10	8.6%

2.4.3 Freeway Analysis Results

Traffic operational analyses were conducted using the CORSIM traffic simulation computer program to evaluate the LOS that would be provided for the Existing Conditions, and the No-Build and Build Alternatives.

Existing Conditions

The lane configurations, AM and PM peak hour traffic volumes, and CORSIM LOS analysis results for the Existing Conditions (2011) are depicted in Figure 2.5 and Figure 2.6. The results of the analysis indicate all segments of the I-10 mainline operate at LOS 'D' or better during the AM and PM peak hours. The supplemental HCS analysis provided results very similar to the CORSIM analysis.

No-Build Alternative

The No-Build Alternative lane configurations, 2040 AM and PM peak hour traffic volume projections, and CORSIM LOS analysis results are shown in Figure 2.7 and Figure 2.8. Under this scenario, significant congestion (LOS 'E' or 'F') would be expected to occur in the following segments of the I-10 mainline:

- AM Peak Hour - eastbound I-10 mainline from Tangerine Road to Ina Road
- PM Peak Hour - westbound I-10 mainline from Cortaro Road to Ina Road

In the PM peak hour, severe congestion is expected in the westbound direction of travel at the eastern end of the project. Since this bottleneck is anticipated at the beginning of the study area, the CORSIM simulation shows that the congestion is inhibiting the traffic from entering the system and not allowing the traffic to flow beyond Cortaro Road. Therefore, west of Cortaro Road, the corridor operates at LOS 'D' since the traffic is bottlenecked east of Ina Road. Therefore, the supplemental HCS analysis shows that all westbound segments would operate as LOS 'E' or 'F'. The supplemental HCS analysis for eastbound I-10 provided results very similar to the CORSIM analysis.

Build Alternative

The Build Alternative lane configurations, 2040 AM and PM peak hour traffic volume projections, and CORSIM LOS analysis results are shown in Figure 2.9 and Figure 2.10. Under this scenario, all segments of the I-10 mainline would operate at LOS 'D' or better during the AM and PM peak hours. The supplemental HCS analysis provided results very similar to the CORSIM analysis.

2.4.4 Interchange Analysis Results

The results of the interchange LOS analysis are shown in Table 2.8.

Existing Conditions

The existing lane configurations and AM and PM peak hour traffic volumes for the Existing Conditions (2011) are depicted in Figure 2.11 and Figure 2.12. As shown in Table 2.8, the results of the analysis indicate Avra Valley Road currently operates at LOS 'B' during the AM and PM peak hours and Cortaro Road currently operates at LOS 'E' during the AM and PM peak hours.

No-Build Alternative

The No-Build Alternative lane configurations and 2040 AM and PM peak hour traffic volume projections are shown in Figure 2.13 and Figure 2.14. As shown in Table 2.8, significant congestion (LOS 'E' or 'F') would be expected to occur at both the Avra Valley Road and Cortaro Road TIs.

Build Alternative

Based on the prevalent use of full diamond interchanges along I-10, and the one-way frontage roads, diamond interchanges were considered the primary alternative for inclusion in the Build Alternative. The Build Alternative would include full diamond interchanges at Avra Valley Road and Cortaro Road with parallel ramp connections to the I-10 mainline in both directions. The traffic analyses were performed with two travel lanes in each direction on Avra Valley Road, and three travel lanes in each direction on Cortaro Road. The Build Alternative lane configurations and 2040 AM and PM peak hour traffic volume projections are shown in Figure 2.15 and Figure 2.16. As shown in Table 2.8, the overall interchanges would operate at LOS 'D' or better during the AM and PM peak hours.

Table 2.8 – Interchange Analysis Results

Option	Approach	Period	Delay (Sec/Veh)	LOS	Cycle Length (Sec)	Overall Signalized LOS
Avra Valley Road						
Existing Conditions	EB Frontage Road (stop control)	AM	13.2	B	N/A	N/A
	EB Exit Ramp (stop control)	AM	10.2	B	N/A	N/A
	WB Exit Ramp (stop control)	AM	10.1	B	N/A	N/A
	EB Frontage Road (stop control)	PM	13.6	B	N/A	N/A
	EB Exit Ramp (stop control)	PM	11.0	B	N/A	N/A
	WB Exit Ramp (stop control)	PM	11.3	B	N/A	N/A
2040 No-Build Alternative	EB Frontage Road (stop control)	AM	148.5	F	N/A	N/A
	EB Exit Ramp (stop control)	AM	112.4	F	N/A	N/A
	WB Exit Ramp (stop control)	AM	133.1	F	N/A	N/A
	EB Frontage Road (stop control)	PM	375.5	F	N/A	N/A
	EB Exit Ramp (stop control)	PM	56.1	F	N/A	N/A
	WB Exit Ramp (stop control)	PM	254.4	F	N/A	N/A
2040 Build Alternative	EB Exit Ramp	AM	21.3	C	60	C
	WB Exit Ramp		21.4	C		
	Avra Valley Rd. NB		22.9	C		
	Avra Valley Rd. SB		30.8	C		
	EB Exit Ramp	PM	21.2	C	60	C
	WB Exit Ramp		21.7	C		
	Avra Valley Rd. NB		21.8	C		
	Avra Valley Rd. SB		28.4	C		
Cortaro Road						
Existing Conditions	EB Exit Ramp	AM	53.3	D	153	E
	WB Exit Ramp		40.7	D		
	Cortaro Rd. NB		57.2	E		
	Cortaro Rd. SB		62.1	E		
	EB Exit Ramp	PM	61.0	E	153	E
	WB Exit Ramp		48.9	D		
	Cortaro Rd. NB		78.1	E		
	Cortaro Rd. SB		61.5	E		
2040 No-Build Alternative	EB Exit Ramp	AM	66.1	E	153	E
	WB Exit Ramp		63.2	E		
	Cortaro Rd. NB		75.9	E		
	Cortaro Rd. SB		85.1	F		
	EB Exit Ramp	PM	54.6	D	153	E
	WB Exit Ramp		65.6	E		
	Cortaro Rd. NB		107.0	F		
	Cortaro Rd. SB		77.5	E		
2040 Build Alternative	EB Exit Ramp	AM	60.2	E	90	D
	WB Exit Ramp		34.8	C		
	Cortaro Rd. NB		48.6	D		
	Cortaro Rd. SB		54.9	D		
	EB Exit Ramp	PM	39.8	D	90	D
	WB Exit Ramp		36.5	D		
	Cortaro Rd. NB		40.5	D		
	Cortaro Rd. SB		40.6	D		

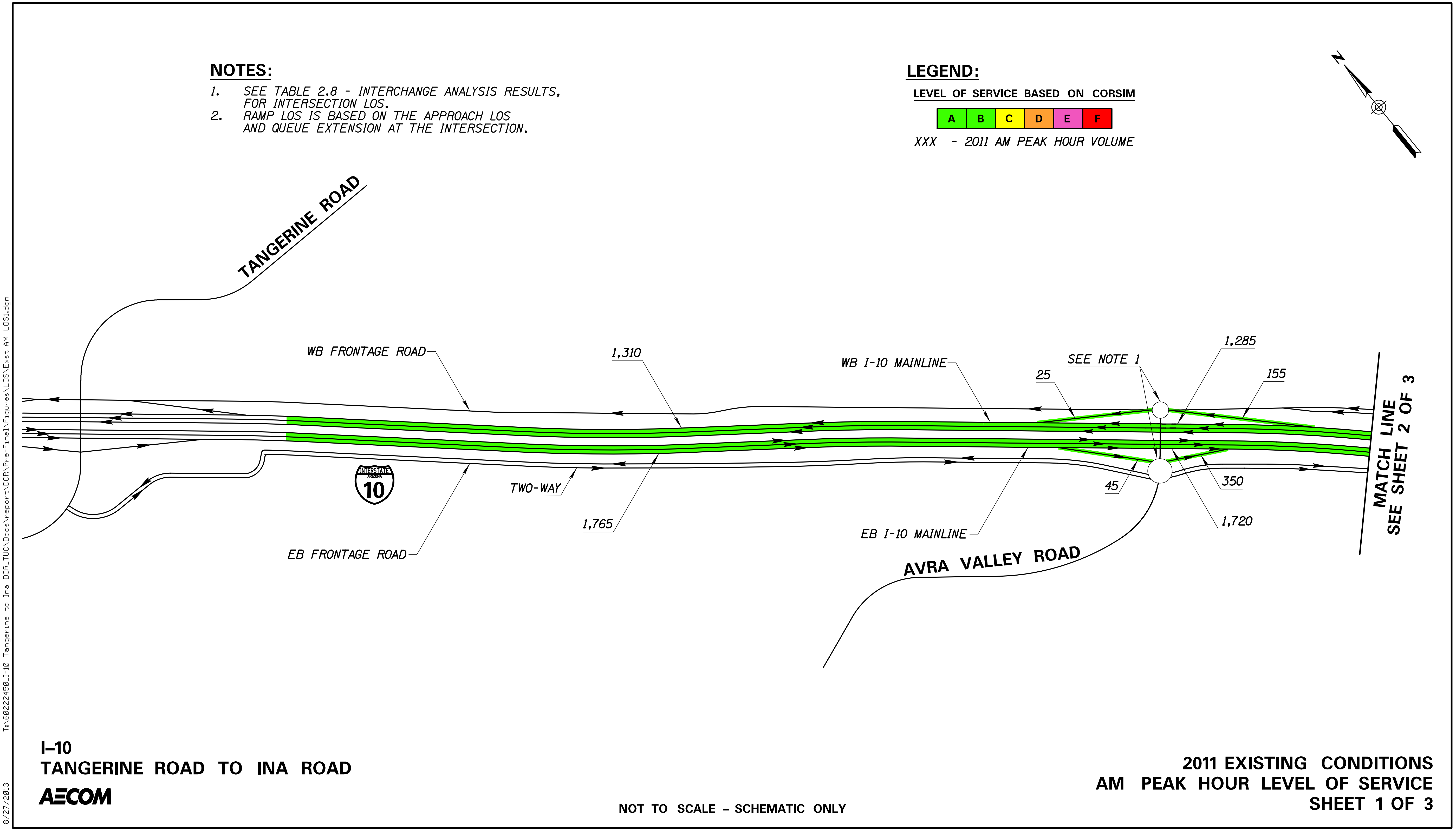
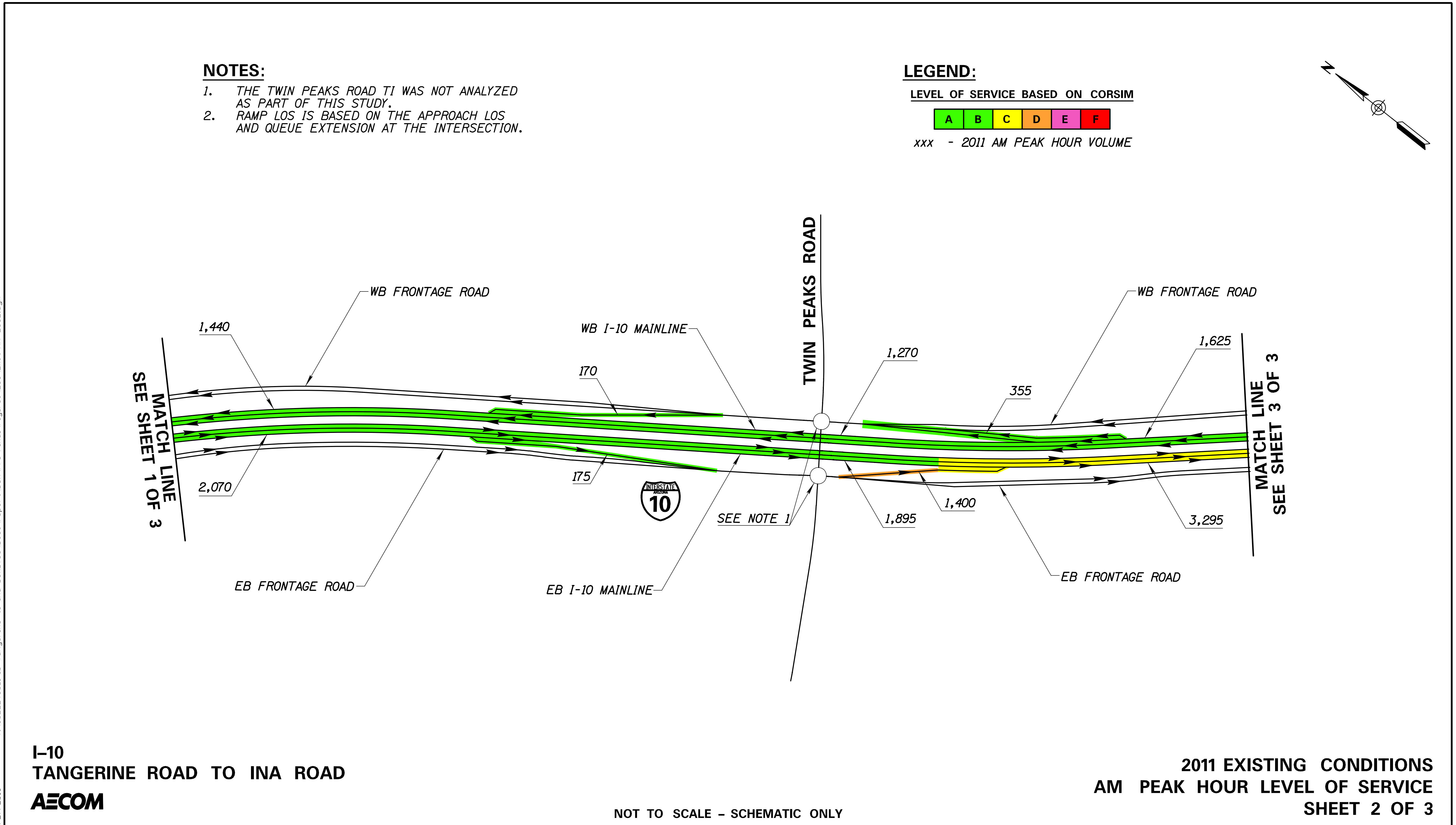


Figure 2.5 – 2011 Existing Conditions AM Peak Hour Level Of Service



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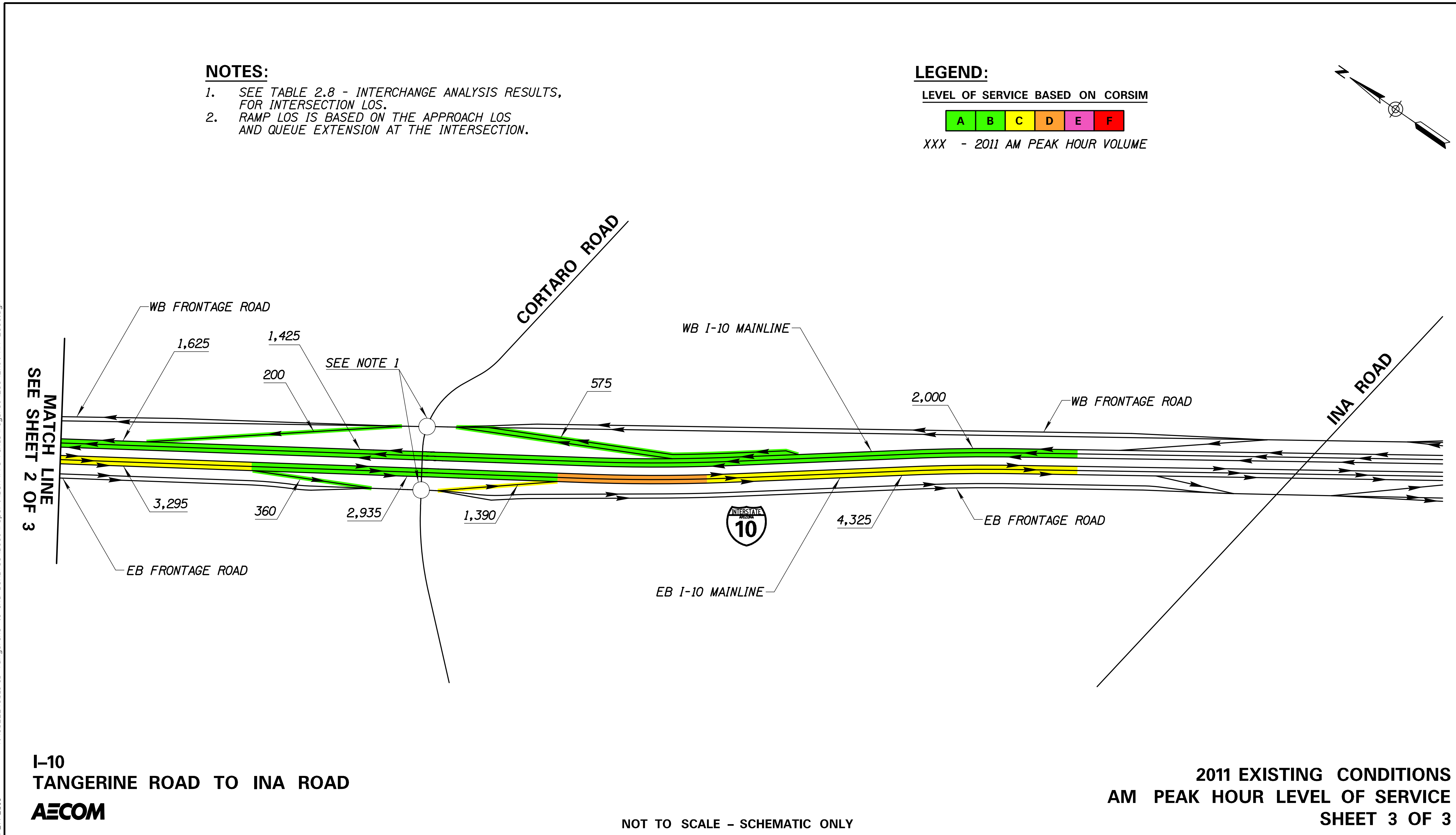

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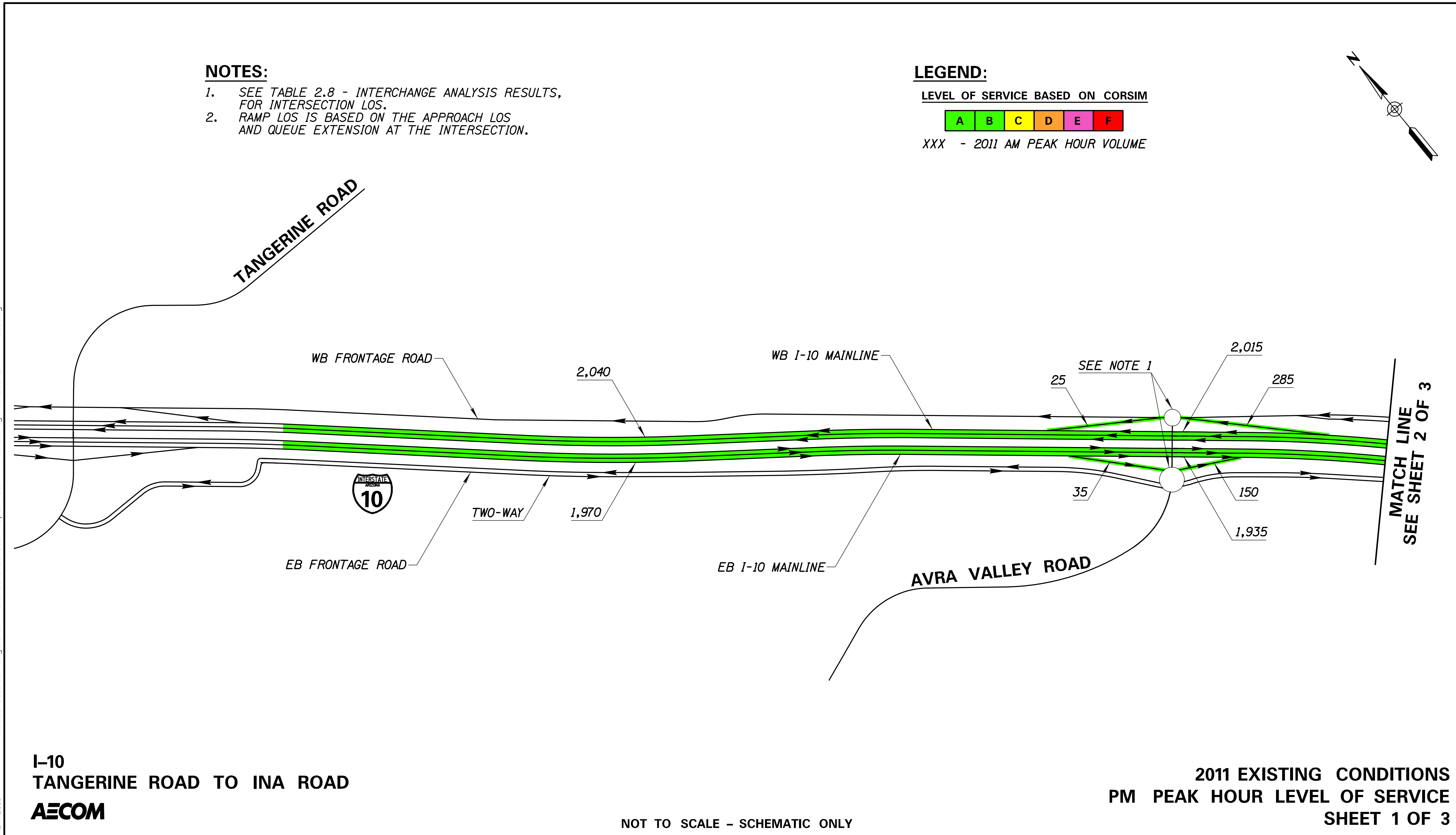
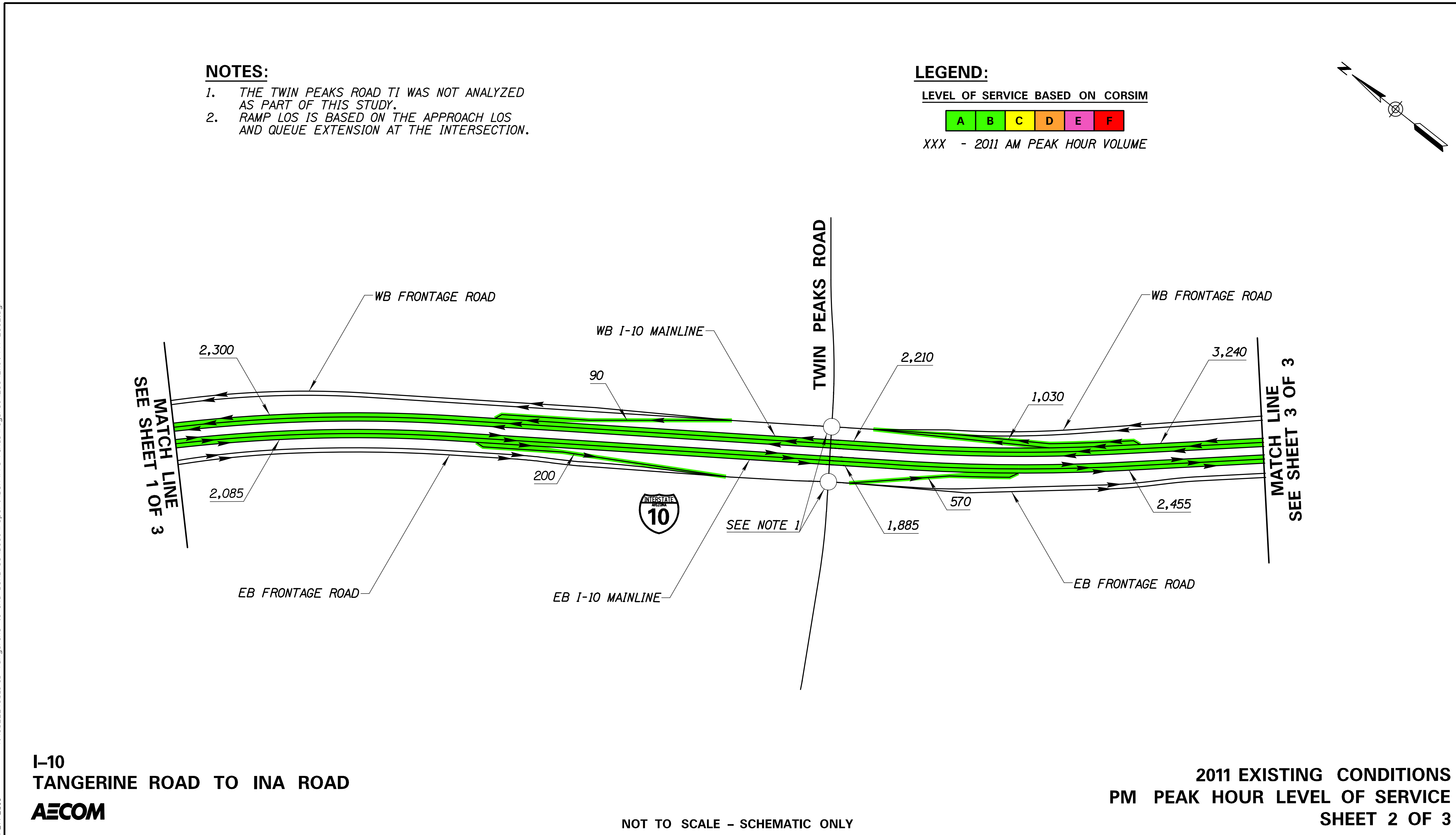


Figure 2.6 – 2011 Existing Conditions PM Peak Hour Level Of Service



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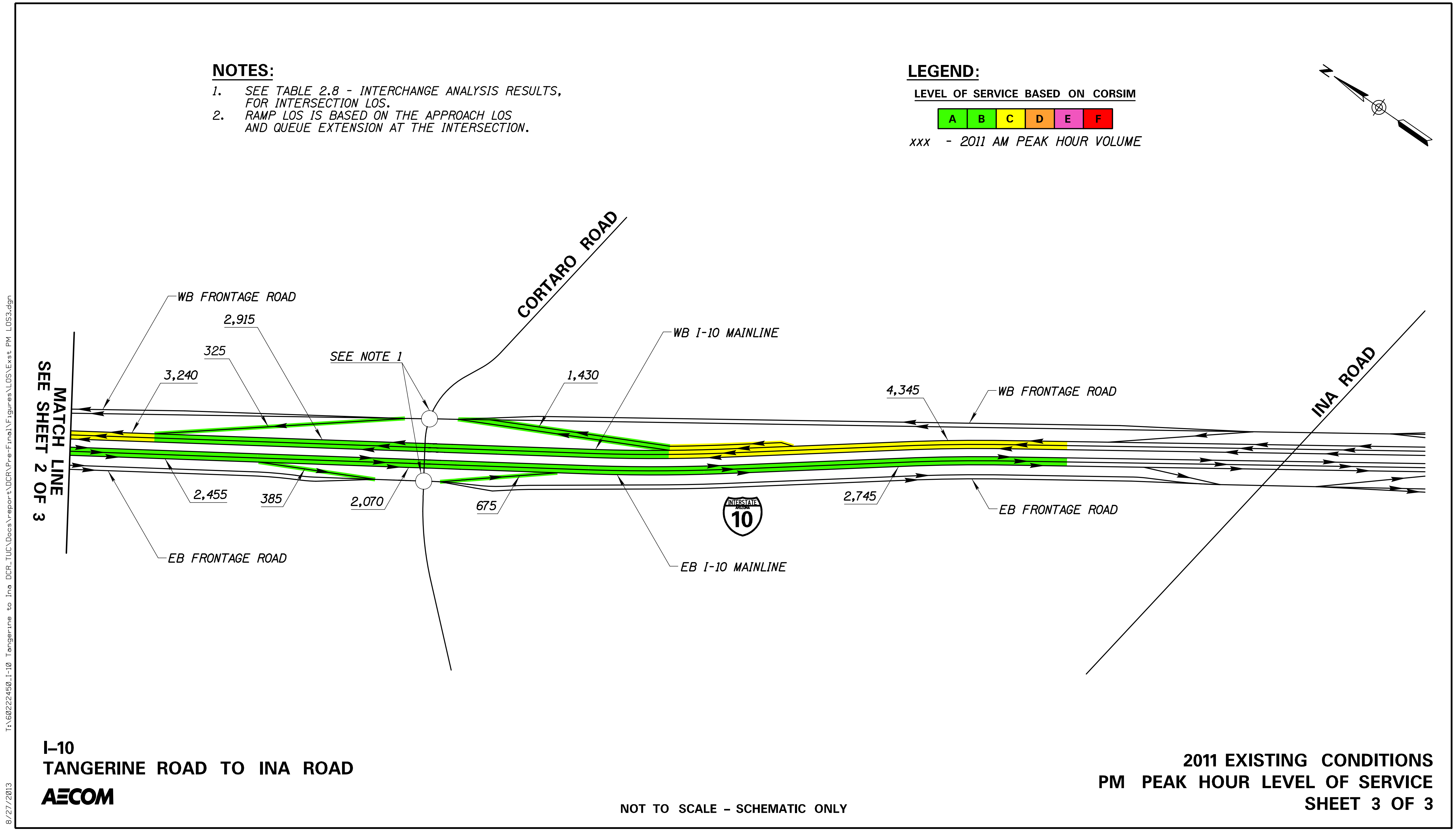

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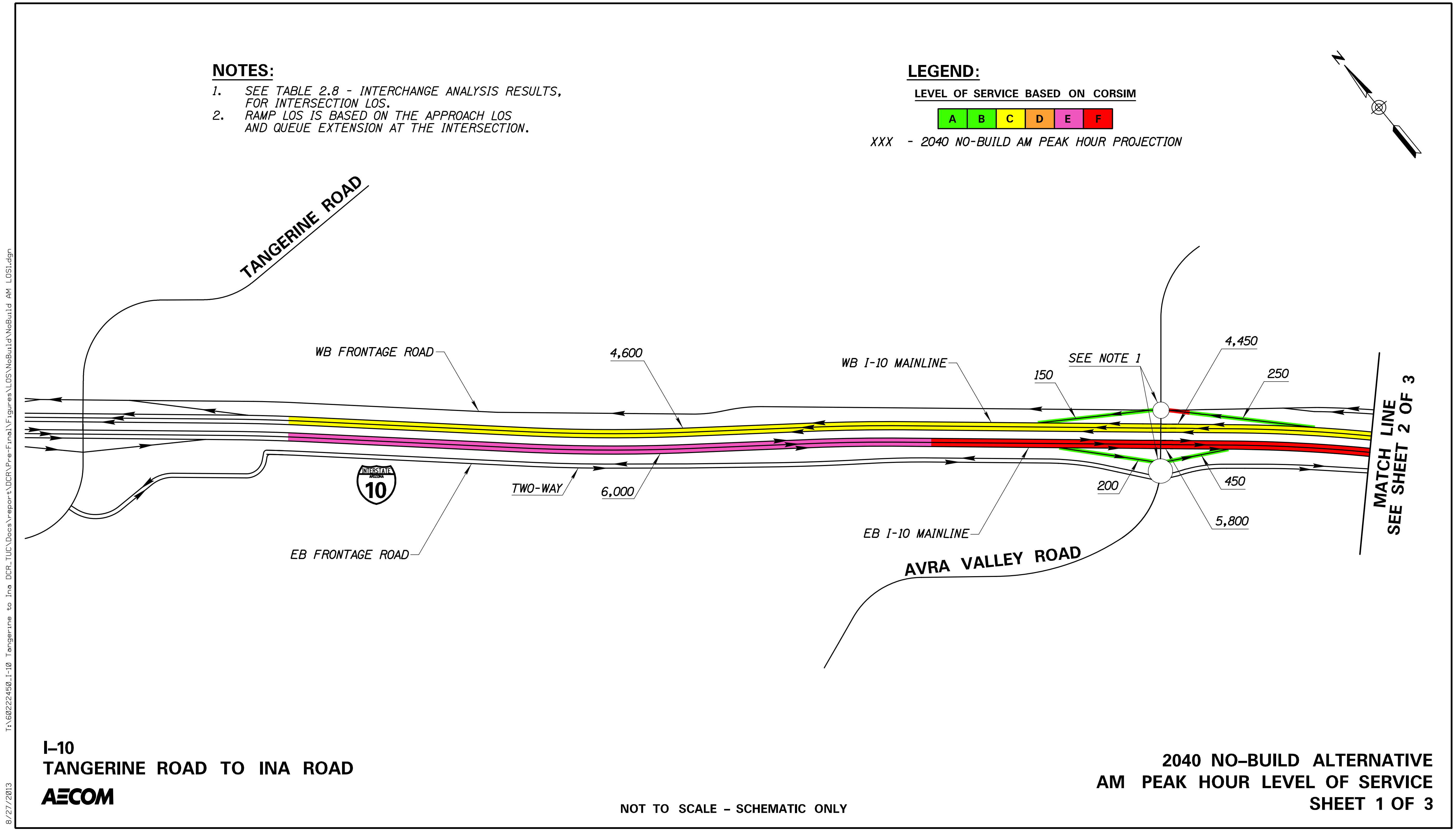
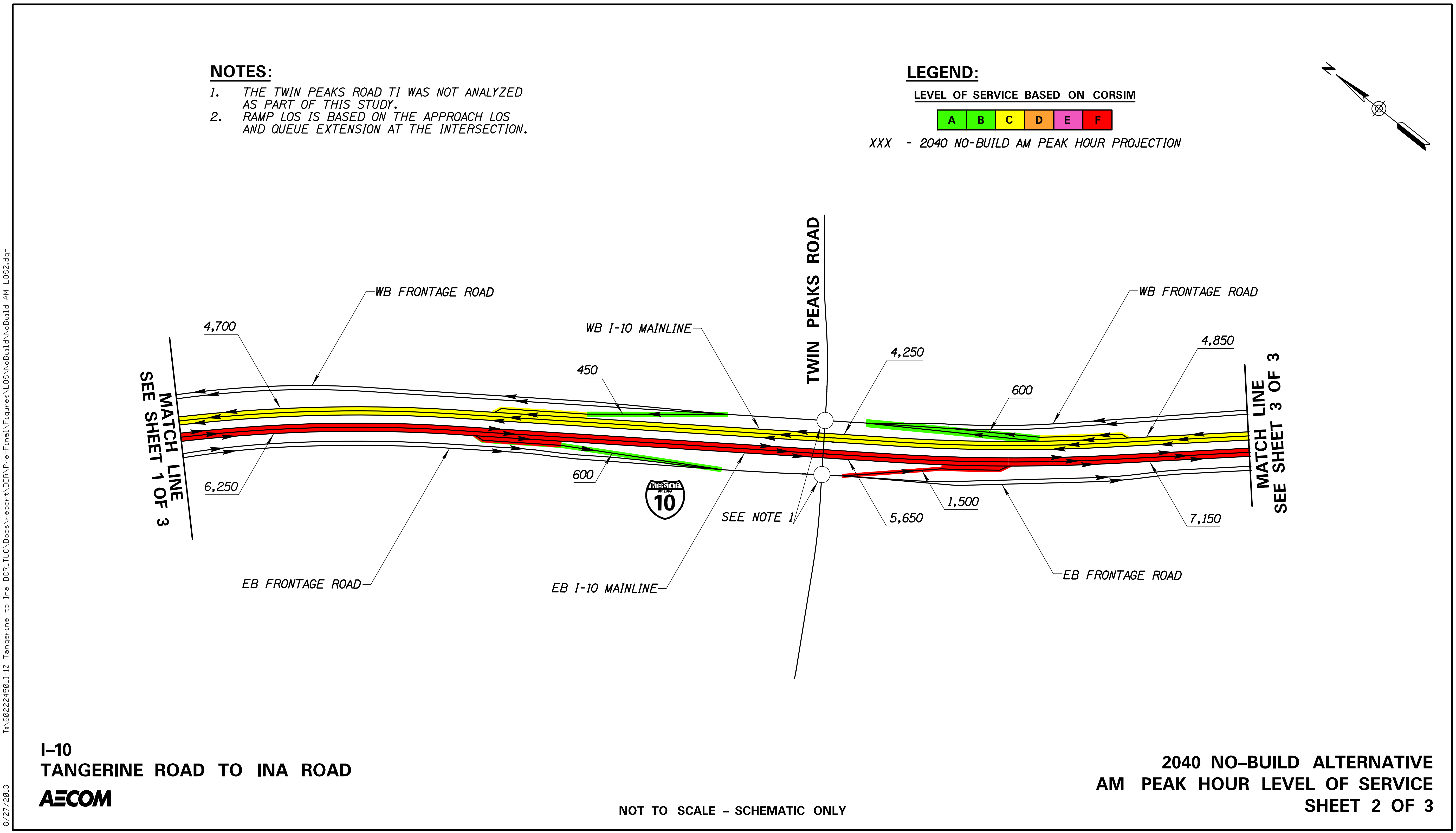


Figure 2.7 – 2040 No-Build Alternative AM Peak Hour Level Of Service



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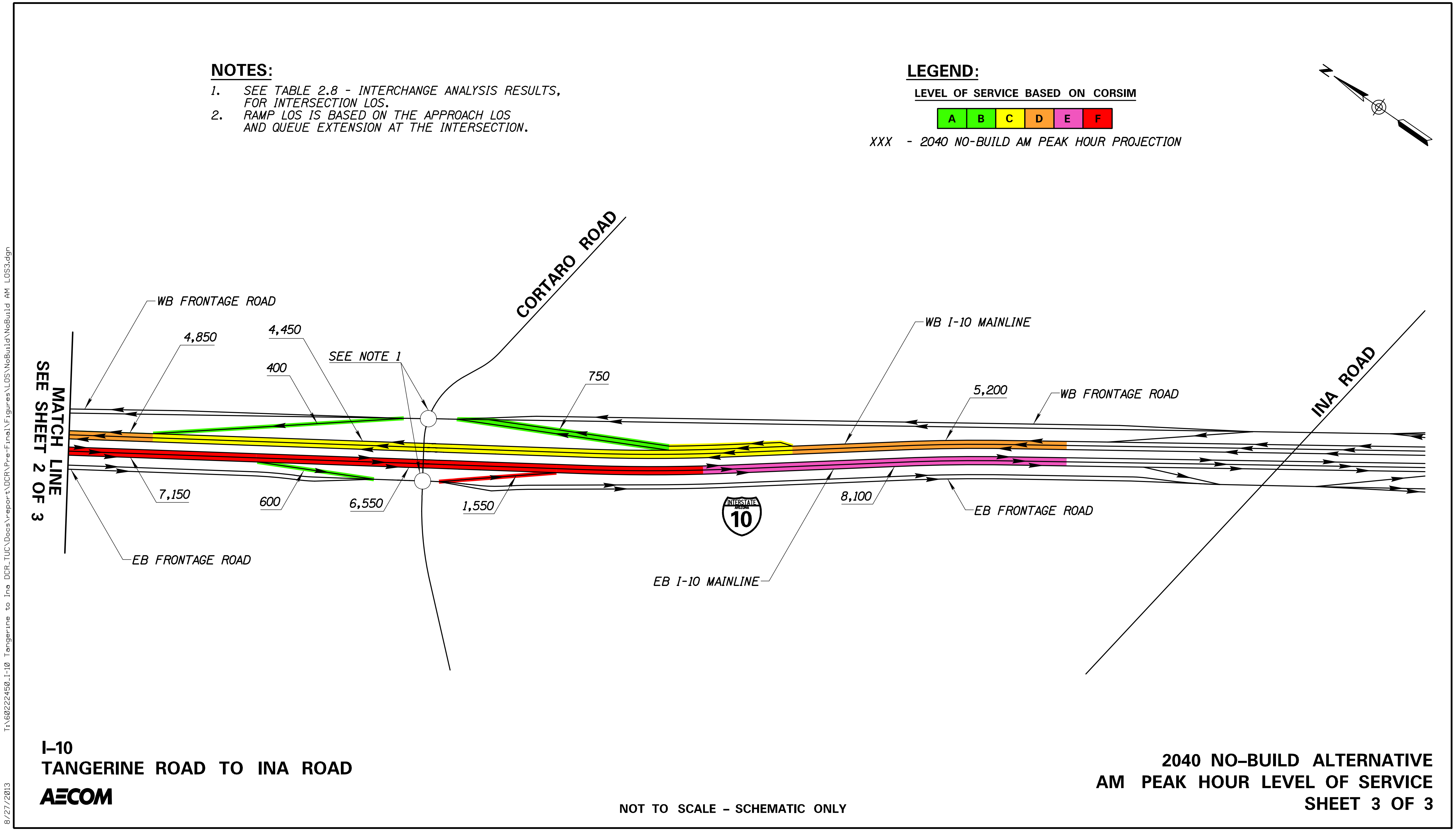

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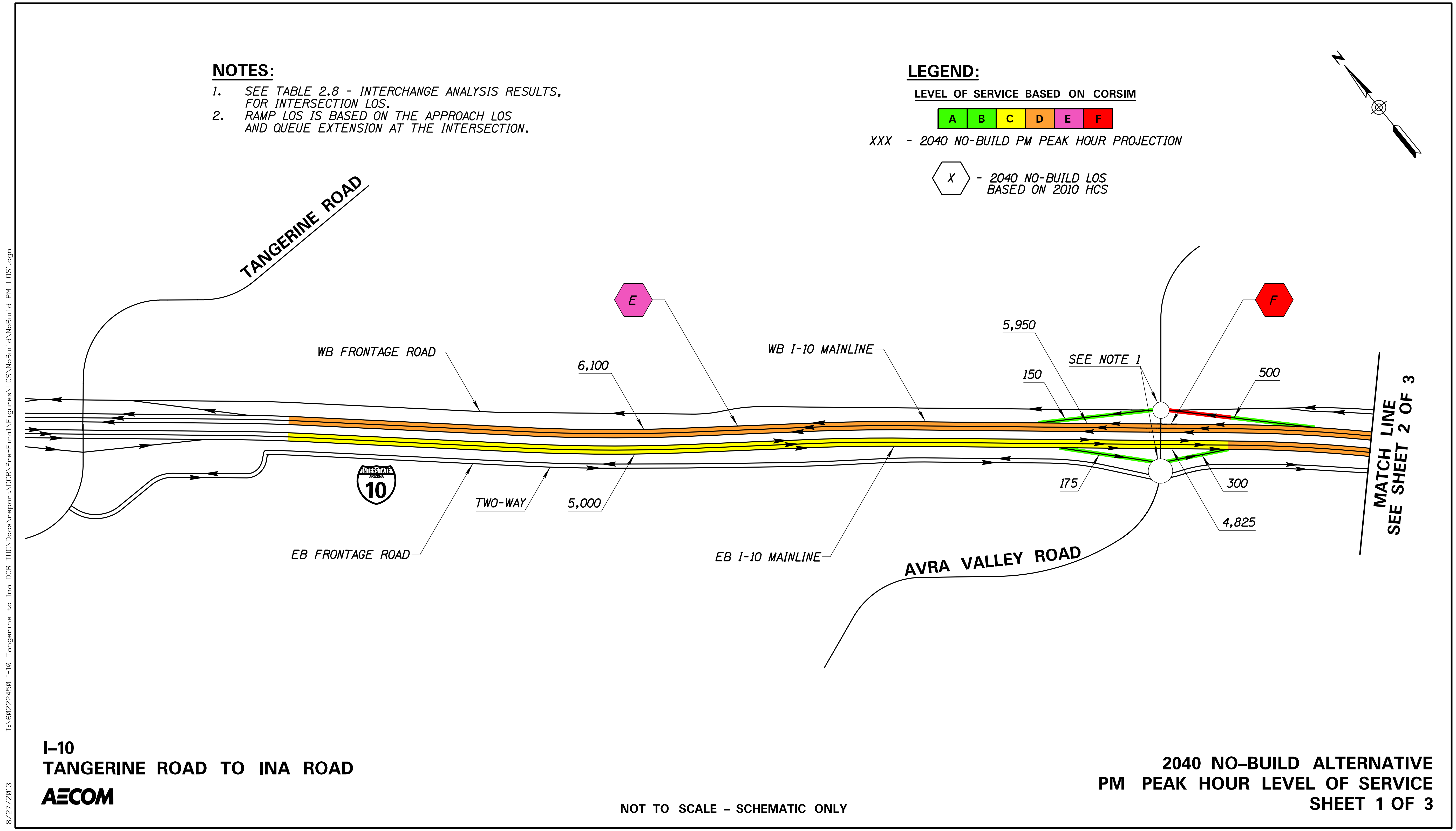
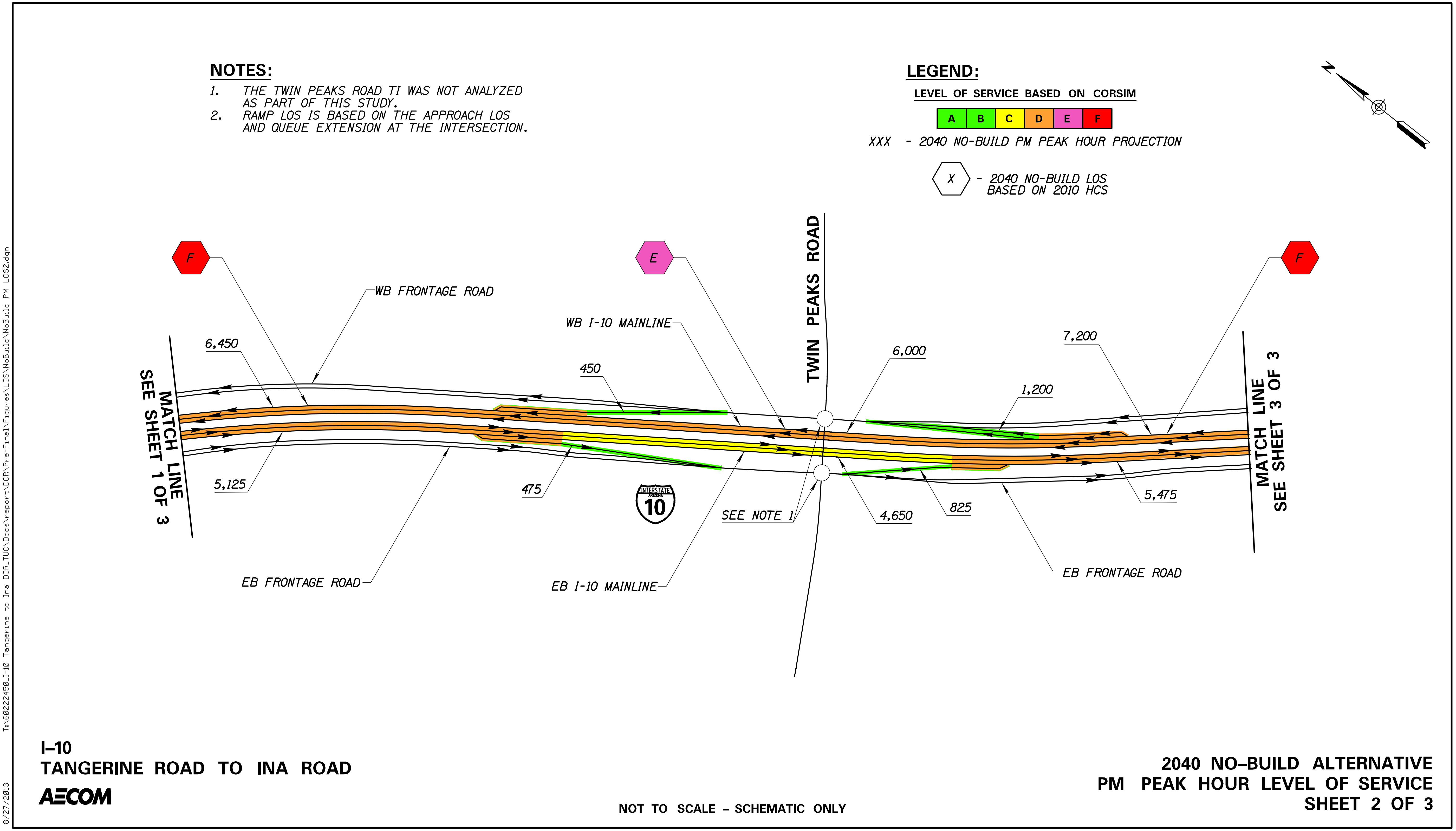


Figure 2.8 – 2040 No-Build Alternative PM Peak Hour Level Of Service



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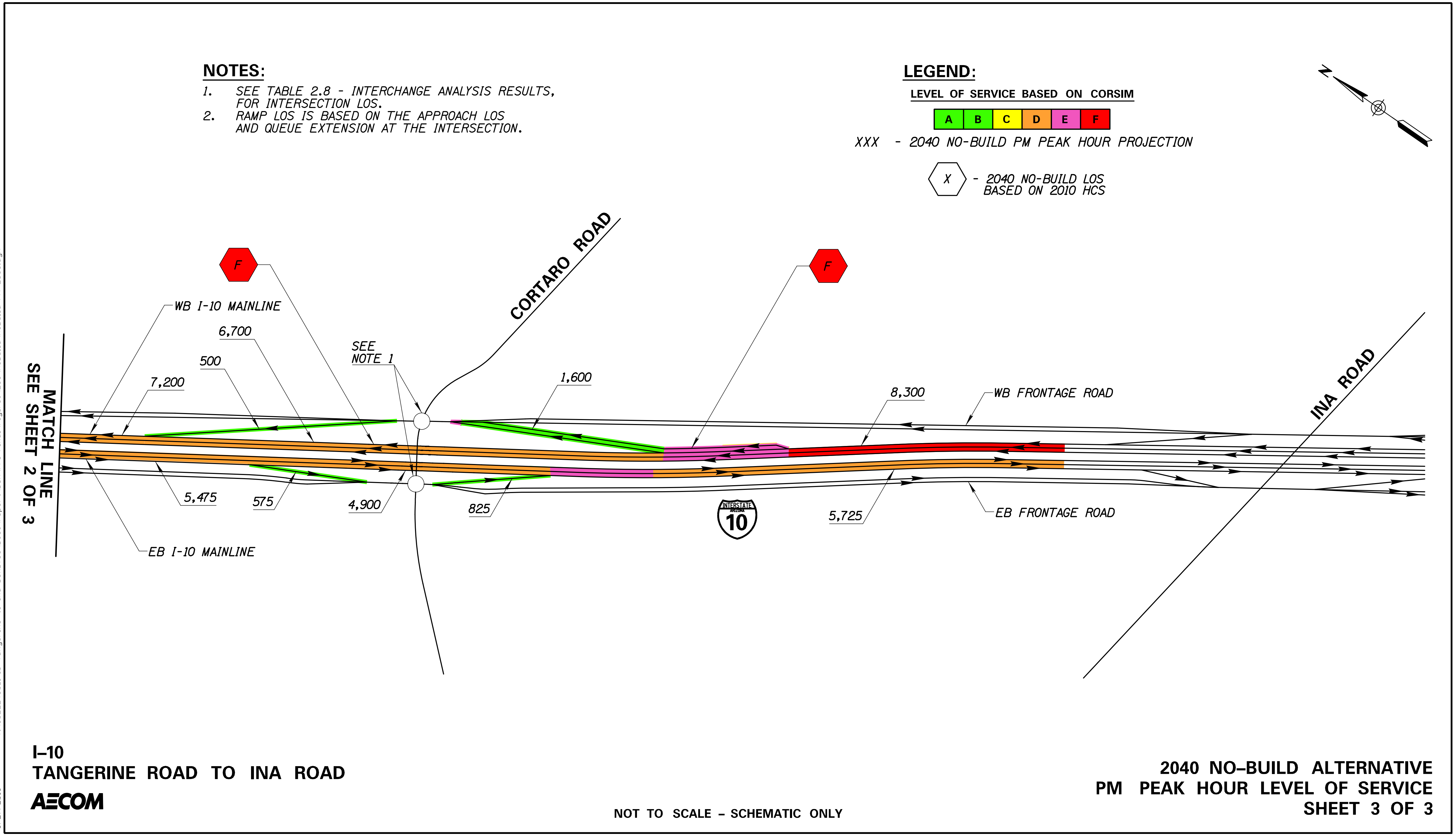

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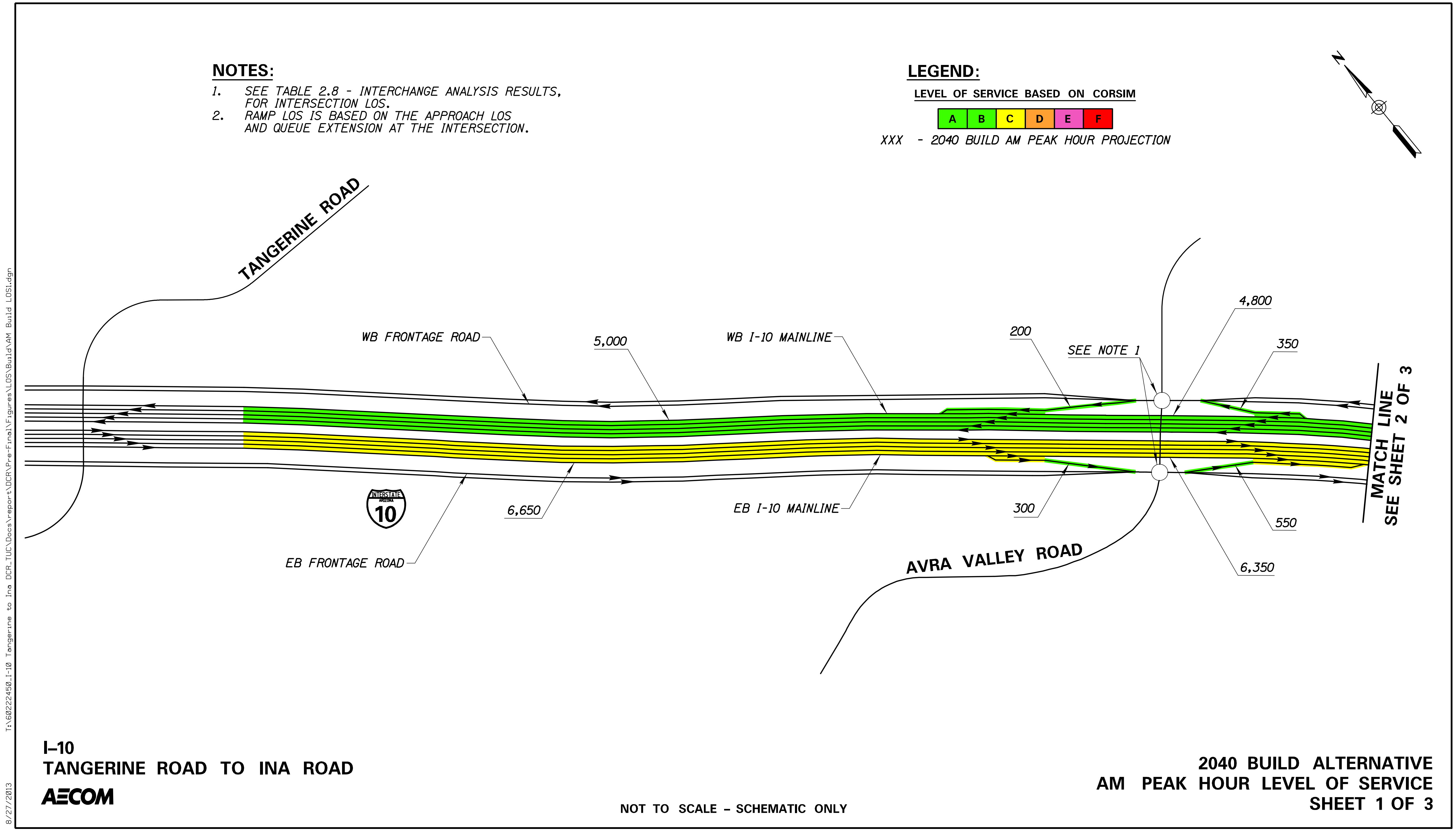


Figure 2.9 – 2040 Build Alternative AM Peak Hour Level Of Service

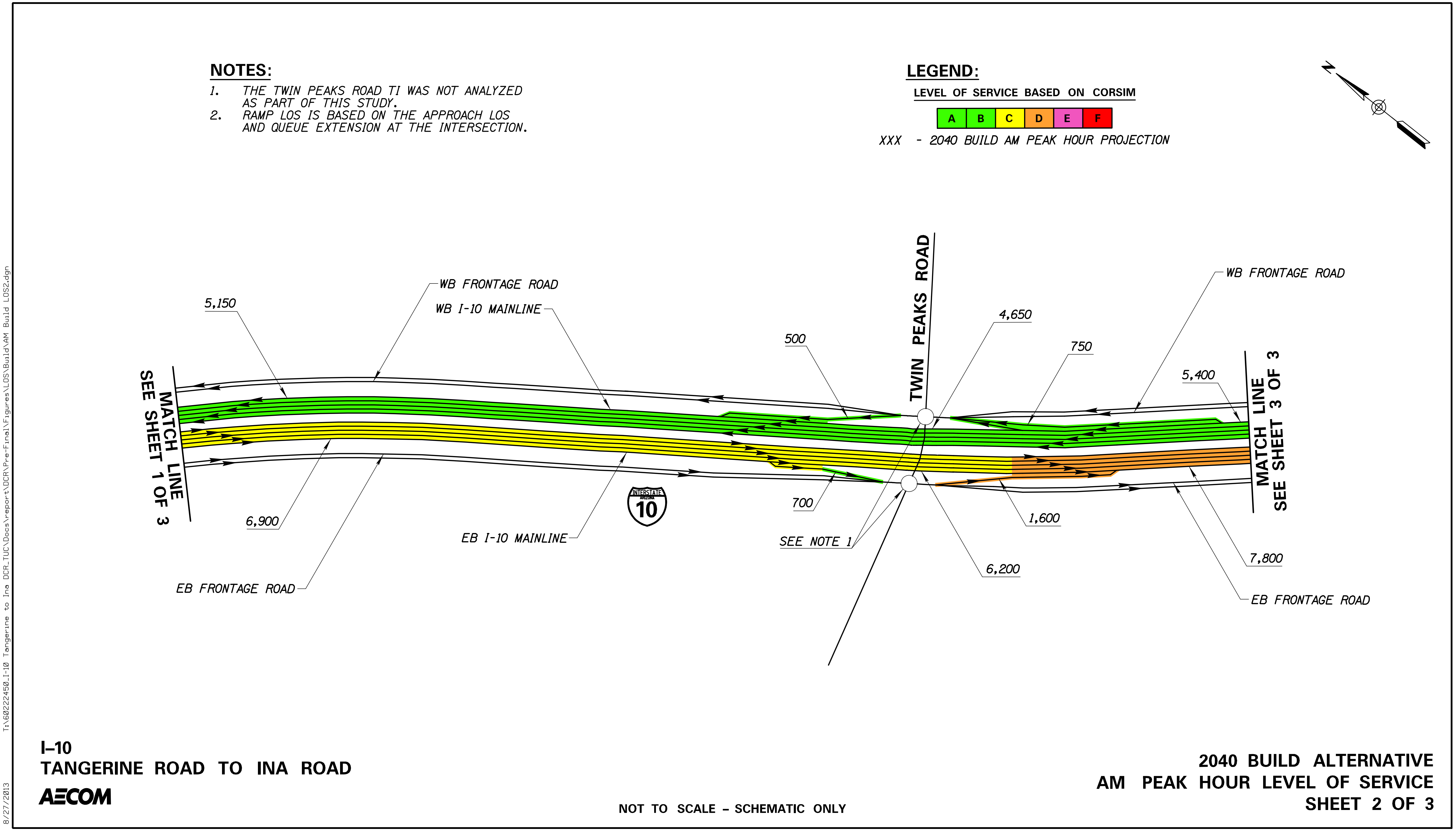
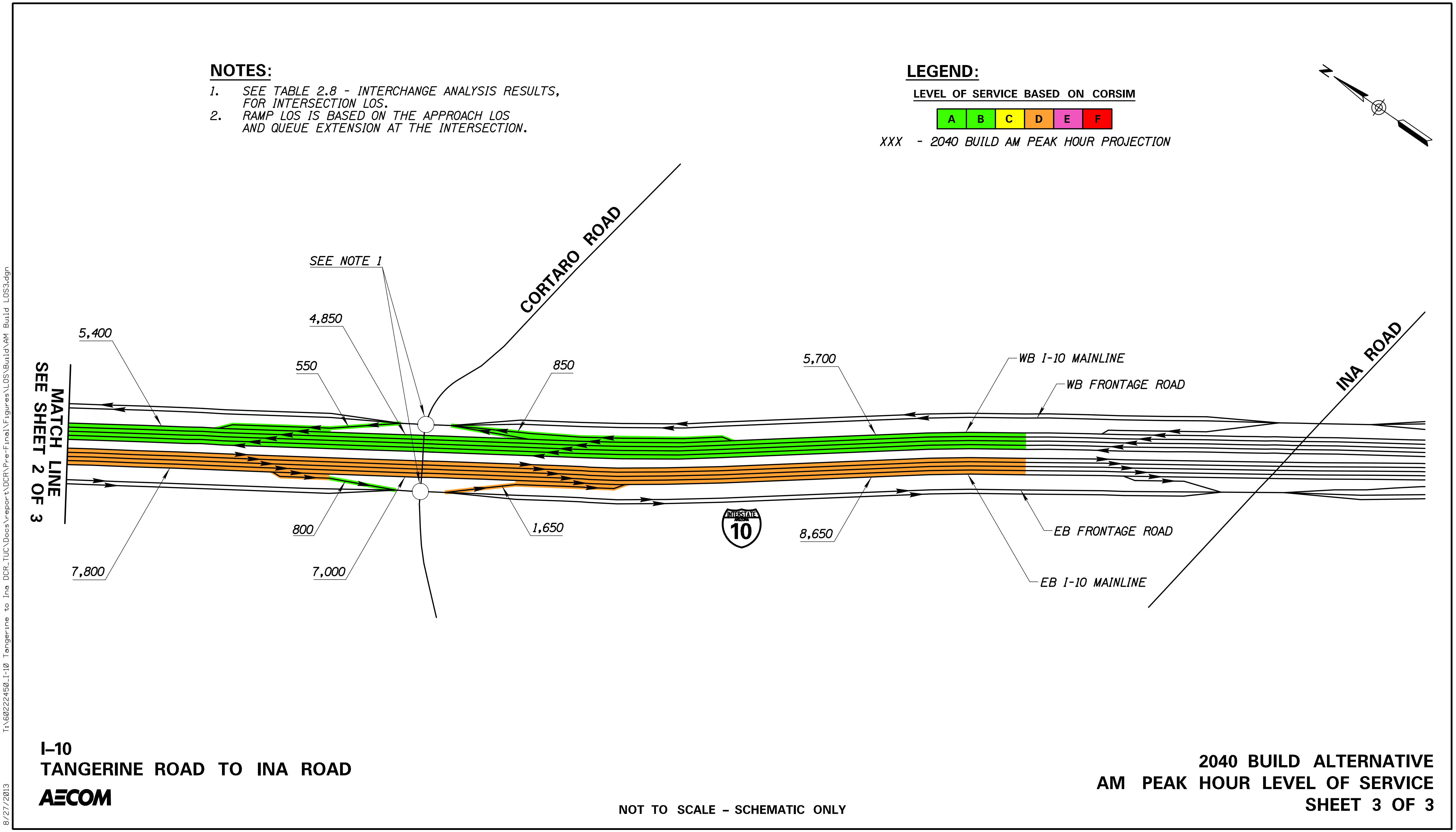


Figure 2.9 – Continued



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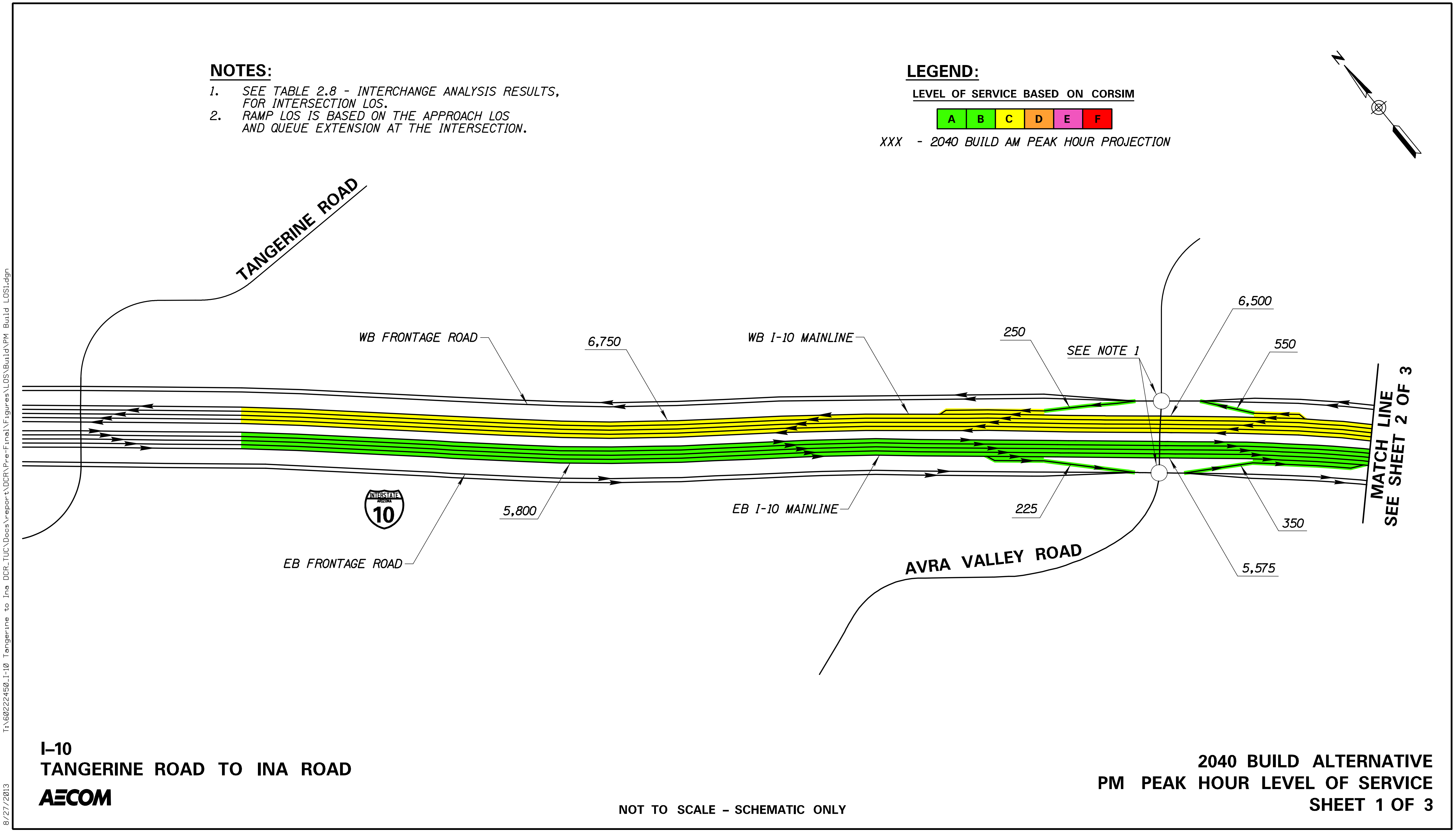
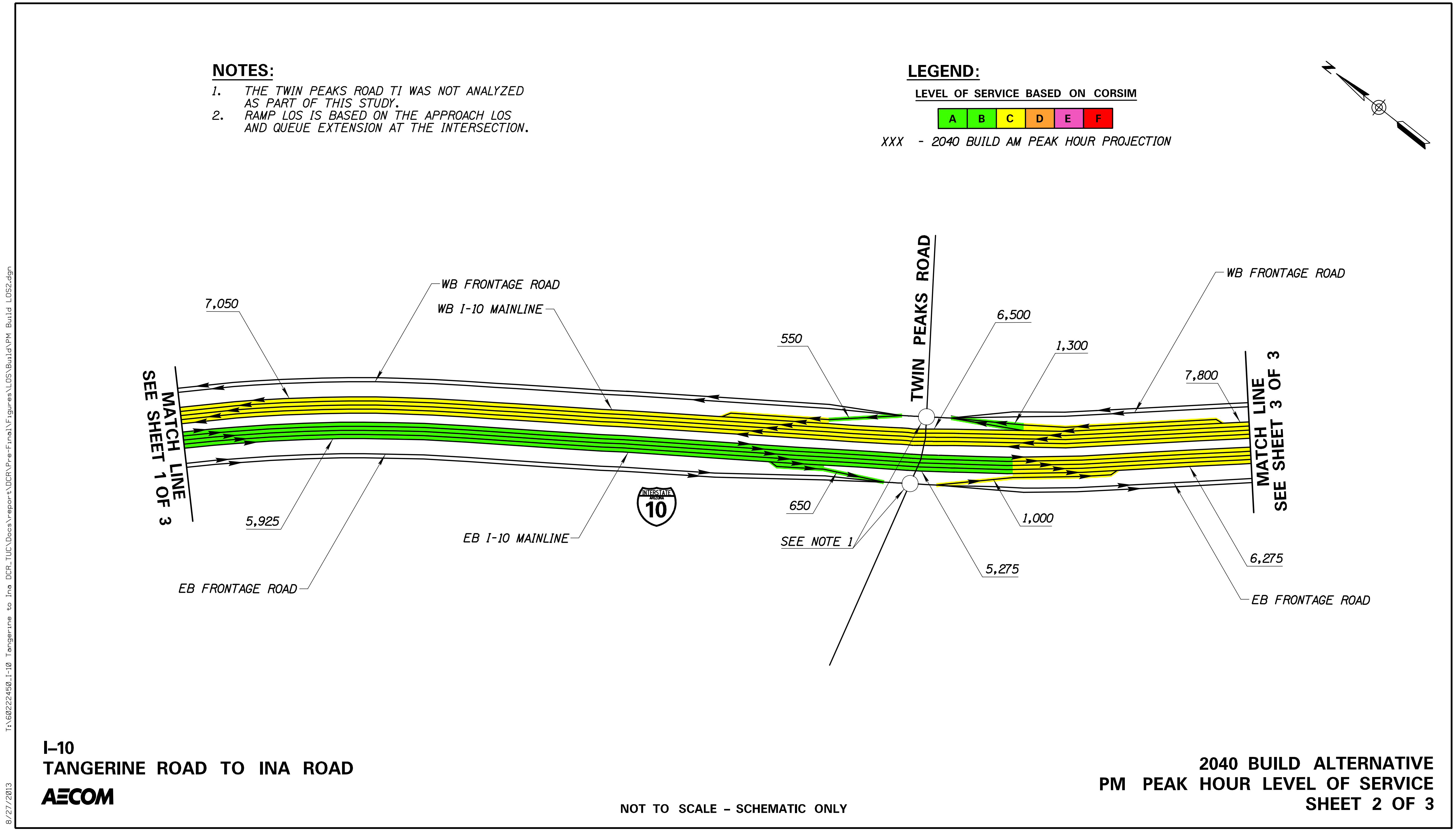


Figure 2.10 – 2040 Build Alternative PM Peak Hour Level Of Service



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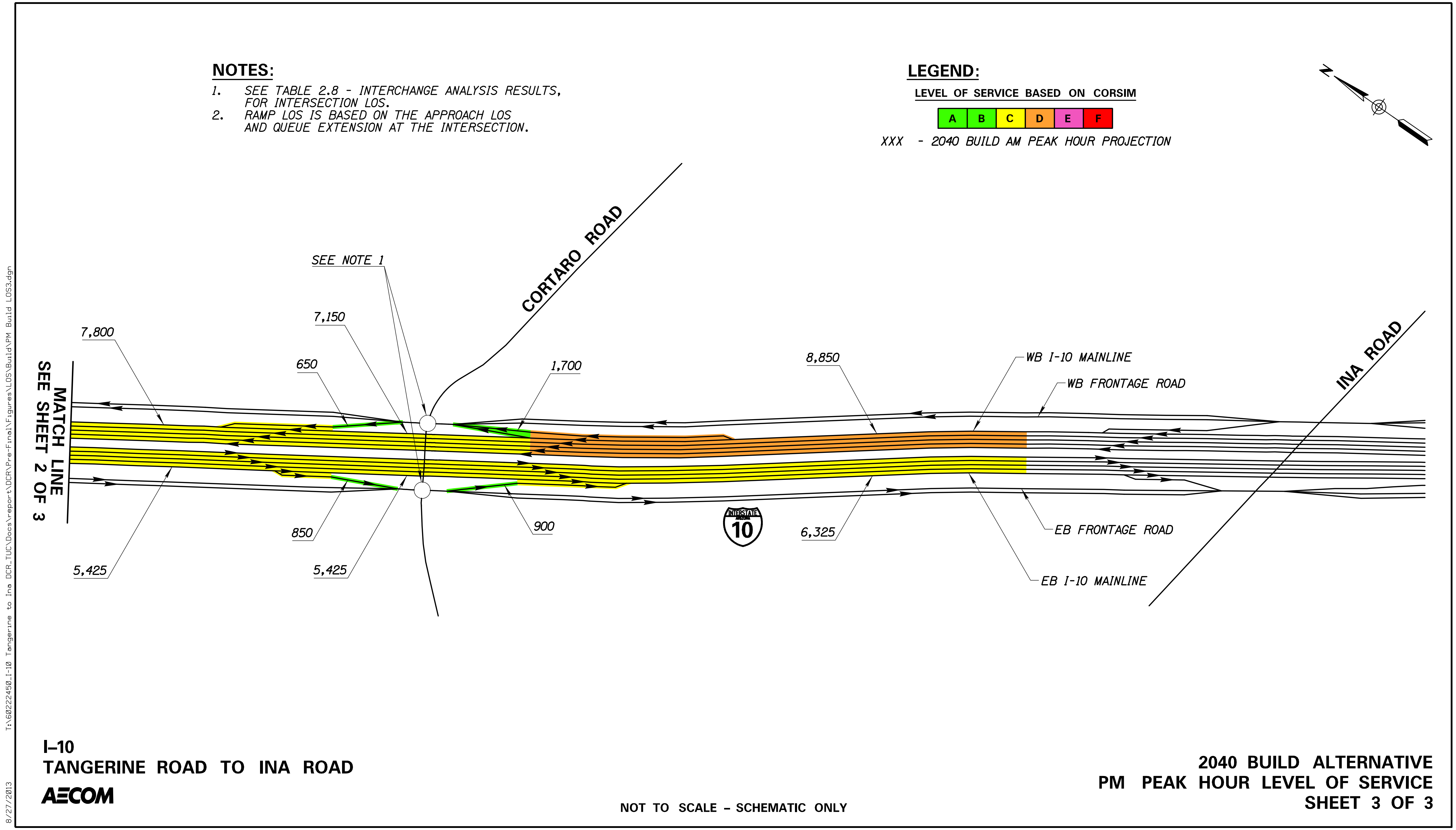

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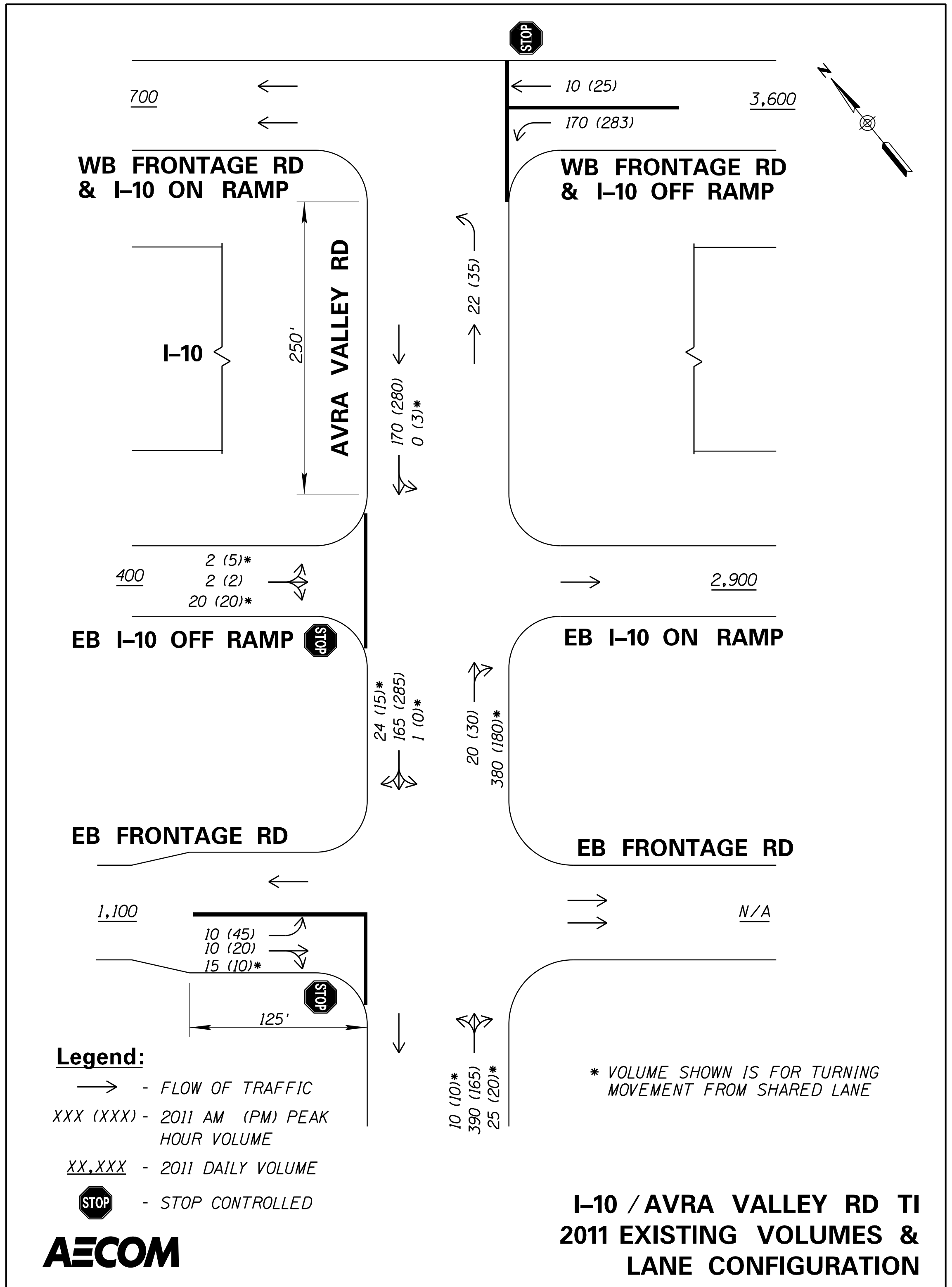

Figure 2.11 – I-10/Avra Valley Road TI
2011 Existing Volumes & Lane Configuration

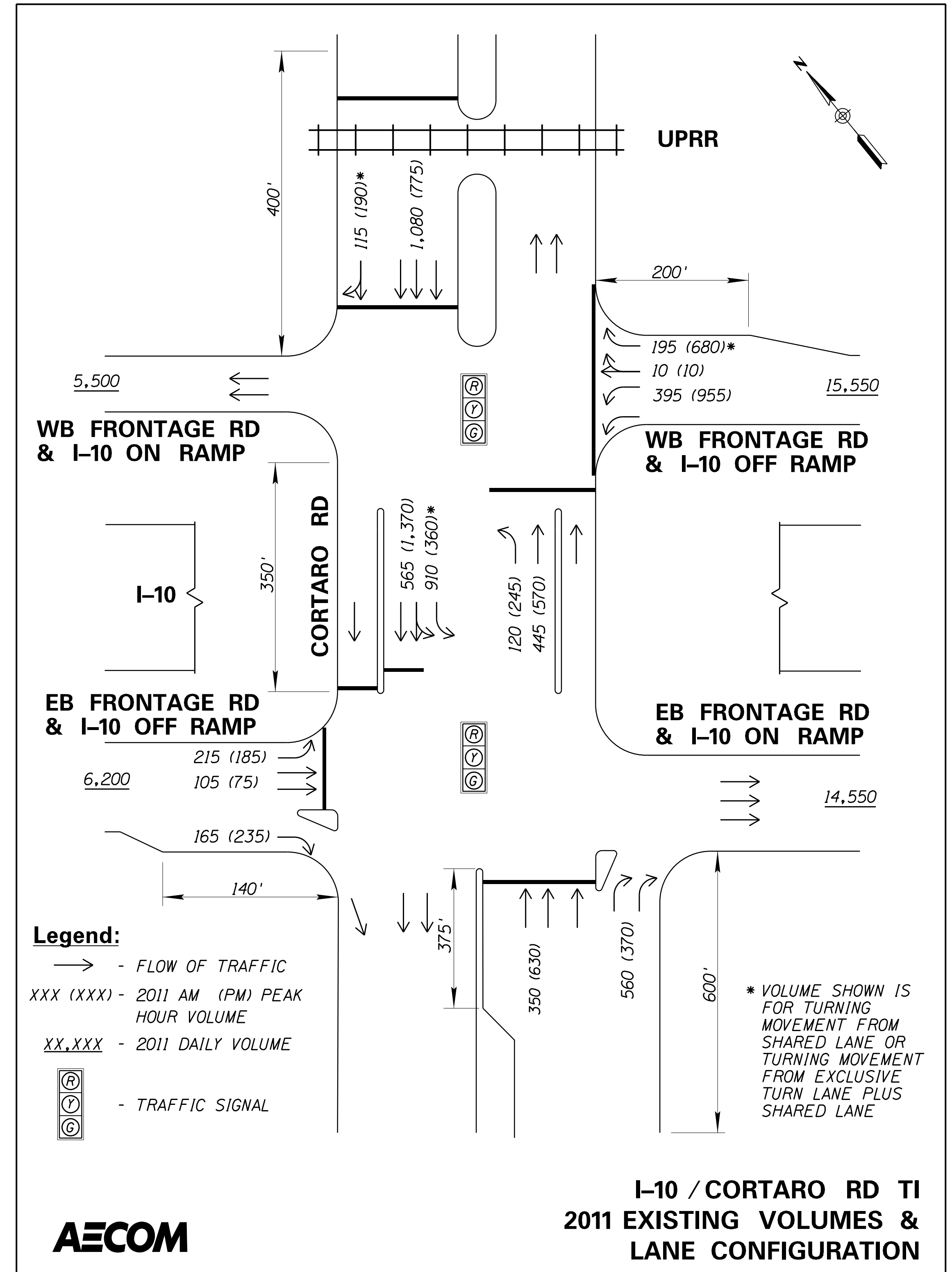

Figure 2.12 – I-10/Cortaro Road TI
2011 Existing Volumes & Lane Configuration

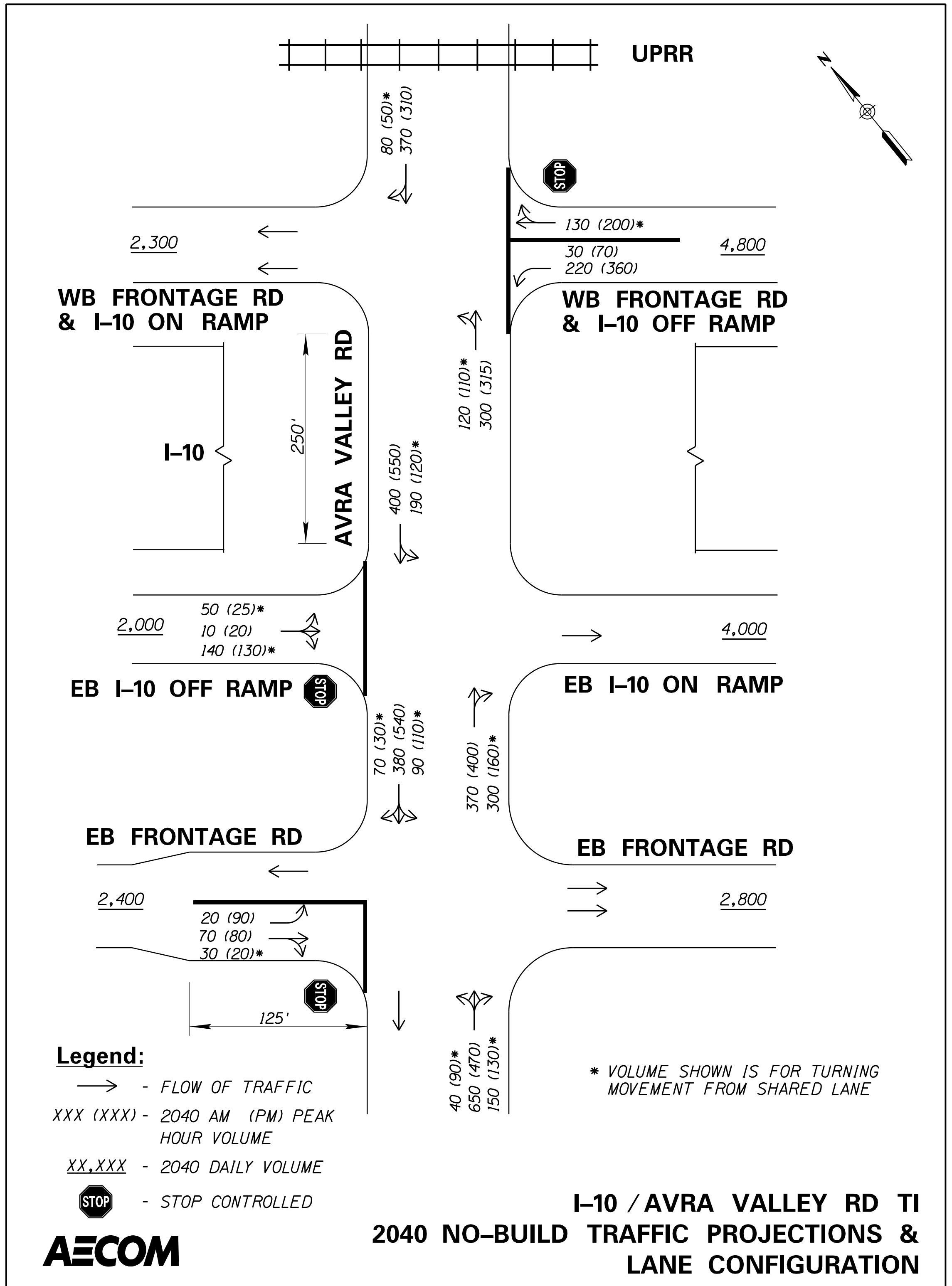

Figure 2.13 – I-10/Avra Valley Road TI
2040 No-Build Traffic Projections & Lane Configuration

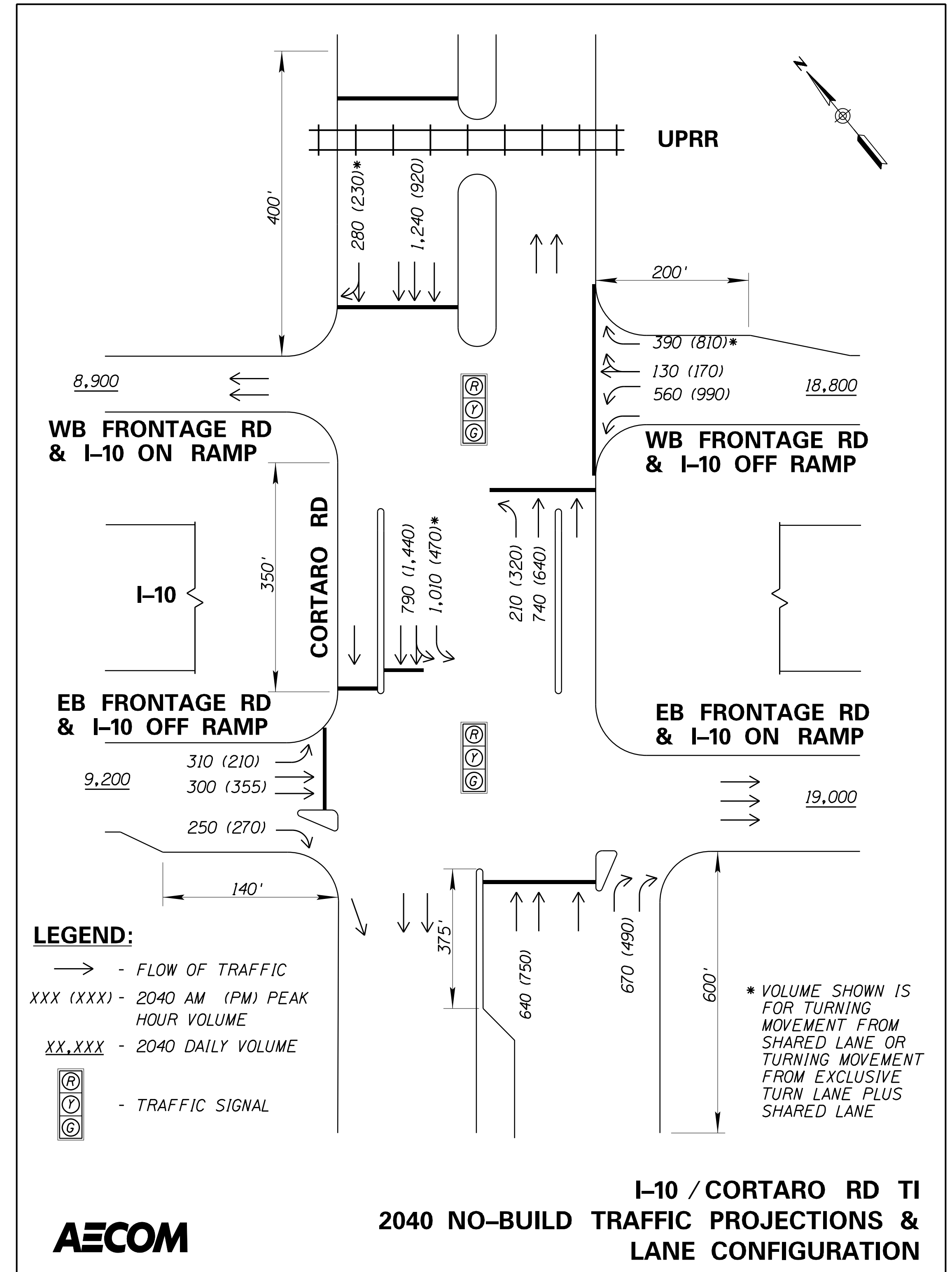

Figure 2.14 – I-10/Cortaro Road TI
2040 No-Build Traffic Projections & Lane Configuration

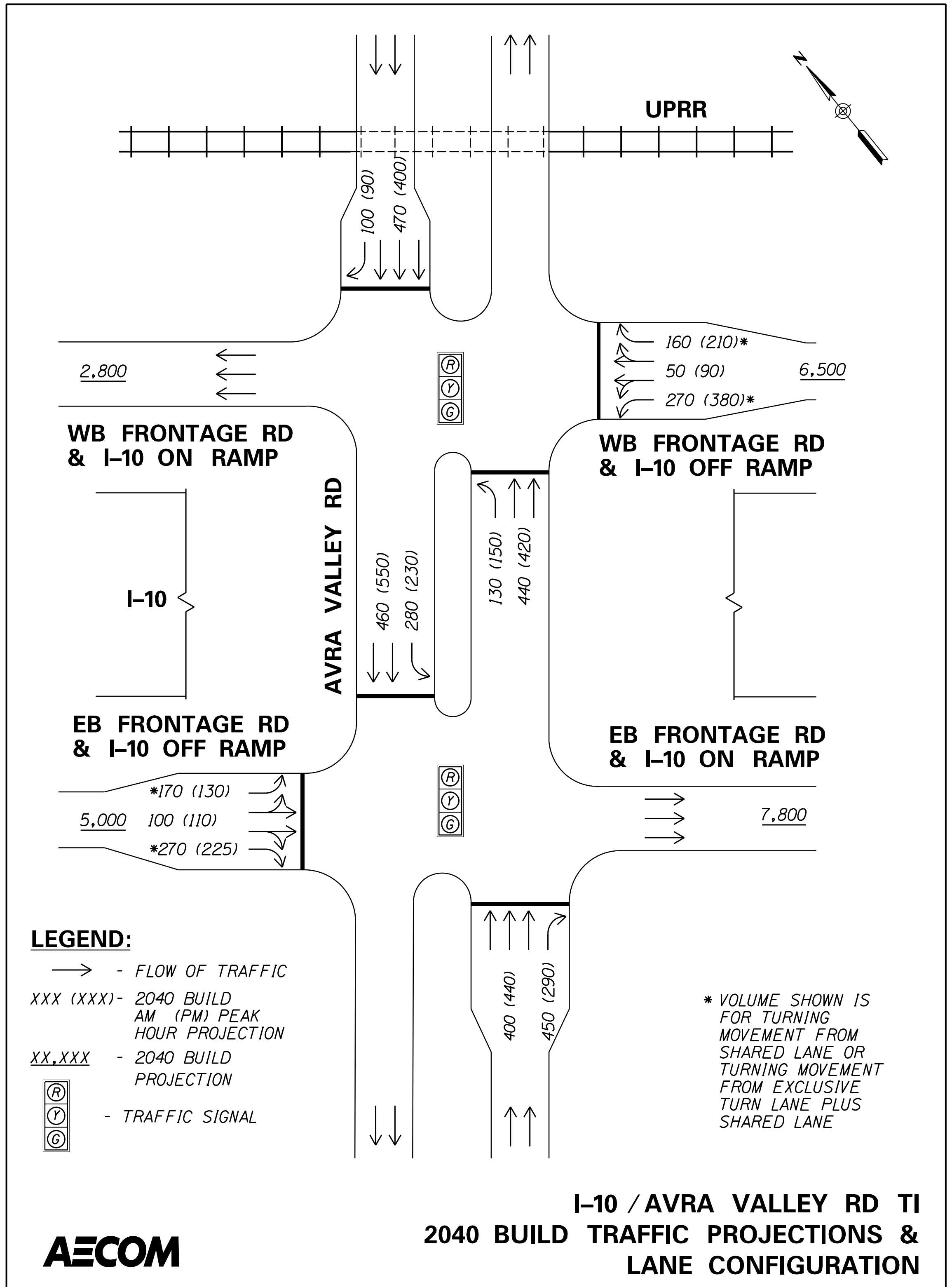

Figure 2.15 – I-10/Avra Valley Road TI
2040 Build Traffic Projections & Lane Configuration

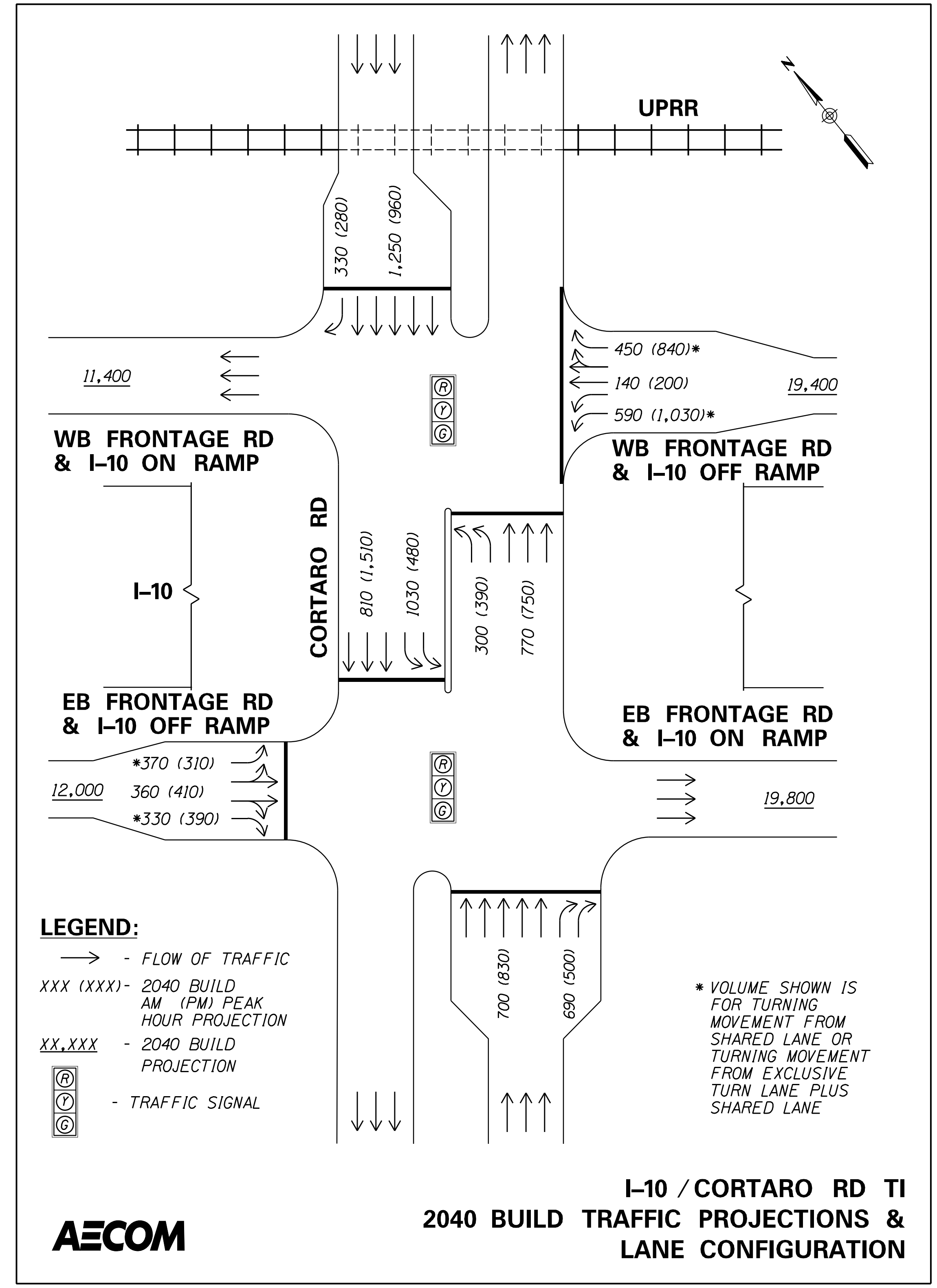

Figure 2.16 – I-10/Cortaro Road TI
2040 Build Traffic Projections & Lane Configuration

3.0 DESIGN CONCEPT ALTERNATIVES

3.1 INTRODUCTION

This section of the DCR documents design options that were considered and evaluated to plan for the I-10 Corridor between Tangerine Road and Ina Road to accommodate future traffic volumes. The design concept alternative development and evaluation process was divided into three categories as follows:

- I-10 Typical Section – evaluated the number of lanes, median configuration, and frontage road configuration along I-10
- Traffic Interchange Location Options – evaluated the location of traffic interchanges along the corridor
- Crossroad Alignment Options – evaluated crossroad alignment options based on the traffic interchange location recommendations

The *Final Alternative Selection Report (February 2013),* prepared as part of this study, documented the evaluation process used to determine the ultimate I-10 cross-section and the recommended location of the Avra Valley Road and Cortaro Road TIs to carry forward for further evaluation.

3.2 ALTERNATIVES PREVIOUSLY EVALUATED

3.2.1 I-10 Typical Section

As documented in the *Final Alternative Selection Report,* four Build alternatives were considered for the I-10 Typical Section.

<u>Alternative 1</u>
I-10 would be reconstructed to include four travel lanes in each direction (eight-lane freeway) with a closed median and continuous one-way frontage roads. The frontage roads would generally be parallel to the I-10 mainline and would connect to the ramps near the traffic interchanges. Access to adjacent parcels would be provided by the one-way frontage roads.

<u>Alternative 2</u>
I-10 would be reconstructed to include five travel lanes in each direction (ten-lane freeway) with a closed median and continuous one-way frontage roads. The frontage roads would generally be parallel to the I-10 mainline and would connect to the ramps near the traffic interchanges. Access to adjacent parcels would be provided by the one-way frontage roads.

<u>Alternative 3</u>
I-10 would be reconstructed to include five travel lanes in each direction (ten-lane freeway) with a 76-foot-wide open median. This alternative would utilize the existing frontage roads (typically two 12-foot-wide travel lanes with one-foot-wide inside and outside shoulders) which would not be extended and would remain discontinuous. Access to adjacent parcels would be provided by the existing frontage roads.

<u>Alternative 4</u>
I-10 would be reconstructed to include five travel lanes in each direction (ten-lane freeway) with a closed median and continuous two-way frontage roads. The frontage roads would generally be parallel to the I-10 mainline except near the traffic interchanges where they would be offset from the ramps approximately 1,400 feet. Access to adjacent parcels would be provided by the two-way frontage roads.

The I-10 cross-section evaluation (fully documented in the *Final Alternative Selection Report)* resulted in the following recommendations:

- Alternative 2 (ten-lane freeway with a closed median and one-way frontage roads) was carried forward for further evaluation. Alternative 2 would meet the projected 2040 travel demand and contain continuous one-way frontage roads, which would provide flexibility for incident management and would be compatible with standard ADOT practice and planned improvements to the west and east
- Alternative 1 was eliminated from further consideration, as it does not meet the projected PAG 2040 travel demand, and it is not compatible with the planned improvements to the west and east
- Alternative 3 was eliminated from further consideration, as the use of an open median and the existing frontage roads would present several issues including a greater right-of-way width, no flexibility for incident management, high cost, and lack of compatibility with planned improvements to the west and east. The frontage roads would continue to be discontinuous
- Alternative 4 was eliminated from further consideration, as two-way frontage roads present substantial issues such as limiting flexibility for incident management. They must be offset from the interchanges; which result in high costs and potential traffic operational issues. For these reasons, ADOT does not typically use two-way frontage roads

3.2.2 Traffic Interchange Locations

The existing traffic interchanges are spaced between 1¾ and 2½ miles apart between Tangerine Road and Ina Road. The Tangerine Road DCR and preliminary plans shows the Tangerine Road TI being relocated approximately 2,500 feet to the west of its existing location. There are no additional traffic interchanges proposed between Tangerine Road and Ina Road in the Town of Marana's Transportation Plan. Therefore, the existing and currently planned future traffic interchange locations are generally in accordance with the ADOT and FHWA desired two-mile minimum spacing between interchanges.

Build Alternatives were not considered for the Twin Peaks Road TI, as construction was completed in Fiscal Year 2010 in accordance with the Town of Marana's Transportation Plan. The interchange includes a grade-separated crossing of the UPRR, and can accommodate a widened I-10 ten-lane cross-section. Improvements to I-10 would require the reconstruction of the existing ramp gores, or could require the installation of barrier along the outside shoulders near the existing bridge abutments.

Both the Avra Valley Road and Cortaro Road TIs would require full reconstruction to meet the projected 2040 travel demand and provide the number of travel lanes shown in the Town of Marana's Transportation Plan. In addition, both locations would include a grade-separated railroad crossing. Therefore, in order to facilitate construction, consideration was given to relocating the interchanges.

As documented in the *Final Alternative Selection Report,* four Build alternatives were considered for the Avra Valley Road TI location as described below. In each alternative, Avra Valley Road would be reconstructed to a divided, four-lane (two travel lanes in each direction) roadway per the Town of Marana's Transportation Plan, with left- and right-turn lanes as warranted. The Town of Marana could extend Avra Valley Road north of I-10 utilizing a right-of-way corridor that has been established as part of the Cascada development.

<u>Alternative 1</u>
The Avra Valley Road TI would be reconstructed at its current location at grade and I-10 would cross over Avra Valley Road. The Avra Valley Road extension to the north would create a new at-grade crossing of the UPRR.

<u>Alternative 2</u>
The Avra Valley Road TI would be relocated approximately ½ mile to the east. Avra Valley Road would be elevated and I-10 lowered. The Avra Valley Road extension to the north would create a new grade-separated crossing of the UPRR.

<u>Alternative 3</u>
The Avra Valley Road TI would be reconstructed at its current location. Avra Valley Road would be elevated and I-10 lowered. The Avra Valley Road extension to the north would create a new grade-separated crossing of the UPRR.

<u>Alternative 4</u>
The Avra Valley Road TI would be relocated approximately ½ mile to the west. Avra Valley Road would be elevated and I-10 lowered. The Avra Valley Road extension to the north would create a new grade-separated crossing of the UPRR.

The crossroad location evaluation (fully documented in the *Final Alternative Selection Report)* resulted in the following recommendations at Avra Valley Road:

- Alternative 3 (existing location with grade-separated UPRR crossing) was carried forward for further evaluation
- Alternative 1 was eliminated from further consideration, since it does not separate rail from vehicular traffic, is not consistent with the Town of Marana's long-range plans, and is not consistent with current and planned ADOT, FHWA, and UPRR improvements along the I-10 corridor. In addition, adding an at-grade UPRR crossing would not be approved by the UPRR or Arizona Corporation Commission (ACC) without removing two existing at-grade crossings
- Alternative 2 was eliminated from further consideration, since it would reduce the interchange spacing to less than two miles, would encroach into a designated wildlife corridor, and could adversely affect the planned wildlife crossing of I-10. This alternative would also have the tightest horizontal geometry as Avra Valley Road would be located between I-10 and the Santa Cruz River. In addition, relocating the interchange to the east would require constructing a new roadway extending southeast from existing Avra Valley Road to connect to the new interchange with I-10
- Alternative 4 was eliminated from further consideration, as it would have substantial impacts to existing and future land uses, including the existing mining operations located south of I-10. In addition, relocating the interchange to the west would require constructing a new roadway extending north from existing Avra Valley Road to connect to the new interchange with I-10

As documented in the *Final Alternative Selection Report,* alternatives to relocate the Cortaro Road TI to the west or to the east were considered and eliminated from further consideration for the following reasons:

- The land surrounding the Cortaro Road TI is fully developed and the right-of-way acquisition costs would be excessive
- The Town of Marana's General Plan and Transportation Plan both show Cortaro Road at its current location
- The interchange spacing along I-10 is already equal to or slightly less than two miles in both directions and moving the interchange would reduce the spacing in one direction or the other
- Connecting the Cortaro Road TI to another arterial street is not possible, as no other major continuous routes exist, and Pima County is planning improvements to Magee Road to the east to make a continuous east-west connection along Cortaro Road from Silverbell Road to Oracle Road

However, two Build alternatives were considered for the Cortaro Road TI, as described below. In each, Cortaro Road would be reconstructed to a divided, six-lane (three travel lanes in each direction) roadway per the Town of Marana's Transportation Plan), with left- and right-turn lanes as warranted.

<u>Alternative 1</u>
The Cortaro Road TI would be reconstructed at its current location. The existing at-grade crossing of the UPRR would remain and be upgraded to accommodate the widened Cortaro Road. I-10 would cross over Cortaro Road.

<u>Alternative 2</u>
The Cortaro Road TI would be reconstructed at its current location. Cortaro Road would cross over I-10 and the UPRR eliminating the at-grade crossing.

The crossroad location evaluation (fully documented in the *Final Alternative Selection Report)* resulted in the following recommendations at Cortaro Road:

- Alternative 2 (existing location with grade-separated UPRR crossing) was carried forward for further evaluation
- Alternative 1 was eliminated from further consideration, since it does not separate rail from vehicular traffic, is not consistent with the Town of Marana's long-range plans, and is not consistent with current and planned ADOT, FHWA, and UPRR actions along the I-10 corridor

3.2.3 Crossroad Alignment Options

Three Build alternatives were considered for the Avra Valley Road and Cortaro Road alignments, as described below, and discussed in the *Final Alternative Selection Report.*

Avra Valley Road

In each alternative, Avra Valley Road would be reconstructed to a divided, four-lane (two travel lanes in each direction) roadway per the Town of Marana's Transportation Plan, with left- and right-turn lanes as warranted. The existing tangent section of Avra Valley Road would be extended to the south and the existing compound curves would be replaced with a simple horizontal curve, shifting Avra Valley Road slightly east. The Town of Marana could extend Avra Valley Road to the north of I-10, with a grade-separated crossing of the UPRR, utilizing a right-of-way corridor that has been established as part of the Cascada development.

<u>Alignment Alternative 1</u>
The Avra Valley Road TI alignment would be reconstructed at its current location at I-10.

<u>Alignment Alternative 2</u>
The Avra Valley Road TI alignment would be shifted approximately 80 feet east of the existing alignment at I-10.

Alignment Alternative 3
The Avra Valley Road TI alignment would be shifted approximately 80 feet west of the existing alignment at I-10.

The crossroad alignment evaluation (fully documented in the *Final Alternative Selection Report)* resulted in the following recommendations at Avra Valley Road:

- Alternative 2 was carried forward for further evaluation
- Alternative 1 was eliminated from further consideration due to significant constructability issues
- Alternative 3 was eliminated from further consideration due to numerous issues associated with encroachment into the existing mining pit west of Avra Valley Road

Cortaro Road

In all cases, the Cortaro Road TI would be reconstructed to a divided, six-lane (three travel lanes in each direction) roadway (per the Town of Marana's Transportation Plan), with left- and right-turn lanes as warranted.

Alignment Alternative 1
The Cortaro Road TI would be reconstructed to cross over I-10 using the existing horizontal alignment of Cortaro Road.

Alignment Alternative 2
The Cortaro Road TI alignment would be shifted approximately 100 feet east of the existing alignment at I-10.

Alignment Alternative 3
The Cortaro Road TI alignment would be shifted approximately 100 feet west of the existing alignment at I-10.

The crossroad alignment evaluation (fully documented in the *Final Alternative Selection Report)* resulted in the following recommendations at Cortaro Road:

- Alternative 2 was carried forward for further evaluation
- Alternative 1 was eliminated from further consideration due to significant constructability issues, geometric issues, and potential utility impacts
- Alternative 3 was eliminated from further consideration due to right-of-way impacts, potential costs, and proximity to existing homes

3.2.4 Traffic Interchange Configurations

The following interchange types were considered at Avra Valley Road and Cortaro Road:

- Diamond
- Single-point urban (SPUI)
- Diverging diamond
- Cloverleaf interchange
- Partial cloverleaf

The following elements were considered in the evaluation of interchange types:

- Right-of-Way – Diamond, single-point urban, and diverging diamond interchanges would have the smallest right-of-way footprint, while cloverleaf and partial cloverleaf interchanges would have a larger right-of-way footprint
- Driver Expectancy – Diamond interchanges are the most prevalent interchange along I-10 in the Tucson metropolitan area. Therefore, they are the most compatible with driver expectations
- Compatibility with Frontage Roads – Diamond, cloverleaf, and partial cloverleaf interchanges are compatible with frontage roads. Frontage roads can be used with a SPUI; however, an additional signal phase must be added to the traditional three-phase SPUI signal to accommodate the through movement on the frontage road, thus having an "adverse effect" on traffic operations. Frontage roads are also generally not used with diverging diamond interchanges due to additional signal phases, potential limitation of free-flow turning movements, and safety concerns associated with accommodating the frontage road through movement
- Traffic Operations – As shown in Chapter 2, the diamond interchange can provide acceptable operations at both the Avra Valley Road and Cortaro Road TIs

Based on these considerations, it was recommended that the single-point urban, diverging diamond, cloverleaf, and partial cloverleaf interchanges be eliminated from further consideration, and the diamond interchange be carried forward for further evaluation as part of the Build Alternative.

3.2.5 Recommendations from Alternative Selection Report

The *Final Alternative Selection Report* recommended the following Build Alternative be carried forward for further study through the DCR and EA:

- Expand I-10 to add two travel lanes in both directions between Tangerine Road and Ina Road (ten-lane freeway) with a closed median (concrete median barrier)
- Lower the I-10 profile at Avra Valley Road and Cortaro Road
- Include parallel entrance and exit ramps in both directions on I-10 at all traffic interchanges
- Provide continuous two-lane, one-way frontage roads
- Reconstruct the Avra Valley Road TI to:
  - Shift the alignment approximately 80 feet east of the existing alignment
  - Pass over I-10
  - Widen Avra Valley Road to include a raised curbed median, four travel lanes (two travel lanes in each direction) and left- and right-turn lanes as warranted
  - Accommodate the future extension of Avra Valley Road to the north over the UPRR by the Town of Marana or others
- Reconstruct the Cortaro Road TI to:
  - Shift the alignment approximately 100 feet east of the existing alignment
  - Pass over I-10 and the UPRR
  - Widen Cortaro Road to include a raised curbed median, six travel lanes (three travel lanes in each direction) and left- and right-turn lanes as warranted

3.3 DESCRIPTION OF ALTERNATIVES

Based on the findings documented in the *Final Alternative Selection Report,* the No-Build Alternative and one Build Alternative were carried forward for further study through the DCR and EA.

Both the No-Build and Build Alternatives would include improvements at the Tangerine Road and Ina Road TIs, as planned by other projects. At Tangerine Road, a new diamond interchange would be constructed approximately 2,500 feet west of the existing Tangerine Road TI with one-way frontage roads. I-10 would remain at ground level and a realigned Tangerine Road would be constructed to pass over I-10 and the UPRR. The existing Tangerine Road crossing would remain and provide a grade-separated crossing of I-10 and an at-grade crossing of the UPRR. In addition, the Town of Marana intends to widen existing Tangerine Road to a five-lane section north of I-10.

Ina Road is being designed under ADOT Project No. 010 PM 248 H8479 01D. This project would reconstruct Ina Road to pass over I-10 and the UPRR. The I-10 mainline would be reconstructed to accommodate a ten-lane freeway section (five travel lanes in each direction) plus auxiliary lanes. The Ina Road TI would maintain the full diamond interchange configuration at its current location and include parallel entrance and exit ramps. The frontage roads between Cortaro Road and Ina Road are one-way, continuous, two-lane roads, but they would be reconstructed to be compatible with the I-10 mainline and interchange improvements.

3.3.1 No-Build Alternative

The No-Build Alternative would not construct any improvements to I-10 other than the Tangerine Road and Ina Road TI improvements described above. I-10 would continue to provide three travel lanes in each direction (six-lane freeway) with an open median. The frontage roads would remain in their current configuration and access to adjacent parcels would continue to be provided by the existing frontage roads.

The existing Avra Valley Road and Cortaro Road TIs would remain in their current configurations. The Town of Marana, or others, could extend Avra Valley Road to the north with an at-grade crossing of the UPRR. The existing at-grade crossing of the UPRR on Cortaro Road would remain.

3.3.2 Build Alternative

I-10 would be reconstructed to lower the profile and include five travel lanes in each direction (ten-lane freeway) with a closed median, and continuous one-way frontage roads. On I-10, each travel lane would be 12-foot-wide along with 12-foot-wide inside and outside shoulders. The median would contain a 42-inch tall concrete barrier to separate two-way traffic. Parallel entrance and exit ramps would be included in both directions on I-10 at all interchanges. Portions of the eastbound entrance ramp and westbound exit ramp for the new Tangerine Road TI and the entrance and exit ramps at the Twin Peaks Road TI would be reconstructed.

The continuous one-way frontage roads would generally be parallel to the I-10 mainline and would connect to the ramps near the traffic interchanges. The frontage roads would contain two 12-foot-wide travel lanes with 8-foot-wide inside and outside shoulders. Access to adjacent parcels would be provided by the one-way frontage roads. The I-10 Build Alternative typical section is shown in Figure 3.1.

The Avra Valley Road TI would be reconstructed to:

- Shift the alignment approximately 80 feet east of the existing alignment
- Pass over I-10
- Widen Avra Valley Road to include a raised curbed median, four travel lanes (two travel lanes in each direction) and left- and right-turn lanes as warranted
- Accommodate the future extension of Avra Valley Road to the north over the UPRR by the Town of Marana or others

The Cortaro Road TI would be reconstructed to:

- Shift the alignment approximately 100 feet east of the existing alignment
- Pass over I-10 and the UPRR
- Widen Cortaro Road to include a raised curbed median, six travel lanes (three travel lanes in each direction) and left- and right-turn lanes as warranted

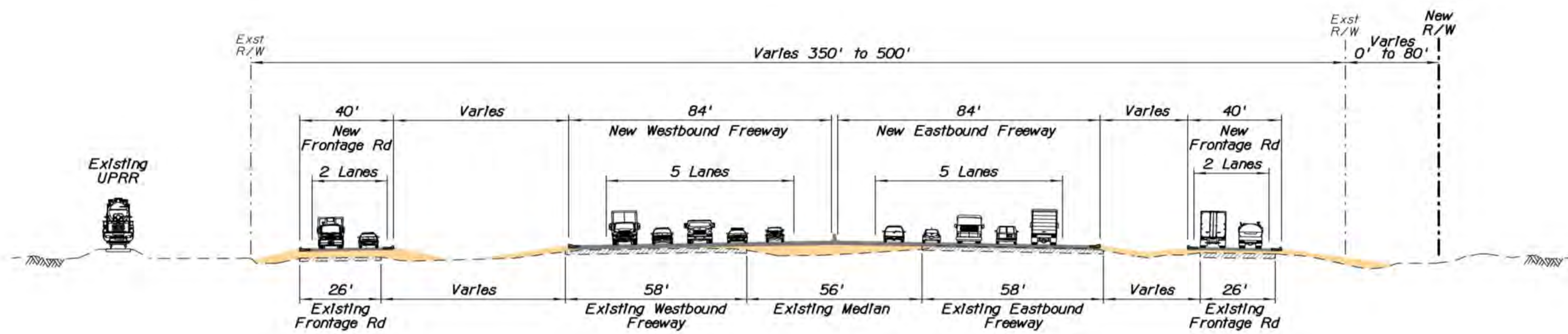

Figure 3.1 – I-10 Build Alternative Typical Section

3.4 ALTERNATIVE EVALUATION

3.4.1 No-Build Alternative Evaluation

The No-Build Alternative would not result in any improvements on the I-10 mainline, ramps, frontage roads or crossroads which would not address the need for the project to:

- Accommodate projected travel demand – The existing configuration would not meet anticipated 2040 travel demand resulting in significant congestion (LOS 'E' or 'F') on I-10 and at the traffic interchanges during peak hour periods
- Support the designation of I-10 as a part of the CANAMEX trade corridor - The expected traffic delays based on future demand would delay regional, interstate, and international trade throughout central Arizona
- Provide a parallel route to I-10 – The existing frontage roads are discontinuous, accommodate two-way traffic, or accommodate only a single lane of traffic. Therefore, the existing configuration would not provide the ability to detour mainline traffic onto the frontage roads when a closure is needed on the mainline due to a crash, construction, or maintenance
- Meet current design standards – The existing sub-standard elements would not be improved, including vertical clearances at the Cortaro Road and Avra Valley Road bridges; undersized drainage culverts; minimum drainage culvert height for maintenance; and frontage road widths
- Eliminate vehicle-train conflicts on major arterials. Cortaro Road would remain in its current configuration, which includes an at-grade railroad crossing of the UPRR. If the Town of Marana extends Avra Valley Road to the north, it would create a new at-grade railroad crossing. The Tangerine Road and other at-grade crossings identified in Table 1.4 (page 9) would also remain
- Be compatible with ADOT, Town of Marana and Pima County long-range plans

3.4.2 Build Alternative Evaluation

The Build Alternative would:

- Operate at LOS 'D' or better during peak hours on all segments of the I-10 mainline and at the Avra Valley Road and Cortaro Road TIs based on the traffic analysis performed with the projected 2040 traffic volumes
- Support the designation of I-10 as part of the CANAMEX trade corridor by maintaining acceptable levels of service through the corridor
- Reconstruct the frontage roads to be continuous and one-way; thereby providing a parallel route to I-10
- Upgrade the existing facilities to current design standards and practices. The drainage facilities constructed with the Twin Peaks Road TI improvements would remain in place
- Eliminate vehicle-train conflicts on Cortaro Road. If the Town of Marana extends Avra Valley Road to the north, the proposed improvements at Avra Valley Road would allow the northward extension of this roadway with an overpass of the UPRR. However, the existing at-grade crossing at Tangerine Road and other at-grade crossings identified in Table 1.4 (page 9) would remain, except the crossing at the abandoned railroad spur east of Avra Valley Road. The tracks at this location (only existing under I-10) would be removed
- Be compatible with ADOT, Town of Marana and Pima County long-range plans

3.5 RECOMMENDATIONS

The No-Build Alternative is not recommended for the following reasons:

- It would not accommodate future travel demand and the majority of the corridor would operate at LOS 'E' or 'F' (unacceptable LOS) during extended periods
- It does not support the designation of I-10 as a part of the CANAMEX trade corridor. The expected traffic delays on I-10 based on future traffic demand would delay regional, interstate, and international trade throughout central Arizona
- It does not provide a parallel route to I-10 for detouring I-10 mainline traffic during incidents, construction, or maintenance
- The existing sub-standard elements would not be improved
- It would maintain all at-grade crossings on major arterials. As mentioned in Section 1.2, approximately 30 to 40 UPRR trains pass through this area per day. The UPRR is almost completed with installing new tracks (double tracking) to the north of the existing tracks to expand the capacity of the Sunset Corridor. The double tracking would result in a higher potential for serious vehicle-train collisions; even longer traffic delays for motorists, emergency responders, pedestrians and other modes of transportation; and higher noise levels from the increase in the number of trains passing through this area. UPRR's ultimate plan to upgrade the corridor to four tracks would result in very undesirable operations at all at-grade crossings in the Sunset Corridor

Therefore, it is recommended that the Build Alternative as described in Section 3.3.2 be carried forward for implementation along the study corridor.

4.0 MAJOR DESIGN FEATURES OF THE RECOMMENDED ALTERNATIVE

4.1 INTRODUCTION

This section describes the design controls and features for the Recommended Alternative. Appendix D contains the preliminary plan sheets for the Recommended Alternative.

4.2 DESIGN CONTROLS

The design elements of the Recommended Alternative were designed to be in conformance with the following standards and guidelines:

- ADOT Roadway Design Guidelines (RDG) 2012 Edition
- ADOT Bridge Design Guidelines
- ADOT Standard Drawings (current revisions and updates)
- ADOT Materials Preliminary Engineering and Design Manual
- Other supplemental ADOT design guidelines and policies
- A Policy on Geometric Design of Highways and Streets (2011) (AASHTO)
- Roadside Design Guide (AASHTO)
- AASHTO LRFD Bridge Design Specifications, 6th Edition
- Pima County and Town of Marana Design Guidelines (for the crossroads)

A summary of the design controls used for the I-10 mainline, ramps, frontage roads and crossroads (Avra Valley Road and Cortaro Road) are presented in Table 4.1.

Table 4.1 – Design Controls

Description Of Criteria	I-10 Mainline	Ramps	Frontage Roads (FR)	Crossroads	
				Avra Valley Rd.	Cortaro Rd.
Design Year	2040				
Classification	Controlled Access Highway, Urban/Fringe Urban	Controlled Access	Urban/Fringe Urban Highway	4-Lane Divided Road (Urban) (PC Fig. 2-7)	6- Lane Arterial (Marana Dtl. No. 120-2)
Design Vehicle	WB-67	WB-67	WB-67	WB-62	
Design Speed (mph)	65	Exit (at Gore): 60 Entrance (at Gore): 55 Body: 50 Ramp/FR Gore: 45	50 Ramp/FR Gore: 50	50	40
Lane Width	12'	12'	12'	11'	12'
Shoulder Widths	Outside: 12' Median: 12'	Left: 2' (+2' W/ Barrier) Right: 2' (+2' W/ Barrier) for Entrance Ramps; 8' (+2' W/ Barrier) for Exit Ramps 2' at Turn Lanes	Left: 8' (+2' W/ Barrier) Right: 8' (+2' W/ Barrier)	Left: 1' Right: 6' (Includes Gutter Width)	Left: 1' Right: 7' (Includes Gutter Width)
Cross Slope	2%	2%	2%	2%	
Superelevation	0.06 ft./ft. Max. RDG Table 202.3B	0.06 ft./ft. Max. RDG Table 202.3B	0.04 ft./ft. Max. RDG Table 202.3A	0.04 ft./ft. Max.	0.04 ft./ft. Max. AASHTO Method 2 (Low Speed Urban)
Minimum Vertical Curve	800'	400'	150'	150'	
Maximum Gradient	3%	Uphill: 4% Downhill: 5% Within 400' of Intersection: 3%	5%	3%	Approach to I-10: 4% At I-10: 3%
Minimum Gradient	W/ Curb & Gutter: 0.4% W/out Curb & Gutter: 0.25%	W/ Curb & Gutter: 0.4%	W/ Curb & Gutter: 0.4%	W/ Curb & Gutter: 0.5% or Match Existing at Tie-In	
Side Slopes	Varies; 3:1 Max.				
Minimum Vertical Clearance	Bridge Structure: 16'-6" Sign Structure: 18'-0"	Bridge Structure: 16'-6" Sign Structure: 18'-0"	Bridge Structure: 16'-6" Sign Structure: 18'-0"	Bridge Structure: • 16'-6" Over Roadway • 23'-6" Over UPRR Sign Structure: 18'-0"	
Median Width	N/A	N/A	N/A	24' Std., 4' Min.	24' Std., 4' Min.
Sidewalk Width	N/A	N/A	N/A(1)	5'	

(1) Per ADOT RDG 107.2A, the highway cross section should provide space for sidewalk to be constructed by others in the future. In areas along the eastbound frontage road with curb and gutter, a bench (7' min, 17' desirable), should be provided behind the curb.

4.3 ROADWAY

The preliminary plans for the Recommended Alternative are presented in Appendix D. In order to accommodate 2040 projected traffic volumes in the study corridor the following improvements are recommended:

I-10 mainline:

- Expand I-10 to a ten-lane freeway consisting of five travel lanes in each direction with a closed median. The mainline expansion and other improvements would require approximately 26 acres of new right-of-way from properties adjacent to the roadway improvements

- Shift the proposed I-10 median centerline north or south (depending on the location) of the existing median centerline to improve the geometry and optimize the available space between the frontage roads and the ADOT right-of-way

- Lower the I-10 profile to go under Avra Valley Road and Cortaro Road. The I-10 profile would continue to pass over Tangerine Road and the UPRR spur track (APC RR OP) west of the Avra Valley Road TI. This UPRR spur track will remain active; therefore, the existing structure would be demolished and reconstructed to meet the railroad's minimum vertical clearance requirements. The abandoned railroad spur east of the Avra Valley Road TI would be demolished; so the profile would be lowered in this area

- Continue to restrict access to and from the interstate to interchange locations

- Reconfigure the frontage roads to be continuous and one-way throughout the study corridor. Widen the frontage roads to accommodate two 12-foot-wide travel lanes and 8-foot-wide shoulders for a total width of 40 feet. The proposed alignment for the frontage roads would generally parallel the proposed I-10 alignment

Traffic Interchanges:

- Maintain full diamond interchanges at Avra Valley Road, Twin Peaks Road and Cortaro Road

- Reconstruct Avra Valley Road and Cortaro Road TIs to be grade-separated over I-10

- Provide parallel entrance ramps at all interchanges that have two lanes in the body of the ramps with one lane being dropped near the mainline gore and one lane connecting to I-10

- Provide one-lane exit ramps eastbound and westbound on I-10 at all traffic interchanges, except that the westbound exit ramps at the Cortaro Road and Twin Peaks Road TIs would continue to have two lanes

- Shift the Avra Valley Road alignment approximately 80 feet east of the existing alignment and widen it to include a raised curbed median and four travel lanes (two lanes in each direction). One left-turn lane would be provided for the northbound to westbound movement and another for southbound to eastbound. One right-turn lane would be provided for the northbound to eastbound movement and another for southbound to westbound. A four-lane approach to Avra Valley Road would be provided for both the eastbound and westbound I-10 exit ramps/frontage roads

- The improvements on Avra Valley Road would terminate just north of I-10 at the ADOT right-of-way. The Town of Marana or others could extend Avra Valley Road to the north over the UPRR

- Shift the Cortaro Road alignment approximately 100 feet east of the existing alignment and widen it to include a raised curbed median and six travel lanes (three lanes in each direction). Two left-turn lanes would be provided for the northbound to westbound movement and the southbound to eastbound movement. Two right-turn lanes would be provided for the northbound to eastbound movement. One right-turn lane would be provided for the southbound to westbound movement. A four-lane approach to Cortaro Road would be provided for the eastbound I-10 exit ramp/frontage road. The westbound approach to Cortaro Road would have five lanes

- Reconstruct the mainline gores at the Twin Peaks Road TI to accommodate the expansion of I-10

- The reconstruction of the Tangerine Road TI is being planned under ADOT Project No. 010 PM 239 H7467 01X. This project would construct a new full diamond interchange approximately 2,500 feet west of the existing Tangerine Road TI and would realign portions of the eastbound frontage road. I-10 would remain at ground level and the crossroad would be constructed to pass over I-10 and the UPRR. This design concept would include eliminating the ramps connecting to I-10 at the existing Tangerine Road TI. Assuming that the interchange is constructed prior to this project, the eastbound entrance ramp and westbound exit ramp would be reconstructed at the gores to accommodate the expansion of I-10

- South of I-10, Tangerine Road is a four-lane divided roadway and the Town of Marana intends to widen it to a five-lane section north of I-10. The I-10 overpass would be reconstructed to accommodate a widened section of Tangerine Road

- The Ina Road TI is being designed under ADOT Project No. 010 PM 248 H8479 01D. This project will reconstruct Ina Road to pass over I-10 and the UPRR. The I-10 mainline will be reconstructed to accommodate a ten-lane freeway section (five travel lanes in each direction) plus auxiliary lanes. The Ina Road TI will maintain the full diamond interchange configuration at its current location and include parallel entrance and exit ramps. The frontage roads between Cortaro Road and Ina Road are one-way, continuous, two-lane roads; however, they would be reconstructed to be compatible with the I-10 mainline and interchange improvements

Other Roadways:

- Near the Rillito Community, Benta Vista Street would be extended to the west to cross the CMID canal. A new roadway would be constructed to connect Benta Vista Street to Rillito Village Trail, along the Portland Avenue alignment. These roadways would provide a two-way connection between the Rillito community and Tangerine Road once the eastbound frontage road is converted to one-way operation

- The Joplin Lane connection to Cortaro Road would be removed with the Recommended Alternative. However, several parcels located north of I-10 and west of Cortaro Road use Joplin Lane for access. The Town of Marana intends to have a future development construct a new access to these parcels. However, the timing of this development is unknown and it may not be in place when the Cortaro Road TI is reconstructed. Therefore, the Cortaro Road TI project may need to include the construction of the alternate access to these parcels, or the connection of Joplin Lane to Cortaro Road may need to be restored to provide right-in/right-out access

4.4 ACCESS CONTROL

Access control exists along the majority of I-10 by the placement of fencing between the I-10 mainline and the frontage road. Fencing is also installed intermittently along ADOT's right-of-way. Access control along I-10 would be maintained in accordance with ADOT and FHWA Access Control Policy requirements.

This study does not recommend the addition of any new interchanges in the study corridor; therefore, a minimum spacing of approximately two miles would be maintained between the traffic interchanges and the access control along I-10 would not change.

The existing frontage road system is not continuous and is composed of both one-way and two-way frontage roads. The ultimate corridor improvements consist of a continuous one-way frontage road system between Tangerine Road and Ina Road. The eastbound and westbound frontage roads would parallel the I-10 mainline and merge with the entrance and exit ramps at each interchange. Existing access points along the frontage roads would be maintained, except that access points falling in the area that is between 400 feet from the back of the ramp/frontage road paved gore and the crossroad (Figure 4.1) would not be allowed.

Along Avra Valley Road and Cortaro Road, full access control would extend a minimum of 300 feet beyond the end of the ramp radius return as specified in Section 506 of the ADOT RDG. There are existing side streets/driveways along both roadways that would be maintained. On Avra Valley Road, the Recommended

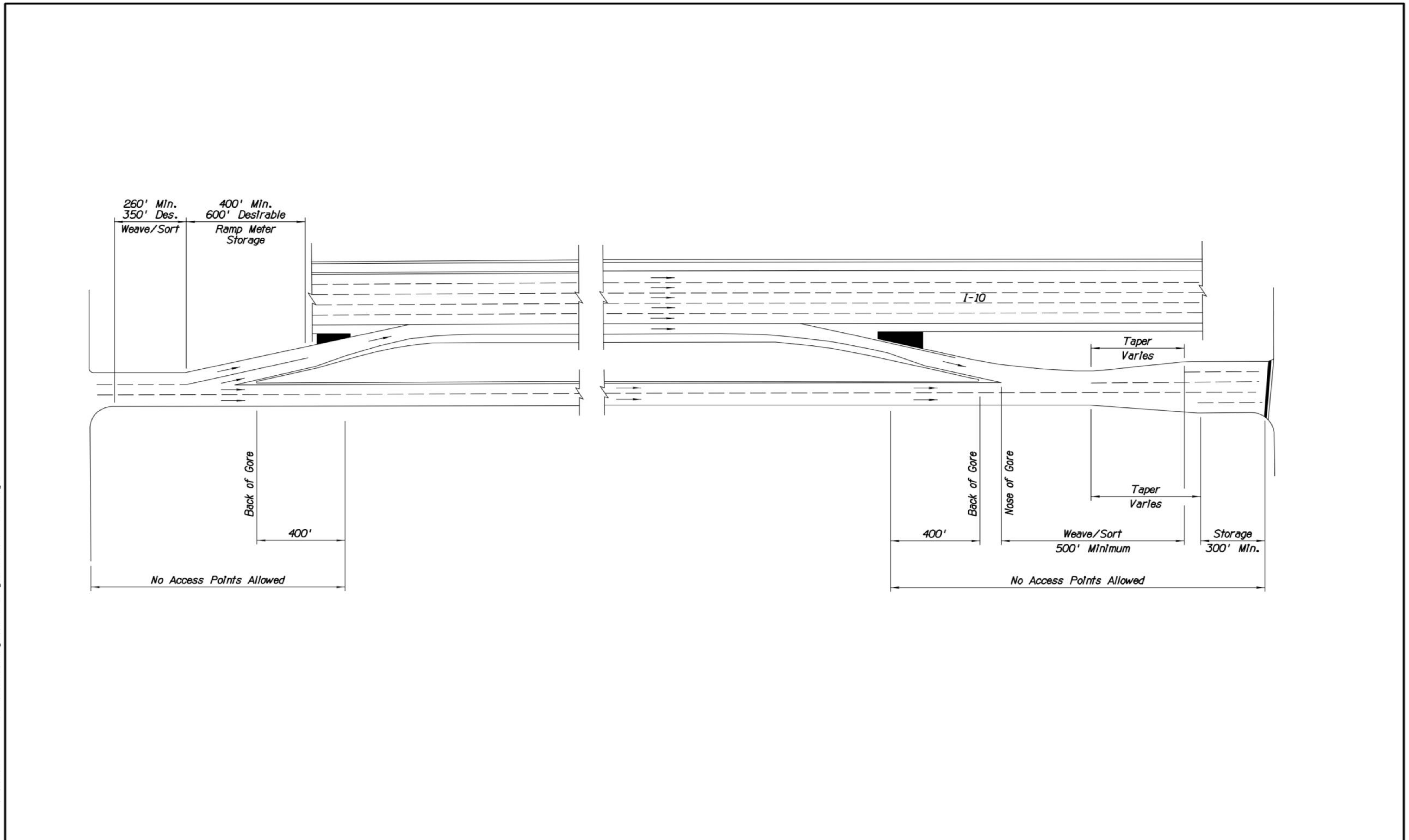

Figure 4.1 – Access Control at Ramp/Frontage Road with Crossroad

Alternative includes an intersection approximately 950 feet beyond the ramp radius and incorporates a median opening to allow full access for businesses on both sides of the road as shown in Figure 4.2. There is a planned development, not yet approved by Pima County, for the southeast quadrant of the Avra Valley Road TI, which shows three access points off of Avra Valley Road and one access point off of the frontage road. These driveways are not reflected on the plan sheets and future coordination would be required with Pima County to ensure that these access points meet ADOT requirements. Access to the eastbound frontage road could be allowed if the access point is at least 400 feet from the gore (Figure 4.1).

Along Cortaro Road, south of I-10, two driveways to the McDonalds Restaurant (west side of Cortaro Road) and one driveway to the Burger King (east side of Cortaro Road) would be eliminated due to Cortaro Road being elevated. The first driveway (right-in/right-out east of Cortaro Road) and the first side street, Cracker Barrel Road (west side of Cortaro Road), to remain are approximately 300 feet beyond the ramp radius as shown in Figure 4.3. All other access points beyond Cracker Barrel Road and the driveway would be maintained. The existing median opening that is located approximately 750 feet from the ramp radius which allows the southbound to eastbound left-turn and the northbound to westbound left-turn would be maintained. North of I-10, the closest driveway (right-in/right-out) is about 900 feet from the ramp radius. There is a planned development, not yet approved by the Town of Marana, for the area on the west side of Cortaro Road and north of I-10 (between Joplin Lane and Cerius Stravenue) that shows a single right-in/right-out only access point off of Cortaro Road. This driveway is not reflected on the plan sheets and future coordination would be required with the Town of Marana to ensure this access point meets ADOT requirements.

The Joplin Lane connection to Cortaro Road would be removed with the Recommended Alternative. However, several parcels located north of I-10 and west of Cortaro Road use Joplin Lane for access. The Town of Marana intends to have a future development construct a new access to these parcels. However, the timing of this development is unknown and it may not be in place when the Cortaro Road TI is reconstructed. Therefore, the Cortaro Road TI project may need to include the construction of the alternate access to these parcels, or the connection of Joplin Lane to Cortaro Road may need to be restored to provide right-in/right-out access.

Access control beyond the 300-foot requirement on the crossroads would be the responsibility of the local jurisdiction. Signed agreements would be needed at each interchange prior to construction to manage access.

The desired access control criteria identified in the ADOT Draft *Access Control Model for Crossroads on Controlled Access Highways*, December 4, 2006, still under development, for an Urban setting call for the first downstream access point be right-in/right-out and 750 feet from the ramp radius and the closest upstream access point 990 feet from the ramp radius. Also, the first open median would not be allowed within 1,400 feet of the ramp radius and a full access signal within 2,640 feet of the ramp radius. Enforcing this criterion would eliminate eight direct access points to existing businesses on Cortaro Road, south of I-10. Therefore, the Recommended Alternative was developed following approved or current criteria included in Section 506 of the ADOT RDG and the ADOT Traffic Engineering Policies, Guidelines, and Procedures 1060.

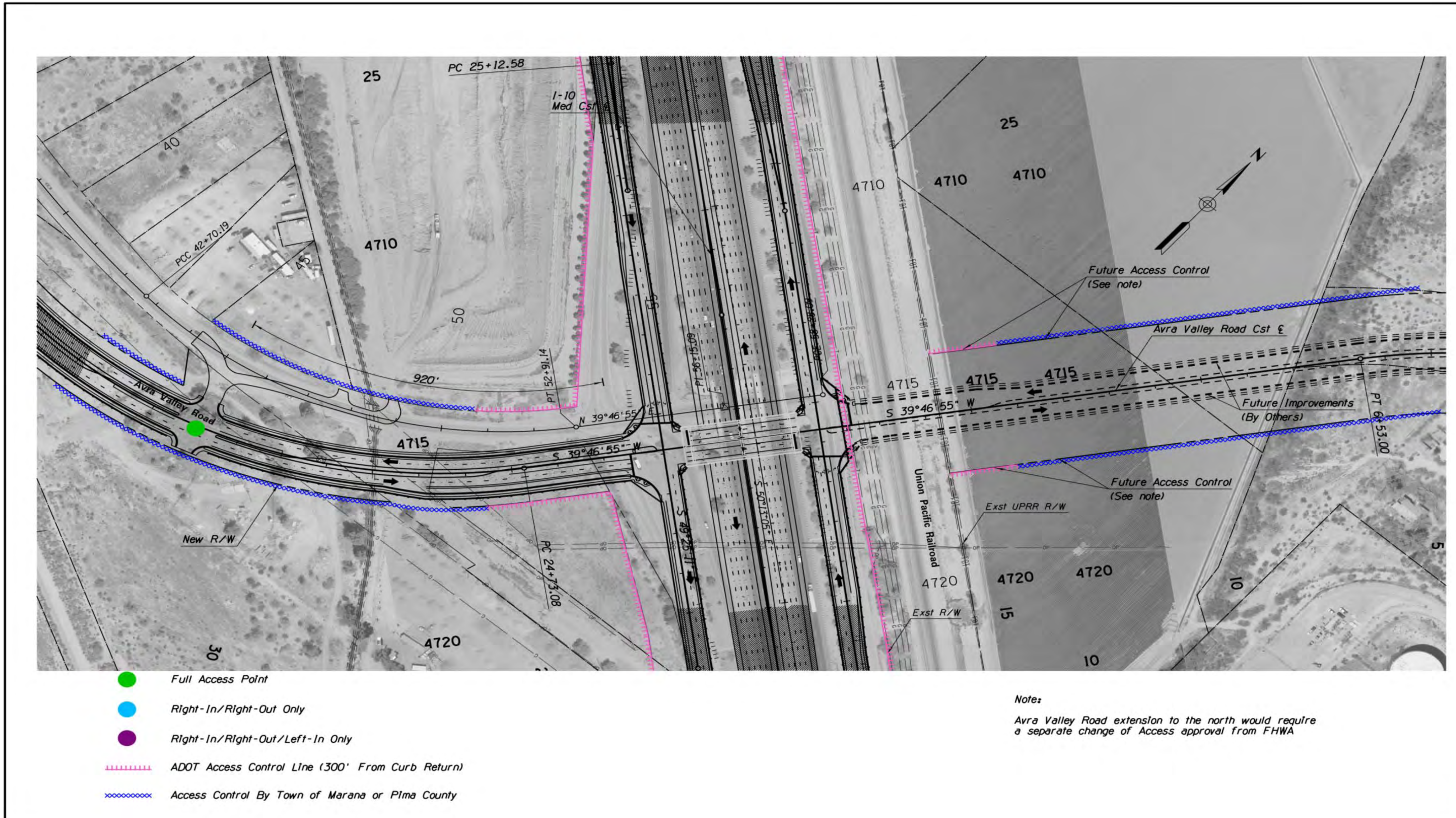

Figure 4.2 – Avra Valley Road Access Points

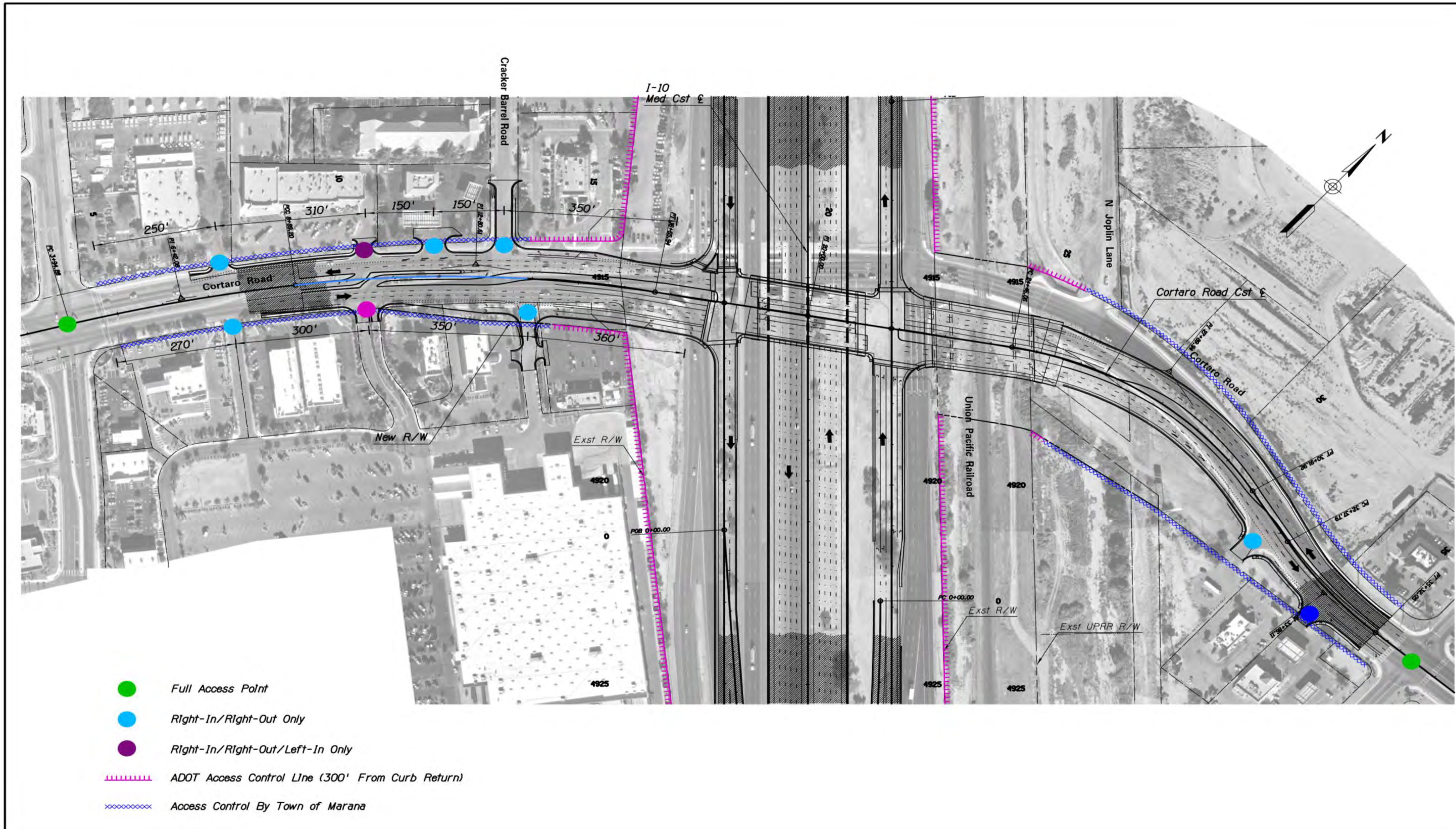

Figure 4.3 – Cortaro Road Access Points

4.5 RIGHT-OF-WAY

New right-of-way would be required from various entities south of I-10 to accommodate the I-10 expansion and frontage road improvements. The ADOT right-of-way line abuts up to the UPRR westernmost right-of-way line; therefore, no new right-of-way would be acquired on the north side of I-10.

In order to elevate Avra Valley Road and Cortaro Road over the I-10 mainline and the UPRR, new right-of-way would be required along the east side of existing Avra Valley Road, south of I-10 and on the east side of existing Cortaro Road north and south of I-10.

The total estimated right-of-way requirement, summarized in Table 4.2, is approximately 26 acres.

Temporary construction easements (TCE's) would also be required for constructing the Recommended Alternative. The TCE locations will be determined during final design. Permanent easements may also be required for utility facilities and would need to be determined during final design.

Table 4.2 – Right-of-Way Requirements

Location No.	Parcel No.	Begin Station	End Station	Approximate Area		Type of Take (Partial or Full)	Current Land Use
				SF	Acre		
Right-of-Way Requirements Along EB Frontage Roads							
1	216-12-024A	4594+82	4608+99	28,784	0.66	Partial	CMID
2	216-12-0270	4598+07	4608+99	13,327	0.31	Partial	Tangerine I-10 LLC\Vacant
3	216-10-005C	4678+54	4682+15	3,656	0.08	Partial	Calif. Portland Cement Co.\Mining
4	226-01-009D	4681+89	4708+02	110,328	2.53	Partial	Calif. Portland Cement Co.\Mining
5	226-01-006A	4716+78	4720+90	22,816	0.52	Partial	Lewis Holdings LLC\Vacant
6	226-01-032A	4722+43	4733+20	104,823	2.41	Partial	Avra Valley Mining & Development LLC\Vacant
7	226-01-032D	4733+11	4742+36	72,264	1.66	Partial	Pima County\Vacant
8	226-08-002A	4741+72	4745+58	15,376	0.35	Partial	Pima County\Vacant
9	226-08-007Q	4745+54	4750+98	20,568	0.47	Partial	Marana Unified School District\Vacant
10	226-08-001B	4745+59	4746+99	9,790	0.22	Full	Cortaro-Marana Irrigation District\Well Site
11	226-08-009E	4750+52	4777+28	158,108	3.63	Partial	State of Arizona\Vacant
12	226-08-007N	4776+72	4781+27	23,680	0.54	Partial	Tucson Quarter Midget Assn.\Race track
13	226-08-0080	4779+28	4780+68	10,011	0.23	Full	Cortaro-Marana Irrigation District\Well Site
14	221-04-0290	4843+53	4857+05	12,028	0.28	Full	Cortaro-Marana Irrigation District\Canal Site
15	221-04-0280	4860+21	4861+61	9,542	0.22	Full	Cortaro-Marana Irrigation District\Well Site
15A	226-23-030A	4880+50	4893+50	19,755	0.45	Partial	First American Title\Landscape buffer for golf course
15B	221-05-2120	4893+50	4897+00	4,244	0.10	Partial	Continental Ranch Development LLC\Vacant
16	221-19-017C	4936+48	4937+70	11,368	0.26	Full	Verizon Wireless LLC\Utility
17	226-35-003D	4976+35	4981+35	7,840	0.18	Partial	Amerco Real Estate Co\Mini Storage
17A	226-35-002E	4960+90	4967+75	10,790	0.25	Partial	2030 East LLC
17B	226-35-002F	4967+75	4972+10	5,830	0.13	Partial	2030 East LLC\Vacant
17C	226-35-002D	4972+10	4976+35	6,390	0.15	Partial	7701 N I-10 Frontage Road LLC\Vacant
18	226-35-003B	4981+35	4982+10	1,600	0.04	Partial	Southwest Value Partners LV Limited
19	226-35-005B	4982+10	4982+45	1,200	0.03	Partial	SVP Investment Managers LP\Vacant
20	226-35-005C	4982+45	4983+50	3,090	0.07	Partial	Town of Marana\Channel
21	221-40-049C	4983+50	4989+04	13,260	0.30	Partial	Coral Investments Inc.\Vacant
22	221-40-049D	4989+04	4992+10	4,360	0.10	Partial	Stellbrink William C
Total R/W Required Along EB Frontage Road				**704,828**	**16.17**		
Right-of-Way Requirements Along Avra Valley Road							
23	226-01-006A	23+00	26+78	45,283	1.04	Partial	Lewis Holdings LLC\Vacant
24	226-01-032A	27+55	42+90	184,941	4.25	Partial	Avra Valley Mining & Development LLC\Vacant
25	226-01-032C	37+91	43+37	20,576	0.47	Partial	Pima County\Vacant
26	226-01-0180	41+16	52+25	91,629	2.10	Partial	Pima County\Vacant
Total R/W Required Along Avra Valley Road				**342,429**	**7.86**		
Right-of-Way Requirements Along Cortaro Road							
27	221-19-008H	24+75	28+00	22,925	0.53	Full	Unisource Energy Corporation\Utility
28	221-05-2240	14+15	15+35	7,190	0.16	Full(1)	Laird Financial Corp\Restaurant
29	221-05-2250	15+35	16+00	4,017	0.09	Full	Continental Ranch Business Park Assn.\Parking lot
30	221-05-2340	12+00	13+70	6,545	0.15	Partial	Vantage West Credit Union\Bank
31	221-05-2350	10+60	12+00	2,065	0.05	Partial	SWT Arizona Investments LLC\Restaurant
32	221-05-2320	13+70	14+15	1,627	0.04	Partial	Wal-Mart Stores\Driveway
33	221-05-2430	14+15	14+15	415	0.01	Partial	Continental Ranch Development, LLC\Landscaping
Total R/W Required Along Cortaro Road				**44,784**	**1.03**		
Right-of-Way Requirements Along Portland Avenue							
34	216-12-0340	10+00	16+00	31,900	0.73	Partial	Cemex Construction Materials LP
35	216-12-0350	16+00	17+00	3,910	0.09	Partial	Cemex Construction Materials LP
Total R/W Required along Portland Avenue				**35,810**	**0.82**		

(1) Area is based on partial acquisition.

4.6 DRAINAGE

A drainage analysis of the watersheds impacting I-10 and the frontage roads was performed using the methodology in the ADOT *Highway Drainage Design Manual Hydrology*. The hydrologic model created for the Twin Peaks Road TI DCR was used as the basis for the current analysis. This model, taken from the *Interstate 10 Traffic Interchange at Twin Peaks/Linda Vista Final Drainage Report, March 2007*, assessed drainage conditions from Ina Road at the upstream end to the Twin Peaks Road TI at the downstream end. The model was updated to include drainage improvements at the Twin Peaks Road TI and the UPRR, and to add the contributing watersheds between Tangerine Road and the Twin Peaks Road TI improvements. Note that the discussions in this section are true directions and not relative to the I-10 east-west designation.

The design criteria presented in the ADOT RDG were used for all cross culverts and on-site drainage. The drainage criteria are summarized as follows:

Cross Drainage

- Design for 50-year storm event
- Headwater elevation for 50-year storm event to be three inches or more below pavement elevation
- Evaluate 100-year for off-site impacts

Pavement Drainage

- Design for 10-year event
- Hydraulic grade line six inches below top of grate or inlet of catch basin
- Allowable spread on mainline = shoulder + ½ lane width
- Allowable spread on ramp = 12 feet for one lane ramp; shoulder + ½ lane width

Channels

- Minimum grade of 0.2%
- Maximum velocity of 30 feet per second (fps)
- Freeboard to be 1/5 the velocity head+flow depth with an absolute minimum of one foot
- Ratio of the channel radius to channel top width to be greater than or equal to three. Superelevation to be applied to curves in channel

In addition, direction has been given by ADOT Tucson District to replace culverts that are three feet high with minimum six-foot high box culverts, and embed culverts into ground where insufficient cover is available. The standard box culvert sizes contained in the new ADOT structure standards should be followed to avoid a special design for box culverts. The District also requested that, although the culvert heights at the Twin Peaks Road TI are not per current standard, they should remain since they were recently constructed.

4.6.1 Existing Cross Drainage Facilities

Existing cross drainage facilities consist of various structures under the UPRR, the westbound frontage road, and the I-10 mainline. Between Ina Road and Avra Valley Road, these structures generally occur in series and are designed to convey flows west toward the Santa Cruz River. In almost every case, the structures under the mainline extend to the west side of the eastbound frontage road. North of Avra Valley Road, I-10 lies on the watershed divide, and a limited number of cross culverts under the westbound frontage road serve to convey on-site drainage toward the railroad. Table 4.3 lists the existing structure at each concentration point along the UPRR. The concentration point naming convention is consistent with that used for the Tortolita Basin Management Studies. I-10 mainline stationing is also provided.

The hydrologic model for determining concentrated flows was also used for combining hydrographs from off-site flow with the accumulated overflow from undersized cross culverts. The analysis indicates that capacity to convey accumulated flow between the westbound frontage and railroad is exceeded near Station 4874+50, and significant overtopping of the westbound frontage road occurs in a 50-year event. The capacity to convey this flow between the westbound frontage road and mainline is also exceeded at this location resulting in overtopping of the mainline as well.

Table 4.3 – Existing Cross Drainage Structures

Concentration Point	I-10 Mainline Station at Concentration Point	Structure Size			
		UPRR	WB Frontage Road	I-10 Mainline	EB Frontage Road
NR 12	5033+66 [a]	1-10’x3’ RCBC	1-10’x3’ RCBC	1-10’x3’ RCBC	1-10’x3’ RCBC
NR 11 (South)	5016+56 [a]	6-48” SSP	4-8’ x 3’ RCBC	-	-
NR 11 (North)	5004+32 [a]	-	2-7’ x 3’ RCBC	2-6’ x 3’ RCBC	2-6’ x 3’ RCBC
NR 10	4993+45 [a]	3-48” SSP	2-8’ x 3’ RCBC	3-8’ x 3’ RCBC	3-8’ x 3’ RCBC
NR 9	4983+20	3-20’ x 2.8’ Bridge	4-8’ x 3’ RCBC	3-10’ x 3’ RCBC	3-10’ x 3’ RCBC
NR 8	4972+75	1-48” SSP	2-24” CMP	-	-
NR 7	4962+82	5-36” SSP	3-10’ x 4’ RCBC	3-10’ x 4’ RCBC	3-10’ x 4’ RCBC
NR 6	4950+90	1-48” SSP	1-5’ x 2.5’ RCBC	-	-
NR 5	4905+00	2-36” SSP	3-5.5’ x 2.5’ RCBC	-	-
NR 4	4891+87	6-36” SSP	1-6’ x 3’ RCBC	-	-
NR 3	4880+84	5-60” SSP	2-4’ x 2’ RCBC	2-8’ x 3’ RCBC	2-8’ x 3’ RCBC
NR 2	4874+80	5-48” SSP	-	-	-
NR 1	4868+03	4-48” SSP	2-6’ x 2.5’ RCBC	2-8’ x 3’ RCBC	2-8’ x 3’ RCBC
CA 6	4847+95	2-60” SSP	2-8’x4’ RCBC	2-8’x4’ RCBC	2-8’x4’ RCBC
CA 5	4832+45	2-60” SSP	3-10’x4’ RCBC	3-10’x4’ RCBC	3-10’x4’ RCBC
CA 4	4812+76	5-60” SSP	2-8’x4’ RCBC	2-8’x4’ RCBC	2-8’x4’ RCBC
CA 3	4795+24	4-15’ x 1.7’ Bridge	4-8’x3’+2-6’x3’ RCBC	4-8’x3’+2-6’x3’ RCBC	4-8’x3’+2-6’x3’ RCBC
CA 2	4769+15	3-20’ x 1.5’ Bridge	6-10’ x 4’ RCBC	6-10’ x 3’ RCBC	6-10’ x 3’ RCBC
CA 1	4781+42	3-36” SSP	1-5’x2.5’ RCBC	1-5’x2.5’ RCBC	1-5’x2.5’ RCBC
PR 1	4744+15	5-60” SSP	2-8’x4’ RCBC	2-8’x4’ RCBC	2-8’x4’ RCBC
PR 2 [b]	4720+69	4-48” SSP	-	-	-
PR 3 [b]	4716+25	3-48” SSP	-	-	-
RU 1 [b]	4692+60	3-60” SSP	-	-	-

Table 4.3 – Continued

Concentration Point	I-10 Mainline Station at Concentration Point	Structure Size			
		UPRR	WB Frontage Road	I-10 Mainline	EB Frontage Road
RU 2 [b]	4682+74	2-7'X4' RCBC	2-10'x4'	-	-
RU 3 [b]	4667+30	-	1-10'x4'	-	-
	4651+82	4-48" SSP	4-10'x5'	-	-
WB 1 [b]	4572+30	2-36" SSP	-	-	-

[a] I-10 Stationing based on I-10, Ina Road to Ruthrauff Road centerline stations.
[b] Runoff pattern changes. On-site drainage from I-10 flows east under the westbound frontage road to the UPRR.
SSP (Smooth Steel Pipe); RCBC (Reinforced Concrete Box Culvert); CMP (Corrugated Metal Pipe)

4.6.2 Proposed Cross Drainage Improvements

Major improvements are proposed under I-10 at the Pines Phase II near Stations 4868+50 and 4880+50 and at the Massingale Wash near Station 4982+60. These locations were selected due to the amount of accumulated flow, and the opportunity to provide an outfall to the Santa Cruz River. At the Pines, provisions were made during development of the golf course and adjacent subdivision to convey flow to the Santa Cruz River. The improvements at Stations 4868+50 and 4880+50 would eliminate overtopping of the I-10 mainline at that location. At Massingale Wash, a new channel is recommended to convey flow from the Massingale Wash to the river. An alignment across private property has been developed with consideration of impacts on business operations. It should be noted that although the Massingale Wash improvements are addressed in this study, these improvements may be constructed with the Ina Road TI improvements.

Culvert improvements would be made at various locations in the study area. Table 4.4 summarizes the proposed improvements.

Table 4.4 – Proposed Cross Drainage Improvements

Station	New Culvert Size and Type	Watersheds (WS)	Comments
Along I-10 Mainline			
4721+00 to 4737+00	Various Sizes RCP		RCP to Convey On-site Drainage Under WB Frontage Road
4735+40	2-8'x6' RCBC	N/A	Replicates existing conditions at the Abandoned Railroad Spur
4743+15	6-8'x6' RCBC	PR 1	
4751+24	4-36" RCP	CA 1	
4767+91	6-10' x 6' RCBC	CA 2	
4795+00	-	CA 3	Existing Culvert to Remain
4812+65	-	CA 4	Existing Culvert to Remain
4831+05	-	CA 5	Existing Culvert to Remain
4844+80	-	CA 6	Existing Culvert to Remain
4868+45	7-10'x6' RCBC	NR 1	
4871+39	4-10'x6' RCBC	NR 2	
4880+44	3-10'x6' RCBC	NR 3	
4891+45	-	NR 4	Eliminate Crossing
4904+70	-	NR 5B	Eliminate Crossing
4950+05 (existing) 4917+36 (proposed)	2-10'x4' RCBC (I-10) 2-42" SSP (UPRR)	NR 6	Eliminate Existing Crossing at Sta 4950+05 and Provide New Culverts Under I-10 and UPRR at Sta 4917+36
4962+36	3-10'x6' RCBC	NR 7	
4972+35	-	NR 8	Eliminate Crossing
4982+63	4-10'x6' RCBC	NR 9	Culvert Size per I-10, Ina Rd. to Ruthrauff Rd. DCR
Along Cortaro Road			
13+57	3-10'x6' RCBC	NR 5A	

4.6.3 Pavement Drainage

South of Avra Valley Road, the mainline, frontage roads, and ramps would be curbed. Catch basins with storm drains would be used to capture the pavement drainage and convey it to the next downstream cross culvert. The storm drain systems would also include area drains to capture the on-site drainage generated between the mainline and frontage roads. The existing system at the Twin Peaks Road TI would be used to the extent practicable.

From Avra Valley Road north where drainage patterns change and runoff flows east, on-site drainage would be captured in area drains and conveyed to the east side of the westbound frontage road at locations as needed to clear flow from the area between the mainline and frontage roads. The storm drain system to be built with the future Tangerine Road TI would be used as an outfall to drain infield areas close to the interchange.

4.6.4 FEMA Floodplains

The majority of the study area is within the 100-year floodplain as defined on FEMA maps 4019C1045L, 4019C1065L, and 4019C1655L. The floodplain begins at Massingale Road at the upstream end and continues through to Tangerine Road. The obstruction of flow and ponding at undersized cross culverts at the UPRR and I-10 creates flooding adjacent to the railroad tracks and between the mainline and railroad. These conditions place the westbound frontage road within the 100-year floodplain. Drainage improvements proposed under this DCR would take additional flow to the Santa Cruz River, and would likely impact the floodplain water surface elevations. The Manning's equation was used to determine potential impacts at four locations between Tangerine Road and Avra Valley Road. The results are shown in Table 4.5.

Table 4.5 – Approximate 100-Year Water Surface Elevations at Four Locations

I-10 Mainline Station	Q_{100} per ADOT Methodology (Existing Cond.)	Q_{100} per ADOT Methodology (Future Cond.)	Existing 100-year WSE (per ADOT Q)	Future 100-year WSE (per ADOT Q)
4609+50	4645	4527	2049.21	2049.30
4636+35	4645	4527	2058.95	2058.98
4666+20	4298	4176	2066.46	2066.44
4701+10	2945	2823	2074.07	2074.02

A more in-depth analysis of the FEMA floodplain using FEMA approved methods is required to account for new improvements under the railroad and I-10. This analysis can then be used to determine the extent of impacts that I-10 may have on the floodplain. Analyzing the impact to the FEMA floodplain and subsequently preparing FEMA map revisions is beyond the scope of this project.

4.6.5 Section 401 and 404 of the Clean Water Act

Discharges of dredged and fill material into Waters of the US (WOUS) are regulated under Section 404 of the Clean Water Act. The US Army Corps of Engineers (USACE) 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 (ADEQ) issues water quality certification under Section 401 of the Clean Water Act.

The Santa Cruz River is a major wash and has been designated a Traditional Navigable Water (TNW) and therefore, the USACE has jurisdiction over it as a WOUS. The construction activity for the Massingale channel (removal of the existing soil cement bank protection and installation of an outlet structure) to provide an outfall to discharge into the Santa Cruz River is anticipated to involve disturbance of less than one-half acre, and therefore, would require under Section 404 an Individual permit from the USACE. Specific permit requirements under Section 404 of the Clean Water Act would be determined during final design, and the appropriate permit would be obtained prior to construction. A Section 401(a) water quality certification from the ADEQ would also be required.

Section 402 AZPDES of the Clean Water Act requires any construction project that would disturb one or more acres of land to obtain a permit for stormwater discharge. The proposed improvements for this project would 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 would exceed one acre.

4.7 STRUCTURES

4.7.1 Bridge Structures

Five new bridges would be constructed with the Recommended Alternative. Two of the bridges would be on the I-10 mainline over Tangerine Road and the active railroad spur (APC RR Spur). One bridge would be constructed to elevate Avra Valley Road over I-10 and two bridges would be constructed on Cortaro Road to elevate it over I-10 and the UPRR. A summary of each of the structures considered is provided in Table 4.6. Individual Structure Selection Reports will be submitted in conjunction with this DCR. The new bridges are proposed to be precast, prestressed AASHTO concrete I-girders. Due to settlement, the recommended foundation type is drilled shafts.

Table 4.6 – Proposed Bridge Structures

Location	Superstructure Type	No. of Spans	Length (ft.)	Width (ft.)	Vertical Clearance (ft.)	Skew	Deck Area (SF)
I-10 Over Tangerine Rd.	AASHTO Type IV Precast Girders	2	180	213± to 205±	18.25 Min.	0º	38,570
I-10 Over APC RR Spur	AASHTO Type III Precast Girders	3	201	174±	23.5 Min.	45º	36,130
Avra Valley Rd. over I-10	AASHTO Type V Mod Precast Girders	2	216	106±	19.4 Min.	0º	23,370
Cortaro Rd. over I-10	AASHTO Type V Mod Precast Girders	2	220	154±	18.2 Min.	10º	34,610
Cortaro Rd. over UPRR	AASHTO Type VI Mod Precast Girders	3	220	166± to 158±	23.5 Min.	11º	36,180

Architectural treatments are a collective term for design-enriching features along an interstate including some or all of the following: formliner-created patterns for concrete structures, metal fabrications applied to structures, distinctive paint palette, and landform graphics. The goal of architectural treatments for this project is to enhance the I-10 corridor, make it less monotonous, give it a distinctive identity, and maintain continuity using similar architectural treatments, color, and plant materials.

Existing architectural treatments along the I-10 corridor in Tucson contain general themes based on regional influences such as cultural history, climate, flora and fauna, surrounding topography and the Santa Cruz River. Each interchange currently has a specific theme which ties into these regional influences. Architectural treatments of the retaining walls, bridge barriers, abutments and piers, and pedestrian fencing would be evaluated and developed further during the final design process. Specific themes and layout would be determined in coordination with ADOT Roadside Development, ADOT Tucson District, public input, and the design team.

Location of the proposed architectural treatments in the project limits includes all retaining walls and bridge treatments.

4.7.2 Retaining Wall Structures

Thirty-two new retaining walls varying from 50 feet to 3,855 feet in length and from one-foot to 36 feet in height would be required as identified on the plans in Appendix D and summarized in Table 4.7. The total area of the walls is approximately 223,500 square feet. The retaining wall types that could be considered for this project are cantilevered walls on spread footings, cantilevered walls on drilled shaft foundations, mechanically stabilized earth (MSE) walls, soil nailed walls, and soldier/tie-back walls. Retaining walls would be designed in accordance with the latest AASHTO *LRFD Bridge Design Specifications – Customary US Units,* 1995 ADOT *Retaining Wall Policy, Memorandum No. 95-02* and ADOT Bridge Design Guidelines.

Table 4.7 – Summary of Proposed Retaining Walls

Wall Location	Wall	Station	Length (Ft.)	Area (SF)	Average Height (Ft.)	Minimum Height (Ft.)	Maximum Height (Ft.)
I-10	WB-6	4572+37, Lt	940	6,240	6	4	8
	WB-7	4584+17, Lt	1,360	2,970	5.5	1	9
	WB-10	4655+25, Lt	1,480	13,921	10.75	2	16
	EB-5	4656+25, Rt	1,220	11,970	10.5	2	17
	EB-6	4670+44, Rt	875	8,740	9.5	2	17
	WB-11	4672+15, Lt	955	8,160	8	2	14
EB Frontage Road	EB-7	4697+50, Rt	1,325	18,900	6.75	3	20
	EB-8	4704+25, Lt	1,120	2,910	6	2	10
	EB-9	4716+39, Lt	620	1,830	6	2	10
	EB-1	4912+38, Lt	252	1,612	6	1	11
	EB-2	4916+50, Lt	343	2,379	7	1	11
	EB-3	4979+50, Rt	200	620	2	1	5
	EB-4	4990+70, Rt	130	527	2	1	5
WB Frontage Road	WB-8	4596+00, Lt	1,625	5,690	3.3	2	5
	WB-12	4675+75, Lt	50	450	3.6	2	5
	WB-13	4676+70, Lt	3,855	40,600	10.6	3	32
	WB-14	4704+30, Rt	1,095	7,190	10.5	2	19
	WB-15	4716+20, Rt	1,185	6,350	10.5	2	19
	WB-16	4716+20, Lt	1,000	20,460	22	12	32
	WB-2	4910+30, Rt	437	5,671	11	1	19
	WB-1	4911+30, Lt	420	4,821	11	1	16
	WB-4	4916+85, Rt	655	8,805	13	1	24
	WB-3	4917+13, Lt	430	4,515	11	1	18
	WB-5	4980+50, Lt	512	22,306	3	4	6
Avra Valley Rd.	AV-2	22+70, Lt	913	10,043	11	4	18
	AV-1	32+40, Lt	1,150	2,300	2	1	4
Cortaro Rd.	CRS-1	11+50, Rt	270	1,541	5	4	10
	CRS-2	14+30, Rt	270	4,548	14	1	22
	CRS-3	25+10, Rt	90	1,507	18	1	36
	CRN-1	12+20, Lt	186	935	4	1	9
	CRN-2	13+55, Lt	480	7,163	14	1	23
	CRN-3	24+90, Lt	795	7,969	12	2	34

New retaining walls along the I-10 corridor may require special design considerations due to the proximity of new walls and existing walls, or new walls in close proximity to the right-of-way. At these locations, the following alternatives should be evaluated during final design:

- Offset the new wall from the existing wall to provide sufficient area to construct a new spread footing
- Provide a specialty wall design that could be founded on:
  - L-shape spread footing
  - Single or multiple rows of drilled shaft foundations utilizing a shaft cap to transfer the loads from the wall to the shafts
  - Tie-back or soil nail walls may be considered. However, the existing roadway embankment may not be suitable for lateral restraint

This study does not include a Wall Selection Report. Adjacent projects on I-10 have used cantilever walls on drilled shaft foundations in some locations, which have significantly higher costs than traditional retaining walls. Therefore, the construction cost estimate is based on the use of a traditional cantilever wall design for walls less than 10 feet tall, and the use of cantilever walls on drilled shaft foundations for walls greater than 10 feet tall. Therefore, an average cost of $104 per square foot has been used for the retaining walls. During final design, an evaluation would be required to evaluate the feasibility of each wall type. The evaluation should include technical viability, right-of-way constraints, construction access availability, maintenance of traffic during construction, and estimated construction costs.

The Tucson District has encountered several issues with MSE wall construction in the past including:

- Backfill placement and compaction
- Strap and panel damage resulting from backfill placement operations
- Panel misalignment
- Joint water-tight seal failure
- Strap conflicts with drainage features
- Strap conflicts with anchor slab lugs
- Friction angle testing/delay issues
- Constructability (forming concerns) for wall coping beam
- Replacing panels with the same architectural treatment

Therefore, during final design, coordination will be required with the Tucson District to determine the feasibility of MSE walls.

4.7.3 Noise Barriers

A noise analysis was conducted to assess the impacts that future I-10 mainline traffic volumes would have in the study area. The FHWA Traffic Noise Model (TNM) 2.5 was used to calculate noise levels under existing conditions, and the No-Build and Build Alternatives. The existing noise environment was determined using a combination of noise measurements and modeling. Noise measurements were conducted at eight sites within the project area in early October 2012 to characterize the existing noise environment. Because the noise impact determination includes a comparison of existing and future modeled noise levels, existing noise levels were also predicted using TNM 2.5 to ensure consistency when comparing existing to future noise levels. Measured ambient Leq noise levels at residential receivers ranged from 57 decibels (dBA) at the residences in Continental Ranch near Cortaro Road to 72 dBA near a residence within the community of Rillito east of Tangerine Road. All of the observed ambient noise levels are representative of rural communities along a highway corridor.

Based on the results summarized in the Draft Noise Report prepared by AECOM (dated September 2013), future traffic noise levels at many modeled receiver locations are predicted to approach or exceed the FHWA Noise Abatement Criteria (NAC) under the Recommended Alternative; therefore, noise abatement measures were considered where impacts are predicted to occur. Noise abatement measures considered include horizontal and vertical alignment changes, real property acquisition, traffic management, and noise barrier construction. Noise barriers were considered the only effective means to mitigate the predicted impacts.

Of the barrier locations evaluated, two noise barriers were found to be feasible and reasonable and are recommended for incorporation into the project. The first noise barrier, identified on the plans in Appendix D from Station 4605+50± to 4641+00±, is recommended to mitigate noise impacts within the community of Rillito. It is approximately 3,603 feet in length along the eastbound mainline edge of pavement, east of Tangerine Road. The height of the wall varies from eight to 14 feet above the pavement surface.

The second barrier, identified on the plans in Appendix D from Station 4850+00± to 4900+00±, is recommended to mitigate noise impacts within the Continental Ranch community; which represent both existing single-family houses and undeveloped single-family housing lots. It is approximately 5,000 feet in length along the eastbound mainline edge of pavement between Tiffany Loop and Arizona Pavilions Drive. The height of the wall varies from eight to 18 feet above the pavement surface.

Public support for noise barriers is a factor that must be met for a noise abatement measure to be considered reasonable. The level of public support from property owners and residents should be gauged during the public involvement aspect of the environmental process to determine if there is opposition to the barriers.

The final recommendation on the construction of these noise barriers would be determined during completion of the project's final design and public involvement process. This noise analysis was completed based upon preliminary design plans for this study. The abatement recommendations would require further evaluation during final design to ensure that all policy goals and engineering requirements are met.

4.8 TRAFFIC DESIGN

4.8.1 Signing and Pavement Marking

All of the existing guide signs along the I-10 mainline and ramps would be removed and new guide signs installed on cantilever sign supports or tubular sign bridges per ADOT standards. All of the frontage road and crossroad signing impacted by the proposed improvements would also be removed and replaced. The exception to this is at the Twin Peak Road TI where the proposed improvements would match into improvements already completed. Since the interchanges in the Recommended Alternative are service traffic interchanges spaced approximately every two miles, and conventional entrance and exit ramps are proposed, unusual signing conditions are not expected.

Pavement marking for the proposed improvements would be in accordance with ADOT standard practices. No other special conditions are anticipated.

4.8.2 Freeway Management System

As mentioned in Section 1.5.8 of this report, there is an existing DMS supported on a U-Pole, designated as Number 412 in the ADOT *Statewide Dynamic Message Sign Masterplan*, on westbound I-10 at Station 4770+50 (MP 245.3). This DMS was recently relocated to this location as part of the Twin Peaks Road TI improvements. The DMS Number 412 would need to be removed and replaced on a new support structure with the proposed improvements in the Recommended Alternative. Additionally, Table 4.8 lists the location of the proposed installation of DMSs identified in the DMS Masterplan in the study corridor.

Table 4.8 – Proposed Location of Dynamic Message Signs

Location	Milepost	Direction	Cardinal Direction
East of Avra Valley Rd.	243.5	EB	SE
East of Cortaro Rd.	247.2	EB	SE
East of Cortaro Rd.	247.9	EB	NW

Conduit and pullboxes were installed for future ramp metering on the Twin Peaks Road TI eastbound and westbound entrance ramps as part of the Twin Peaks Road TI improvements. Minor adjustments would be needed to the conduit and pullbox locations. New conduit and pullboxes would be installed at the Avra Valley Road TI and Cortaro Road TI eastbound and westbound entrance ramps for future ramp metering. No loop detectors would be installed for ramp metering.

New conduit and pullboxes would be installed along both sides of the mainline in the entire project corridor to accommodate a future fiber-optic trunk line.

Additional FMS devices would be installed including closed-circuit television (CCTV) cameras, vehicle detection systems (VDS), and total count stations (TCS). The exact location, type, and number of FMS devices would be better defined during final design in coordination with the ADOT Transportation Technology Group. A general concept for the use and placement of the FMS devices are described below:

- CCTV cameras are typically installed at one-mile intervals on the freeway and are placed at the crossroad interchanges. Two cameras are typically located at a service traffic interchange. Spacing is often reduced where the horizontal and vertical alignments necessitate additional cameras for complete roadway coverage. There are CCTV cameras located at the Ina Road TI. CCTV cameras would be required at the Avra Valley Road, Twin Peaks Road, and Cortaro Road TIs. Cameras would also be required midway between the interchanges since they are about two miles apart

- VDS are typically installed at locations where a traffic volume or speed change is anticipated. These locations would be at one-mile intervals and at entrance and exit ramps. VDS would be required at the interchanges and midway between the interchanges since they are about two miles apart

- TCS are typically installed half way between two subsequent interchanges. TCS would be required between the interchanges

4.8.3 Lighting and Signals

As part of the reconstruction of the I-10 mainline and ramps, the lighting at the entrance and exit ramps in the study area would be removed. High mast lighting would be installed throughout the corridor between the I-10 mainline and the eastbound and westbound frontage roads. Continuous street lighting would be installed on Avra Valley Road and Cortaro Road. The street lighting on Twin Peaks Road would be maintained.

The existing traffic signal system at the Cortaro Road/frontage road intersections would be removed and replaced with a new traffic signal system including intersection lighting. A new traffic signal system with intersection lighting would be installed at the intersections of Avra Valley Road and the frontage roads. All new traffic signal systems would include video detection equipment and provisions for emergency vehicle pre-emption. The traffic signal system on Twin Peaks Road would be retained.

4.9 UTILITY AND RAILROAD COORDINATION

Utilities

The reconstruction of this corridor would have impacts to numerous utilities. Major utilities in the study area, anticipated conflicts due to the proposed improvements, and possible mitigation measures are listed in Table 4.9.

Table 4.9 – Major Utilities and Anticipated Conflicts

Existing Utility/ Agency	Facility Type	Control Line	Location				Anticipated Conflict	Mitigation/ Remarks
			Beginning		Ending			
			Station	Offset	Station	Offset		
CAP	Water Transmission Line	I-10	4589+49	72' Lt	-	-	Retaining Wall & Roadway Fill	Verify No Impact
CMID	Canal/ Pipeline/ Siphon		4596+31	206' Rt	4610+06	211' Rt	Roadway, Grading, & Retaining Wall	Relocate/ Reconstruct
			4614+75	752' Rt	-	-		
		Avra Valley Rd.	27+95	65' Lt	28+30	134' Rt		
		I-10	4742+79	217' Rt	4791+88	175' Rt		
			4841+29	215' Rt	4976+21	132' Lt		
			4897+22	159' Lt	4897+25	279' Rt		
			4922+35	325' Rt	4922+37	213' Lt		
			4979+15	156' Rt	-	-	Retaining Wall	
			4981+25	350' Rt	4981+75	398' Lt	Drainage	
	Ground-Water Well		4860+74	95' Lt	-	-	Roadway, Grading & Access Control	Relocate
			4897+20	100' Lt	-	-		
			4929+70	113' Lt	-	-		
PCRWRD	18" Sewer	I-10	4757+08	200' Lt	4757+31	223' Rt	Roadway & Grading/ Relocated CMID	Relocate/ Reconstruct
	12" Sewer (Force Main)		4791+38	1325' Rt	4981+63	413' Rt	Drainage	
	12" Sewer	Cortaro Rd.	12+28	72' Lt	12+85	103' Rt	Roadway, Grading, & Retaining Wall	
	24" Sewer		14+75	102' Lt	18+86	110' Rt		
	18" Sewer		18+86	110' Rt	30+05	45' Lt		
	Sewer	Tangerine Rd.	13+80	2' Rt	23+00	72' Lt		
TEP	OP Line	I-10	4596+32	223' Rt	4609+65	232' Rt	Relocated CMID	Relocate/ Reconstruct
	OP Line Crossing		4621+24	-	-	-	Roadway, Grading, & Retaining Wall	
			4631+63	-	-	-		
			4647+45	-	-	-		
	OP Power Line		4682+22	188' Rt	4685+66	200' Lt		
			4687+93	188' Lt	-	-		
	OP Lines Crossing (2)		4718+40	-	-	-		
	OP Line Crossing (3)		4724+38	-	-	-		
TEP	UGP Line	I-10	4742+96	190' Rt	4755+65	174' Rt	Roadway & Grading/ Relocated CMID	Relocate/ Reconstruct
	OP Line		4742+96	190' Rt	4746+04	118' Lt		
			4742+96	190' Rt	4755+74	195' Rt		
			4746+04	118' Lt	4750+10	213' Rt		
			4808+74	143' Lt	4817+79	144' Lt		
	UGP Line		4810+51	0' Rt	-	-		
	OP Line		4808+13	315' Rt	4809+34	143' Lt		
			4809+68	127' Lt	4904+03	157' Lt		
			4811+78	146' Rt	4811+75	129' Lt		
			4834+18	112' Lt	-	-		
			4808+74	143' Lt	4817+79	144' Lt		
			4810+51	0' Rt	-	-		
	UGP Line		4844+16	221' Rt	4872+35	219' Rt		
	OP Line		4844+35	111' Lt	4903+99	245' Lt	Roadway, Grading & Access Control	
	OP Line		4857+87	132' Lt	4861+16	175' Rt	Roadway & Grading	Relocate/ Reconstruct
			4913+00	261' Lt	4919+65	275' Lt	Roadway, Grading, Retaining Wall & Bridge	
			4929+82	295' Lt	4957+47	200' Lt	Roadway, Grading & Access Control	
			4955+69	202' Lt	4959+62	185' Rt		
	UGP Line		4967+46	147' Rt	4992+09	115' Rt	Roadway, Grading, & Retaining Wall	
	OP Line	Avra Valley Rd.	24+75	199' Lt	28+47	175' Rt		
			26+76	54' Lt	29+29	116' Rt		
			27+79	82' Lt	32+69	147' Rt		
			44+33	84' Rt	54+00	32' Lt		
			47+03	87' Rt	52+00	34' Rt		
		Cortaro Rd.	5+85	62' Rt	17+10	73' Lt	Roadway, Grading, Retaining Wall & Bridge	
	OP Lines Crossing (6)		14+32	-	-	-	Roadway, Grading, Retaining Wall, Drainage & Bridge	Reconstruct/ Elevate OP Lines
	UGP Line Crossing (Various)		Various	-	-	-		Relocate/ Reconstruct

Table 4.9 – Continued

Existing Utility/ Agency	Facility Type	Control Line	Location				Anticipated Conflict	Mitigation/ Remarks
			Beginning		Ending			
			Station	Offset	Station	Offset		
Trico Electric Power	OP Line	I-10	4580+69	197' Rt	4585+90	265' Lt	Roadway & Grading	Reconstruct/ Elevate OP Lines
	OP Line Crossing	Tangerine Rd.	24+21	-	-	-		Confirm OP Line Clearance
UPRR	OP Line	I-10	4602+79	180' Lt	-	-	Roadway & Grading	Relocate/ Reconstruct
			4913+37	281' Lt	4918+58	292' Lt	Retaining Wall & Bridge	
	OP Line Crossing	Tangerine Rd.	22+65	-	-	-	Roadway & Grading	Confirm OP Line Clearance
			23+59	-	-	-		Reconstruct/ Elevate OP Lines
Verizon	Telecommunication Tower Site	I-10	4937+25	160' Lt	-	-	Roadway & Grading	Acquire Communications Tower Site
	Underground Telephone		Various		-	-	Roadway, Drainage, & Grading	Relocate
Level 3 Communications/ Wiltel	Underground Cable & Fiber-optic	I-10	4913+37±	320'± Lt	-	-	Roadway & Drainage	Investigate Lowering/ Relocating
Kinder Morgan Energy	Underground Petroleum Pipelines (12", 8" & 6")	I-10	4601+00	180' Lt	4614+00	172' Lt	Roadway & Retaining Wall	Relocate
			4915+00	275' Lt	4918+50	320' Lt		
Unknown	Gas Line	I-10	4609+42	153' Rt	4615+30	175' Rt	Roadway, Drainage, & Grading	Relocate/ Lower
			4680+00	208' Rt	4682+42	192' Rt		
			4731+00	206' Rt	4737+03	202' Rt		
			4737+03	202' Rt	4737+27	238' Lt		
			4795+46	-	-	-	Roadway, Drainage, Utility, & Grading	
			4850+00	149' Rt	4870+00	207' Rt	Roadway, Drainage, & Grading	
			4880+00	209' Rt	4880+60	209' Rt	Drainage	
			4956+00	173' Rt	4992+09	136' Rt	Roadway, Drainage, & Grading	

A preliminary layout for relocating the CMID irrigation canal is shown on the plans in Appendix D for the Recommended Alternative. The preliminary layout shows the irrigation canal being replaced in-kind with a combination of open channel and underground piping through most of the project limits. The segment of canal between Tangerine Road and I-10 Mainline Station 4872+00± would be relocated to the south of I-10. The segment east of I-10 Mainline Station 4872+00± would be reconstructed on the north side of I-10. The pipe sizes would need to be determined in the final design phase to maintain the capacity of the existing facilities. Manholes are also shown on the plans and are generally located at 500-foot spacing. Junction structures were placed where pipes join together. CMID would require the new system to be self-cleaning. This concept is intended to replace the CMID facility in-kind and fully functional with consideration of the "betterment" provision in the FHWA Policy, Utility Relocation and Accommodation on Federal-Aid Highway Projects (Part 645 – Utilities), that limits upgrading utility facilities as part of a federally funded highway construction project requesting reimbursement for utility relocations. Therefore, ADOT would strive to meet any reasonable requirements; however, system upgrades not warranted by the project would not be paid by ADOT. The final design would include identifying maintenance access points throughout the project limits.

There are three well sites that need to be relocated to mitigate conflicts with the proposed improvements. CMID would require that the relocated well sites deliver equivalent pumping rates and request the site be similar in size to the existing well site. ADOT's current opinion is that the well sites could be relocated within the footprint of ADOT's right-of-way and in close proximity to the existing wells through their permitting process. Based on ADOT's permitting requirements, the areas of the new well sites within ADOT's right-of-way would not be considered an easement. CMID would maintain their facilities under their annual maintenance agreement with ADOT. The proposed locations of these well sites are shown on the plans in Appendix D. ADOT does prefer to move the wells outside of the right-of-way, so during final design this issue could be revisited. ADOT reserves the right for its contractor to utilize, on an interim basis, the existing wells for construction water.

When the project advances into final design, and during the right-of-way acquisition process, CMID would be fully compensated for all the costs of drilling, equipping, electrifying, fencing, connecting to relocated canal, and permitting. Any agreement made for relocating/reconstructing the irrigation canal during final design would have to be signed off by both ADOT and CMID. CMID has no infrastructure improvements currently planned within the project limits.

TEP currently uses Joplin Lane to maintain a large overhead transmission line that runs parallel to the east side of the UPRR tracks. Due to ADOT and FHWA access control requirements and Cortaro Road geometry, the Joplin Lane connection to Cortaro Road would be removed under the Recommended Alternative. Coordination efforts during the DCR phase included meeting with TEP to determine if Joplin Lane is a legal access and the possibility of TEP accessing their facilities from the north at Twin Peaks Road. At the time of this DCR, TEP had not provided a response to either question; therefore, further coordination will be needed with TEP, during the final design phase, to determine a viable solution for TEP to access their facilities.

Other utility service providers located in the study limits that could have conflicts with the proposed improvements include Tucson Water, Marana Water, Rillito Water Users Inc., Southwest Gas, AT&T, CenturyLink, Level 3 Communications, Sprint/Nextel, and Xspedias/Time Warner. A comprehensive inventory of all utilities was not completed as part of this study. More detailed design will be completed as individual projects move forward.

During final design, consideration should be given to locating buried utilities that run parallel to the crossroad centerline in utility corridors that could be located along the crossroad right-of-way lines and out of the access control lines. This would allow maintenance to occur outside of the roadway pavement. If site conditions permit, the corridor could be located within the right-of-way. Sleeves could be used under I-10 mainline and ramps and the utility owners could access facilities within the established utility corridors extending outward from the ramps, completely outside of the access control limits and away from the crossroad pavement.

Railroad

ADOT would coordinate with UPRR to construct the overpass at Cortaro Road. As mentioned in Section 1.5.4, UPRR will contribute funds to a project if the existing crossing is replaced with a grade-separated crossing as proposed in the Recommended Alternative.

4.10 EARTHWORK

Approximately 845,000 cubic yards (cy) of excavation and 1,850,000 cy of embankment are anticipated for the Recommended Alternative. Earthwork factors and slope recommendations would need to be developed during final design based on the geotechnical investigations.

4.11 GEOTECHNICAL AND PAVEMENT DESIGN

Geotechnical investigations were not conducted as part of this project. Existing geotechnical field data from borings performed for previous projects within the footprint of the existing structures were used in the preliminary design recommendations for the bridge and wall structures, and pavement design. Detailed geotechnical investigations would be required during the final design phase.

4.11.1 New Bridge Structures

Site soils are generally considered to be poor for the use of shallow spread footings given the potential for soft surficial soils, but are considered well suited for the use of drilled shaft foundations. The proposed foundation type should account for any potential differential settlement based on the results of the final field investigation. Table 4.10 provides a listing of the structures to be reconstructed, the existing foundation types, and preliminary recommended foundation types for the new structures.

Table 4.10 – Summary of Existing and Preliminary Recommended Foundation Types for I-10 Bridges

Structure	Existing Foundation Type	Recommended Foundation Type	General Soil Conditions
Tangerine TIOP	Original Abutments and Piers on Driven Piles Widening Abutments: two 4-foot diameter 44 feet long Drilled Shafts Piers: two 3-foot diameter 37 feet long Drilled Shafts	Drilled Shafts	Soft surficial soils; Interlayered soft to hard silty to clayey sand with occasional layers of gravel and clay. Increasing in density or firmness with increasing depth
APC RR Spur OP	Original Abutments and Piers on Driven Piles Widening Abutments: two 4-foot diameter 36 feet long Drilled Shafts Piers: two 3-foot diameter 51 feet long Drilled Shafts	Drilled Shafts	Soft surficial soils; Interlayered soft to hard silty to clayey sand with some layers of gravel and clay. Increasing in density or firmness with increasing depth
Avra Valley TIOP	Original Abutments and Piers on Driven Piles Widening Abutments: two 4-foot diameter 37 feet long Drilled Shafts Piers: two 3-foot diameter 44 feet long Drilled Shafts	Drilled Shafts	Soft surficial soils; Interlayered soft to hard silty to clayey sand with occasional layers of gravel and clay. Increasing in density or firmness with increasing depth
Cortaro Road TIOP	Original Abutments and Piers on Driven Piles Widening Abutments: two 4-foot diameter 37 feet long Drilled Shafts Piers: two 3-foot diameter 43 feet long Drilled Shafts	Drilled Shafts	Soft surficial soils; Interlayered soft to hard silty to clayey sand with occasional layers of gravel and clay. Increasing in density or firmness with increasing depth

4.11.2 Retaining Walls and Noise Barriers

MSE retaining walls were constructed at the Twin Peaks Road TI. The majority of the new walls would likely be constructed as specialty walls due to the potential for soft surficial soils. Variations of the actual wall types selected would probably be based more upon soil conditions rather than constructability around existing structures. The use of drilled shaft foundations may be preferred in some locations, depending on proximity to existing structures, wall height, and soft soil conditions. Other special design walls such as L-shaped footing walls may be needed due to the proximity of new walls to existing structures.

Based on the Interstate 10 Traffic Interchange at Twin Peaks/Linda Vista Final Geotechnical Report, Golder Associates (June 2008), ground improvements consisting of excavation and recompaction or replacement is recommended for the existing subgrade where MSE walls would be constructed. Post construction settlement of up to 1.5 inches is estimated based on the existing subsurface conditions. In general, the depth of overexcavation and recompaction or replacement would vary between five feet and seven feet below ground surface. The limits of overexcavation should extend a distance equal to the height of the wall in front of the wall and a distance behind the wall equal to 70% of the wall height. See Section 4.7 for information related to the retaining walls for the Recommended Alternative.

4.11.3 Drilled Shaft Construction

Caving sands and gravels were encountered to an approximate depth of 42 feet during construction of the drilled shafts at Cortaro Road. Similar surficial soils were identified in borings throughout the project site. Drilled shaft contractors are strongly advised to consider budgeting for temporary excavation support for drilled shaft construction.

Perched groundwater has been encountered in borings advanced near to or in the Santa Cruz River. Drilled shafts constructed near the Santa Cruz River may encounter perched water. Drilled shaft contractors should plan and budget for dealing with dewatering drilled shafts constructed near the Santa Cruz River.

4.11.4 Subsurface Conditions

The majority of the project alignment is underlain by relatively poor to fair quality subgrade soils. Overexcavation and removal of unsuitable soils was conducted during previous projects. Additionally, cement treated base was utilized to stabilize the subgrade. Table 4.11 list limits of overexcavation performed for construction of the subject portion of I-10.

Table 4.11 – Limits of Overexcavation Performed for Construction of I-10 Within the Project Limits

Project	Depth of Overexcavation	Limits of Overexcavation
Casa Grande – Tucson Highway (I-10) NH-010-D(007)N 010 PM 236 H4582 01C Marana Rd. TI to Cortaro Rd. TI	3 feet	WB Sta 4795+00 to 4895+00
	Cement Treated Base Removal	EB Sta 4795+00 to 4895+00 EB Sta 4523+50 to 4932+90 WB Sta 4567+00 to 4599+00 WB Sta 4651+00 to 4750+00 WB Sta 4898+00 to 4932+00
Casa Grande – Tucson Highway (I-10) STP-NH-010-D(201)N 010 PM 236 H5838 01D Twin Peaks TI	5 - 7 feet (Twin Peaks Rd. Abutments at MSE Walls 1-4)	Twin Peaks Rd. 99+15 to 100+16

4.11.5 Pavement Structural Sections

The Recommended Alternative includes the removal of the existing pavement and the construction of Portland Cement Concrete Pavement (PCCP) on the I-10 mainline, ramps, frontage roads and the crossroads at the interchange. The crossroads beyond the interchange, local streets, driveways and transitions would be constructed with asphaltic concrete (AC) pavement. Table 4.12 shows the preliminary pavement structural sections used for cost estimating purposes.

Table 4.12 – Preliminary Pavement Structural Sections

Roadway	PCCP (Inches)	AC (Inches)	AB (Inches)	AR-ACFC (inches)	Total Thickness
I-10 Mainline	14[(1)]	4	-	1[(2)]	19
Ramps & Crossroads	12½	-	4	1[(3)]	17½
Frontage Roads	11	-	4	-	15
Crossroads Beyond TI	-	10½	6	-	16½
Local Streets	-	3	4	-	7
I-10 Transitions (Travel Lanes)	-	10½	10	½[(4)]	21
Frontage Road Transitions	-	8	7	-	15

(1) Doweled
(2) Excluded on inside shoulder
(3) Excluded on crossroads
(4) Excluded on shoulders
AB – Aggregate Base; AR-ACFC – Asphalt Rubber-Asphaltic Concrete Friction Course

4.12 CONSTRUCTION PHASING AND TRAFFIC CONTROL

Traffic would be managed through detailed traffic control plans and by procedures and guidelines specified in Part VI of the Manual on Uniform Traffic Control Devices (MUTCD), 2009, and the Arizona Supplement of Part VI of the MUTCD. The final construction phasing and traffic control plans would be developed during final design.

Construction to widen the I-10 mainline and new crossroad bridges would have an impact on the traveling public using both the mainline and crossroads. ADOT projects (completed or underway) along the corridor that have lowered I-10 and elevated the crossroads have closed the crossroads under I-10 to through traffic and identified an East-West phasing approach for construction (described below). Coordination would be conducted with ADOT and the local jurisdictions to identify what phasing would benefit the community, maintain access to existing properties and provide continuous access to emergency responders.

The East-West phasing plan to reconstruct the I-10 mainline while lowering I-10 and elevating the crossroads would need to maintain three lanes of traffic in each direction on I-10 with provisions for emergency access, maintaining access to businesses and residences at all times, and not closing two interchanges or consecutive on/off ramps at the same time. With these criteria, each interchange will have to be phased separately.

The East-West phasing approach primarily consists of shifting the existing eastbound or westbound I-10 construction centerline east or west of its existing location (See Figure 4.4). This approach allows for I-10 mainline lanes and adjacent frontage road to be reconstructed with existing I-10 traffic utilizing the opposing I-10 mainline lanes and adjacent frontage road. The east side would be constructed first at the Cortaro Road TI and the section of I-10 between Tangerine Road and Avra Valley Road. The west side would be constructed first at Tangerine Road, Avra Valley Road and Twin Peaks Road. This approach also has several benefits that include: little or no shoring when lanes are shifted as far away as possible from the construction zone, allows for better balanced earthwork when I-10 is lowered and the crossroad is raised to become grade separated with the UPRR and I-10 and will also lessen the need for construction traffic to cross or mix with I-10 traffic.

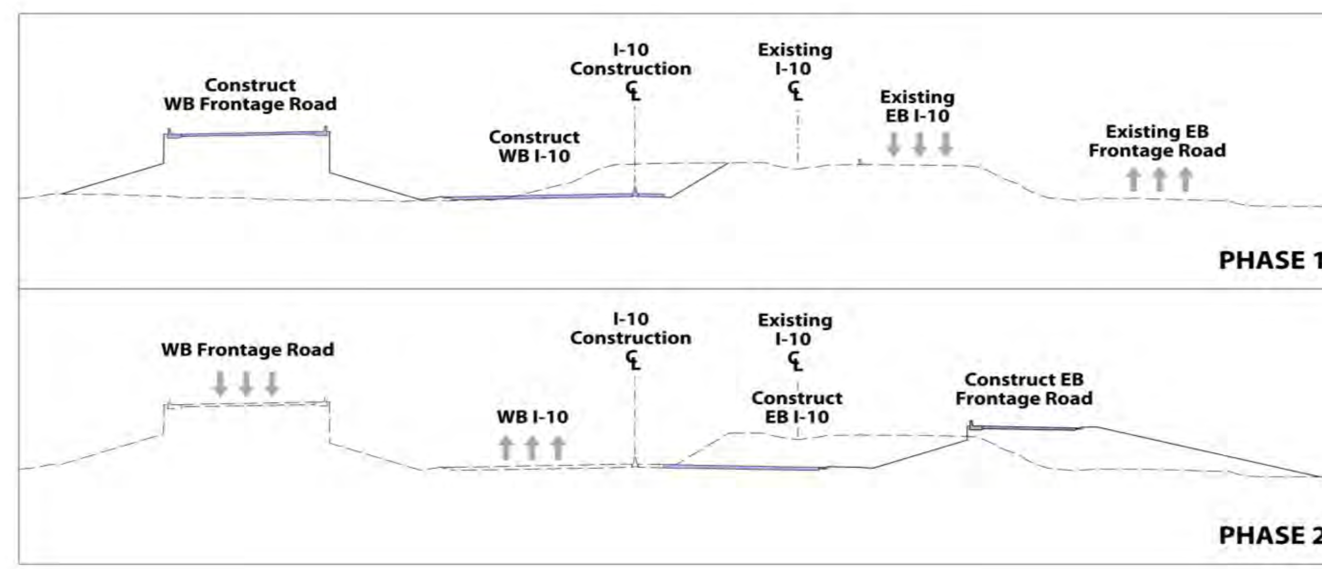

Figure 4.4 – East-West Phasing Approach

As part of the East-West phasing plan, the frontage roads would need to be improved first to accommodate three lanes of detoured I-10 traffic with provisions for emergency access (See Figure 4.5). The frontage roads would be constructed to their ultimate configuration where possible, or temporarily widened in the high fill areas near the crossroads. Crossovers would be constructed to detour I-10 traffic onto the frontage road at locations determined by the proximity of the on- and off-ramps that would remain open (See Figure 4.6).

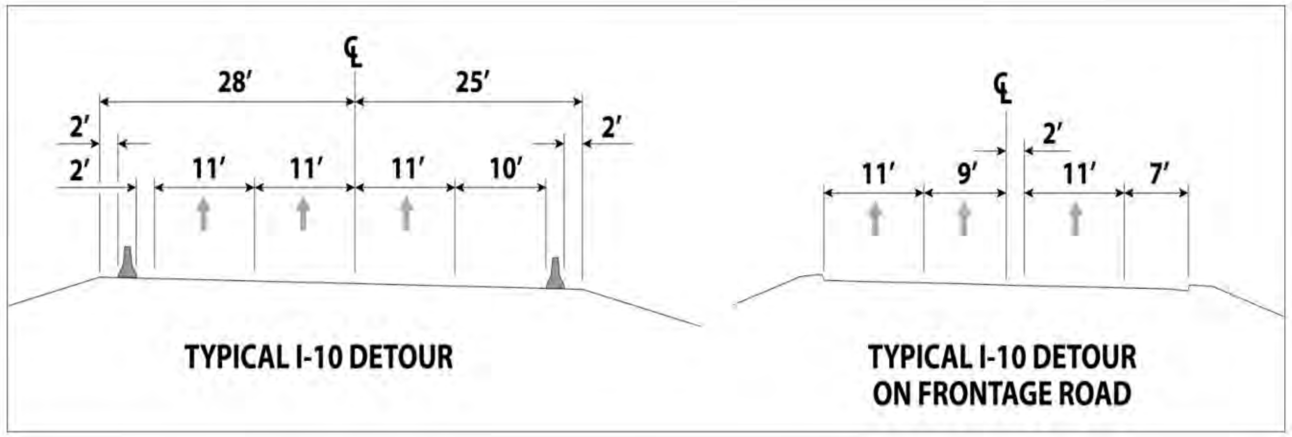

Figure 4.5 – I-10 Mainline and Frontage Road Detours

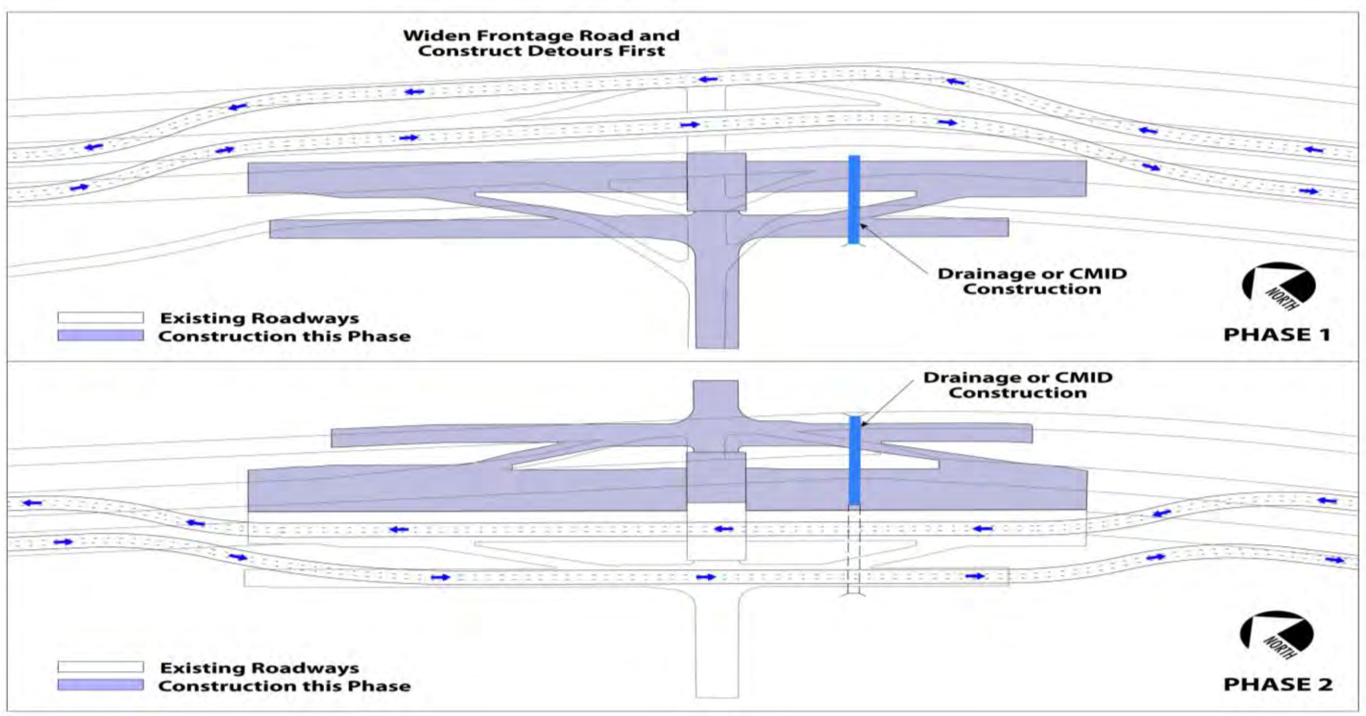

Figure 4.6 – I-10 Mainline Crossover

In addition, drainage structures ideally should be constructed beginning at the downstream end and working to the upstream end (See Figure 4.7). However, with the constraints for the traffic and earthwork, sequencing construction of drainage structures from the downstream end to upstream end is not always possible. If drainage facilities need to be constructed from the upstream end to downstream end, temporary connections to the existing drainage facilities would be needed between construction phases to maintain positive drainage.

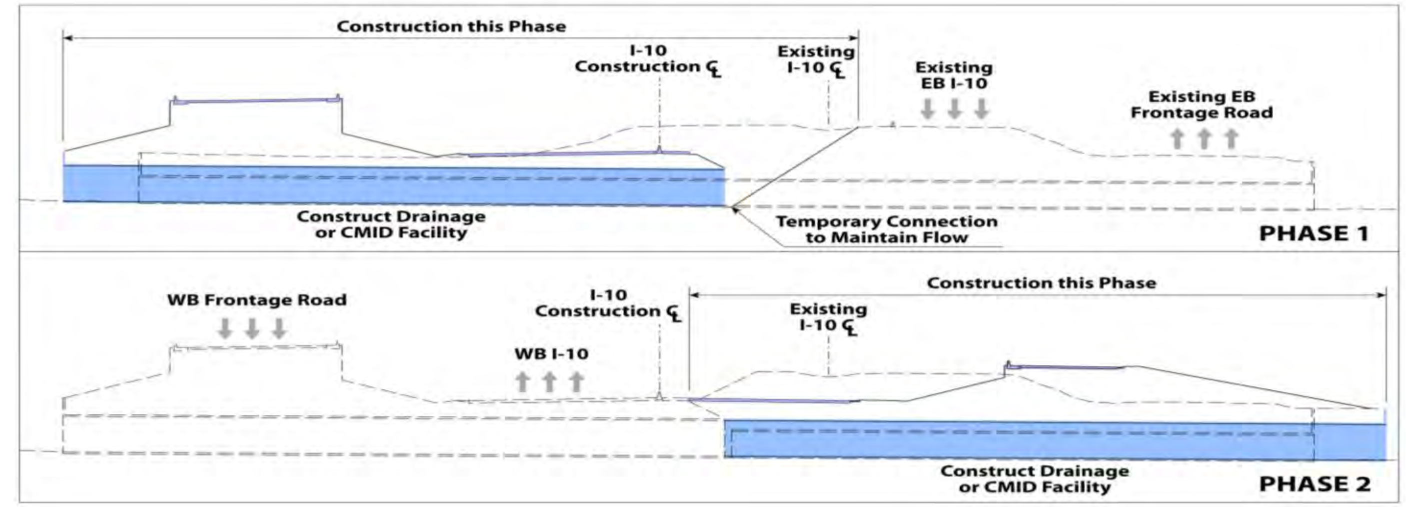

Figure 4.7 – Proposed Drainage/Utility Facility Construction

Due to the majority of the existing CMID irrigation system being reconstructed into an enclosed system, the new CMID irrigation lines crossing I-10 may need to be jack and bored or pump around plans considered in order to keep the system operating as part of the East-West phasing plan. Pump around plans may be more cost effective during short construction phases. See Appendix D for sequencing details and crossover locations.

4.13 WILDLIFE CONNECTIVITY

I-10 crosses through an area that has been designated as an important linkage for wildlife movement between the Tortolita Mountains and the Santa Catalina Mountains. The Tucson-Tortolita Mountains linkage zone was described in the *Arizona's Wildlife Linkages Assessment* report (2006) prepared by ADOT, and the *Arizona Missing Linkages: Tucson – Tortolita – Santa Catalina Mountains Linkage Design Report* (2006) prepared for the Arizona Game and Fish Department (AGFD) by staff members at Northern Arizona University. The segment of I-10 that passes through the Tucson-Tortolita Mountains linkage is approximately 1.4 miles long, between MP 242.5 and 243.9.

The following species were identified in the *Arizona Wildlife Linkage Assessment* report as potentially using the wildlife crossing in the study area:

- Bobcat (*Lynx rufus)*
- Cactus Ferruginous Pygmy Owl (*Glaucidium brasilianum cactorum*)
- Cave Myotis (*Myotis velifer*)
- Javelina (*Tayassu tajacu*)
- Kit Fox (*Vulpes macrotis*)
- Mountain Lion (*Felis concolor*)
- Mule Deer (*Odocoileus hemionus*)

- Pocketed Free-Tailed Bat (*Nyctinomops femorosaccus*)
- Sonoran Desert Tortoise (*Gopherus morafkai*)

In November 2011, scoping letters were distributed to various Federal and State agencies, local jurisdictions, and other stakeholders to identify their issues and concerns associated with the study. Scoping meetings were held for the agencies and the public in December 2011. Throughout the scoping process comments were received from several stakeholders that indicated the protection and enhancement of wildlife connectivity will be one of the primary concerns for this study. Entities that submitted input focused on wildlife connectivity are as follows: AGFD, Pima County Department of Transportation, the Town of Marana, the Tucson Audubon Society, and the Coalition for Sonoran Desert Protection (CSDP).

Most of the responses regarding wildlife connectivity identified a potential wildlife crossing location in the vicinity of an abandoned railroad spur underpass structure located about 1,800 feet (MP 243.35) east of Avra Valley Road. Cumulatively, the scoping responses also highlighted the amount of previous study and work associated with the Tucson-Tortolita-Santa Catalina Mountains wildlife linkage zone. In addition to the 2006 AGFD report noted above, the wildlife linkage zone in the study area was identified as a Critical Landscape Connection in the Pima County Sonoran Desert Conservation Plan. The Town of Marana has included a 1.0-km wide corridor for the wildlife linkage in the vicinity of the railroad spur underpass near Avra Valley Road in their Draft Habitat Conservation Plan.

Much of the land in the vicinity of the existing Avra Valley Road TI and abandoned railroad spur is vacant or undeveloped. In support of enhancing the wildlife linkage, open space acquisition and protection efforts have set aside much of the land north and south of I-10 in this area. Further detail on the properties adjacent to the crossing point that have been acquired or protected can be found in the Tucson-Tortolita Mountains Wildlife Linkage Working Group Work Plan, which is attached to the agency scoping response from the Coalition for Sonoran Desert Protection in Appendix A.

While initial input from stakeholders suggested the abandoned railroad spur structure be modified and enhanced to promote wildlife movement through the underpass structure, further study and coordination has determined that an underpass structure would not be practical at this location. The proposed improvements to I-10 would widen the highway and close the existing open median, creating a longer, more enclosed path crossing underneath I-10. With these constraints, an underpass structure would not be able to achieve the visual openness required for wildlife to use it. Additionally, the UPRR tracks parallel to I-10 represent a second barrier that wildlife would need to cross. Therefore, the most appropriate type of wildlife crossing in this location would be an elevated structure that crosses over I-10, both frontage roads, and the UPRR tracks.

At a coordination meeting held on November 26, 2012 and attended by representatives from ADOT, Pima County, the Town of Marana, Tucson Audubon Society, AGFD, and CSDP stakeholders came to the consensus that future efforts to implement a wildlife crossing will focus on an overpass structure in the vicinity of the existing abandoned railroad spur. Locating the overpass near the existing abandoned railroad spur would build on previous efforts that acquired and protected large tracts of open space in the vicinity of the existing abandoned railroad spur and ensure these investments are not lost.

The future wildlife structure would likely be a multi-span bridge that would include bridge piers in the median of I-10, and between the mainline and frontage roads. It is envisioned that this structure would span from the southern ADOT right-of-way to the northern UPRR right-of-way. In addition, ADOT does not intend to bear any financial responsibility for the planning, design, or construction of a future wildlife overpass structure, but may accommodate the incorporation of the planning, design, or construction of such a structure within ADOT's planning, design, and construction of improvements to increase capacity on I-10 where partnership(s) with local entities are available. Representatives from Pima County and the Regional Transportation Authority (RTA) provided the following statements:

"As a local stakeholder, Pima County expects, at a minimum, to be involved in the planning and coordination stages of any ADOT plans to widen Interstate 10 between Tangerine Road and Ina Road. The County's participation in these project phases is also critical to ensure that plans to widen Interstate 10 acknowledge and give due consideration to the public's substantial investment in acquiring open space properties that were secured with the specific intent of contributing to the land base necessary to accommodate a wildlife crossing structure in the vicinity of the existing Avra Valley Road interchange."

Pima County

"The RTA anticipates participating in the cost of the wildlife crossing on I-10."

RTA

The installation of fencing, guardrail or embankment at least six feet high should be evaluated during final design to guide animals to the overpass structure and discourage animals from crossing the roadways. Special consideration should also be given to managing human activity on and near the overpass.

4.14 TRANSIT AND PARK-AND-RIDE LOTS

The Arizona Pavilions park-and-ride lot would not be impacted by proposed roadway improvements. ADOT allows park and ride use of vacant land in their right-of-way just east of the McDonalds restaurant on Cortaro Road. Access to this park-and-ride lot would be maintained from Cracker Barrel Road. During final design, coordination would be required to determine if bus pull-outs should be included with the construction.

4.15 BICYCLE AND PEDESTRIAN FACILITIES

4.15.1 Bicycles

As stipulated in ADOT's Bicycle Policy MGT 02-1, bicyclists have the right to operate in a legal manner on all roadways open to public travel, with the exception of fully controlled-access highways. I-10 is a fully controlled-access highway; therefore, bicycles are prohibited from using this facility. The frontage roads, designed to include eight-foot-wide shoulders on both sides of the roadway, except on the approaches to the crossroads where the shoulders are four feet wide, could be used by bicyclists. ADOT will not sign or designate bikeways on any roadways on the State Highway System or roads in State-owned right-of-way without concurrence of the District Engineer or State Bicycle Coordinator.

Tangerine Road, Avra Valley Road and Cortaro Road include, at a minimum, six-foot-wide shoulders that could be used by bicyclists. A four-foot-wide minimum bicycle lane is designed between the through and right-turn lanes. There are no restrictions on these crossroads for bicyclists wanting to use the travel and turn lanes.

4.15.2 Pedestrians

ADOT's policy is not to construct sidewalks as part of a highway project with some exceptions (Section 107.2 of the ADOT RDG). The eastbound frontage road should include a provision for local agencies or developers to install sidewalk in back of the curb to the outside of the roadway. In areas where a retaining wall is constructed at the edge of pavement, ADOT Tucson District would prefer to locate the sidewalk at ground level rather than on the elevated roadway. If the local jurisdiction or others install sidewalk in these areas, it would be installed on the ground in back of the wall. This could be revisited during final design.

Tangerine Road, Avra Valley Road and Cortaro Road include at least a five-foot-wide sidewalk on both sides of the crossroads. Where the sidewalk is installed in back of curb, the width is a minimum of six feet.

4.16 DESIGN EXCEPTIONS

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

All of the ADOT non-conforming existing features in the study limits would be reconstructed to meet current ADOT design criteria.

4.17 INTERGOVERNMENTAL AGREEMENTS

The construction of the roadway improvements identified under the Recommended Alternative would require Intergovernmental Agreements (IGAs). The IGAs would be required to set the new ADOT maintenance limits on the crossroads, finalize the access management along the crossroads, and maintenance of the Massingale Channel and Benta Vista Street/Portland Avenue extension. These and any other IGAs would be identified during the final design phase.

5.0 ITEMIZED ESTIMATE OF PROBABLE COSTS

5.1 OVERALL PROJECT COST ESTIMATE

The estimate of probable cost to construct the Recommended Alternative as a single project is $391,200,000, including right-of-way costs provided by ADOT Right-of-Way. It is anticipated that this project would be constructed in phases as described in Section 6.0 – Implementation Plan; therefore, Tables 5.1 through 5.3 provide a breakdown of the estimated costs by project as determined by the implementation process. The total estimate of probable cost to construct the project according to the implementation plan is $412,100,000. The following assumptions were made in the development of the cost estimates:

- All bridges would be constructed to their ultimate configuration in Phases I and II, and would not be widened in Phase III
- All retaining walls would be constructed to their ultimate configuration in Phases I and II, and would not be reconstructed in Phase III
- All concrete box culverts would be constructed to their ultimate configuration in Phases I and II, and would not be lengthened in Phase III
- Catch basins along I-10 constructed in Phases I and II would be reconstructed in Phase III
- Curb and gutter and barrier along I-10 constructed in Phases I and II would be reconstructed in Phase III
- Freeway guide signs installed in Phases I and II would be reconstructed in Phase III
- Phase III would include paving a new overlay and restriping I-10
- The Massingale Channel and associated box culvert at I-10 mainline Station 4982+63 should be constructed with the Ina Road TI improvements. The estimate of probable cost for these improvements is $4,823,000 including a 20% contingency

Table 5.1 – Estimate of Probable Project Costs for the Cortaro Road TI Improvements (Phase I)

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
2020001	Clearing and Grubbing	L.SUM	1	$ 80,000.00	$ 80,000.00
2020002	Remove Bridge	L.SUM	1	$ 150,000.00	$ 150,000.00
2020020	Removal of Concrete Curb	L.FT.	6,400	$ 2.50	$ 16,000.00
2020021	Removal of Concrete Curb and Gutter	L.FT.	6,100	$ 4.00	$ 24,400.00
2020025	Removal of Concrete Sidewalks, Driveways and Slabs	SQ.FT.	30,500	$ 1.50	$ 45,800.00
2020029	Removal of Asphaltic Concrete Pavement	SQ.YD.	389,759	$ 2.00	$ 779,600.00
2020050	Removal of Structure (Box Culvert)	L.SUM	1	$1,760,900.00	$1,760,900.00
2020058	Remove and Salvage (Existing Cable Barrier)	L.FT.	16,780	$ 3.00	$ 50,400.00
2020072	Remove and Salvage Guardrail	L.FT.	5,000	$ 3.00	$ 15,000.00
2020101	Remove Fence	L.FT.	39,704	$ 3.00	$ 119,200.00
2030301	Roadway Excavation	CU.YD.	191,972	$ 6.00	$1,151,900.00
2030900	Borrow (In Place)	CU.YD.	677,674	$ 7.00	$4,743,800.00
3030022	Aggregate Base, Class 2	CU.YD.	24,048	$ 24.00	$ 577,200.00
3030102	Aggregate Base (Class 6)	CU.YD.	5,457	$ 24.00	$ 131,000.00
4010011	Portland Cement Concrete Pavement (11")	SQ.YD.	141,323	$ 35.00	$4,946,300.00
4010016	Portland Cement Concrete Pavement (12.5")	SQ.YD.	6,450	$ 40.00	$ 258,000.00
4010019	Portland Cement Concrete Pavement (14")	SQ.YD.	12,480	$ 50.00	$ 624,000.00
4010040	Portland Cement Concrete Pavement (Reinforced) (14" Doweled)	SQ.YD.	272,887	$ 52.00	$14,190,200.00
4010312	Load Transfer Dowel Assembly (12-Ft)	EACH	11,727	$ 90.00	$ 1,055,500.00
4040111	Bituminous Tack Coat	TON	110	$ 450.00	$ 49,500.00
4040116	Apply Bituminous Tack Coat	HOUR	204	$ 160.00	$ 32,700.00
4040125	Fog Coat	TON	6	$ 660.00	$ 4,000.00
4040262	Asphalt Binder (PG 64-16)	TON	1,317	$ 550.00	$ 724,400.00
4040282	Asphalt Binder (PG 76-16)	TON	2,650	$ 600.00	$ 1,590,000.00
4060021	Asphaltic Concrete (Base Mix)	TON	63,469	$ 55.00	$ 3,490,800.00
4140040	Asphaltic Concrete Friction Course (Asphalt-Rubber)	TON	11,986	$ 32.00	$ 383,600.00
4140042	Asphalt Rubber Material (For AR-ACFC)	TON	1,079	$ 550.00	$ 593,500.00
4140044	Mineral Admixture (For AR-ACFC)	TON	1,065	$ 90.00	$ 95,900.00
4160004	Asphaltic Concrete (3/4" Mix) (End Product) (Special Mix)	TON	9,860	$ 30.00	$ 295,800.00
4160031	Mineral Admixture	TON	235	$ 90.00	$ 21,200.00
6018111	Reinforced Concrete Box Culvert (L.Sum of CBC's Within Project)	L.SUM	1	$7,234,100.00	$7, 234,100.00
9050026	Guardrail Terminal (Tangent Type)	EACH	17	$ 2,500.00	$ 42,500.00
9080001	Concrete Curb (C-05.10) (Type A)	L.FT.	4,808	$ 12.00	$ 57,700.00
9080084	Concrete Curb and Gutter (C-05.10) (Type B)	L.FT.	6,020	$ 13.00	$ 78,300.00
9080085	Concrete Curb and Gutter (C-05.10) (Type C)	L.FT.	1,666	$ 13.00	$ 21,700.00
9080086	Concrete Curb and Gutter (C-05.10) (Type D)	L.FT.	54,040	$ 14.00	$ 756,600.00
9080087	Concrete Curb and Gutter (C-05.10) (Type E)	L.FT.	19,108	$ 15.00	$ 286,700.00
9080201	Concrete Sidewalk (C-05.20)	SQ.FT.	11,310	$ 4.00	$ 45,300.00
9080296	Concrete Sidewalk Ramp (Type A, B, C & D)	EACH	28	$ 1,500.00	$ 42,000.00
9100008	Concrete Barrier (Half) (C-10.52)	L.FT.	15,852	$ 60.00	$ 951,200.00
9100014	Concrete Barrier (Half) (C-10.55)	L.FT.	1,634	$ 60.00	$ 98,100.00
9100015	Concrete Barrier (SD 1.01)	L.FT.	3,647	$ 60.00	$ 218,900.00
9100036	Concrete Barrier (Special Half)	L.FT.	3,076	$ 140.00	$ 430,700.00
9100201	Concrete Median Barrier	L.FT.	16,369	$ 65.00	$ 1,064,000.00
9140127	Retaining Wall	SQ.FT.	54,771	$ 104.00	$ 5,696,200.00
	Cortaro Road I-10 Overpass	L.SUM	1	$4,642,880.00	$ 4,642,880.00
	Cortaro Road UPRR Overpass	L.SUM	1	$5,673,790.00	$ 5,673,790.00
	Traffic Items (Signing, Pavement Marking Lighting, FMS) (10% of Pavement Cost)	L.SUM	1	$2,906,400.00	$ 2,906,400.00
	Traffic Signals (3-Leg Intersection)	EACH	2	$ 225,000.00	$ 450,000.00
	Drainage Improvements	L.SUM	1	$9,837,200.00	$ 9,837,200.00
				ROADWAY SUBTOTAL:	**$78,534,870.00**
	Maintenance and Protection of Traffic (5%)	L.SUM		$3,927,000.00	$3,927,000.00
	Dust and Water Palliative (0.75%)	L.SUM		$ 590,000.00	$ 590,000.00
	Quality Control (0.75%)	L.SUM		$ 590,000.00	$ 590,000.00
	Construction Surveying (1.5%)	L.SUM		$1,179,000.00	$1,179,000.00
	Landscaping (3%)	L.SUM		$2,357,000.00	$2,357,000.00
	Erosion Control (0.3%)	L.SUM		$ 236,000.00	$ 236,000.00
	Mobilization (8% of all Construction Items)	L.SUM		$8,500,000.00	$8,500,000.00
				SUBTOTAL	**$95,913,870.00**
	Unidentified Items (20%)	L.SUM		$19,183,000.00	$19,183,000.00
				SUBTOTAL	**$115,096,870.00**

Table 5.1 – Continued

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
	Construction Engineering (9%)	L.SUM		$10,359,000.00	$10,359,000.00
	Construction Contingencies (5%)	L.SUM		$ 5,755,000.00	$ 5,755,000.00
	Indirect Cost Allocation (9.46%)	L.SUM		$10,889,000.00	$10,889,000.00
	Engineering Design (includes Surveying and Geotechnical) (8% of all Items)	L.SUM		$ 9,208,000.00	$ 9,208,000.00
	Right-of-Way	L.SUM		$ 4,335,200.00	$ 4,335,200.00
	Environmental Mitigation (Unknown at this time)	L.SUM		-	-
	Utilities (CMID)	L.SUM		$ 2,403,000.00	$ 2,403,000.00
	Utilities (Overhead Power Transmission Relocations)	L.SUM		$ 1,000,000.00	$ 1,000,000.00
	Utilities (Other Relocations) (3%)	L.SUM		$ 3,453,000.00	$ 3,453,000.00
				TOTAL PROJECT COST	**$162,499,070.00**

Table 5.2 – Estimate of Probable Project Costs for the Avra Valley Road TI Improvements (Phase II)

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
2020001	Clearing and Grubbing	L.SUM	1	$ 100,000.00	$ 100,000.00
2020002	Remove Bridge	L.SUM	1	$ 600,000.00	$ 600,000.00
2020020	Removal of Concrete Curb	L.FT.	1,130	$ 2.50	$ 2,900.00
2020021	Removal of Concrete Curb And Gutter	L.FT.	4,860	$ 4.00	$ 19,500.00
2020029	Removal of Asphaltic Concrete Pavement	SQ.YD.	529,590	$ 2.00	$ 1,059,200.00
2020050	Remove of Structure (Box Culvert)	L.SUM	1	$ 1,235,500.00	$ 1, 235,500.00
2020058	Remove and Salvage (Existing Cable Barrier)	L.FT.	24,860	$ 3.00	$ 74,600.00
2020072	Remove and Salvage Guardrail	L.FT.	23,800	$ 3.00	$ 71,400.00
2020101	Remove Fence	L.FT.	106,496	$ 3.00	$ 319,500.00
2030301	Roadway Excavation	CU.YD.	652,679	$ 6.00	$ 3,916,100.00
2030900	Borrow (In Place)	CU.YD.	386,568	$ 7.00	$ 2,706,000.00
3030022	Aggregate Base, Class 2	CU.YD.	34,505	$ 24.00	$ 828,200.00
3030102	Aggregate Base (Class 6)	CU.YD.	28,466	$ 24.00	$ 683,200.00
4010011	Portland Cement Concrete Pavement (11")	SQ.YD.	189,734	$ 35.00	$ 6,640,700.00
4010016	Portland Cement Concrete Pavement (12.5")	SQ.YD.	18,854	$ 40.00	$ 754,200.00
4010019	Portland Cement Concrete Pavement (14")	SQ.YD.	69,000	$ 50.00	$ 3,450,100.00
4010040	Portland Cement Concrete Pavement (Reinforced) (14" Doweled)	SQ.YD.	351,215	$ 52.00	$ 18,263,300.00
4010312	Load Transfer Dowel Assembly (12-Ft)	EACH	18,003	$ 90.00	$ 1,620,300.00
4040111	Bituminous Tack Coat	TON	129	$ 450.00	$ 58,100.00
4040116	Apply Bituminous Tack Coat	HOUR	230	$ 160.00	$ 36,800.00
4040125	Fog Coat	TON	8	$ 660.00	$ 5,400.00
4040262	Asphalt Binder (PG 64-16)	TON	4,700	$ 550.00	$ 2,585,000.00
4040282	Asphalt Binder (PG 76-16)	TON	708	$ 600.00	$ 424,800.00
4060021	Asphaltic Concrete (Base Mix)	TON	94,000	$ 55.00	$ 5,170,000.00
4140040	Asphaltic Concrete Friction Course (Asphalt-Rubber)	TON	25,906	$ 32.00	$ 829,000.00
4140042	Asphalt Rubber Material (For AR-ACFC)	TON	2,332	$ 550.00	$ 1,282,600.00
4140044	Mineral Admixture (For AR-ACFC)	TON	236	$ 90.00	$ 21,300.00
4160004	Asphaltic Concrete (3/4" Mix) (End Product) (Special Mix)	TON	14,150	$ 30.00	$ 424,500.00
4160031	Mineral Admixture	TON	1,028	$ 90.00	$ 92,600.00
6018111	Reinforced Concrete Box Culvert (L.Sum of CBC's Within Project)	L.SUM	1	$ 4,300,100.00	$ 4,300,100.00
9050026	Guardrail Terminal (Tangent Type)	EACH	2	$ 2,500.00	$ 5,000.00
9080084	Concrete Curb and Gutter (C-05.10) (Type B)	L.FT.	3,984	$ 13.00	$ 51,800.00
9080086	Concrete Curb and Gutter (C-05.10) (Type D)	L.FT.	32,635	$ 14.00	$ 456,900.00
9080087	Concrete Curb and Gutter (C-05.10) (Type E)	L.FT.	14,273	$ 15.00	$ 214,100.00
9080089	Concrete Curb and Gutter (PCDOT 209, Type 1(G))	L.FT.	5,329	$ 15.00	$ 80,000.00
9080109	Concrete Single Curb (C-05.10) (Type A1)	L.FT.	3,515	$ 15.00	$ 52,800.00
9080111	Concrete Single Curb (PCDOT 209, Type (1))	L.FT.	5,171	$ 15.00	$ 77,600.00
9080201	Concrete Sidewalk (C-05.20)	SQ.FT.	29,570	$ 4.00	$ 118,300.00
9080296	Concrete Sidewalk Ramp (Type A, B, C & D)	EACH	22	$ 1,500.00	$ 33,000.00
9100008	Concrete Barrier (Half) (C-10.52)	L.FT.	12,863	$ 60.00	$ 771,800.00
9100014	Concrete Barrier (Half) (C-10.55)	L.FT.	7,496	$ 60.00	$ 449,800.00
9100015	Concrete Barrier (SD 1.01)	L.FT.	18,411	$ 60.00	$ 1,104,700.00
9100036	Concrete Barrier (Special Half)	L.FT.	1,914	$ 140.00	$ 268,000.00
9100201	Concrete Median Barrier	L.FT.	22,248	$ 65.00	$ 1,446,200.00
9140127	Retaining Wall	SQ.FT.	231,693	$ 104.00	$ 24,096,100.00
	Tangerine Road Overpass	L.SUM	1	$ 3,475,600.00	$ 3,475,600.00
	APC Railroad Overpass	L.SUM	1	$ 3,804,300.00	$ 3,804,300.00
	Avra Valley Road Underpass	L.SUM	1	$ 3,033,000.00	$ 3,033,000.00
	Traffic Items (Signing, Pavement Marking Lighting, FMS) (10% of Pavement Cost)	L.SUM	1	$ 4,317,100.00	$ 4,317,100.00
	Traffic Signals (3-Leg Intersection)	EACH	4	$ 225,000.00	$ 900,000.00
	Drainage Improvements	L.SUM	1	$ 2,295,800.00	$ 2,295,800.00
				ROADWAY SUBTOTAL:	**$ 104,626,800.00**
	Maintenance and Protection of Traffic (5%)	L.SUM		$ 5,232,000.00	$ 5,232,000.00
	Dust and Water Palliative (0.75%)	L.SUM		$ 785,000.00	$ 785,000.00
	Quality Control (0.75%)	L.SUM		$ 785,000.00	$ 785,000.00
	Construction Surveying (1.5%)	L.SUM		$ 1,570,000.00	$ 1,570,000.00
	Landscaping (3%)	L.SUM		$ 3,139,000.00	$ 3,139,000.00
	Erosion Control (0.3%)	L.SUM		$ 314,000.00	$ 314,000.00
	Mobilization (8% of all Construction Items)	L.SUM		$ 11,323,000.00	$ 11,323,000.00
				SUBTOTAL	**$ 127,774,800.00**
	Unidentified Items (20%)	L.SUM		$ 25,555,000.00	$ 25,555,000.00
				SUBTOTAL	**$ 153,329,800.00**
	Construction Engineering (9%)	L.SUM		$ 13,800,000.00	$ 13,800,000.00
	Construction Contingencies (5%)	L.SUM		$ 7,667,000.00	$ 7,667,000.00
	Indirect Cost Allocation (9.46%)	L.SUM		$ 14,505,000.00	$ 14,505,000.00
	Engineering Design (Includes Surveying and Geotechnical) (8% of all Items)	L.SUM		$ 12,267,000.00	$ 12,267,000.00
	Right-of-Way	L.SUM		$ 2,128,000.00	$ 2,128,000.00
	Environmental Mitigation (Unknown at this time)	L.SUM		-	-
	Utilities (CMID)	L.SUM		$ 1,207,410.00	$ 1,207,410.00
	Utilities (Overhead Power Transmission Relocations)	L.SUM		$ 1,000,000.00	$ 1,000,000.00
	Utilities (Other Relocations) (3%)	L.SUM		$ 4,600,000.00	$ 4,600,000.00
				TOTAL PROJECT COST	**$ 210,504,210.00**

Table 5.3 – Estimate of Probable Project Costs for the I-10 Expansion to Ten Lanes (Phase III)

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
2020021	Removal of Concrete Curb and Gutter	L.FT.	45,051	$ 4.00	$ 180,300.00
2020027	Removal of Concrete Barrier	L.FT.	27,747	$ 12.00	$ 333,000.00
2020031	Removal of Portland Cement Concrete Pavement	SQ.YD.	93,565	$ 12.00	$ 1,122,800.00
3030022	Aggregate Base, Class 2	CU.YD.	13,514	$ 24.00	$ 324,400.00
3030102	Aggregate Base (Class 6)	CU.YD.	33,924	$ 24.00	$ 814,200.00
4010016	Portland Cement Concrete Pavement (12.5")	SQ.YD.	24,491	$ 40.00	$ 899,700.00
4010019	Portland Cement Concrete Pavement (14")	SQ.YD.	117,403	$ 50.00	$ 5,870,200.00
4040111	Bituminous Tack Coat	TON	35	$ 450.00	$ 15,800.00
4040116	Apply Bituminous Tack Coat	HOUR	202	$ 160.00	$ 32,300.00
4040262	Asphalt Binder (PG 64-16)	TON	1,089	$ 550.00	$ 599,300.00
4060021	Asphaltic Concrete (Base Mix)	TON	27,769	$ 55.00	$ 1,527,300.00
4140040	Asphaltic Concrete Friction Course (Asphalt-Rubber)	TON	41,416	$ 32.00	$ 1,325,300.00
4140042	Asphalt Rubber Material (For AR-ACFC)	TON	3,728	$ 550.00	$ 2,050,400.00
4140044	Mineral Admixture (For AR-ACFC)	TON	384	$ 90.00	$ 34,600.00
4160031	Mineral Admixture	TON	201	$ 90.00	$ 18,200.00
9080084	Concrete Curb and Gutter (C-05.10) (Type B)	L.FT.	10,004	$ 13.00	$ 130,100.00
9080085	Concrete Curb and Gutter (C-05.10) (Type C)	L.FT.	1,666	$ 13.00	$ 21,700.00
9080087	Concrete Curb and Gutter (C-05.10) (Type E)	L.FT.	33,381	$ 15.00	$ 500,800.00
9100008	Concrete Barrier (Half) (C-10.52)	L.FT.	21,152	$ 60.00	$ 1,269,200.00
9100015	Concrete Barrier (Half) (SD 1.01)	L.FT.	6,595	$ 60.00	$ 395,700.00
	Traffic Items (Signing, Marking, Lighting, FMS) (10% of Pavement Cost)	L.SUM	1	$ 1,351,200.00	$ 1,351,200.00
	Drainage Improvements	L.SUM	1	$ 990,000.00	$ 990,000.00
				ROADWAY SUBTOTAL:	**$ 19,806,500.00**
	Maintenance and Protection of Traffic (5%)	L.SUM		$ 991,000.00	$ 991,000.00
	Dust and Water Palliative (0.75%)	L.SUM		$ 149,000.00	$ 149,000.00
	Quality Control (0.75%)	L.SUM		$ 149,000.00	$ 149,000.00
	Construction Surveying (1.5%)	L.SUM		$ 298,000.00	$ 298,000.00
	Landscaping (3%)	L.SUM		$ 595,000.00	$ 595,000.00
	Erosion Control (0.3%)	L.SUM		$ 60,000.00	$ 60,000.00
	Mobilization (8% of all Construction Items)	L.SUM		$ 2,150,000.00	$ 2,150,000.00
				SUBTOTAL	**$ 24,198,500.00**
	Unidentified Items (20%)	L.SUM		$ 4,840,00.00	$ 4,840,000.00
				SUBTOTAL	**29,038,500.00**
	Construction Engineering (9%)	L.SUM		$ 2,614,000.00	$ 2,614,000.00
	Construction Contingencies (5%)	L.SUM		$ 1,452,000.00	$ 1,452,000.00
	Indirect Cost Allocation (9.46%)	L.SUM		$ 2,748,000.00	$ 2,748,000.00
	Engineering Design (Includes Surveying and Geotechnical) (8% of all Items)	L.SUM		$ 2,324,000.00	$ 2,324,000.00
	Right-of-Way	L.SUM		-	-
	Environmental Mitigation (Unknown at this time)	L.SUM		-	-
	Utilities (Other Relocations) (3%)	L.SUM		$ 872,000.00	$ 872,000.00
				TOTAL PROJECT COST	**$ 39,048,500.00**

5.2 ESTIMATE OF FUTURE MAINTENANCE COSTS

An estimate of the future maintenance costs that would result from the additional roadway lane miles within the corridor was evaluated for the Recommended Alternative. The annual maintenance costs were discussed with the ADOT Maintenance Group. The additional maintenance costs for the ultimate ten-lane freeway would be $2,300,000 per year, as reflected in Table 5.4

Table 5.4 – Future Maintenance Costs

Annual Maintenance Cost Per Lane Mile Using PeCoS Latest FY Data[1]	
Category	**Metro Tucson**
1. Paved Surfaces & Shoulders	600
2. Roadside	3,070
3. Drainage & Environmental	300
4. Rest Areas	
5. Traffic Operations – Signal, Lighting; Signing & Striping; ITS	1,030
6. Landscaping	3,360
7. Winter Storms	
8. Emergency Response	130
9. Miscellaneous Maintenance[2]	2,400
10. Support & Other Operating Expenses	3,150
11. Other Specialty Items[3]	
MCL = Maintenance Cost per Lane Mile	**$14,040**
Annual Maintenance Cost of Project at PA/DCR Phase	**Metro Tucson[6]**
PW = Total Pavement Width[4]	12
NL = Number of Lane Miles	1
LP = Length of Project in Miles	93
PMC = Current Project Maintenance Cost	**$1,310,000**
Annual Maintenance Cost of Project at Beginning of Maintenance Phase	**Metro Tucson[6]**
IF = Inflation Factor[5]	1.058
N = Number of Years to Maintenance Phase	10
PMCA = Project Maintenance Cost Including Inflation	**$2,300,000**

Notes:
1. Lane mile width is 12 ft. Total maintenance lane miles = 27,722 miles
   Metropolitan Phoenix maintenance lane miles = 2,016 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.
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.

There is currently $2.3 million allocated in the ADOT Five-Year Transportation Facilities Construction Program (2014 - 2018) for the design of the Cortaro Road TI in FY 2017 (Phase I) and $2.7 million in FY 2018 for right-of-way acquisition.

6.0 IMPLEMENTATION PLAN

6.1 INTRODUCTION

The purpose of this section is to recommend an implementation strategy for the Recommended Alternative. Funding is currently identified in the ADOT Five-Year Transportation Facilities Construction Program (2014 - 2018) for the reconstruction of the Ina Road TI in Fiscal Year (FY) 2016 and the Cortaro Road TI design in FY 2017. This funding would include the design/reconstruction of the I-10 mainline and frontage roads.

The Implementation Plan was developed to propose a logical sequence of construction phasing that would systematically build the ultimate I-10 corridor improvements as future traffic demands warrant and funding becomes available. The plan considers the need for improvements based on traffic demand, construction staging to maintain traffic during construction, and minimizing duplication or repetition of effort over short- and long-term periods.

The traffic data for this study was the basis for projecting the I-10 mainline future traffic volumes, in five-year increments, to determine how the mainline would operate in the future and facilitate developing the Implementation Plan. The traffic projections are shown in Table 6.1.

Table 6.1 – I-10 Mainline Traffic Projections

Segment	Traffic Projections (vpd)				
	2015	2020	2025	2030	2035
Tangerine Rd. to Avra Valley Rd.	71,800	94,500	117,100	139,800[1]	162,400
Avra Valley Rd. to Twin Peaks Rd.	77,100	99,800	122,500	145,300[1]	168,000
Twin Peaks Rd. to Cortaro Rd.	92,000	114,300	136,600[1]	158,900	181,200[2]
Cortaro Rd. to Ina Rd.	108,200	129,700[1]	151,200	172,800	194,300[2]

[1] Maximum traffic volume based on acceptable LOS for a six-lane freeway on this segment of I-10
[2] Maximum traffic volumes based on acceptable LOS for an eight-lane freeway on this segment of I-10

As indicated in Table 6.1, I-10, in its existing configuration, is expected to experience traffic volumes that would result in the mainline operating at unacceptable LOS by the year 2020 between the Cortaro Road and Ina Road TIs and by year 2025 between the Twin Peaks Road and Cortaro Road TIs. The segments between the Tangerine Road and Avra Valley Road TIs and the Avra Valley Road and Twin Peaks Road TIs would experience unacceptable LOS by year 2030.

The following project construction phasing is recommended:

- Phase I: Years 2015 to 2020
  - Reconstruct the Cortaro Road TI (MP 246.7)
  - Reconstruct the frontage roads from the Twin Peaks Road TI (MP 244.9) to the Ina Road TI (MP 248.7)
  - Reconstruct and expand I-10 from the Twin Peaks Road TI (MP 244.9) to the Ina Road TI (MP 248.7) to provide four lanes in each direction
- Phase II: Years 2025 to 2030
  - Reconstruct the Avra Valley Road TI (MP 243)
  - Reconstruct the frontage roads from the Tangerine Road TI (MP 240.5) to the Twin Peaks Road TI (MP 244.9)
  - Reconstruct and expand I-10 from Tangerine Road (MP 240.5) to the Twin Peaks Road TI (MP 244.9) to provide four lanes in each direction

- Phase III: Years 2035 to 2040
  - Expand I-10 to a ten-lane freeway

6.2 PHASE I – RECONSTRUCT THE CORTARO ROAD TI, I-10 AND FRONTAGE ROADS

The Cortaro Road TI is currently operating at an unacceptable LOS 'E'. The I-10 mainline between the Cortaro Road and Ina Road TIs is projected to operate at capacity by 2020 for a six-lane freeway. The segment of the I-10 mainline between the Twin Peaks Road and Cortaro Road TIs would experience unacceptable LOS by Year 2025.

Therefore, the recommendation is to reconstruct the Cortaro Road TI in Phase I. Since the reconstruction of the interchange includes realigning and lowering I-10 and elevating Cortaro Road, this project would include reconstructing the I-10 mainline to the configuration for the Recommended Alternative.

Phase I should:

- Reconstruct the Cortaro Road TI to:
  - Shift the alignment approximately 100 feet east of the existing alignment
  - Pass over I-10 and the UPRR
  - Widen Cortaro Road to include a raised curbed median, six travel lanes (three travel lanes in each direction) and left- and right-turn lanes as warranted

- Reconstruct the eastbound frontage road between Station 4852+11± and Station 4992+14± and the westbound frontage road between Station 4835+33± and Station 4991+95± to widen the roadway to accommodate two-12-foot-wide travel lanes and 8-foot-wide shoulders for a total width of 40 feet

- Reconstruct I-10 from the Twin Peaks Road TI to the Ina Road TI (Station 4820+00± to Station 4981+80±) to:
  - Lower the profile to go under Cortaro Road
  - Widen the mainline to an eight-lane freeway with a closed median (concrete median barrier) and provisions for expanding to a ten-lane freeway

Reconstructing I-10 to an eight-lane freeway with a closed median would be compatible with the proposed improvements for the mainline included in the scope of the Ina Road TI project. The Cortaro Road Bridge underpass would be designed to accommodate the future expansion of I-10 to a ten-lane freeway by making provisions for the fifth lane to the outside of the I-10 pavement edge. This phase also includes modifications to the eastbound entrance and westbound exit ramps at the Twin Peaks Road TI.

The following assumption was made for this phase:

- The proposed improvements for the I-10, Ina Road TI to Ruthrauff Road TI segment would be completed as identified in the ADOT Five-Year Transportation Facilities Construction Program (2014

- 2018) approved in June 2013. The Ina Road TI is planned to be under construction in FY 2016 and the Ruthrauff Road TI in FY 2018. The design and construction of the Orange Grove Road and Sunset Road TIs have not been programmed. The Orange Grove Road and Sunset Road TIs would need to be completed prior to striping the I-10 mainline to accommodate four travel lanes in each direction west of the Ina Road TI.

6.3 PHASE II - RECONSTRUCT THE AVRA VALLEY ROAD TI, I-10 AND FRONTAGE ROADS

Based on the traffic analysis, the operation of the existing configuration at the Avra Valley Road TI is forecasted to operate at an unacceptable LOS 'F' by Year 2030. However, if significant development occurs to the south of I-10 and/or if Avra Valley Road is extended to the north, this would create the need to implement this phase before 2030. The I-10 mainline from Tangerine Road to the Twin Peaks Road TI is projected to operate at capacity by 2030 for a six-lane freeway.

Therefore, the recommendation is to reconstruct the Avra Valley Road TI in Phase II. Since the reconstruction of the interchange includes realigning and lowering I-10 and elevating Avra Valley Road, this project would include reconstructing the I-10 mainline to the configuration for the Recommended Alternative. The Avra Valley Road Bridge underpass would be designed to accommodate the future expansion of I-10 to a ten-lane freeway by making provisions for the fifth lane to the outside of the 1-10 pavement edge.

Phase II should:

- Reconstruct the Avra Valley Road TI to:
  - Shift the alignment approximately 80 feet east of the existing alignment
  - Pass over I-10 and make provisions for the future extension of Avra Valley Road to the north over the UPRR by the Town of Marana or others
  - Widen Avra Valley Road to include a raised curbed median, four travel lanes (two travel lanes in each direction) and left- and right-turn lanes as warranted

- Reconstruct the eastbound frontage road between Station 4580+50± and Station 4796+54± and the westbound frontage road between Station 4576+25± and Station 4794+60± to:
  - Be continuous and one-way
  - Widen the roadway to accommodate two 12-foot-wide travel lanes and 8-foot-wide shoulders for a total width of 40 feet

- Reconstruct I-10 from Tangerine Road to the Twin Peaks Road TI (Station 4554+00± to Station 4820+00±) to:
  - Lower the profile to go under Avra Valley Road
  - Widen the mainline to an eight-lane freeway with a closed median (concrete median barrier) and provisions for expanding to a ten-lane freeway

The proposed improvements would also include:

- Modifications to the eastbound exit and westbound entrance ramps at the Twin Peaks Road TI
- Extending Benta Vista Street to the west to cross over the CMID irrigation canal. A new roadway would be constructed to connect Benta Vista Street to Rillito Village Trail, along the Portland Avenue alignment. Portland Avenue would be stop controlled

The following assumptions were made for this phase:

- The new Tangerine Road TI, approximately 2,500 feet west of the existing Tangerine Road TI, and the conversion of the existing interchange to a grade-separated crossing without ramp connections to I-10 is completed
- The Town of Marana improvements to widen Tangerine Road to a five-lane section, north of I-10, would be completed

6.4 PHASE III - EXPAND I-10 TO A TEN-LANE FREEWAY

I-10 would be reconstructed in Phase I and II to an eight-lane freeway with provisions for expanding to a ten-lane freeway. Expansion to a ten-lane facility would be accomplished by adding 12 feet of pavement width to the outside pavement edge of the eight-lane I-10 facility and restriping the mainline. The improvements would also involve removing and replacing the curb or barrier and reconstructing the catch basins along the outside shoulder, and relocating the freeway guide signs. The five-lane section would consist of five 12-foot-wide travel lanes and 12-foot-wide inside and outside shoulders. Based on the traffic analysis, traffic operations would warrant expanding I-10 to five travel lanes in each direction between the Twin Peaks Road and Ina Road TIs by 2035 and Tangerine Road and the Twin Peaks Road TI after 2035.

7.0 AASHTO CONTROLLING DESIGN CRITERIA

The Recommended Alternative would reconstruct the mainline, ramps, frontage roads, and crossroads; therefore, a comparison of the existing roadway conditions to current standards and criteria was not performed.

7.1 AASHTO NON-CONFORMING GEOMETRIC DESIGN ELEMENTS

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

All of the ADOT non-conforming existing features in the study limits would be reconstructed to meet current ADOT design criteria.

7.2 REQUEST FOR AASHTO DESIGN EXCEPTION

There would be no AASHTO design exceptions necessary for the improvements identified in this study's Recommended Alternative alignment.

8.0 SOCIAL, ECONOMIC AND ENVIRONMENTAL CONCERNS

A Working Draft EA, dated December 2013, was developed in accordance with the National Environmental Policy Act of 1969 (NEPA) and the policies of the FHWA as the lead federal agency and is currently on file with ADOT's Environmental Planning Group (EPG). When the project is programmed and meets FHWA criteria of fiscal constraint, the NEPA process may resume. At that time, the Working Draft EA and supporting technical studies will be reviewed for consistency with current conditions within the project area, applicable regulations and requirements, and required mitigation. Re-evaluation may be required based on changed conditions or regulations. It is anticipated that, at a minimum, the following information will be updated or re-evaluated: socioeconomic data, Title VI and Environmental Justice, cultural resources, Section 4(f) resources, air quality impacts, noise analysis, biological resources, and hazardous materials assessment. The Working Draft EA will then be revised for ADOT and FHWA review and comment. Once approved by ADOT and FHWA, the Draft EA will be made available for public comment. Pertinent comments received on the Draft EA would be reflected in the Final EA. The EA will need to be completed during the design phase. A brief summary of resource impacts that were analyzed in the Working Draft EA is included below.

8.1 LAND OWNERSHIP, JURISDICTION, AND USE

As described in Section 1.5.3 of this DCR, the study area encompasses property under the jurisdiction of Pima County, the Town of Marana, and the ASLD. Land in the study area is under a combination of public and private ownership. Continued coordination with these entities and affected property owners will be required as design of roadway improvements progresses.

8.2 SOCIAL AND ECONOMIC CONSIDERATIONS

Socioeconomic impacts would result from acquisition of right-of-way, temporary impacts from construction, and access changes in the project area. It is anticipated the right-of-way acquisitions would be in areas surrounding the Avra Valley Road and Cortaro Road TIs and along the eastbound frontage road. Based upon preliminary calculations, over 70 percent of the proposed new right-of-way required is currently undeveloped. However, right-of-way acquisitions would affect utility facilities, several businesses, a mining operation, race track, and golf course. The reconstruction of Cortaro Road over I-10 would eliminate an existing access point at Joplin Lane, which currently provides an informal access route to several homes and businesses north of the TI. The conversion of the eastbound frontage road to one-way operation would affect local access and circulation for the community of Rillito. More detailed information is available in the Working Draft EA on file with ADOT's EPG.

8.3 TITLE VI AND ENVIRONMENTAL JUSTICE

Demographic data indicate the population within the study area has a relatively high proportion of disabled, minority, low income, elderly, and female head-of-household. Specifically, the proportion of the population that is low-income is much higher within the community of Rillito when compared to those of the Town of Marana and Pima County. More detailed information on these populations is available in the Working Draft EA on file with ADOT's EPG.

8.4 CULTURAL RESOURCES

A site file and records search of the Area of Potential Effect (APE) and a surrounding one-half mile radius identified more than 65 prehistoric and historic cultural resource sites and structures. Portions of the APE have not been surveyed for archaeological cultural resources. A reconnaissance survey was conducted to identify buildings and structures eligible for inclusion in the National Register of Historic Places (NRHP). Eight historic-age properties, including one district, were identified within one-half mile of the APE. Additional research will be required in order to make an eligibility recommendation for several of these properties.

Due to the presence of cultural resources in or immediately adjacent to the ADOT right-of-way, it is anticipated the project would not be able to avoid all known cultural resources and would result in an adverse effect on NRHP-eligible cultural resources. Further study and cultural resources survey will be required to completely inventory and identify cultural resources within the APE, as well as determine project effect on individual sites. A Programmatic Agreement would be required to guide this process.

8.5 SECTION 4(f) RESOURCES

Nine historic cultural resource properties that may be eligible for protection under Section 4(f) were identified by conducting an inventory of known historic properties that have been previously determined eligible or could be eligible for listing in the NRHP:

- Rillito Railroad Station building – Unevaluated but treated as eligible for listing in the NRHP under Criterion A
- Arizona Portland Cement Company – Eligible under Criterion A
- UPRR (AZ EE:5:53([ASM]) – Eligible under Criterion A and D
- Active Railroad Spur (AZ EE:5:53[ASM]) – Eligible under Criteria A and D
- Abandoned Railroad Spur (AZ AA:12:871[ASM]) – Eligible under Criteria A and D
- Proctor Ranch – Eligible under Criterion A
- Choate Ranch – Unevaluated but treated as eligible under Criterion A
- Irrigation Canal (AZ AA:12:901[ASM]) – Eligible Under Criteria A and D
- Irrigation Canal (AZ AA:12:902[ASM]) – Eligible under Criteria A and D

There is one publicly-owned park within the project area: Rillito Vista Park in Rillito. This one-acre neighborhood park is located approximately 500 feet south of the eastbound frontage road along Robinson Street, and includes a lighted basketball court, volleyball court, playgrounds, picnic ramada, and restrooms.

More detailed information and a preliminary Section 4(f) evaluation are available in the Working Draft EA on file with ADOT's EPG. Further documentation of any Section 4(f) determinations, consultations, coordination, and approvals will be required to establish compliance with the Section 4(f) process. Archival research could be needed to substantiate NRHP eligibility of some of the historic resources.

8.6 SECTION 6(f) RESOURCES

The Rillito Vista Park in Rillito received a Land and Water Conservation Fund Act grant in 1981. The proposed improvements in the Recommended Alternative would not convert the park or park property to a non-recreational purpose. Therefore, there are no impacts to this Section 6(f) resource.

8.7 AIR QUALITY ANALYSIS

This project is in an air quality nonattainment area for particulate matter (PM_{10}) and within an air quality maintenance area for carbon monoxide. These areas have transportation control measures in the State Implementation Plan. This project is not yet included in the PAG Transportation Improvement Program: 2013-2017 or the PAG Regional Transportation Plan: 2040. There is currently $2.3 million allocated in the ADOT Five-Year Transportation Facilities Construction Program (2014 - 2018) for the design of the Cortaro Road TI in FY 2017 (Phase I) and $2.7 million in FY 2018 for right-of-way acquisition. Pima County is in attainment status for the pollutants sulfur dioxide, nitrogen dioxide, fine particulate matter, ozone, and lead.

An air quality analysis conducted for the project determined that the Recommended Alternative is not expected to cause or contribute to an exceedance of the National Ambient Air Quality Standards. A quantitative analysis of future levels of mobile source air toxics (MSATs) determined that the net effect of the project would be a reduction in MSAT emissions between 2011 and 2040. The air quality analysis will need to be updated or re-evaluated to reflect changes in projected traffic volumes, regulatory requirements, or attainment status of the study area.

8.8 TRAFFIC NOISE ANALYSIS

Noise-sensitive land uses within the study area include homes, an RV park, a golf course, and a neighborhood park. Measured hourly-equivalent ambient noise levels at residences ranged from 57 to 72 A-weighted decibels (dBA). The FHWA Traffic Noise Model 2.5 was used to predict future noise levels under the Recommended Alternative. Future noise levels under the Recommended Alternative are predicted to approach or exceed the FHWA Noise Abatement Criteria of 64 dBA at many residences within the study area. Two noise barriers were found to be reasonable and feasible and are preliminarily recommended for incorporation into the project. The noise barriers are located along the eastbound mainline edge-of-pavement near the community of Rillito and near the Continental Ranch development.

Further evaluation will be required if new developments are permitted or constructed prior to completion of the NEPA process. Additionally, any design changes affecting horizontal or vertical alignments could require an update to the noise analysis.

8.9 WATER RESOURCES

A preliminary field investigation identified seven washes crossing the study area that could potentially be considered jurisdictional Waters of the US (Waters). A jurisdictional delineation will be required to formally establish the limits of the Waters. During final design, the project plans will need to be reviewed to determine the extent of temporary and permanent impacts to the Waters and identify the appropriate Clean Water Act permits that would need to be obtained prior to any ground-disturbing activities within Waters.

8.10 SOLE SOURCE AQUIFERS

The Upper Santa Cruz and Avra Valley Basin sole source aquifer underlies the study area. Under the Memorandum of Understanding (MOU) between the EPA and the FHWA dated November 2002, any proposed project that is within a designated sole source aquifer and which is subject to analysis through an EA is subject to a Section 1424(e) review by the EPA. Coordination with the EPA will be required when the NEPA process resumes.

8.11 BIOLOGICAL RESOURCES

8.11.1 Vegetation and Invasive Species

Construction of the Recommended Alternative would require ground disturbance outside of the existing paved areas. Because a large portion of the project area is located in a developed corridor, a minor amount of vegetation would be impacted.

A preliminary field review indicated the presence of Arizona-listed invasive species within the project area. Further study, including contacting the ADOT Natural Resources Management Section, would be required to characterize invasive species concerns for this project. To prevent the introduction of invasive species, all earth-moving and hauling equipment would be washed at the contractor's storage facility prior to entering the construction site. To prevent invasive species seeds from leaving the site, the contractor would inspect all construction equipment and remove all attached plant/vegetation debris prior to leaving the construction site. All disturbed soils that would not be landscaped or otherwise permanently stabilized by construction would be seeded using species native to the project vicinity.

During final design, a native plant survey would be required. A preliminary field review indicated protected native plants occur within the project area, and could potentially be disturbed by construction activities. Therefore, the ADOT Roadside Development Section would notify the Arizona Department of Agriculture (ADA) at least 60 days prior to the start of construction so that the ADA can determine the disposition of those plants.

8.11.2 Threatened/Endangered Species, Designated Critical Habitat, and Sensitive Species

A Biological Evaluation was completed and approved that identified potential impacts to special status species. The US Fish and Wildlife Service (USFWS) threatened, endangered, proposed, and candidate species list for Pima County was analyzed to determine the potential for federally-listed species to occur within the project area. The following three species were analyzed in detail: Desert tortoise, Sonoran Desert population (*Gopherus morafkai*); lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*); and northern Mexican gartersnake (*Thamnophis eques megalops*). It is not anticipated that the Recommended Alternative would affect the lesser long-nosed bat or northern Mexican gartersnake. It is anticipated the Recommended Alternative could affect individuals of the Sonoran Desert Tortoise, but that the project is not likely to result in a trend toward federal listing or loss of viability. During construction, the contractor would be required to adhere to the AGFD's Guidelines for Handling Sonoran Desert Tortoises Encountered on Development Projects (available online at the following address: http://www.azgfd.gov/hgis/pdfs/Tortoisehandlingguidelines.pdf).

8.12 PRIME AND UNIQUE FARMLANDS

Soils within the project corridor include those classified as prime farmland if irrigated and protected from flooding and farmland of unique importance. The Recommended Alternative received a score of 100 on the NRCS-CPA-106 form, which is based on the relative value of the farmland, the limited amount of the corridor that is actually farmed, and the absence of any indirect effects on remaining farms and farm support services. As projects receiving a total score on the National Resources Conservation Service (NRCS) form NRCS-CPA-106 of less than 160 are not subject to the farmland protection provisions of the Farmland Protection Policy Act, it is not anticipated other alternatives would need to be considered or that farmlands in the project area would need to be protected from conversion to non-agricultural uses. During final design, continued coordination with the NRCS would be required to determine if any design or land use changes affect this rating.

8.13 HAZARDOUS MATERIALS

A preliminary initial site assessment consisting of a review of regulatory site history and a limited field review was conducted to assess specific sites of potential concern within the project area. Based upon this assessment, testing for asbestos and lead-based paint in buildings would be required during the right-of-way acquisition process. Testing for asbestos and lead-based paint in transportation infrastructure would need to be completed within six months of the start of construction. The hazardous materials assessment would need to be updated or re-evaluated prior to bid advertisement.

An Environmental Overview is provided in Appendix E. More detailed information is available in the Working Draft EA on file with ADOT's EPG.

Appendices