



Interstate 10/Interstate 17 Corridor Master Plan (FY 2014) Alternatives Screening Technical Report

September 12, 2017

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Interstate 10/Interstate 17 Corridor Master Plan (FY 2014)

Alternatives Screening Technical Report

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September 12, 2017

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Abbreviations and Acronyms

ADOT	Arizona Department of Transportation	HOV	high-occupancy vehicle
AEP	Alternatives Evaluation Partners (representatives from MAG, ADOT, FHWA, Valley Metro, Phoenix, Chandler, Guadalupe and Tempe)	I-10	Interstate 10
ALERT	Arizona Local Emergency Response Team	I-17	Interstate 17
ARID	anonymous re-identification devices	ICAP	indirect cost allocation plan
ASU	Arizona State University	ICM	Integrated Corridor Management
ASTR	<i>Alternatives Screening Technical Report</i>	IGA	intergovernmental agreement
ATM	active traffic management	ITS	intelligent transportation systems
BRT	bus rapid transit	LOS	level of service
CAD	computer-aided dispatch	MAG	Maricopa Association of Governments
CCTV	closed-circuit television	MAP-21	Moving Ahead for Progress in the 21st Century Act
C-D	collector-distributor	MCDOT	Maricopa County Department of Transportation
CIP	Capital Improvement Program	mph	miles per hour
CMF	crash modification factor	MOE	measure of effectiveness
DHOV	direct high-occupancy vehicle ramp, providing HOV access in system and service traffic interchanges	NAR	<i>Needs Assessment Report</i>
DMS	dynamic message signs	NEPA	National Environmental Policy Act
DPS	Arizona Department of Public Safety	North Stack	I-17/SR-101L North Stack system traffic interchange in North Phoenix
DSRC	dedicated short-range communication	Pecos Stack	I-10/SR-202L Pecos Stack system traffic interchange in Ahwatukee/Chandler
DSS	Decision Support System	PEL	Planning and Environmental Linkages
EIS	environmental impact statement	PIO	public information officer
EJ	environmental justice	RADS	Regional Archived Data System
FAA	Federal Aviation Administration	REACT	Regional Emergency Action Coordination Team
FCDMC	Flood Control District of Maricopa County	RFHP	Regional Freeway and Highway Program
FHWA	Federal Highway Administration	ROW	right of way
FMS	Freeway Management System	RTP	<i>MAG Regional Transportation Plan, for the 2035 horizon</i>
FSP	Freeway Service Patrol	Section 4(f)	Section 4(f) of the Department of Transportation Act of 1966
FY	fiscal year	Section 6(f)	Section 6(f) of the Land and Water Conservation Act
GIS	geographic information system	Split	I-10/I-17 Split system traffic interchange
HAWK	high-intensity activated crosswalk (signalized)	SPUI	single-point urban interchange
HCM	<i>Highway Capacity Manual</i>	SR	State Route
HCRS	Highway Condition Reporting System	SR-101L	Loop 101, Arizona State Route 101 Loop
HPA	Highest Performing Alternative	SR-202L	Loop 202, Arizona State Route 202 Loop
HOT	high-occupancy toll	Stack	I-10/I-17 Stack system traffic interchange
		T2050	Transportation 2050, current plan for the City of Phoenix
		TDM	transportation demand management

TIP	Transportation Improvement Program
Title VI	Title VI of the Civil Rights Act of 1964
TOC	Traffic Operations Center
TMC	Traffic Management Center
TSM	transportation system management
TSMO	transportation system management and operations
TSP	transit signal priority
UPRR	Union Pacific Railroad
US-60	U.S. Route 60
v/c	volume-to-capacity
VHT	vehicle hours traveled
VMT	vehicle miles traveled

1 Executive Summary

1.1 Study Overview

The Maricopa Association of Governments (MAG), in partnership with the Federal Highway Administration (FHWA) and Arizona Department of Transportation (ADOT), launched the Spine study to develop a Corridor Master Plan for the Interstate 10 (I-10) and Interstate 17 (I-17) corridor in February 2014. This corridor is referred to as the “Spine” because it serves as the backbone for transportation in the Phoenix metropolitan area. In fact, the corridor handles about 40 percent of all daily freeway traffic in the region. In June 2015, the Spine study team completed the *Needs Assessment Report* (NAR). This report documented the environmental issues; operational problems; safety concerns; bicycle, pedestrian and transit gaps; economic drivers; infrastructure condition and public feedback concerning the corridor. The NAR became the document that was used to generate alternatives for improvements and to evaluate them. This *Alternatives Screening Technical Report* (ASTR) documents the Spine study process since June 2015.

1.1.1 Background

Starting in 2001, ADOT and FHWA developed corridor planning studies in the form of design concept reports and environmental impact statement (EIS) studies as part of the I-10 Corridor Improvement Study and I-17 Corridor Improvement Study. These studies considered ways to meet future travel demand on both I-10 and I-17 in the Phoenix area. Primary recommendations from these EISs focused on adding lanes to the freeway main lines to meet level of service (LOS) targets identified by ADOT in the *ADOT Roadway Design Guide*.

Because the EIS studies pointed toward adding general capacity with as many as six additional lanes on certain segments, program funding in MAG’s Regional Freeway and Highway Program (RFHP) did not support the proposed improvements. Additionally, political concerns were raised by MAG Regional Council members about the need to add significant capacity on I-10 or I-17, and they encouraged another study to identify other options for meeting future travel demand. ADOT and MAG agreed to rescind the studies in October 2012 after determining that separate studies may not result in the best overall plan and that many of the studies’ recommendations were not prudent. FHWA accepted this decision. However, the knowledge gained from the EIS studies, coupled with subsequent analysis, identified several near-term improvements that could be carried forward and implemented by ADOT immediately through a separate but parallel effort with the Spine study. Although the EIS studies were cancelled, much of the planning, engineering and environmental information from those studies has been folded into this I-10/I-17 Corridor Master Plan.

1.1.2 Location of Study Area

The I-10/I-17 Corridor Master Plan is a planning-level study for proposed transportation improvements in Maricopa County and within Chandler, Tempe, Phoenix and Guadalupe. The 31-mile Spine corridor begins at the I-10/State Route (SR) 202L Pecos Stack system traffic interchange (Pecos Stack) in the southern part of Phoenix, extends north and west on I-10 (Maricopa Freeway) to the I-10/I-17 Split system traffic interchange (Split), then continues north on I-17 (Black Canyon Freeway) past the I-10/I-17 Stack system traffic interchange (Stack) to the I-17/SR-101L North Stack system traffic interchange (North Stack) (Figure 1-1). Although the I-10 Inner Loop from the Split to the Stack is within the study area, it was excluded from the Spine study because the Deck Park Tunnel precludes any future widening and has a set of its own unique issues. MAG launched a separate study in 2016 that focused solely on the I-10 Inner Loop.

The corridor study area shown in Figure 1-1 extends approximately 1.5 miles on each side of the defined Interstate corridor. The assumed 3-mile corridor width includes the following parallel arterial streets: 48th Street and 56th Street/Priest Drive from Chandler Boulevard to Broadway Road, Kyrene Road from Chandler Boulevard to Southern Avenue, Baseline Road from 35th Avenue to the Union Pacific Railroad (UPRR) line, Southern Avenue from 35th Avenue to the UPRR line, Broadway Road from 35th Avenue to the UPRR line, Buckeye Road from 35th Avenue to 24th Street, 27th Avenue from Lower Buckeye Road to SR-101L, and 19th Avenue and 35th Avenue from Baseline Road to SR-101L. Figure 1-1 shows the project vicinity.

1.1.3 Purpose of the Study

The I-10/I-17 Corridor Master Plan effort analyzed various long-term strategies to improve mobility in the corridor. The study evaluated the full range of transportation modes and concepts to identify the best multimodal system solutions. These long-term improvements are envisioned as a combination of traditional solutions, new technology and increased use of transit. The key outcome of the Spine study is a detailed strategy to manage traffic in the I-10 and I-17 corridors through 2040. Study recommendations will be programmed in the MAG *Regional Transportation Plan* (RTP) and Transportation Improvement Program (TIP).

At the beginning of the study, the MAG RTP allocated \$1.47 billion through 2025 for the Spine study area. The Spine study identifies how to best allocate these funds to achieve the greatest benefit to the region. It also defines funding shortfalls associated with the preferred corridor improvement approach so that additional funding allocations can be identified.

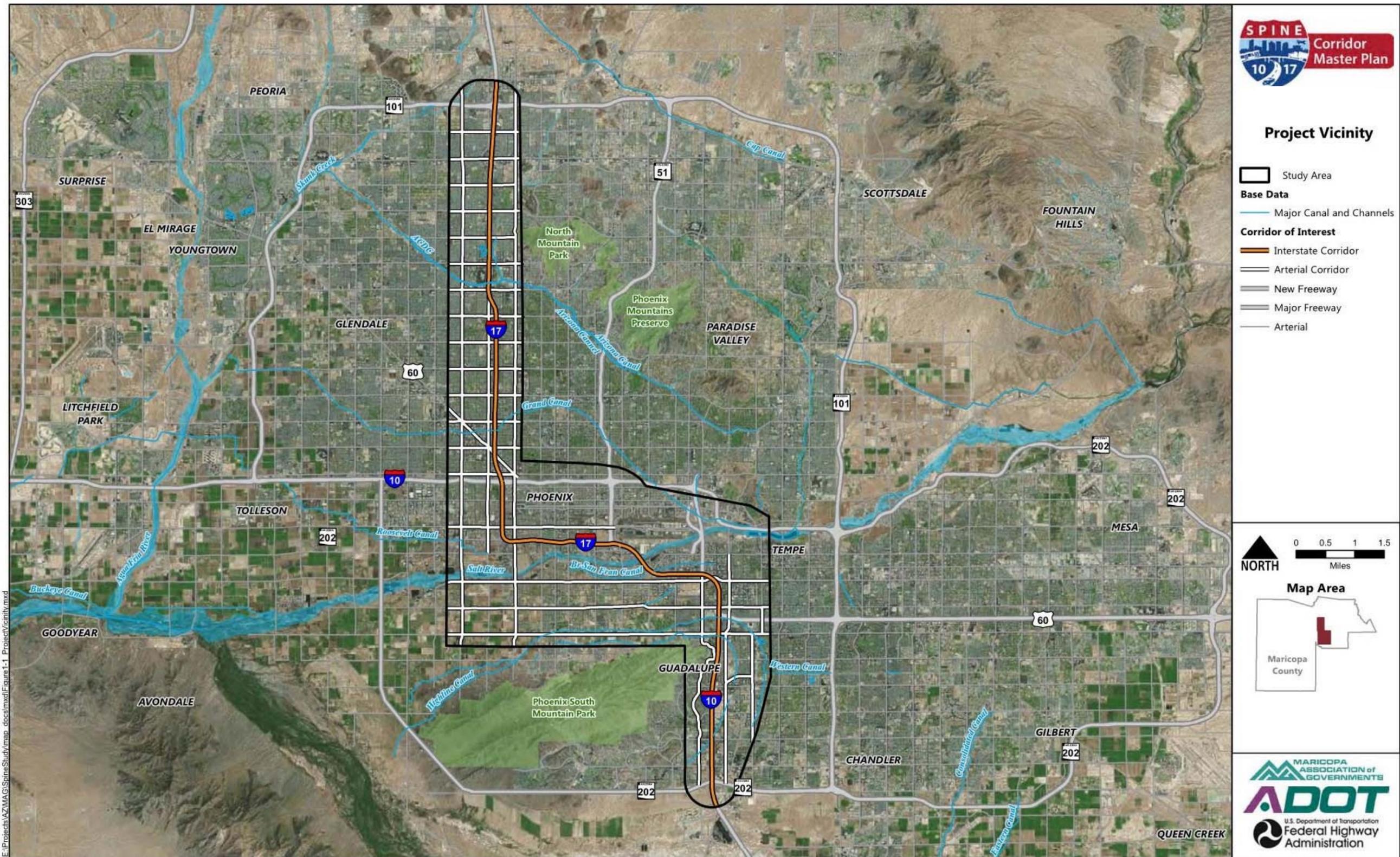
The primary purpose of the I-10/I-17 Corridor Master Plan is to develop an improvement and implementation strategy to appropriately manage travel demand and movements in the I-10 and I-17 corridors. The strategy has identified a group of projects to incorporate into the RTP and TIP. Phases of the projects will then be programmed for future environmental clearances, design, right of way (ROW) acquisition and construction.

1.1.4 Project Management and Team Organization

The Spine study developed five partner groups that lead the decision-making process. Group membership was determined by the three key partner agencies: MAG, ADOT and FHWA.

- **Charter Partners:** Consist of elected officials and executive-level representatives from MAG, ADOT, FHWA and Valley Metro. This group met several times over the course of the study to receive status updates and to provide direction or make key decisions as requested.
- **Management Partners:** Consist of senior management from MAG, ADOT and FHWA. This group was the core management team for the study and met weekly (at the beginning of the study) to monthly during the alternatives screening process. This group directed the day-to-day work on the study and contributed to key decisions during the alternatives screening process.
- **Planning Partners:** Consist of management and technical staff from the cities and town and their respective departments, designated Native American communities (Ak-Chin Indian Community, Salt River Pima-Maricopa Indian Community, Gila River Indian Community and Tohono O’odham Nation), MAG, ADOT, FHWA and Valley Metro. This group met just a few times over the course of the study to receive status updates.

Figure 1-1. Project Vicinity



Source: ADOT, ALRIS, FEMA

Map Last Updated: 8/29/2017

- **Alternatives Evaluation Partners (AEP):** Consist of the Management Partners and senior representatives from MAG member agencies affected by actions in the corridor. This group oversaw the alternatives screening process and was involved with major decisions and direction during the alternatives screening process.
- **Agency Partners:** Consist of representatives from other agencies with an interest in the study, including, but not limited to, the U.S. Army Corps of Engineers, Federal Aviation Administration (FAA), Federal Transit Administration and Flood Control District of Maricopa County (FCDMC). This group met just a few times over the course of the study to receive status updates, and meetings were frequently held in conjunction with another partner meeting.

1.2 Summary of Meetings

Dozens of meetings were held throughout the duration of the Spine study process. Most meetings were Management Partner meetings, but many more involved the AEP, especially during the alternatives evaluation screening process. MAG committee presentations were conducted throughout the screening process as major milestones occurred, and member agency council presentations also occurred as requested. Overall, 75 meetings occurred during the alternatives development and screening process—up to the final MAG Regional Council approval of the recommended alternative. All 75 meetings are listed in Chapter 2.

As the screening process was concluding, four public meetings were hosted by MAG to present the results of the Spine study alternatives screening process.

1.2.1 Public Meetings

The public outreach effort and feedback gathered during the Spine study has been robust, with two major rounds of public meetings and comment periods. The first round of public meetings occurred during the NAR development and is documented in that report in detail. That round of public meetings provided valuable input about the issues and concerns in the corridor for the freeways, interchanges, arterials, and transit, bicycle and pedestrian facilities. This information helped target specific solutions for these issues. The second round of public outreach occurred in early 2017 and shared the results of the alternatives screening process and the recommended alternative with the public. A total of four public meetings occurred along the corridor. The details of this outreach effort are described in Chapter 5 and Appendix C of this document.

1.3 Alternatives Development

After finalizing the NAR in June 2015, a 2-day workshop was held to develop concepts that addressed the issues identified within the Spine corridor. MAG hosted the Alternatives Development Workshop on June 22 and 23, 2016. It was attended by personnel from MAG, ADOT, FHWA, City of Phoenix, City of Tempe, City of Chandler, Valley Metro, the Arizona Department of Public Safety (DPS) and transportation and mobility experts from the Spine study team. Appendix A provides the workshop presentation. The workshop generated over 349 unique ideas and strategies that were carried forward into the alternatives screening process. Once the ideas and strategies were compiled, the AEP—made up of the Management Partners, City of Phoenix, City of Tempe, City of Chandler and Valley Metro—was created to assist with the screening process and to achieve consensus so that the recommended alternative emerging from the Spine study would achieve full support from all the agencies involved.

1.4 Alternatives Screening

The alternatives that emerged from the Alternatives Development Workshop went through a four-level screening process (Figure 1-2) that is discussed in detail in Chapter 4 of this report. This screening process was done under the supervision of the Management Partners, with valuable input provided from the AEP. The Charter Partners were updated at major milestones during the process. At the beginning of the screening process, three other preliminary studies from around the country were reviewed by the Spine Management Partners to assist in developing the organization of the screening process and the screening criteria. The three reviewed studies were:

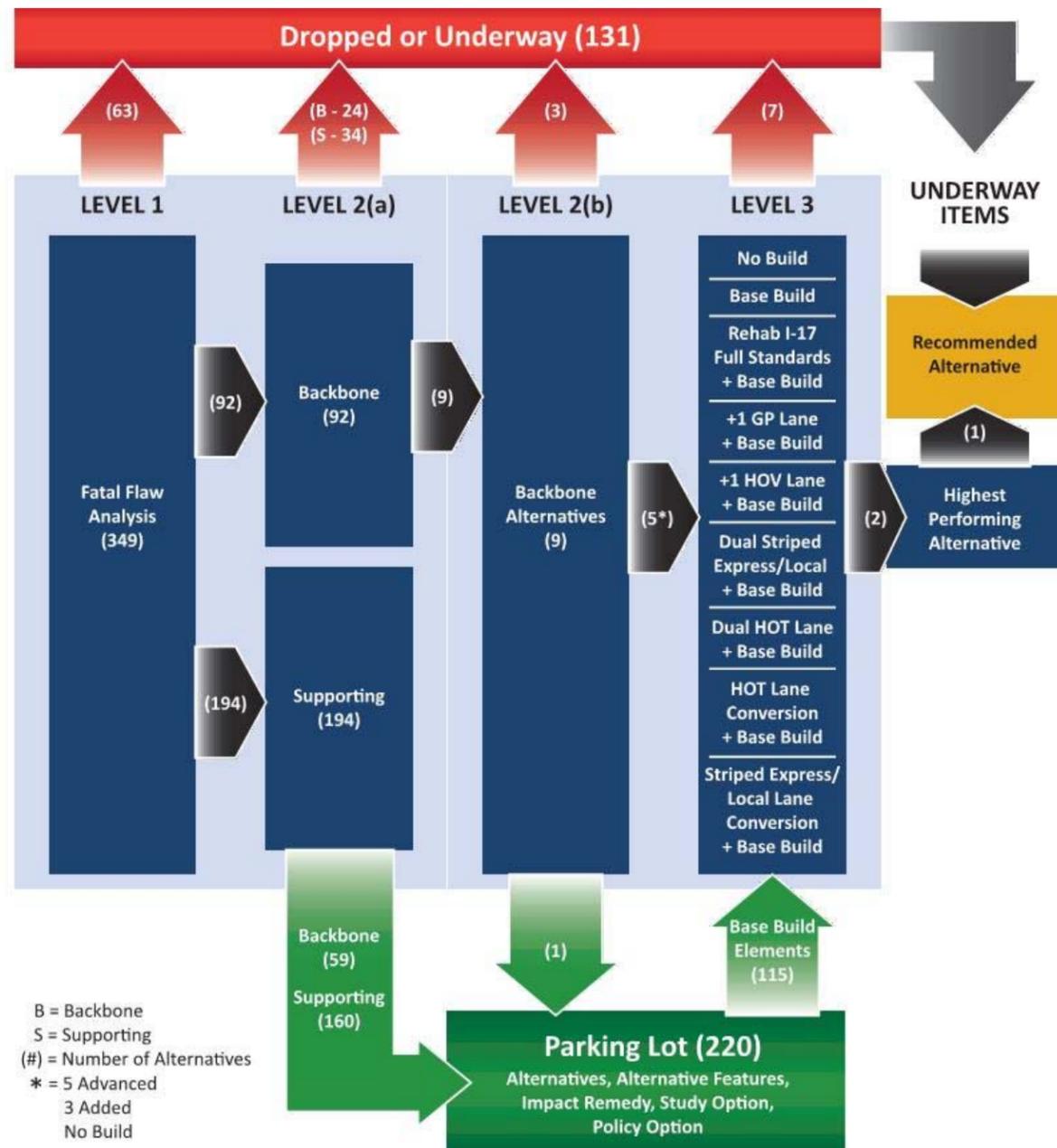
- I-25 Valley Highway EIS (Colorado Department of Transportation)¹
- I-70 East Mountain Corridor EIS (Colorado Department of Transportation)²
- I-405 Corridor Program (Washington State Department of Transportation)³

¹ <https://www.codot.gov/projects/north-i-25-eis>; project limits were I-25 from I-70 to Wellington

² <http://www.i-70east.com/>; project limits were I-70 from I-25 to Tower Road

³ <http://www.wsdot.wa.gov/projects/I405/>; project limits were the entire I-405 corridor in the Seattle area

Figure 1-2. Alternative Screening and Selection Process



optimization, expand/modernize, performance and sustainability. All of the alternatives were recommended to be categorized as one of eight options noted in Table 1-1. These categories were chosen to provide definition of the 286 alternatives to help the study team further refine the alternatives in future screenings. Alternatives that were classified as an alternative category advanced to the second stage of the Level 2 screening. Other alternatives that were classified as an alternative feature, impact remedy, policy option, study option or parking lot were placed in the “parking lot” (see Figure 1-2) to be evaluated as a supporting feature to corridor-wide alternatives in Level 3. The remaining alternatives were recommended to be dropped based on performance or because the project was already underway.

Table 1-1. Level 2A Recommendation Categories

Recommendation	Comment/Notes
Alternative	Reflects the backbone or core alternative concepts.
Alternative Feature	Reflects an element or feature to be added to or considered as part of a backbone/core alternative(s).
Impact Remedy	Reflects elements or concepts that can be considered as an alternative implementation impact remedy.
Policy Option	Reflects concepts that can be considered upon an agency policy change or legislative solution.
Study Option	Reflects concepts that can be considered upon further study.
Parking Lot	Reflects all concepts classified as an alternative feature, impact remedy, policy option or study option. Parking lot ideas will not receive any further analysis in Level 2B or Level 3 screening and will be revisited once the preferred alternative is selected.
Underway	Reflects concepts that are already being implemented and are, therefore, exempt from future consideration.
Drop	Reflects concepts that are recommended to be eliminated from further consideration.

The second stage of the Level 2 screening, noted as Level 2B, evaluated only the nine corridor-wide alternatives that advanced from Level 2A and focused on the ability to implement those alternatives. The implementation criteria used for the Level 2B screening were practicability, agency support, alternative adaptability and programming flexibility. Five alternatives advanced from the Level 2B screening to Level 3. These five alternatives were classified as “backbone” alternatives to signify options that could address travel demand throughout the entire 31-mile corridor.

In Level 3, the screening qualitatively and quantitatively analyzed the five backbone alternatives that advanced from the Level 2B screening and compared them against each other, the base build and the no-build alternatives. The no-build alternative was based on existing conditions, the ADOT near-term improvement program and the base build alternative. The no-build and base build alternatives were included as part of the five corridor-wide alternatives that advanced from the Level 2B screening and the two additional corridor-wide alternatives that were developed in the Level 3 analysis.

Level 3 analyzed the corridor-wide alternatives based on infrastructure, safety, public acceptance, corridor operations and the operations and safety of service traffic interchanges and weaving segments within the Spine corridor. The results of the analysis demonstrated that the best alternative was the expansion of managed capacity, such as the high-occupancy vehicle (HOV) lanes or high-occupancy toll (HOT) lanes system, by adding an additional lane and providing system continuity throughout the Spine corridor. It was recommended that a

The first level of screening consisted of a fatal flaw and qualitative screening. If alternatives did not address the purpose and need of the Spine study—as presented in the purpose and need statement in the NAR—the alternative was dropped from consideration. In addition, any alternative that was already part of the Near Term Improvements program was categorized as “Underway.” Each alternative was evaluated qualitatively by the study team to determine whether it met the project’s purpose and need.

The 286 alternatives that advanced to the Level 2 screening were divided into two categories: backbone and supporting alternatives. The backbone alternatives addressed issues on a corridor-wide basis, while the supporting alternatives focused on spot improvements. In the first stage of the Level 2 screening, noted as Level 2A, backbone and supporting alternatives were quantitatively analyzed based on the following criteria:

managed lane system be advanced from Level 3 and that two configurations of the managed lane system called the Highest Performing Alternative (HPA) be evaluated in the Level 4 screening.

The Level 4 screening evaluated the two hybrid options of the managed lane system (HPA1 and HPA2) to determine which configuration best served the Spine corridor.

Key features of HPA1 include:

- Adding one general purpose lane from Ray Road to Baseline Road on I-10;
- Adding a second managed lane between U.S. Route 60 (US-60) and the Split on I-10;
- Reconstructing I-17, adding a single managed lane and auxiliary lanes between the Split and the Stack on I-17;
- Adding a second managed lane between Grand Avenue and the North Stack, reconstructing portions of I-17 as needed;
- Adding direct HOV (DHOV) connections at a future Galveston DHOV traffic interchange, the SR-143 traffic interchange, Sky Harbor Circle North on I-10, the Split, Grand Avenue and the North Stack;
- Adding collector-distributor (C-D) roads between the Elliot Road traffic interchange and the SR-143 traffic interchange along I-10;
- Reconfiguring interchanges at I-10/Baseline Road, I-10/Broadway Road/SR-143, I-17/Jefferson/Adams, I-17/Indian School Road, I-17/Camelback Road, I-17/Glendale Avenue, I-17/Northern Avenue, I-17/Thunderbird Road and I-17/Bell Road;
- Accommodating light rail transit crossings of I-17 at Central Avenue, Van Buren Road, Camelback Road and Mountain View Road; and
- Implementing numerous bicycle and pedestrian improvements, including several new dedicated bicycle and pedestrian structures over the Interstate.

HPA2 is identical to HPA1, except for the following changes:

- On I-10 between US-60 and the Split, one additional general purpose lane would be added in addition to the additional managed lane noted above. The resulting freeway section would be two managed lanes, six general purpose lanes and one auxiliary lane in each direction;
- The DHOV ramps at I-10/Sky Harbor Circle North are not included, and are instead replaced with DHOV ramps at I-17/7th Street; and
- The ramps on I-17 between 16th and 7th streets and between 7th and 19th avenues are reversed to improve ramp grades and to move weaving from the main line to the frontage roads.

In addition to screening the hybrid options with the Level 3 criteria, Level 4 analyzed the impacts on environmental priority resources, as outlined in the NAR. The results of the Level 4 screening were presented at the AEP meeting on December 2, 2016, and consensus was reached to move forward with recommending HPA2. Although HPA2 cost more than HPA1, the additions to the enhanced managed lane system, which included an additional general purpose lane between US-60 and the Split and a reserved ramp configuration between the Split and the Durango Curve, provided enough benefit and value that the AEP decided it was worth the additional cost.

1.5 Agency and Public Feedback on the Recommended Alternative

The Spine study's public involvement program was designed to obtain diverse engagement and thorough investigation of issues to best inform study outcomes. Chapter 5 describes the methods, strategies and outcomes of the second round of engagement, which focused on soliciting feedback on the draft recommendation. The majority of the feedback received on the recommendation was supportive, with a large majority of the respondents supporting doing something to fix the problem.

From January 4 to February 17, 2017, the study team held stakeholder and public information meetings, attended various community events to educate and engage members of the community, and solicited comments through a variety of techniques. These techniques included a study website, agency scoping letters, media coverage, e-blasts and e-newsletters, social media, newspaper display notices, an online comment form, an interactive online map viewer, stakeholder presentations and event attendance, and four in-person public meetings held in three locations spread across the limits of the study area. A total of 233 people signed the attendance list at the four public meetings, although many more attended.

Feedback received from the public and stakeholders resulted in two additions to the recommended alternative: the addition of a Knox Road bicycle and pedestrian crossing over I-10 and the reconfiguration of the I-17/Glendale Avenue traffic interchange into a high-capacity interchange similar to the others being proposed in the corridor. Both of these requests were considered by the Management Partners and were added to the final recommendation.

A total of 496 public comments were received during the public comment period. Demographic data showed the respondents were geographically spread across the Spine corridor. Most respondents were commuters in the corridor, property owners or nearby residents. Over 80 percent of the respondents use the corridor at least once a week, and 59 percent use it five or more times per week. Most of the respondents (89 percent) use their personal vehicles within the corridor. The other 11 percent of respondents use other modes.

The public feedback forms expressed various opinions with regard to the recommended alternative:

- A majority (59 percent) of the public comments supported the expanded managed lane recommendation.
- When asked about their thoughts regarding the use of designated entry points to the managed lanes, support dropped to just 45 percent for this feature. This result prompted the study team to evaluate this feature in more detail, the results of which can be found in Appendix B of this report.
- Regarding the need to acquire new ROW for the project, 59 percent agreed that it was acceptable to acquire new ROW, but only if a fair value was paid to acquire the property and relocate the tenants.
- Feedback regarding the inclusion of bicycle and pedestrian crossings varied across the corridor, but an overwhelming majority of respondents opposed the Osborn Road bicycle and pedestrian bridge over I-17. In response, the Management Partners agreed to remove this crossing from the recommendation. The public also voiced concerns regarding the Osborn Road bicycle and pedestrian crossing during the public meeting process for the adoption of the 2040 RTP.

Details from the agency and public feedback can be found in Chapter 5 and in Appendix C of this report.

1.6 Recommended Alternative

Based on the alternatives development, screening and agency and public input phases of the study, the Spine study has concluded that HPA2 is the recommended alternative, with the following modifications:

- Removal of the I-17 Osborn Road/Grand Canal bicycle/pedestrian crossing;
- Addition of an I-17/Glendale Avenue high-capacity interchange; and
- Addition of a new bicycle/pedestrian crossing over I-10 at Knox Road.

The recommended alternative is an expanded managed lane system, combined with numerous localized improvements along the Spine corridor. Generally, this means that the current managed lanes (HOV lanes) would be expanded with a second HOV lane in segments where HOV lanes currently exist, new HOV lanes would be added where none exist today and DHOV ramps would be added to connect and terminate this expanded system. Operational flexibility regarding how these managed lanes could be used to address the uncertainty of future needs is a key advantage of this recommendation. In addition to the managed lane elements, some additional general purpose widening is proposed, most notably on I-10 between the I-17 Split and US-60 and between US-60 and Ray Road. Localized improvements would target deficient interchanges, weaving sections, bicycle and pedestrian crossings, traffic interchange upgrades and arterial capacity gaps. Features of the recommended alternative are discussed in Chapter 6 in more detail and are summarized in Table 1-2.

The final recommendation was adopted into the draft 2040 RTP, contingent on a new finding of conformity, on May 24, 2017, by the MAG Regional Council. Figures 1-3 and 1-4 illustrate the recommended alternative as presented to the public and governing bodies.

Figure 1-3. Recommended Alternative Map

The recommendations for the 35-mile portion of Interstates I-10 and I-17 "Spine" Corridor are a collection of improvements focused on operations and safety for the traveling public. Key components of the Corridor Master Plan Recommendations include the concept of additional managed lanes (such as high occupancy vehicle/HOV), modernization of 24 traffic interchanges, safer pedestrian and bicycle crossings at 20 different locations (including nine separate structures), and coordinated crossings of light rail transit at four locations.

*** What is a Managed Lane?**

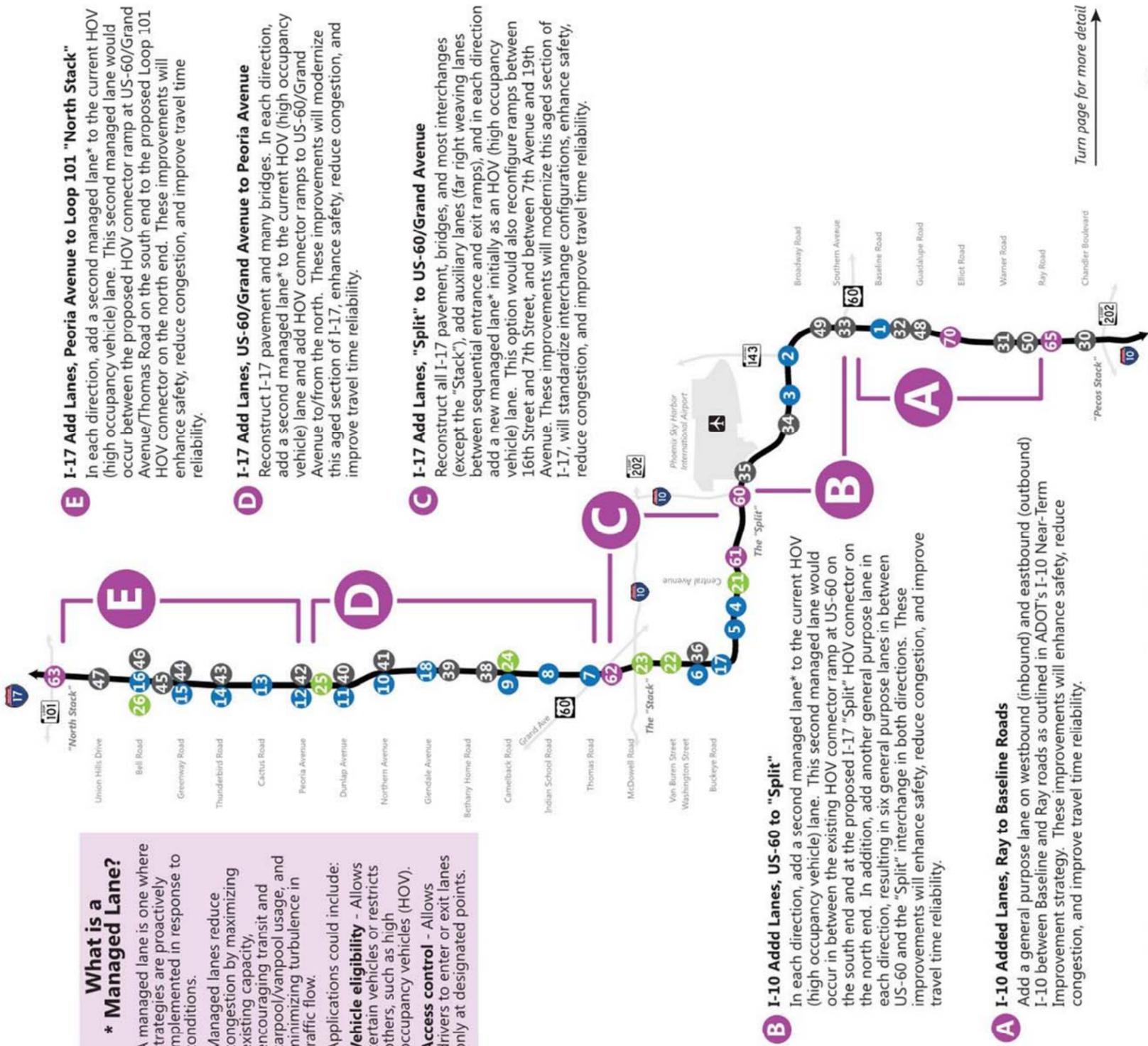
A managed lane is one where strategies are proactively implemented in response to conditions.

Managed lanes reduce congestion by maximizing existing capacity, encouraging transit and carpool/vanpool usage, and minimizing turbulence in traffic flow.

Applications could include:

Vehicle eligibility - Allows certain vehicles or restricts others, such as high occupancy vehicles (HOV).

Access control - Allows drivers to enter or exit lanes only at designated points.



E I-17 Add Lanes, Peoria Avenue to Loop 101 "North Stack"

In each direction, add a second managed lane* to the current HOV (high occupancy vehicle) lane. This second managed lane would occur between the proposed HOV connector ramp at US-60/Grand Avenue/Thomas Road on the south end to the proposed Loop 101 HOV connector on the north end. These improvements will enhance safety, reduce congestion, and improve travel time reliability.

D I-17 Add Lanes, US-60/Grand Avenue to Peoria Avenue

Reconstruct I-17 pavement and many bridges. In each direction, add a second managed lane* to the current HOV (high occupancy vehicle) lane and add HOV connector ramps to US-60/Grand Avenue to/from the north. These improvements will modernize this aged section of I-17, enhance safety, reduce congestion, and improve travel time reliability.

C I-17 Add Lanes, "Split" to US-60/Grand Avenue

Reconstruct all I-17 pavement, bridges, and most interchanges (except the "Stack"), add auxiliary lanes (far right weaving lanes between sequential entrance and exit ramps), and in each direction add a new managed lane* initially as an HOV (high occupancy vehicle) lane. This option would also reconfigure ramps between 16th Street and 7th Street, and between 7th Avenue and 19th Avenue. These improvements will modernize this aged section of I-17, will standardize interchange configurations, enhance safety, reduce congestion, and improve travel time reliability.

B I-10 Add Lanes, US-60 to "Split"

In each direction, add a second managed lane* to the current HOV (high occupancy vehicle) lane. This second managed lane would occur in between the existing HOV connector ramp at US-60 on the south end and at the proposed I-17 "Split" HOV connector on the north end. In addition, add another general purpose lane in each direction, resulting in six general purpose lanes in between US-60 and the "Split" interchange in both directions. These improvements will enhance safety, reduce congestion, and improve travel time reliability.

A I-10 Added Lanes, Ray to Baseline Roads

Add a general purpose lane on westbound (inbound) and eastbound (outbound) I-10 between Baseline and Ray roads as outlined in ADOT's I-10 Near-Term Improvement Strategy. These improvements will enhance safety, reduce congestion, and improve travel time reliability.

Legend

- # Traffic Interchange Modifications
- # Transit Improvements
- # Bicycle and Pedestrian Improvements
- # Lane and Ramp Improvements

Other Improvements:

- # Additional staffing and support resources for ADOT's Traffic Operations Center, which monitors the freeway system and uses traffic management strategies to reduce congestion and coordinate response to crashes.
- # Implement strategies that respond to advancements in transportation technologies, such as active traffic management tools and tactics related to connected and autonomous vehicles.

Notes:

Numbers reference location not priority. Program funding and scheduling will affect delivery of these improvements. These are preliminary recommendations subject to more detailed engineering and environmental studies.



Turn page for more detail →

Figure 1-4. Legend for Recommended Alternative Map (in Figure 1-3)

- CORRIDOR MASTER PLAN RECOMMENDATIONS**
- 1 I-10 and Baseline Road Interchange Improvements** Reconfigure traffic interchange to improve safety and capacity. An alternative interchange configuration that will be considered is the diverging diamond interchange.
- 2 I-10 and SR-143/Broadway Road Interchange Improvements** Focus a high level of investment at this location to improve interchange safety and efficiency between I-10 and SR-143 by reconfiguring interchange(s), reconstructing bridges, and adding a dedicated high occupancy vehicle (HOV) ramp from SR-143 to I-10. The Broadway Road interchange will also be upgraded as part of the SR-143 interchange reconstruction.
- 3 I-10 and 40th Street Interchange Improvements** Upgrade traffic interchange to improve safety and efficiency, and to accommodate the I-10 mainline widening through the interchange.
- 4 I-17 and 7th Avenue Interchange Improvements** Upgrade traffic interchange with additional arterial street lanes on 7th Avenue and other operational upgrades.
- 5 I-17 and 19th Avenue Interchange Improvements** Upgrade traffic interchange with additional arterial street lanes on 19th Avenue and other operational upgrades.
- 6 I-17 and Jefferson, I-17 and Adams Interchange Improvements** Reconfigure traffic interchanges to improve safety and efficiency as well as to incorporate bicycle and pedestrian improvements.
- 7 I-17 and Thomas Road Interchange Improvements** Upgrade traffic interchange and complete other operational improvements to increase safety and capacity.
- 8 I-17 and Indian School Road Interchange Improvements** Reconfigure into a high capacity traffic interchange to better accommodate large east-west arterial movements on Indian School Road and improve bike and pedestrian safety. A three-level platform diamond interchange is one possible solution for this location.
- 9 I-17 and Camelback Road Interchange Improvements** Reconfigure into a high capacity traffic interchange to better accommodate large east-west arterial movements and light rail transit on Camelback Road and improve bike and pedestrian safety. A three-level platform diamond interchange is one possible solution for this location.
- 10 I-17 and Northern Avenue Interchange Improvements** Reconfigure into a high capacity traffic interchange to better accommodate large east-west arterial movements on Northern Avenue and improve bike and pedestrian safety. A three-level platform diamond interchange is one possible solution for this location.
- 11 I-17 and Dunlap Road Interchange Improvements** Upgrade traffic interchange as well as accommodate other operational improvements to increase safety and capacity.
- 12 I-17 and Peoria Avenue Interchange Improvements** Upgrade traffic interchange as well as complete other operational improvements to increase safety, capacity and incorporate bicycle and pedestrian improvements. This improvement would include an upgrade to the drainage system to reduce the likelihood of flooding on Peoria Avenue under I-17.
- 13 I-17 and Cactus Road Interchange Improvements** Reconfigure traffic interchange and accommodate other operational improvements to increase safety and capacity. This improvement would include an upgrade to the drainage system to reduce the likelihood of flooding on Cactus Road under I-17.
- 14 I-17 and Thunderbird Road Interchange Improvements** Reconfigure into a high capacity traffic interchange to better accommodate large east-west arterial movements on Thunderbird Road as well as other operational improvements to increase safety, capacity and incorporate bicycle and pedestrian improvements. A three-level platform diamond interchange is one possible solution for this location. This improvement would include an upgrade to the drainage system to reduce the likelihood of flooding on Thunderbird Road under I-17.
- 15 I-17 and Greenway Road Interchange Improvements** Upgrade traffic interchange as well as complete other operational improvements to increase safety and capacity. This improvement would include an upgrade to the drainage system to reduce the likelihood of flooding on Greenway Road under I-17.
- 16 I-17 and Bell Road Interchange Improvements** Reconfigure into a high capacity traffic interchange to better accommodate large east-west arterial movements on Bell Road. A three-level platform diamond interchange is one possible solution for this location. This improvement would also expand the highly utilized existing Park-and-Ride lot in the southwest corner of the interchange.
- 17 I-17 and Grant Street Interchange Elimination** Eliminate this low-volume traffic interchange to improve corridor safety and to accommodate the interchange improvements at Jefferson and Adams.
- 18 I-17 and Glendale Ave Interchange Improvements** Reconfigure into a high capacity interchange to better accommodate large east-west arterial improvements on Glendale Ave, as well as other operational improvements to increase safety, capacity, and incorporate bicycle and pedestrian movements. A three-level platform diamond interchange is one possible solution for this location.
- 21 I-17 and Central Avenue Light Rail Transit Crossing** Reconstruct I-17 over Central Avenue and accommodate light rail transit on Central Avenue.
- 22 I-17 and Van Buren Road Light Rail Transit Crossing** Reconstruct the Van Buren Road bridge over I-17 and accommodate light rail transit on Van Buren Road over I-17 and accommodate the Jefferson/Adams traffic interchange reconfiguration.
- 23 I-10/I-17 Direct Access Bus Ramp at the "Stack" Interchange** Construct ramps from the median of I-10 west of the "Stack," routed south along the southbound frontage road on I-17 to Van Buren Road. Ramps would be constructed to accommodate future light rail transit (as part of the planned Capitol/I-10 West Light Rail Extension Phase II). Southbound frontage road would be closed to vehicular traffic between McDowell and Van Buren roads.
- 24 I-17 and Camelback Road Light Rail Transit Crossing** Accommodate light rail transit crossing of I-17 in conjunction with the I-17 interchange reconstruction.
- 25 I-17 and Mountain View Light Rail Transit Crossing** Accommodate a dedicated light rail transit crossing of I-17 in the vicinity of the existing MetroCenter area.
- 26 Bell Road Park and Ride Expansion** Expand the existing over-capacity park-and-ride lot in conjunction with I-17 and Bell Road traffic interchange reconfiguration.
- 30 Bicycle/Pedestrian Bridge over I-10 at Chandler Boulevard** Construct bicycle and pedestrian bridge over freeway.
- 31 I-10 and Warner Road Interchange Upgrades** Upgrade traffic interchange to improve safety and efficiency and to incorporate bicycle and pedestrian improvements as outlined in Tempe's 2015 Transportation Master Plan.
- 32 Bicycle/Pedestrian Bridge over I-10 at Highline Canal** Construct bicycle and pedestrian bridge over freeway to connect Phoenix, Tempe, and Guadalupe trails and to offer a safe bicycle alternative to traveling through the Baseline Canal Road interchange.
- 33 Bicycle/Pedestrian Bridge over I-10 at Western Canal** Construct bicycle and pedestrian bridge over freeway as outlined in Tempe's 2015 Transportation Master Plan to connect with Phoenix 2014 Comprehensive Bicycle Master Plan efforts.
- 34 I-10 and 32nd Street Interchange Upgrades** Upgrade traffic interchange to improve safety and efficiency and to incorporate bicycle and pedestrian improvements as outlined in Phoenix's 2014 Comprehensive Bicycle Master Plan.
- 35 I-10 and 24th Street Interchange Upgrades** Upgrade traffic interchange to improve safety and efficiency and to incorporate bicycle and pedestrian improvements as outlined in Phoenix's 2014 Comprehensive Bicycle Master Plan.
- 36 I-17 and Jefferson/Adams Interchange Upgrades** Upgrade traffic interchange to improve safety and efficiency and to incorporate bicycle and pedestrian improvements as outlined in Phoenix's 2014 Comprehensive Bicycle Master Plan.
- 38 Bicycle/Pedestrian Bridge over I-17 at Missouri Avenue** Construct bicycle and pedestrian bridge over freeway as outlined in Phoenix's 2014 Comprehensive Bicycle Master Plan.
- 39 Bicycle/Pedestrian Bridge over I-17 at Maryland Avenue** Maintain the existing bicycle/pedestrian bridge over I-17, or replace if impacted by the proposed freeway improvements.
- 40 Bicycle/Pedestrian Crossing under I-17 at the Arizona Canal** Maintain the existing bicycle/pedestrian crossing under I-17, or replace if impacted by the proposed freeway improvements.
- 41 I-17 and Northern Avenue Interchange Upgrades** Upgrade traffic interchange to improve bicycle and pedestrian safety. Integrate into the interchange reconstruction.
- 42 I-17 and Peoria Avenue Interchange Upgrades** Upgrade traffic interchange to improve bicycle and pedestrian safety. Integrate into the interchange reconstruction.
- 43 I-17 and Thunderbird Road Interchange Upgrades** Upgrade traffic interchange to improve bicycle and pedestrian safety and connectivity consistent with the Phoenix's 2014 Comprehensive Bicycle Master Plan. Integrate into the interchange reconstruction.
- 44 I-17 and Greenway Road Interchange Upgrades** Upgrade traffic interchange to improve safety and connectivity consistent with the Phoenix's 2014 Comprehensive Bicycle Master Plan.
- 45 Bicycle/Pedestrian Bridge over I-17 at Paradise Lane/Grandview** Construct bicycle and pedestrian bridge over freeway as outlined in Phoenix's 2014 Comprehensive Bicycle Master Plan.
- 46 I-17 and Bell Road Interchange Upgrades** Upgrade traffic interchange to improve bicycle and pedestrian safety and connectivity consistent with the Phoenix's 2014 Comprehensive Bicycle Master Plan. Integrate into the interchange reconstruction noted above.
- 47 I-17 and Union Hills Drive Interchange Upgrades** Upgrade traffic interchange to improve bicycle and pedestrian safety and connectivity consistent with the Phoenix's 2014 Comprehensive Bicycle Master Plan.
- 48 Bicycle/Pedestrian Bridge over I-10 at Guadalupe** Construct bicycle and pedestrian bridge over freeway as outlined in ADOT's I-10 Near-Term Improvement strategy.
- 49 Bicycle/Pedestrian Bridge over I-10 at Alameda** Construct bicycle and pedestrian bridge over freeway as outlined in ADOT's I-10 Near-Term Improvement strategy and Tempe's 2015 Transportation Master Plan.
- 50 Bicycle/Pedestrian Bridge crossing I-10 at Knox Rd** Construct bicycle pedestrian crossing as recommended by City of Tempe to support the Bikelit Seats Route identified in the City's Transportation Master Plan.
- 60 "Split" Direct High Occupancy Vehicle (DHOV) Connectors** Construct DHOV connectors between I-17 and I-10 to the southeast at the "Split." This would represent the western end of the second managed lane being proposed on I-10 to the southeast of this location.
- 61 I-17 Direct High Occupancy Vehicle (DHOV) Ramps** Construct DHOV ramps in the median of I-17 to and from the east at 7th Street. The objective of this proposed ramp would be to provide an access into downtown Phoenix for Express buses coming from the southeast part of the Valley, but would be accessible to all high occupancy traffic as well.
- 62 I-17 Direct High Occupancy Vehicle (DHOV) Ramps** Construct DHOV ramps in the median of I-17 at US-60/Grand Avenue/Thomas Road to and from the north. This would represent the southern end of the second managed lane being proposed on I-17 to the north of this location. The objective of this proposed ramp would be to provide access into downtown Phoenix and the Central Avenue core for Express buses coming from the north part of the Valley, but would be accessible to all high occupancy traffic as well. This would alleviate high occupancy weaving that occurs at the southern end of the existing high occupancy lanes today.
- 63 I-17 and Loop 101 (Agua Fria Freeway) Direct High Occupancy Vehicle (DHOV) Connectors** Construct DHOV connectors between I-17 to and from the south and Loop 101 (Agua Fria Freeway) to and from the west. This would represent the northern end of the second managed lane being proposed on I-17 to the south of this location.
- 65 I-10 and Galveston Road Direct High Occupancy Vehicle (DHOV) Ramp** Construct DHOV ramps from Galveston Road to I-10 to and from the north. Galveston Road would be built over I-10, connecting 50th Street to 54th Street.
- 70 I-10 Collector-Distributor Road System, Elliot Road to Baseline Road** Extend the existing barrier-separated collector-distributor lanes between US-60 and Baseline Road south from Baseline Road to Elliot Road. These barrier separated roadways adjacent to the freeway would move lane changing (or "weaves") away from the high-speed freeway traffic thus improving safety and operations and provide roadway options between Elliot and Baseline where suitable arterial redundancy does not exist.
- # Lane/Ramp Improvements**

Table 1-2. Spine Recommended Alternative Features

Spine Corridor Segment	Improvement Category	Summary of Improvements
Pecos Stack to US-60	I-10 Main Line Improvements	<ul style="list-style-type: none"> • Add one general purpose lane in each direction from Baseline Road to Ray Road. • Extend the existing C-D road north of Baseline Road farther south to the Elliot Road traffic interchange.
	Interchange Modifications	<ul style="list-style-type: none"> • Warner Road traffic interchange: Safety and capacity improvements. • Baseline Road traffic interchange: Major upgrades to address capacity, congestion and safety. High priority should be given to the east-to-south and north-to-west movements to implement an Integrated Corridor Management (ICM) strategy on Baseline Road. A diverging diamond interchange (DDI) conversion is one possible alternative that should be evaluated.
	Arterial Improvements	<ul style="list-style-type: none"> • None, except as related to the interchange modifications.
	Transit Improvements	<ul style="list-style-type: none"> • Add a new DHOV traffic interchange at Galveston Road, with DHOV ramps to and from the north, and connecting Galveston Road over I-10 between 50th and 54th streets to connect future Phoenix and Chandler park-and-ride lots.
	Bicycle and Pedestrian Improvements	<ul style="list-style-type: none"> • Address Chandler Boulevard bicycle lane continuity over I-10. • Add a new dedicated bicycle and pedestrian bridge over I-10 in the Knox Road corridor. • Upgrade the Warner Road traffic interchange to enhance bicycle and pedestrian safety. • Add a new dedicated bicycle and pedestrian bridge over I-10 at Guadalupe Road. • Add a new dedicated bicycle and pedestrian bridge over I-10 at the Highline Canal Trail. • Add a new dedicated bicycle and pedestrian bridge over I-10 at the Western Canal Trail.
I-10, US-60 to SR-143	I-10 Main Line Improvements	<ul style="list-style-type: none"> • Upgrade the main line section to include six general purpose and two HOV lanes in each direction. • Extend existing C-D roads south of US-60 north to SR-143 in both directions to solve main line weaving issues.
	Interchange Modifications	<ul style="list-style-type: none"> • US-60 traffic interchange: Modify as necessary to integrate extended C-D roads. • Broadway Road traffic interchange: Reconstruct the traffic interchange, to include bridge replacement, to give priority to the east-to-south and north-to-west movements to implement an ICM strategy on Broadway Road and to address queuing issues associated with the eastbound (southbound) on ramp and the westbound (northbound) off ramp. • SR-143 traffic interchange: Reconstruct to include bridge replacements over I-10, high-capacity ramps for the south-to-east and west-to-north movements, enhanced driver expectancy for the end-of-freeway condition for southbound SR-143 transitioning to 48th Street, weaving section upgrades on SR-143 between I-10 and University Drive and a new DHOV ramp between SR-143 and I-10 to and from the south.
	Arterial Improvements	<ul style="list-style-type: none"> • None, except as related to the interchange modifications.

Table 1-2. Spine Recommended Alternative Features

Spine Corridor Segment	Improvement Category	Summary of Improvements
I-10, US-60 to SR-143 (cont.)	Transit Improvements	<ul style="list-style-type: none"> • Nothing specific, except the benefit transit service realizes from the second HOV lane in each direction on I-10 and the DHOV ramp at the SR-143 traffic interchange.
	Bicycle and Pedestrian Improvements	<ul style="list-style-type: none"> • Add a new dedicated bicycle and pedestrian bridge over I-10 at Alameda Drive.
I-10, SR-143 to the I-17 Split	I-10 Main Line Improvements	<ul style="list-style-type: none"> • Upgrade the main line section to include six general purpose, two HOV and an auxiliary lane in each direction. • Provide for a new DHOV ramp at the Split in the median of I-10 between the Salt River bridge and 24th Street. • Widen the Salt River bridge to accommodate the proposed section, and the DHOV at the Split, as necessary.
	Interchange Modifications	<ul style="list-style-type: none"> • 40th Street traffic interchange: Modify this traffic interchange to accommodate the widening of I-10. This may require changing the traffic interchange configuration to eliminate the existing loop ramp. • 32nd Street: Bicycle and pedestrian improvements. • 24th Street: Bicycle and pedestrian improvements.
	Arterial Improvements	<ul style="list-style-type: none"> • None, except as related to the interchange modifications. • Broadway Road improvements may be implemented within this segment to incorporate ICM.
	Transit Improvements	<ul style="list-style-type: none"> • Nothing specific, except the benefit transit service realizes from the second HOV lane in each direction on I-10 and the DHOV ramp at the Split.
	Bicycle and Pedestrian Improvements	<ul style="list-style-type: none"> • Upgrade the 32nd Street traffic interchange to enhance bicycle and pedestrian safety. • Upgrade the 24th Street traffic interchange to enhance bicycle and pedestrian safety.
	I-17, Split to the Stack	I-17 Main Line Improvements

Table 1-2. Spine Recommended Alternative Features

Spine Corridor Segment	Improvement Category	Summary of Improvements
I-17, Split to the Stack (cont.)	Interchange Modifications	<ul style="list-style-type: none"> • 16th Street traffic interchange to 19th Avenue traffic interchange: Complete reconstruction of these traffic interchanges and grade separations, including the I-17 bridge replacement over these cross streets and railroads. Interchange types would likely remain as tight diamonds, with possible modifications including the reverse ramp configurations noted above. Cross roads would be widened with through lanes and turn lanes so that the I-17 crossings are no longer the arterial constraints. The 7th Street traffic interchange would be modified to incorporate a median DHOV connection, as noted in the <i>Transit Improvements</i> row below. • Grant Street traffic interchange: Remove ramps at this traffic interchange, but replace the Grant Street bridge over I-17 for continued access to the frontage road system. • UPRR bridge crossing: Replace the railroad bridge over I-17. • Jefferson/Adams Street traffic interchange: Reconfigure this traffic interchange into a standard split diamond configuration. • Van Buren Street grade separation: Replace this bridge, with provisions for the future light rail train crossing. • Stack: No changes proposed except possibly minor ramp gore adjustments.
	Arterial Improvements	<ul style="list-style-type: none"> • Reconstruct one-way frontage roads along both sides of I-17. • Convert the southbound frontage road by closing it to vehicular traffic between McDowell and Van Buren roads to a two-way transit corridor for the light rail Capitol/I-10 West extension. • Significant arterial improvements along 7th Street, Central Avenue, 7th Avenue, 19th Avenue and Van Buren Road associated with traffic interchange and grade separation replacements and light rail transit integration.
	Transit Improvements	<ul style="list-style-type: none"> • Add an HOV lane in the corridor coupled with the proposed DHOV connection to the I-10 HOV lanes at the Split; completes the HOV system in the central core. • Add a DHOV traffic interchange at I-17, and 7th Street will add a south access into the downtown core. Initially, this DHOV will include only the east side ramps to serve the Southeast Valley express buses; however, it will be designed to also accept the west side DHOV ramps to accommodate the HOV traffic coming from the Southwest Valley when the SR-30 connection is made. • Reconstruct I-17 at both Central Avenue and Van Buren Road to accommodate the planned light rail train crossings at these two locations. • Convert the southbound frontage road between McDowell and Van Buren roads to a two-way transit corridor for the light rail Capitol/I-10 West extension.
	Bicycle and Pedestrian Improvements	<ul style="list-style-type: none"> • Upgrade all the traffic interchange and grade separation crossings that are being reconstructed to enhance bicycle and pedestrian safety as part of the traffic interchange upgrades. Special attention will be given to the Jefferson/Adams traffic interchange for consistency with the Phoenix bicycle plan.

Table 1-2. Spine Recommended Alternative Features

Spine Corridor Segment	Improvement Category	Summary of Improvements
I-17, Stack to Dunlap Avenue	I-17 Main Line Improvements	<ul style="list-style-type: none"> • Upgrade the main line section to include three general purpose lanes, two HOV lanes and an auxiliary lane in each direction from Grand Avenue north to SR-101L. • Upgrade the main line section to include three general purpose lanes, one HOV lane and an auxiliary lane in each direction from the Stack to Grand Avenue. • Replace all I-17 main line pavement along with the McDowell Road bridge, the BNSF bridge, the Grand Avenue bridge and the Grand Canal bridge to allow for main line widening. • Add a DHOV ramp at Grand Avenue to and from the north along I-17. Studies suggest widening I-17 for this DHOV north of Thomas Road for access to/from the north, with the DHOV then crossing over Thomas Road.
	Interchange Modifications	<ul style="list-style-type: none"> • McDowell Road traffic interchange: Replace the bridge. • Grand Avenue: No traffic interchange currently exists; add a DHOV to and from the north along I-17 that becomes the southern terminus of the dual HOV lanes. Replace both the Grand Avenue and BNSF bridges. Add connections between Grand Avenue and Thomas Road for improved circulation. • Indian School Road traffic interchange, Camelback Road traffic interchange, Glendale Road traffic interchange and Northern Avenue traffic interchange: Upgrade these four traffic interchanges to high-capacity service interchanges, with an emphasis on east-to-west through volumes on the crossroads. Three-level diamonds should be considered. Additionally, Camelback Road traffic interchange needs to accommodate the planned light rail train crossing of I-17 at this location. • Dunlap Avenue traffic interchange: Safety and performance upgrades.
	Arterial Improvements	<ul style="list-style-type: none"> • Reconstruct one-way frontage roads along both sides of I-17. • Significant arterial improvements along the crossroads where traffic interchange improvements are being incorporated, especially along Indian School Road, Camelback Road, Glendale Road and Northern Avenue. • Add a third eastbound lane on Glendale Avenue between 24th and 19th avenues. • Add a third westbound lane on Dunlap Avenue between the I-17 traffic interchange and 19th Avenue.
	Transit Improvements	<ul style="list-style-type: none"> • Add an HOV lane in the corridor coupled with the proposed DHOV connection to Grand Avenue to improve freeway transit service to and from the north part of the Valley into the downtown core and Central Avenue. • Camelback Road traffic interchange reconstruction will accommodate the planned light rail train crossings at this location.
	Bicycle and Pedestrian Improvements	<ul style="list-style-type: none"> • Upgrade all the traffic interchange and grade separation crossings that are being reconstructed to enhance bicycle and pedestrian safety as part of the traffic interchange upgrades. Special emphasis will be on the Northern Avenue traffic interchange where bicycle and pedestrian crashes are higher than average. • Add a new dedicated bicycle and pedestrian bridge over I-17 at Missouri Avenue, consistent with the Phoenix bicycle plan. • Replace the dedicated bicycle and pedestrian bridge over I-17 at Maryland Avenue, which will need to be reconstructed to accommodate the I-17 widening.

Table 1-2. Spine Recommended Alternative Features

Spine Corridor Segment	Improvement Category	Summary of Improvements
I-17, Dunlap Avenue to North Stack	I-17 Main Line Improvements	<ul style="list-style-type: none"> • Replace all I-17 main line pavement between Dunlap and Peoria avenues. • Replace all bridges between Dunlap Avenue and Bell Road (excluding Dunlap Avenue). Reprofile I-17 as necessary to update all crossings to have required minimum vertical clearances. • Upgrade the main line section to include three general purpose lanes, two HOV lanes and an auxiliary lane in each direction. • Add a DHOV ramp at the North Stack between the western and the southern legs of the traffic interchange. This represents the northern terminus of the dual HOV lanes on I-17. This requires I-17 to be flared between Union Hills Drive and Utopia Road. Corresponding widening would be required along SR-101L between 27th and 35th avenues. • Upgrade the drainage system at the Peoria, Cactus, Thunderbird and Greenway traffic interchanges to eliminate those four pump stations, converting the system to a gravity storm drain to the Arizona Canal Diversion Channel (ACDC).
	Interchange Modifications	<ul style="list-style-type: none"> • Peoria Avenue traffic interchange, Cactus Road traffic interchange and Greenway Road traffic interchange: Reconstruct these three traffic interchanges using the same configuration, but expanded to include a cross section on the cross road under I-17 to match the approaches once the bridges have been replaced. Add new turning lanes as required. Drainage system replaced as noted above. • Thunderbird Road traffic interchange and Bell Road traffic interchange: Upgrade these two traffic interchanges to high-capacity service interchanges, with an emphasis on east-to-west through volumes on the crossroads. Three-level diamonds should be considered. Expand the park-and-ride lot at Bell Road and I-17 in conjunction with the traffic interchange reconstruction.
	Arterial Improvements	<ul style="list-style-type: none"> • Reconstruct one-way frontage roads along both sides of I-17 as needed. • Significant arterial improvements along the crossroads where traffic interchange improvements are being incorporated. • Add a third eastbound lane to Peoria Avenue between 28th and 25th avenues for continuity. • Expand Cactus Road to include three through lanes in each direction between 28th Drive and 25th Avenue for continuity. • Expand Greenway Road to three westbound through lanes and two eastbound through lanes between 29th and 19th avenues for continuity.
	Transit Improvements	<ul style="list-style-type: none"> • Add an HOV lane in the corridor coupled with the proposed DHOV connection at SR-101L to improve freeway transit service to and from the north part of the Valley into the downtown core and Central Avenue. • Provide for a planned light rail transit crossing over I-17 on its own dedicated bridge at Mountain View Road, coupled with an elevated station over the existing southbound frontage road. • Expand the park-and-ride lot in the southwestern corner of the I-17/Bell Road traffic interchange in conjunction with reconstruction of that traffic interchange.

Table 1-2. Spine Recommended Alternative Features

Spine Corridor Segment	Improvement Category	Summary of Improvements
I-17, Dunlap Avenue to North Stack (cont.)	Bicycle and Pedestrian Improvements	<ul style="list-style-type: none"> • Upgrade all the traffic interchange and grade separation crossings that are being reconstructed to enhance bicycle and pedestrian safety as part of the traffic interchange upgrades. Special emphasis will be on the Peoria Avenue traffic interchange where bicycle and pedestrian crashes are higher than average. • Upgrade the Union Hills Road traffic interchange to improve bicycle and pedestrian facilities consistent with the Phoenix bicycle plan. • Add a new dedicated bicycle and pedestrian bridge over I-17 at Paradise Lane consistent with the Phoenix bicycle plan.
System wide	Technology	<ul style="list-style-type: none"> • Implement technology elements along the entire Spine corridor as the region determines is applicable to improve capacity, safety and operations and to respond to the evolving use of autonomous and connected vehicles. Chapter 7 of this report defines the numerous technologies that could be implemented. However, given the rapidly changing nature of technology, the recommendations and suggestions noted in this report are meant to be flexible to respond to new developments.
	Lane and Shoulder Widths	<ul style="list-style-type: none"> • All lane and shoulder widths would be constructed to the current ADOT standards for urban freeway construction, to the extent feasible. Notable exceptions are identified in Section 6.4 of this report.

This study has produced a set of concept plans for the recommended alternative that can be seen in Chapter 6 of this report. This concept represents one possible interpretation of the features described in this chapter resulting from the Spine recommendation. This concept should not be interpreted as the only possible solution since further engineering, environmental and public outreach is needed to refine the project(s). The concept was developed so that a project, or list of projects, could be defined in terms of costs, schedules and implementation for inclusion in the RTP.

1.7 Implementation Strategy, Cost Opinions, and Planning and Environmental Linkages

Since rebalancing activities in 2012, \$1.47 billion has been allocated in the RTP by the MAG Regional Council for improving the I-10 and I-17 corridors that make up the Spine study. No specific improvements were identified in the RTP as the MAG Regional Council has looked to this Corridor Master Plan to provide definition for specific actions. Throughout 2016 and into 2017, the RFHP has undergone a rebalancing effort because more money has come into the program from both revenue increases and cost savings. MAG, ADOT and FHWA have identified several elements of the Spine study recommendation that have been prioritized as being the early projects from the Corridor Master Plan for construction. Because the Spine study recommendation total cost is approaching \$2.8 billion, approximately half of the Corridor Master Plan is recommended for future programming and construction. At that time, the remaining Corridor Master Plan projects are identified as unfunded during the remaining life of MAG RFHP approved by Maricopa County voters in November 2004 as part of Proposition 400. Although the projects are noted as unfunded in the current RFHP, the current RTP has

identified reasonable expectations of funding to provide for programming the remaining projects recommended in the Corridor Master Plan.

Section 1.7.1 summarizes the projects that have been funded during the RTP rebalancing effort, their programmed costs and the approximate project schedules. Section 1.7.2 summarizes one possible list of projects that can be implemented in a future RTP RFHP, their approximate cost and justification for the projects' limits and definitions. Section 8.3 of this report summarizes the detailed cost opinions of the funded and unfunded projects emerging from the Spine recommendation. Finally, Section 1.7.3 describes the Planning and Environmental Linkages (PEL) Questionnaire and Checklist that has been completed in conjunction with the Spine study and how this documentation should be used to inform the National Environmental Policy Act (NEPA) process on all of the projects described in Tables 1-3 and 1-4.

1.7.1 Implementation Strategy – Funded Projects

Table 1-3 lists projects in the Spine study recommendation that are programmed and funded in the RTP, sorted by construction start dates, as of June 28, 2017—when the MAG Regional Council took action (agenda item 5F) to approve these projects. Note that programmed costs do not necessarily match the projects costs defined in Table 8-3. This occurred because the costs used for programming were the best available information at the time the programming effort occurred in early 2017, prior to the finalization of this document.

Table 1-3. Funded and Programmed RTP Projects from the Spine Study Recommendation

RTP Map ID ^a	Project	Lead Agency	Supporting Agencies	Figures 1-3 and 1-4 Key Map ID Elements ^b	Programmed Cost	Construction Start Date
15	I-17: ACDC to Greenway drainage improvements	ADOT	—	Drainage portions of 12, 13, 14, 15	\$30,000,000	January 2019
9	I-17/Central Avenue bridge replacement	ADOT	Valley Metro	21	\$23,500,000	May 2019
11	I-17/Indian School Road traffic interchange	ADOT	City of Phoenix	8	\$59,450,000	January 2020
4, 5, 6	I-10: Split to SR-202L (includes all of the I-10 Spine recommendation <i>except</i> for those noted in Table 1-4) ^c	ADOT	Cities of Phoenix and Tempe	A, B, 2, 3, 32, 33, 34, 35, 48, 49	\$525,500,000	May 2021
12	I-17/Camelback Road traffic interchange	ADOT	City of Phoenix, Valley Metro	9, 24	\$68,600,000	July 2021
14	I-17/Northern Avenue traffic interchange	ADOT	City of Phoenix	10	\$66,850,000	January 2024
10	I-17: Split to 19th Avenue ^c	ADOT	—	4, 5, and portions of C	\$217,350,000	January 2024

Table 1-3. Funded and Programmed RTP Projects from the Spine Study Recommendation

RTP Map ID ^a	Project	Lead Agency	Supporting Agencies	Figures 1-3 and 1-4 Key Map ID Elements ^b	Programmed Cost	Construction Start Date
13	I-17/Glendale Avenue traffic interchange	ADOT	City of Phoenix	18	\$75,000,000	January 2025
16	I-17/Thunderbird Road traffic interchange	ADOT	City of Phoenix	Interchange portion of 14, 43	\$113,650,000	July 2026
17	I-17/Bell Road traffic interchange	ADOT	City of Phoenix, Valley Metro	16, 26, 46	\$96,350,000	July 2026
Total					\$1,276,250,000	

^a "RTP Map ID" refers to this funded project's identifier in the MAG RFHP.

^b If only a portion of the Spine key map project ID is part of the project list, it is noted as a "portion of" the project.

^c Indicates those projects that construct major portions or key elements of the expanded managed lane infrastructure.

1.7.2 Implementation Strategy – Unfunded Projects

Table 1-4 lists those projects in the Spine study recommendation that are not funded in the current RTP RFHP, but are expected to be funded when future funding becomes available. These project descriptions and limits are subject to change to match funding constraints, timing priorities or alternative delivery packaging. For programming, project dependencies are noted in the last column.

Table 1-4. Unfunded Projects from the Spine Study Recommendation

Project	Lead Agency	Supporting Agencies	Figures 1-3 and 1-4 Key Map ID Elements ^a	Project Cost Opinion	Schedule Dependencies
I-10/Chandler Boulevard traffic interchange bicycle and pedestrian upgrades	ADOT	Cities of Phoenix and Chandler	30	\$6,091,000	None
I-10: Galveston Road DHOV traffic interchange	ADOT	Cities of Phoenix and Chandler	65	\$46,539,000	None, except may not want to construct until local park-and-rides are open.
I-10: Knox Road bicycle and pedestrian bridge	ADOT	Cities of Phoenix and Tempe	50	\$7,219,000	None
I-10/Warner Road traffic interchange	ADOT	Cities of Phoenix and Tempe	31	\$11,536,000	None

Table 1-4. Unfunded Projects from the Spine Study Recommendation

Project	Lead Agency	Supporting Agencies	Figures 1-3 and 1-4 Key Map ID Elements ^a	Project Cost Opinion	Schedule Dependencies
I-10: Baseline to Elliot C-D roads	ADOT	—	70	\$98,989,000	None
I-10/Baseline Road traffic interchange	ADOT	City of Tempe	1	\$25,940,000	Ideally, traffic interchange would be done after the I-10: Baseline to Elliot C-D roads are open.
Split traffic interchange DHOV connector ^b	ADOT	City of Phoenix	60	\$102,159,000	Project should be completed just before or along with the I-17 inner loop HOV lanes opening.
I-17: 19th Avenue to Indian School Road (includes I-17/7th Street east side DHOV ramps) ^b	ADOT	City of Phoenix, Valley Metro	Portions of C and D, 6, 7, 17, 22, 23, 36, 61	\$376,338,000	None – project connects to the existing HOV lanes on I-17. Ideally, it would be completed prior to the FCDMC project to address floodplain issue in the area.
I-17: Indian School Road to Dunlap Road traffic interchange (includes the I-17/Grand Avenue DHOV connector) ^b	ADOT	City of Phoenix	Portion of D, 11, 38, 39, 41, 62	\$421,132,000	None
I-17: Dunlap Road traffic interchange to SR-101L traffic interchange (excluding the I-17/SR-101L DHOV connector) ^b	ADOT	City of Phoenix, Valley Metro	E and portions of D; interchange portions of 12, 13; and 15, 25, 40, 42, 44, 45, 47	\$310,234,000	Completed during or after the completion of the I-17: Stack to Dunlap Road traffic interchange segment.
I-17/SR-101L traffic interchange North Stack DHOV connector ^b	ADOT	City of Phoenix	63	\$139,187,000	Completed during or after the completion of the I-17: Dunlap Road traffic interchange to SR-101L traffic interchange segment.
Total				\$1,545,364,000	

^a If only a portion of the Spine key map project ID is part of the project list, it is noted as a “portion of” the project.

^b Indicates those projects that construct major portions or key elements of the expanded managed lane infrastructure.

1.7.3 Planning and Environmental Linkages Questionnaire and Checklist

The Spine study team has completed a PEL Questionnaire and Checklist using the ADOT-defined template. The PEL process was created in response to the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, which sought to develop corridor studies that could be used more directly to inform the NEPA process on projects identified by the corridor study. The ADOT PEL Questionnaire and Checklist were developed to provide guidance, particularly for transportation and environmental planners, regarding how to most effectively link the transportation planning and NEPA processes.

The PEL Questionnaire and Checklist was used to effectively influence the scope, content and process employed during the Spine study. Completion of this questionnaire and checklist supported the PEL process and served dual objectives:

- Provided guidance to the Spine study Management Partners regarding the level of detail needed to ensure that information collected and decisions made during the Spine study could be used during the subsequent NEPA processes for the proposed projects described in this chapter.
- Provides the future NEPA study team(s) with documentation regarding the outcomes of the transportation planning process, including the history of decisions made and the level of detailed analyses undertaken.

Application of Planning and Environmental Linkages to the Future Spine Recommended Projects

The approved and signed PEL Questionnaire and Checklist for the Spine study will be included as an appendix to the Spine study Corridor Master Plan document, scheduled for completion by the end of 2017. The signed PEL Questionnaire and Checklist will document how the study met the requirements of 23 Code of Federal Regulations § 450.318 (Subpart C: Metropolitan Transportation Planning and Programming). The PEL will provide the basis and justification for the alternatives evaluation phase of the future NEPA documents associated with the Spine study recommended alternative projects, regardless of which agency undertakes the NEPA documentation. Ultimately, this will simplify and accelerate all NEPA documents for every Spine study recommended project.

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2 Introduction and Background

2.1 Study Overview

MAG, in partnership with FHWA and ADOT, launched the Spine study to develop a Corridor Master Plan for the I-10 and I-17 corridor. This corridor is referred to as the “Spine” because it serves as the backbone for transportation in the Phoenix metropolitan area. In fact, the corridor handles approximately 40 percent of all daily freeway traffic in the region.

2.1.1 Background

In recent years, ADOT and FHWA developed corridor planning studies in the form of design concept reports and EIS studies as part of the I-10 Corridor Improvement Study and I-17 Corridor Improvement Study. These studies considered ways to meet future travel demand and add capacity (for example, general purpose lanes) to both I-10 and I-17 in the Phoenix area. Primary recommendations from these EISs focused on adding lanes to the freeway main lines to meet LOS targets identified by ADOT in the *ADOT Roadway Design Guide*.

Because the EIS studies pointed toward adding general capacity with as many as six additional lanes on certain segments, program funding in MAG’s RFHP did not support the proposed improvements. Additionally, political concerns were raised by MAG Regional Council members about the need to add significant capacity on I-10 or I-17, and they encouraged another study to identify other options for meeting future travel demand. The two previous studies identified long-term improvements that would have required more funding than was available in the RTP for either corridor. ADOT and MAG agreed to rescind the studies in October 2012 after determining that separate studies may not result in the best overall plan and that many of the studies’ recommendations were not prudent. FHWA accepted this decision. However, the knowledge gained from the EIS studies, coupled with subsequent analyses, identified several near-term improvements that could be carried forward and implemented by ADOT immediately through a separate but parallel effort with the Spine study. Although the EIS studies were cancelled, much of the planning, engineering and environmental information from those studies has been folded into this new I-10/I-17 Corridor Master Plan.

2.1.2 Location of Study Area

The I-10/I-17 Corridor Master Plan is a planning-level study for proposed transportation improvements in Maricopa County and within the cities of Chandler, Tempe and Phoenix and the town of Guadalupe. The 31-mile Spine corridor begins at the Pecos Stack in the southern part of Phoenix, extends north and west on I-10 (Maricopa Freeway) to the Split, then continues north on I-17 (Black Canyon Freeway) past the Stack to the North Stack (Figure 1-1). Although the I-10 Inner Loop from the Split to the Stack is within the study area, it is excluded from the Spine study because the Deck Park Tunnel precludes any future widening and has a set of its own unique issues. MAG launched a separate study in 2016 that focused solely on the I-10 Inner Loop.

As shown in Figure 2-1, the corridor study area extends approximately 1.5 miles on each side of the defined Interstate corridor. The assumed 3-mile corridor width includes the following parallel arterial streets: 48th Street and 56th Street/Priest Drive from Chandler Boulevard to Broadway Road, Kyrene Road from Chandler Boulevard to Southern Avenue, Baseline Road from 35th Avenue to the UPRR line, Southern Avenue from 35th Avenue to the UPRR line, Broadway Road from 35th Avenue to the UPRR line, Buckeye Road from 35th Avenue to 24th Street, 27th Avenue from Lower Buckeye Road to SR-101L, and 19th and 35th avenues from Baseline Road to SR-101L. Figure 2-1 shows the project vicinity.

2.1.3 Purpose of the Study

The I-10/I-17 Corridor Master Plan effort analyzed various long-term strategies to improve mobility in the corridor. The study evaluated the full range of transportation modes and concepts to identify the best multimodal, system solutions. These long-term improvements are envisioned as a combination of traditional solutions, new technology and increased use of transit. The key outcome of the Spine study is a detailed strategy to manage traffic in the I-10 and I-17 corridors through 2040. Study recommendations will be programmed in the MAG RTP and TIP.

At the beginning of the study, the MAG RTP allocated \$1.47 billion for the Spine study area. The Spine study identifies how to best allocate these funds to achieve the greatest benefit to the region. It also defines funding shortfalls associated with the preferred corridor improvement approach so that additional funding allocations can be identified. The results of the funding allocation and shortfall are in Chapter 8.

The primary purpose of the I-10/I-17 Corridor Master Plan is to develop an improvement and implementation strategy to appropriately manage travel demand and movements in the I-10 and I-17 corridors. The strategy identifies a group of projects to incorporate into the RTP and TIP. Phases of the projects will then be programmed for future environmental clearances, design, ROW acquisition and construction.

2.1.4 Needs Assessment Report

Prior to this report, the Spine study produced the NAR. The purpose of the NAR was to document the existing conditions and issues within the Spine corridor. Subjects the NAR covered included environmental, operations, roadway infrastructure, transit, bicycles and pedestrians, safety, technology, commerce and economic development factors, and public and agency feedback. The NAR was used extensively to inform the alternatives screening process and will be used to inform future NEPA actions resulting from the Corridor Master Plan.

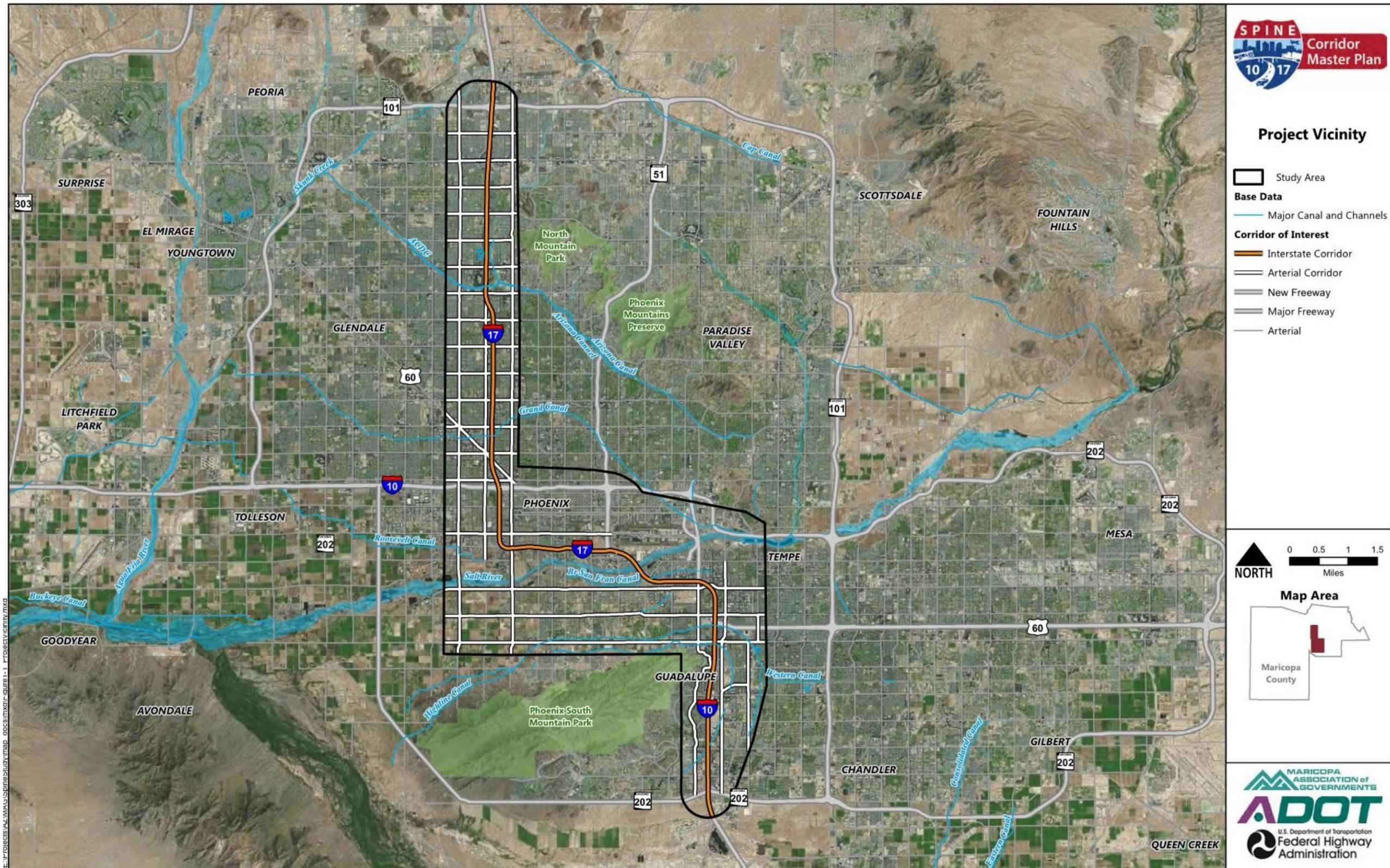
2.2 No-Build Alternative Assumptions

The RTP identifies a program of projects throughout the Phoenix metropolitan area for construction. These projects are separate from the improvements that will be recommended through the Spine study. The Interstate improvement projects, identified by MAG and ADOT, within the Spine study area (named the “near-term improvements”) were planned for construction over the next 3 years and were included in the “no-build” alternative for 2040. The near-term improvements include:

ADOT-planned projects:

- I-17 Active Traffic Management System enhancement;
- Additional I-10 outbound (eastbound) lane between SR-51 and US-60;
- I-10 ramp improvements between Broadway and Baseline roads that will relieve congestion by “braiding” ramps to minimize weaving traffic and lane changes and will add a pedestrian bridge over I-10 on the Alameda Drive alignment;
- Additional general purpose lanes in each direction on I-10 between Ray and Baseline roads and a pedestrian bridge over I-10 at Guadalupe Road; and
- Construction and opening of the SR-202L (South Mountain Freeway).

Figure 2-1. Project Vicinity



Source: ADOT, ALRIS, FEMA

Map Last Updated: 8/29/2017

The RTP near-term improvements also include transit projects, as follows:

Valley Metro near-term improvements to its light rail network:

- Northwest Phase I Light Rail Transit Extension to Dunlap Avenue;
- Northwest Phase II Light Rail Transit Extension to Metrocenter;
- Capitol/I-10 West Light Rail Transit Extension;
- South Central Light Rail Transit Extension; and
- West Phoenix/Central Glendale Transit Corridor.

As the Spine study evolved and the RFHP rebalancing efforts over 2016 and 2017 unfolded, the I-17 Active Traffic Management System project was cancelled. The I-10 outbound lanes, the ramp improvements between SR-143 and US-60, and the additional general purpose lane south of Baseline Road were all cancelled as near-term projects and instead integrated into the Spine recommendation. The South Mountain Freeway and all the Valley Metro projects continue to advance as stand-alone projects.

2.3 Local Transportation Plans and Initiatives

The Spine study area is completely contained within Chandler, Tempe, Phoenix and Guadalupe. In addition to the MAG RTP and the ADOT State Transportation Improvement Program, each of the local municipalities, Valley Metro and Phoenix Sky Harbor International Airport have transportation plans and initiatives that outline their vision for transportation within their jurisdictions. All of the pertinent transportation plans and initiatives were taken into account when developing the recommended alternative for the Spine study. The major local agency transportation plans and initiatives are listed below:

- City of Chandler
 - *Transportation Master Plan (2009)*
 - *General Plan (2008)*
- City of Tempe
 - *Transportation Master Plan (2015)*
 - *General Plan 2040 (2015)*
- City of Phoenix
 - *Transportation Master Plan 2050 (2015)*
 - *Bicycle Plan (2014)*
 - *General Plan (2015)*
 - *Sky Harbor Airport Layout Plan (2011)*
- Town of Guadalupe
 - *General Plan (1992)*

- Valley Metro
 - *5-year Capital Program*
 - *MAG RTP, Transit Lifecycle Program*

2.3.1 Phoenix Transportation 2050

On August 25, 2015, Transportation 2050 (T2050), a 35-year citywide transportation plan, was approved by Phoenix voters. T2050 increases Phoenix’s existing transportation sales tax by three-tenths of a cent to seven-tenths of a cent (or 70 cents on a \$100 purchase) to fund a program of transportation improvements through 2051. The additional money generated by the sales tax increase will fund bus service improvements, light rail construction, new transit-related technology, bicycle and pedestrian infrastructure, and street improvements, all of which are outlined in Phoenix’s *Transportation Master Plan 2050* by the Citizens Committee on the Future of Phoenix Transportation. The following are the key goals of T2050:

- Improved frequency of local bus service
- Service through midnight on weekdays and 2 a.m. on weekends for local bus and Dial-A-Ride service
- New transit-related technology, such as Wi-Fi on buses and trains, reloadable transit passes, real-time data for Dial-A-Ride and security improvements for bus and light rail
- 75 miles of new RAPID commuter bus routes
- 42 miles of new light rail
- 1 new light rail station
- 680 miles of new asphalt pavement on major arterial streets
- 1,000 miles of new bicycle lanes
- 135 miles of new sidewalks
- 2,000 new street lights
- \$240 million for major street improvement projects

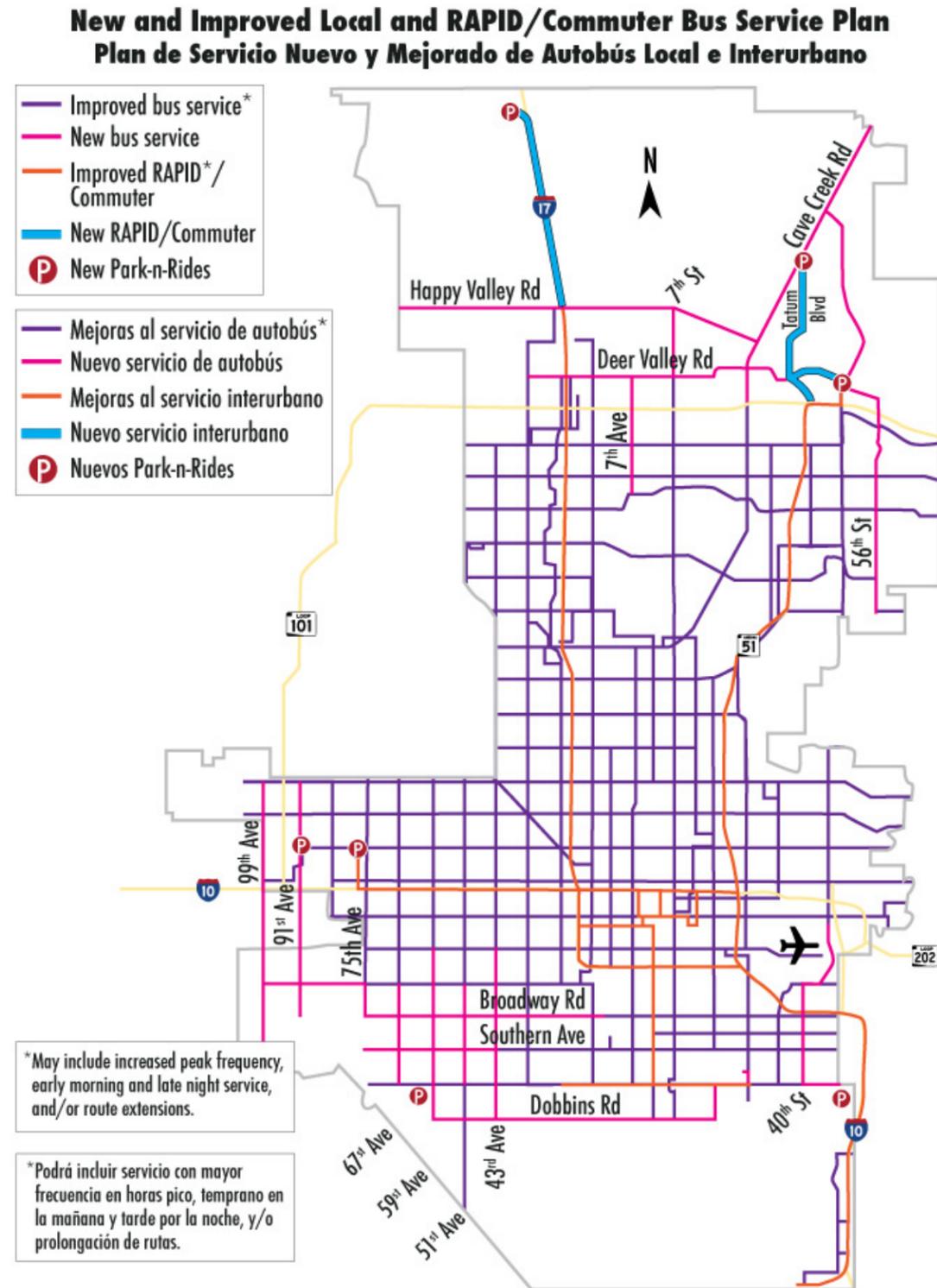
It is understood that T2050 will contain projects that contribute to the goals and objectives of the Spine study. Since the T2050 program has yet to be fully developed and adopted by the Phoenix City Council, it will not be incorporated into the final ASTR. A more detailed look at these improvements can be found in Figures 2-2 to 2-4.

2.3.2 Key Commerce Corridors

In 2014, ADOT designated most Interstate routes within Arizona as Key Commerce Corridors. This designation was made to advance the conversation for improving and promoting economic activity throughout the state. Within metropolitan Phoenix, both I-10 and I-17 have this designation.

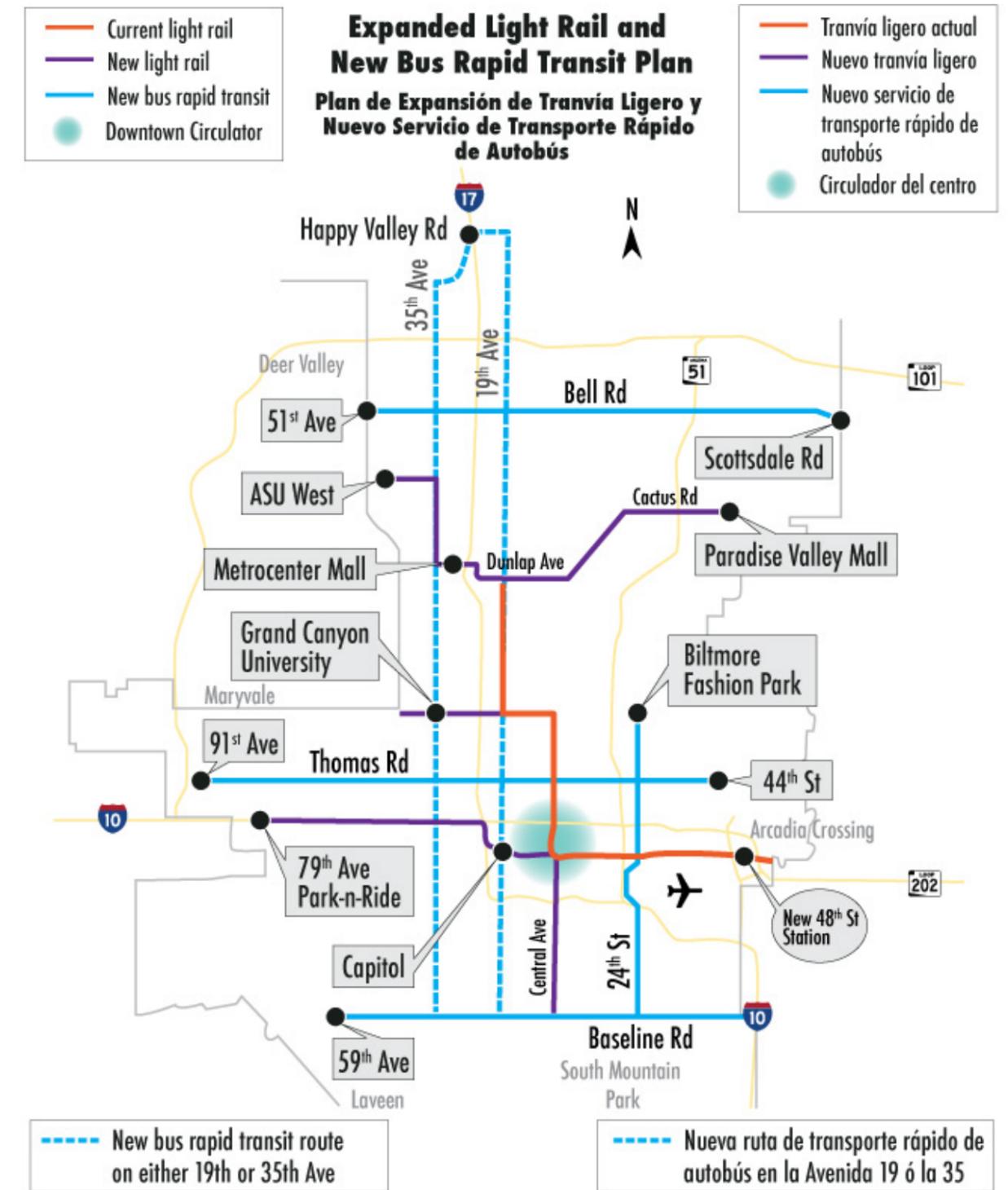
The Spine corridor is located at a junction of routes to three major markets: Texas to the east, California to the west and Mexico to the south. ADOT has identified key corridors that connect these three markets to Phoenix and has tentative plans to improve them. Studies are currently underway regarding how to improve these key corridors, and the study results will be taken into consideration moving forward.

Figure 2-2. T2050 New Bus Map



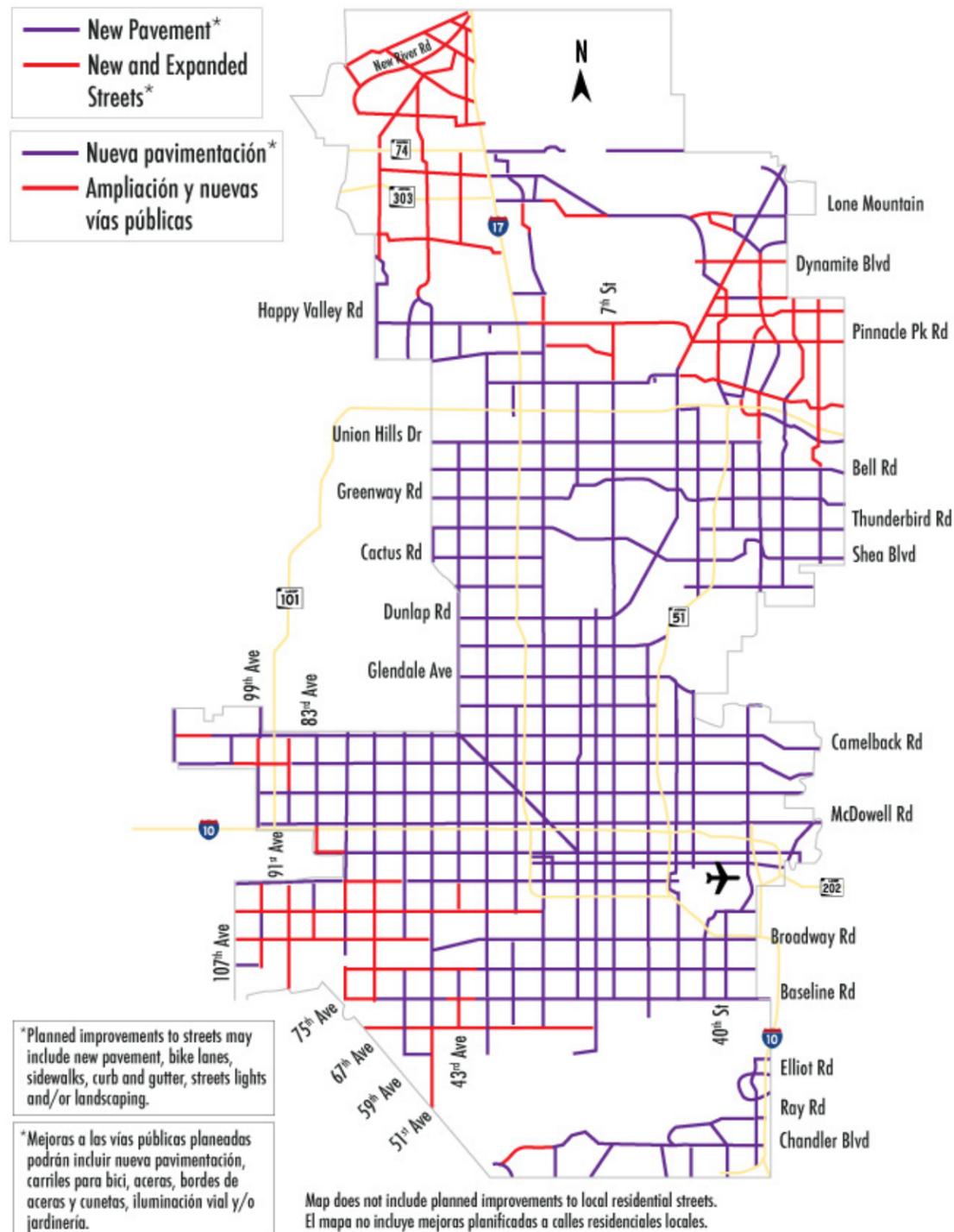
Source: <http://movephx.org/get-the-facts/maps/>

Figure 2-3. T2050 New Light Rail Transit Map



Source: <http://movephx.org/get-the-facts/maps/>

Figure 2-4. T2050 New Street Map



Source: <http://movephx.org/get-the-facts/maps/>

2.4 Moving Ahead for Progress in the 21st Century

Moving Ahead for Progress in the 21st Century (MAP-21), signed into law in 2012, created a performance-based and multimodal program to address the many challenges facing the U.S. transportation system. An element of MAP-21 established Transportation Performance Management to implement performance measures by using system information.

By establishing performance-based criteria, MAP-21 increases the accountability and transparency of federal surface transportation programs and improves decision making by basing it on performance-based planning and programming.

MAP-21 established the following seven performance-based criteria and goals:

- **Safety:** To achieve a significant reduction in traffic fatalities and serious injuries on all public roads.
- **Infrastructure condition:** To maintain the highway infrastructure asset system in a state of good repair.
- **Congestion reduction:** To achieve a significant reduction in congestion on the National Highway System.
- **System reliability:** To improve the efficiency of the surface transportation system.
- **Freight movement and economic vitality:** To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets and support regional economic development.
- **Environmental sustainability:** To enhance the performance of the transportation system while protecting and enhancing the natural environment.
- **Reduced project delivery delays:** To reduce project costs, promote jobs and the economy and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices.

It should be noted that the Fixing America's Surface Transportation Act, or "FAST Act," was signed into law in 2015. Because newer surface transportation acts replace those that precede them, the MAP-21 performance metrics were carried forward into the FAST Act. These performance criteria and goals were used extensively during the screening process to identify the best performance- and outcome-based transportation program.

2.5 Project Management and Team Organization

The Spine study developed five partner groups that lead the decision-making process. Group membership was determined by the three key partner agencies: MAG, ADOT and FHWA.

- **Charter Partners:** Consist of elected officials and executive-level representatives from MAG, ADOT, FHWA and Valley Metro. This group met several times over the course of the study to receive status updates and to provide direction or make key decisions as requested.
- **Management Partners:** Consist of senior management from MAG, ADOT and FHWA. This group was the core management team for the study and met anywhere from weekly to monthly during the alternatives screening process. This group directed the day-to-day work on the study and contributed to key decisions during the alternatives screening process.

- **Planning Partners:** Consist of management and technical staff from the cities and town and their respective departments, designated Native American communities (Ak-Chin Indian Community, Salt River Pima-Maricopa Indian Community, Gila River Indian Community and Tohono O’odham Nation), MAG, ADOT, FHWA and Valley Metro. This group met just a few times over the course of the study to receive status updates.
- **Alternatives Evaluation Partners (AEP):** Consist of the Management Partners and senior representatives from MAG member agencies affected by actions in the corridor. This group oversaw the alternatives screening process and was involved with major decisions and direction during the alternatives screening process.
- **Agency Partners:** Consist of representatives from other agencies with an interest in the study, including, but not limited to, the U.S. Army Corps of Engineers, FAA, Federal Transit Administration and FCDMC. This group met just a few times over the course of the study to receive status updates, and meetings were frequently held in conjunction with another partner meeting.

2.6 Summary of Meetings

Meetings were held throughout the duration of the Spine study process. Most meetings entailed coordination between the involved agencies and between the involved agencies and the Spine study team. Several meetings were also held for updating agencies and committees with the progress of the Spine study. Four public meetings were also hosted by MAG to present the results of the Spine study alternative screening process. All 75 of the meetings that occurred during the alternatives development and screening process up to the final MAG Regional Council approval of the recommended alternative are listed in Table 2-1.

Table 2-1. Summary of Meetings During the Alternatives Screening Process

Date	Meeting Type	Purpose	Agencies Present
1/12/2015–1/14/2015	Cost Risk Assessment	Workshop to evaluate I-10 Near Term Improvements from SR-143 to Ray Road. Outcome of this workshop informed the alternatives evaluation phase of the Spine study. The final report is included in Appendix D.	MAG, ADOT, FHWA and HDR
6/1/2015	Management Partners Meeting	Meeting topics included the 2015 TIGER Grant Application for the bus ramp at the Stack, the study update e-blast, the corridor travel demand profiles, the guiding principles, the upcoming transmittal of the draft NAR, the status of the <i>Controlling Design Criteria Report</i> and the final geographic information system (GIS) online viewer of all the NAR datasets.	MAG, ADOT, FHWA, HDR and Jacobs
6/15/2015	Management Partners Meeting	Meeting focused on the format, schedule and meeting materials for the Alternatives Development Workshop.	MAG, ADOT, FHWA, HDR and Jacobs
6/22/2015–6/23/2015	Alternatives Development Workshop	Brainstorm alternatives to solve the issues identified in the NAR.	MAG, ADOT, FHWA, Phoenix, Chandler, Tempe, Maricopa County Department of Transportation (MCDOT), HDR, Wilson, CH2MHill and Jacobs

Table 2-1. Summary of Meetings During the Alternatives Screening Process

Date	Meeting Type	Purpose	Agencies Present
8/3/2015	Management Partners Meeting	Status report including schedule updates, creation of the AEP and alternatives brainstorming workshop results.	MAG, ADOT, FHWA, HDR and Jacobs
8/24/15	Alternatives Review Workshop	Discussion on how to organize and screen the alternatives developed in the Alternatives Development Workshop.	MAG, ADOT, FHWA, HDR and Jacobs
8/31/2015	Management Partners Meeting	Based on the feedback from the August 24 Alternatives Review Workshop, HDR compiled a system of categories and geographic sections for organizing the alternatives. General consensus was this was the appropriate strategy going forward. Focus then turned to the screening process itself. Attention was given to the guiding principles and the screening criteria. Additional work was needed with the Management Partners to achieve consensus on these points.	MAG, ADOT, FHWA, HDR and Jacobs
9/3/2015	AEP Meeting	The purpose of this meeting was to introduce the project to these participants, providing a rough outline of the screening process, each of their roles and responsibilities being part of this group and the goals we hope to accomplish at the end—full agency consensus on a recommended alternative.	MAG, ADOT, FHWA, City of Phoenix, City of Tempe, Valley Metro, HDR and Jacobs
9/8/2015	Executive Management Meeting	Progress meeting to update MAG, ADOT and FHWA Arizona.	MAG, ADOT and FHWA
9/15/2015	Transportation Policy Committee	Updated the Transportation Policy Committee leadership on purpose and need, alternatives guiding principles and the outcomes of the June 2015 workshop.	MAG Member Agencies
10/7/2015	ITS Technology Work Group Meeting	Group focused on developing a range of alternatives using technology. Group was given a target date of April 2016 to have a final recommendation prepared.	MAG, ADOT, FHWA, City of Phoenix, City of Tempe, City of Chandler, HDR and Kimley-Horn
10/9/2015	NAR Comment Resolution Meeting	Comment resolution meeting with the City of Phoenix on the NAR comments they provided.	MAG, City of Phoenix and HDR
10/27/2015	Freight Partners Coordination Meeting	Internal HDR team conference call to coordinate freight elements and introduce GLD Partners to the project. GLD is a team member we have yet to use as we were waiting for the freight focus to enter into the project discussion.	HDR, Jacobs, Wilson, Kimley-Horn and GLD
11/10/2015	City of Phoenix Transportation and Infrastructure Committee	Progress meeting to advise the Phoenix City Council subcommittee on project purpose and need, alternatives development and outcomes of the public meetings and alternatives workshop.	City of Phoenix Transportation and Infrastructure Committee

Table 2-1. Summary of Meetings During the Alternatives Screening Process

Date	Meeting Type	Purpose	Agencies Present
11/16/2015	Management Partners Meeting	Topics included an overview of the three-level screening process, the revised project schedule, the alternative sorting of backbone and supporting concepts, the formation of the backbone working groups and the scope of the second round of public outreach.	MAG, ADOT, FHWA, HDR and Jacobs
11/16/2015	AEP Meeting	Topics included an overview of the three-level screening process, the revised project schedule, the alternative sorting of backbone and supporting concepts, the formation of the backbone working groups and the scope of the second round of public outreach.	MAG, ADOT, FHWA, City of Phoenix, City of Tempe, HDR and Jacobs
12/1/2015	Technology Working Group Meeting	Discussed a wide array of technology and freight issues.	MAG, ADOT, FHWA, City of Phoenix, City of Tempe, City of Chandler, HDR and Kimley-Horn
12/17/2015	City of Chandler Transportation Commission	Progress meeting to advise the Transportation Commission on project purpose and need, alternatives development and outcomes of the public meetings and alternatives workshop.	City of Chandler Transportation Commission
12/21/2015	AEP Meeting	Topics included finalizing the Level 2 screening criteria tool and then performing a weighted pairing analysis with the meeting participants to apply weights to the criteria.	MAG, ADOT, FHWA, City of Phoenix, City of Chandler, HDR and Jacobs
12/22/2015	Spine Coordination Meeting with Phoenix Sky Harbor International Airport	Meeting focused on introducing new Sky Harbor staff to the project and discussing coordination items between the airport and the freeway system.	MAG, Phoenix Sky Harbor International Airport and HDR
1/5/2016	Technology Working Group Meeting	Discussed freight movement, current plans for the I-17 near-term technology project, Active Traffic Management (ATM) and ICM applications in the Spine corridor, enforcement, connected and autonomous vehicles and traveler information.	MAG, ADOT, City of Tempe, HDR and Kimley-Horn
1/12/2016	System Traffic Interchange Working Group Meeting	This meeting was this group's kickoff meeting.	MAG, ADOT, FHWA, City of Phoenix, City of Tempe, City of Chandler and HDR
1/12/2016	Highway Capacity Working Group	This meeting was this group's kickoff meeting.	MAG, ADOT, FHWA, City of Phoenix, City of Tempe, City of Chandler, Wilson and HDR

Table 2-1. Summary of Meetings During the Alternatives Screening Process

Date	Meeting Type	Purpose	Agencies Present
1/19/2016	Technology Working Group Meeting	The group discussed potential freeway alternatives, including consideration for expanding ATM and ICM concepts from the I-17 near-term improvement project to other parts of the Spine corridor. The group also discussed concepts for automating enforcement, particularly in conjunction with ATM. Important needs identified included data acquisition (and alternatives for collecting real-time data), integrating real-time performance information into operations, and potential impacts of connected and autonomous vehicles.	MAG, ADOT, FHWA, City of Phoenix, City of Tempe, City of Chandler, HDR and Kimley-Horn
1/25/2016	Phoenix Sky Harbor International Airport Land Use Coordination Meeting	Meeting to discuss City of Phoenix Aviation Department's activities for Phoenix Sky Harbor International Airport expansion and I-10 access needs.	MAG, ADOT, City of Phoenix and HDR
1/25/2016, 1/26/2016, 2/8/2016, 2/10/2016	Cost-Risk Assessment and Value Planning Workshop	Workshop to evaluate I-17 between the Split and 19th Avenue. Outcome of this workshop informed the alternatives evaluation phase of the Spine study. The final report is included in Appendix D.	MAG, ADOT, FHWA, Valley Metro, Phoenix and HDR
3/1/2016	Executive Management Meeting	Outcome of the meeting was for MAG to prepare a detailed work plan to present to the other agencies for final concurrence before changing the direction of how the Spine study will evaluate alternatives.	MAG, ADOT and FHWA
3/15/2016	MAG Bicycle and Pedestrian Committee	Update on project planning process and responses for 2014 public meetings.	MAG Bicycle and Pedestrian Committee
4/11/2016	Phoenix Sky Harbor International Airport Land West Access Coordination Meeting	Follow-up to the January 2016 meeting; additional discussion about I-10 access needs.	MAG, ADOT, City of Phoenix and HDR
4/14/2016	Level 2 Alternatives Screening Workshop	Alternatives were numerically scored based on various categories (Enhances Existing System Utilization, Enhances Safety, Improves Travel Time Reliability, Replaces Deficient Infrastructure, Reduces Congestion Duration, Disproportional Impacts to Title VI and EJ Communities, Practicability, Agency Support, Alternative Adaptability and Programming Flexibility) with justifications. HDR was present only to provide background information on the alternatives being scored.	MAG, ADOT and HDR

Table 2-1. Summary of Meetings During the Alternatives Screening Process

Date	Meeting Type	Purpose	Agencies Present
5/2/2016	Management Partners Meeting	Results of the Level 2 Alternatives Screening were reviewed and discussed.	MAG, ADOT, FHWA and HDR
5/16/2016	Management Partners Meeting	Results of the Level 2 Alternatives Screening were reviewed and discussed. Also reviewed the compilation and finalization of the data for the service traffic interchange evaluation to prioritize the needs of the service traffic interchanges in the corridor.	MAG, ADOT, FHWA and HDR
6/6/2016	Management Partners Meeting	Agency comments on the results of the Level 2 Alternatives Screening were reviewed and discussed.	MAG, ADOT, FHWA and HDR
6/27/2017–6/30/2017	Value Planning Workshop	Workshop to evaluate I-17/Camelback Road traffic interchange options. Outcome of this workshop informed the alternatives evaluation phase of the Spine study. The final report is included in Appendix D.	MAG, ADOT, FHWA, Valley Metro, Phoenix, HDR and AECOM
7/29/2016	Valley Metro NW Extension Coordination Meeting	Initial discussions for identifying access needs and coordinating improvements between MAG, ADOT and Valley Metro on the Metrocenter and Glendale light rail extension.	MAG, ADOT and Valley Metro
9/14/2016	MAG Management Committee	Study update for MAG member agency city managers regarding alternatives and project budget amendment.	MAG Management Committee
9/19/2016	MAG Regional Council Executive Committee	Regional Council Executive Committee meeting.	MAG Regional Council Executive Committee
9/21/2016	MAG Transportation Policy Committee	Study update for Transportation Policy Committee regarding alternatives.	MAG Transportation Policy Committee
9/22/2016	Management Partners Meeting	Reviewed the detailed engineering and operational results for the six build and no-build alternatives. Results of meeting indicated an analysis of two additional build alternatives needed to be included in the study.	MAG, ADOT, FHWA and HDR
10/24/2016	Management Partners Meeting	Review the detailed engineering and operational results for the eight build and no-build alternatives. Results of meeting concluded with a draft recommendation of the HPA to carry to the public meetings.	MAG, ADOT and HDR
11/16/2016	Town of Guadalupe Briefing	Briefed on the draft recommendation of the HPA to carry to the public meetings in late January. Meeting was attended by Town of Guadalupe staff, included Acting Town Manager and Town Councilmember.	MAG, Town of Guadalupe and HDR

Table 2-1. Summary of Meetings During the Alternatives Screening Process

Date	Meeting Type	Purpose	Agencies Present
11/17/2016	City of Chandler Briefing	Briefed on the draft recommendation of the HPA to carry to the public meetings in late January. Meeting was attended by City of Chandler staff, including representatives from City Manager's office and Transportation and Development Department (including Streets Maintenance and Transit).	MAG, City of Chandler and HDR
11/17/2016	City of Tempe Briefing	Briefed on the draft recommendation of the HPA to carry to the public meetings in late January. Meeting was attended by City of Tempe staff, including representatives from City Manager's office and Public Works Department (including Transportation and Transit Divisions).	MAG, City of Tempe and HDR
11/18/2016	City of Phoenix Briefing	Briefed on the draft recommendation of the HPA to carry to the public meetings in late January. Meeting was attended by several City of Phoenix staff members representing several departments in the City. The meeting ran long, and many could not stay longer, so another meeting was scheduled for December 2 to complete the presentation.	MAG, City of Phoenix and HDR
11/29/2016	Camelback Planning Partners	Coordination with stakeholders near Camelback Road and I-17 regarding concepts for integrating a potential light rail operation into the I-17/Camelback Road traffic interchange.	Camelback Planning Partners
12/2/2016	AEP Meeting	Presented results of alternative screening, with a focus on HPA1 and HPA2. Meeting concluded with a consensus to create a recommended alternative that contains elements of both HPA1 and HPA2, thereafter referred to as just HPA (or the recommended alternative, as it relates to the public information materials). This consensus on a recommended alternative represented a major milestone in the Spine study.	MAG, ADOT, FHWA, City of Phoenix, City of Chandler, City of Tempe, Valley Metro, HDR and Wilson
12/2/2016	City of Phoenix Briefing (continuation of meeting from 11/18/2016)	Brief various City of Phoenix departments on the recommended alternative. This was the continuation of the meeting from November 18, 2016. Attendees responded favorably to the presentation.	MAG, City of Phoenix and HDR
12/7/2016	ADOT Coordination Meeting	Presentation of the Spine recommended alternative elements along I-10 to the ADOT Santan field office staff and Parsons Brinckerhoff (general engineering consultant for the I-10 Near Term Improvements project). Elements of the design were explained. ADOT intends to evaluate the recommendation elements and see how many can be incorporated into the Near-Term Improvements project.	MAG, ADOT, HDR and Parsons Brinckerhoff
12/12/2016	Executive Management Meeting	Progress meeting with MAG, ADOT and FHWA Arizona regarding the Corridor Master Plan recommendations in advance of the public meetings in January 2017.	MAG, ADOT and FHWA Arizona

Table 2-1. Summary of Meetings During the Alternatives Screening Process

Date	Meeting Type	Purpose	Agencies Present
12/19/2016	Management Partners Meeting	Meeting was focused on reviewing the public meeting materials and to make sure the Management Partners were comfortable with the content, messaging and feedback being requested.	MAG, ADOT, FHWA and HDR
1/5/2017	MAG Transportation Review Committee	Progress meeting to present the Corridor Master Plan as recommended by the Management Partners.	MAG Transportation Review Committee
1/10/2017	City of Tempe Transportation Commission	Briefed on the draft recommendation of the HPA to carry to the public meetings in late January.	City of Tempe Transportation Commission
1/20/2017	Four Southern Tribes Cultural Resources Working Group Coordination	Presentation of the Corridor Master Plan recommendations.	Ak-Chin, Salt River Pima-Maricopa, Gila River, Tohono O'odham
1/24/2017	Spine Public Meeting	Spine public meeting to present the best-performing alternative over the lunch hour at the MAG offices.	Study team and members of the public
1/24/2017	Spine Public Meeting	Spine public meeting to present the best-performing alternative in the evening at the MAG offices.	Study team and members of the public
1/25/2017	Spine Public Meeting	Spine public meeting to present the best-performing alternative in the evening in Guadalupe.	Study team and members of the public
1/31/2017	Spine Public Meeting	Spine public meeting to present the best-performing alternative in the evening at the Washington Activity Center in Phoenix.	Study team and members of the public
2/13/2017–2/17/2017	Value Planning Workshop	Workshop to evaluate I-10/West Sky Harbor Access options. Outcome of this workshop informed the alternatives evaluation phase of the Spine study. The final report is included in Appendix D.	MAG, ADOT, FHWA, Phoenix, Phoenix Sky Harbor International Airport and its consultants and HDR
2/14/2017	City of Phoenix Transportation and Infrastructure Committee	Study update and recommended alternative overview.	City of Phoenix
3/6/2017	Management Partners	Reviewed feedback received from the public meetings.	MAG, ADOT, FHWA and HDR
3/30/2017	MAG Transportation Review Committee	Detailed presentation of the recommended alternative—no action requested—for information only.	MAG Transportation Review Committee
3/31/2017	AZ Bike Summit	Presentation of the Corridor Master Plan recommendations.	AZ Bike Summit

Table 2-1. Summary of Meetings During the Alternatives Screening Process

Date	Meeting Type	Purpose	Agencies Present
4/11/2017	City of Phoenix Transportation and Infrastructure Committee	Presentation of the Corridor Master Plan recommendations. Discussions about incorporating future light rail crossings of I-17 as they relate to the Spine recommendation.	City of Phoenix
4/12/2017	MAG Management Committee	Detailed presentation of the recommended alternative—no action requested—for information only.	MAG Management Committee
4/19/2017	MAG Transportation Policy Committee	Detailed presentation of the recommended alternative—no action requested—for information only.	MAG Transportation Policy Committee
4/26/2017	MAG Regional Council	Detailed presentation of the recommended alternative—no action requested—for information only.	MAG Regional Council
4/27/2017	MAG Transportation Review Committee	Accepted the final recommendation from the I-10/I-17 Corridor Master Plan for I-10 between the Split and the Pecos Stack and for I-17 between the Split and the North Stack for inclusion in the MAG 2040 RTP, contingent on a new finding of conformity.	MAG, Phoenix, Tempe, Chandler and Guadalupe
5/2/2017	Cost Risk Assessment	Workshop to evaluate I-17/Central Avenue bridge replacement relative to the Valley Metro South Central Light Rail Project. Outcome of this workshop informed the alternatives evaluation phase of the Spine study. The final report is included in Appendix D.	MAG, ADOT, FHWA, Valley Metro, Phoenix and HDR
5/3/2017	Cost Risk Assessment	Workshop to evaluate I-17/Mountain View crossing relative to the Valley Metro Northwest Extension Phase II Light Rail Project. Outcome of this workshop informed the alternatives evaluation phase of the Spine study. The final report is included in Appendix D.	MAG, ADOT, FHWA, Valley Metro, Phoenix and HDR
5/10/2017	MAG Management Committee	Accepted the final recommendation from the I-10/I-17 Corridor Master Plan for I-10 between the Split and the Pecos Stack and for I-17 between the Split and the North Stack for inclusion in the MAG 2040 RTP, contingent on a new finding of conformity.	MAG, Phoenix, Tempe, Chandler and Guadalupe
5/16/2017 and 5/18/2017	Cost Risk Assessment	Workshop to evaluate the I-17 traffic interchanges at Indian School Road, Northern Avenue, Glendale Avenue, Thunderbird Road and Bell Road. Outcome of this workshop informed the alternatives evaluation phase of the Spine study. The final report is included in Appendix D.	MAG, ADOT, FHWA, Phoenix and HDR
5/17/2017	Cost Risk Assessment	Workshop to evaluate the I-17 drainage improvements between the ACDC and Greenway Road. Outcome of this workshop informed the alternatives evaluation phase of the Spine study. The final report is included in Appendix D.	MAG, ADOT, FHWA, Phoenix and HDR

Table 2-1. Summary of Meetings During the Alternatives Screening Process

Date	Meeting Type	Purpose	Agencies Present
5/17/2017	MAG Transportation Policy Committee	Accepted the final recommendation from the I-10/I-17 Corridor Master Plan for I-10 between the Split and the Pecos Stack and for I-17 between the Split and the North Stack for inclusion in the MAG 2040 RTP, contingent on a new finding of conformity.	MAG, ADOT, Phoenix, Tempe, Chandler and Guadalupe
5/24/2017	MAG Regional Council	Accepted the final recommendation from the I-10/I-17 Corridor Master Plan for I-10 between the Split and the Pecos Stack and for I-17 between the Split and the North Stack for inclusion in the MAG 2040 RTP, contingent on a new finding of conformity.	MAG, ADOT, Phoenix, Tempe, Chandler and Guadalupe
6/21/17–6/23/17	Cost Risk Assessment	Workshop to evaluate the Valley Metro Capitol/I-10 West Light Rail Extension and its crossing of I-17 at Van Buren Road. Outcome of this workshop informed the alternatives evaluation phase of the Spine study.	MAG, ADOT, FHWA, Valley Metro, Phoenix, AECOM and HDR

3 Initial Corridor Concepts

3.1 Introduction

Once the Spine corridor’s existing information and issues were compiled in the NAR, a 2-day workshop was scheduled to brainstorm concepts that addressed corridor-wide issues and specific issues at spot locations. All the concepts brainstormed in the workshop were then organized and screened in a four-level screening process (see Chapter 4).

3.2 Alternatives Development Workshop

On June 22 and 23, 2015, MAG hosted the Alternatives Development Workshop to generate ideas to address the Spine corridor issues identified in the NAR. Every partner organization represented by the Charter Partner group was invited to attend and participate in the workshop. The 2-day workshop was attended by personnel from MAG, ADOT, FHWA, City of Phoenix, City of Tempe and transportation and mobility experts from the Spine study team. Participants who signed into the workshop are listed in Table 3-1.

Table 3-1. Alternatives Development Workshop Attendance

Name	Agency	6/22/2015 Attendance	6/23/2015 Attendance
Bob Hazlett	MAG	X	X
Chaun Hill	MAG	X	
Dave Moody	MAG	X	X
Sarath Joshua	MAG	X	
Julie Walker	MAG	X	
Brent Cain	ADOT	X	
Dan Gabiou	ADOT	X	
Mike Kies	ADOT	X	
Steve Boschen	ADOT		X
Abu Mohsenim	ADOT		X
Shajed Haque	ADOT		X
Tom Deitering	FHWA	X	
Alan Hansen	FHWA	X	
Ed Stillings	FHWA	X	X
Toni Whitfield	FHWA	X	
Jenny Grote	City of Phoenix Street Transportation		X
Eileen Yazzie	City of Phoenix Street Transportation	X	X
Kini Knudson	City of Phoenix Street Transportation	X	
Bruce Littleton	City of Phoenix ITS	X	X

Table 3-1. Alternatives Development Workshop Attendance

Name	Agency	6/22/2015 Attendance	6/23/2015 Attendance
Marshall Riegel	City of Phoenix ITS	X	X
Catherine Hollow	City of Tempe	X	
John Hoang	City of Tempe	X	
Brian Bombardier	HDR	X	X
Michael LaBianca	HDR	X	X
Scott Miller	HDR	X	X
Jill Bennett	HDR	X	X
Jeremy Neuman	HDR	X	X
Rick Pilgrim	HDR	X	X
Helayne Dominguez	HDR	X	X
Jack Allen	Jacobs	X	X
Lisa Burgess	Kimley-Horn	X	
Deanna Haase	Kimley-Horn	X	X
Dan Marum	Wilson	X	X
Amy Moran	Wilson	X	X
Mike Falini	CH2MHill	X	X

The Alternatives Development Workshop was organized so that a timeslot was given to each of the 10 segments as follows:

- System wide concepts
- Interstate segment-specific concepts:
 - I-10: SR-202L to Baseline Road
 - I-10: Baseline Road to the Split
 - I-17: Split to the Stack
 - I-17: Stack to ACDC
 - I-17: ACDC to North Stack
- Arterial-specific concepts:
 - 48th Street, 56th/Priest Street and Kyrene Road
 - Broadway Road, Southern Avenue and Baseline Road

- o 35th Avenue, 27th Avenue and 19th Avenue
- o I-17: east-to-west arterials

Three additional sets of concepts were integrated into each of these 10 segment discussions:

- Technology concepts
- Transit concepts
- Bicycle and pedestrian concepts

The agenda for the workshop is shown in Figure 3-1.

At the beginning of each time allotment, the existing conditions and issues for each of the categories were presented to the attendees. The detailed information presented to the attendees can be found in the presentation included in Appendix A. The remainder of the allotted time was spent developing strategies and specific alternatives to address the issues in those segments. The NAR and the Spine study team were available as resources for the duration of the Alternatives Development Workshop if the attendees had any questions concerning the Spine corridor. Over the course of the 2-day workshop, 450 ideas were generated that fell within the 13 categories of improvements noted above. Attendees were directed to use the Alternatives Log Form, shown in Figure 3-2, for each of their ideas. These forms used unique alternative ID numbers for subsequent cataloging and affiliation with a particular category and segment. Attendees were encouraged to take extra log forms with them and submit additional ideas to the study team up to 3 days after the workshop.

After the Alternatives Development Workshop, the Spine study team took the 450 concepts generated during the workshop and collected in the days afterwards and developed an organizational system through which the ideas could be catalogued by category and geographical segment. Concepts that were outside the Spine study area were referred to the appropriate agencies; duplicate concepts were combined and similar concepts were merged where applicable. Once the Spine study team reviewed and organized all of the concepts, the 450 concepts were reduced to 349 concepts, which were carried forward into the alternatives screening process. The AEP (Management Partners plus the Cities of Phoenix, Tempe and Chandler, the Town of Guadalupe and Valley Metro) was created to assist with the alternatives screening process so that the recommended alternative that emerged from the Spine study would achieve full support from all the agencies involved.

To ensure that the feedback received from the public during the public outreach period 3 months earlier was considered during the brainstorming phase of the study, the feedback was shared with workshop participants in the presentation. To reinforce this messaging throughout the workshop, a poster was created and was prominently displayed during the entire 2-day workshop to serve as a constant reminder regarding what was most important to the public in terms of solutions for the corridor. This poster is shown in Figure 3-3.

Chapter 4 describes in detail the concepts developed and how those concepts were screened down to a single recommended alternative over the course of about 18 months.

Figure 3-1. Alternatives Development Workshop Agenda

Workshop Overview

MONDAY, JUNE 22, 2015

8:00 – Study Process and Workshop Overview

8:15 – System-wide Brainstorming

8:45 – Segment I1 Brainstorming

9:45 – Break

10:00 – Segment A1 Brainstorming

10:45 – Segment I2 Brainstorming

12:00 – Lunch (provided)

1:00 – Segment I2 (continued)

1:30 – Segment A2 Brainstorming

3:45 – Break

4:00 – Segment I3 Brainstorming

5:00 – Adjourn

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Workshop Overview

TUESDAY, JUNE 23, 2015

8:00 – Segment I3 (continued)

9:00 – Segment I4 Brainstorming

10:30 – Break

10:45 – Segment I5 Brainstorming

12:00 – Lunch (provided)

1:00 – Segment I5 (continued)

2:00 – Segment A3 Brainstorming

3:30 – Break

3:45 – Segment A4 Brainstorming

5:00 – Adjourn

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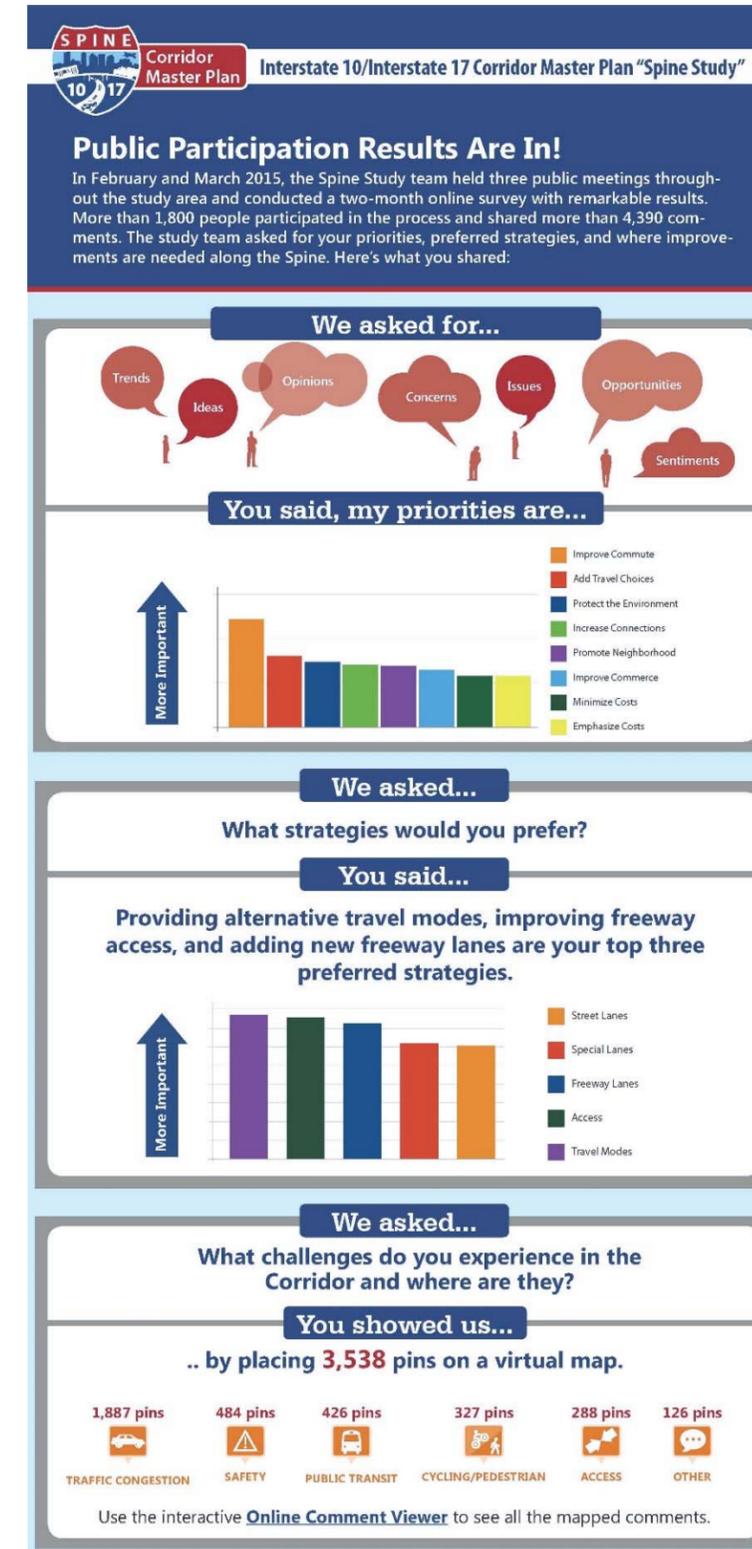
Figure 3-2. Alternatives Development Workshop Log Form

I-10/I-17 "Spine" Corridor Master Plan Alternatives Brainstorming Workshop (6/22/15 and 6/23/15) Alternative Log Form (Due by 6/26/15)

Alternative ID:	A1-500	Submitter Name/Email (in case clarification is needed):
Issues Addressed (check all that apply):		
<input type="checkbox"/> Environmental	<input type="checkbox"/> Arterial Infrastructure	<input type="checkbox"/> Safety
<input type="checkbox"/> Operations	<input type="checkbox"/> Transit	<input type="checkbox"/> Commerce
<input type="checkbox"/> Interstate Infrastructure	<input type="checkbox"/> Bike/Pedestrian	<input type="checkbox"/> Technology
Location:		
Description/Sketch (attach figures if desired with Alternative ID clearly labeled):		
<div style="border: 1px solid black; width: 100%; height: 100%; background-image: linear-gradient(to right, black 1px, transparent 1px), linear-gradient(to bottom, black 1px, transparent 1px); background-size: 20px 20px;"> </div>		
Figure/Map: Yes / No	Other Segments Affected:	

NOTE: Submit all alternatives to Jeremy Neuman (Jeremy.Neuman@hdrinc.com) by no later than 6/26/15.

Figure 3-3. Summary of March 2015 Public Feedback on the Spine Study



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4 Screening Process

4.1 Overview

After the Alternatives Development Workshop, a method with criteria had to be developed to screen all of the proposed alternatives by the Management Partners and the AEP. Three studies from around the country were reviewed to develop the Spine screening process:

- I-25 Valley Highway EIS (Colorado Department of Transportation)¹
- I-70 East Mountain Corridor EIS (Colorado Department of Transportation)²
- I-405 Corridor Program (Washington State Department of Transportation)³

The most significant finding from the studies was how to set up the organization of the alternatives and the progression of screening the alternatives. The Management Partners and AEP completed all of the alternatives screening under the supervision of the Charter Partners. Alternatives from the Alternative Development Workshop were separated into two main categories: backbone and supporting. *Backbone alternatives* affected the entire Spine corridor, and *supporting alternatives* affected only segments, interchanges or specific spots on the corridor. Within the main categories, the backbone category was subdivided into five subcategories:

- Highway capacity
- New routes
- New transit
- System traffic interchange
- Technology

The supporting category was subdivided into seven subcategories:

- Arterial modifications
- Bicycle/pedestrian
- Policy
- Service traffic interchange
- Travel demand management (TDM)/transportation system management (TSM)
- Transit enhancements
- Weaves

By dividing the alternatives into these categories, the study team could focus on the backbone alternatives, which would provide the greatest benefit to the entire corridor. Once the backbone alternatives had been

analyzed and narrowed down, the supporting alternatives could be added to the backbone alternatives to address specific issues.

Each alternative was assigned an alphanumeric identification to indicate the alternative's category and geographical location. The alternatives' identifiers are outlined below:

- S – System Wide Alternative
- I1 – Interchange Alternative – I-10: SR-202L to Baseline Road
- I2 – Interchange Alternative – I-10: Baseline Road to 24th Street
- I3 – Interchange Alternative – I-17: 24th Street to the Stack
- I4 – Interchange Alternative – I-17: Stack to the ACDC/Arizona Canal
- I5 – Interchange Alternative – I-17: ACDC/Arizona Canal to SR-101L
- A1 – Arterial Alternative – 48th Street, Priest Drive and Kyrene Road
- A2 – Arterial Alternative – Baseline Road, Southern Avenue, Broadway Avenue and Buckeye Road
- A3 – Arterial Alternative – 35th Avenue, 27th Avenue and 19th Avenue
- A4 – Arterial Alternative – McDowell Road, Thomas Road, Grand Avenue, Indian School Road, Camelback Road, Bethany Home Road, Glendale Avenue, Northern Avenue, Dunlap Avenue, Peoria Avenue, Cactus Road, Thunderbird Road, Greenway Road, Bell Road and Union Hills Drive
- T – Transit
- ITS – Intelligent Transportation System
- BP – Bicycle/Pedestrian

The alternative screening and selection process was developed with four levels of screening (Figure 4-1):

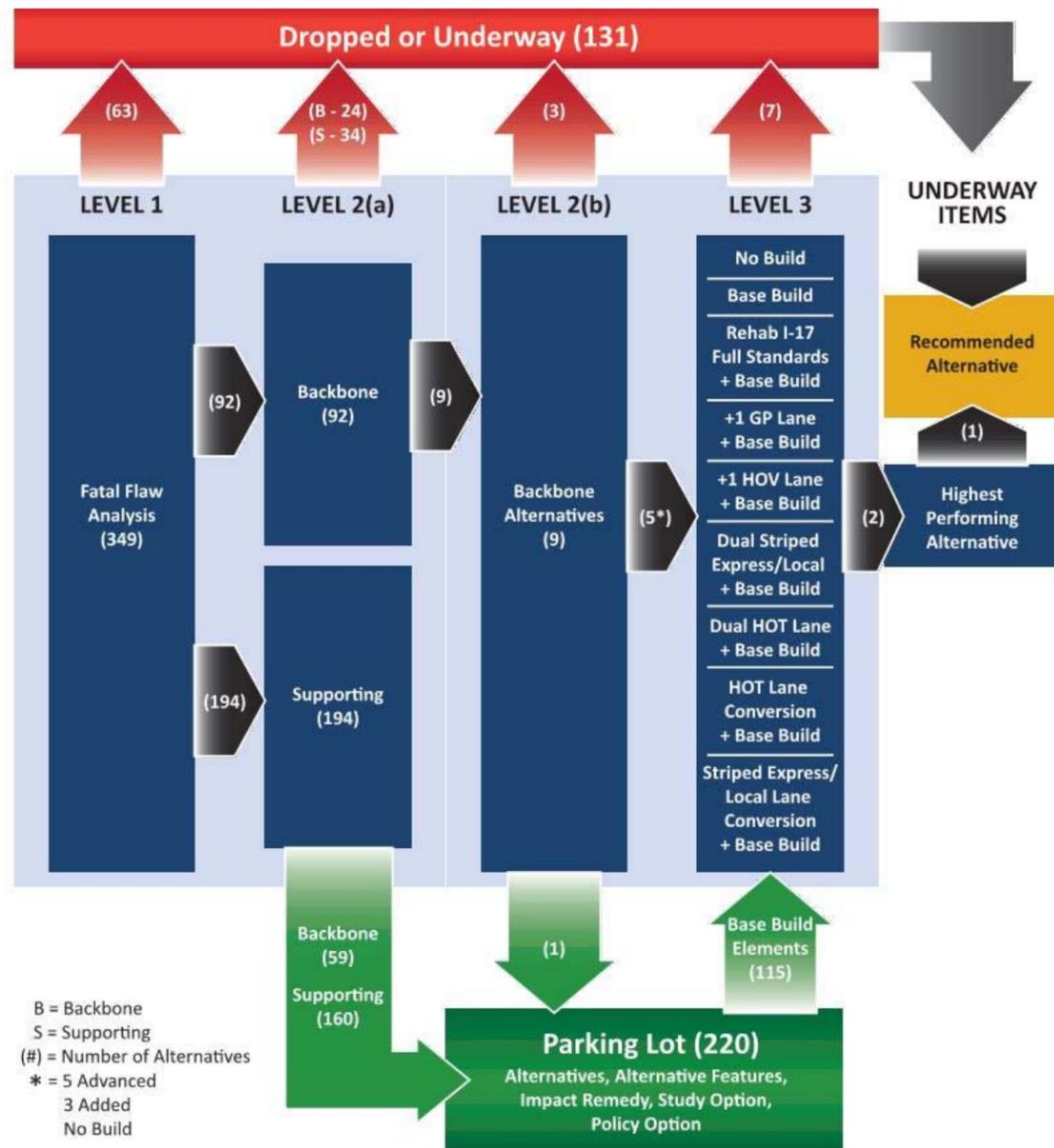
- Level 1 – Fatal flaw and qualitative (349 alternatives)
- Level 2 – Two-phase quantitative screening of backbone and supporting alternatives:
 - Level 2A – Optimization, expand/modernize, performance and sustainability (286 alternatives)
 - Level 2B – Implementation (9 alternatives)
- Level 3 – Quantitative screening of backbone alternatives with supporting alternative elements
 - Environmental, operations, engineering, safety and commerce/economic development (9 alternatives)
- Level 4 – Quantitative hybrid alternative screening (2 alternatives)

¹ <https://www.codot.gov/projects/north-i-25-eis>; project limits were I-25 from I-70 to Wellington

² <http://www.i-70east.com/>; project limits were I-70 from I-25 to Tower Road

³ <http://www.wsdot.wa.gov/projects/I405/>; project limits were the entire I-405 corridor in the Seattle area

Figure 4-1. Alternative Screening and Selection Process



4.2 Level 1 Screening

The Level 1 screening of the 349 alternatives was a fatal flaw, qualitative screening to quickly eliminate the alternatives that did not meet the purpose and need of the project. When necessary, a minimal amount of quantitative analysis was completed for alternatives where qualitative analysis alone would not suffice to determine whether the alternatives met the purpose and need. Table 4-1 shows the Level 1 screening and provides explanations for why alternatives were dropped.

Table 4-1. Level 1 Screening

Combined Alternative ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening
S-1000	Construct HOT lanes or convert HOV lanes to HOT lanes (at grade or elevated).		Backbone	Highway capacity	Keep
S-1001	Add a second 2+ HOV lane.		Backbone	Highway capacity	Keep
S-1003	Add one additional general purpose lane in each direction to Interstate.		Backbone	Highway capacity	Keep
S-1004	Add two additional general purpose lanes in each direction to Interstate.		Backbone	Highway capacity	Keep
S-1005	Add three additional general purpose lanes in each direction to Interstate.		Backbone	Highway capacity	Keep
S-1031	Create barrier-separated express/local lane system.	Concept would have significant ROW and environmental impacts along I-17. Will be evaluated on a segment basis.	Backbone	Highway capacity	Keep
S-1037	Add a second 2+ HOV lane with extra-wide inside shoulders (16 feet) for enforcement purposes and to provide the necessary width for future managed lanes conversion.		Backbone	Highway capacity	Keep
S-1038	Create a striped express/local lane system.	Added on August 24, 2015.	Backbone	Highway capacity	Keep
I1-1010	Free express lanes from SR-202L to Broadway Curve.	See S-1029.	Backbone	Highway capacity	Keep
I2-1023	Reevaluate the 1988 C-D system plan, which was a smaller footprint than the EIS terminated recently. Potentially review 1988 plan to route C-D roads south of Split to connect with I-17 and avoid Phoenix Sky Harbor International Airport issues. Limit trucks to local lane section of C-D system.		Backbone	Highway capacity	Keep
I2-1033	Restore HOV balance.		Backbone	Highway capacity	Keep
I3-1000	Access management for north-to-south frontage roads.		Backbone	Highway capacity	Keep
I3-1004	Replace I-17 in kind with current standards to replace the aging infrastructure. Will redesign to reflect the high truck percentages in this segment corridor.		Backbone	Highway capacity	Keep
I3-1018	Extend HOV lanes throughout entire I-17.		Backbone	Highway capacity	Keep
I4-1000	Widen I-17 to full design standards (12-foot lanes and full shoulders).		Backbone	Highway capacity	Keep
I4-1002	Extend HOV lanes through the Stack interchange.		Backbone	Highway capacity	Keep
I4-1003	Eliminate frontage roads to widen I-17 within existing ROW.	Significant access impacts on adjacent residential and businesses.	Backbone	Highway capacity	Keep
I4-1004	Add frontage roads lanes/capacity.		Backbone	Highway capacity	Keep
I4-1005	Limit frontage road access.	Significant access impacts on adjacent residential and businesses.	Backbone	Highway capacity	Keep
I4-1011	Flatten S-curve near Metrocenter/evaluate vertical profile; develop crash map to find cause of accidents.		Backbone	Highway capacity	Keep
I4-1015	Reduce frontage road to one lane to widen I-17.	Frontage road already one lane in several areas.	Backbone	Highway capacity	Keep
I4-1053	Access management plans/frontage road system.		Backbone	Highway capacity	Keep
I1-1018	C-D roads between Pecos Stack and US-60.		Backbone	Highway capacity	Keep
S-1007	Add bus/bus rapid transit (BRT)-only lanes to the Interstate, heavily using park-and-rides.		Backbone	Highway capacity	Keep
S-1008	Add truck-only lanes to the Interstate.		Backbone	Highway capacity	Keep
S-1021	Hard shoulder running.	Only analyze inside shoulder running because the Spine system has (or will have) auxiliary lanes throughout the corridor and DPS's position is to not have outside shoulder running.	Backbone	Highway capacity	Keep
S-1010	Add bus/BRT-only lanes to the arterial corridors of interest.		Backbone	New transit	Keep
S-1039	Heavy transit within Interstate ROW for the length of the Spine corridor.	Added on August 24, 2015.	Backbone	New transit	Keep
I4-1017	Reconsider commuter rail services on Grand Avenue to Phoenix Central Business District.	Compass study considered this and recommended this option.	Backbone	New transit	Keep

Table 4-1. Level 1 Screening

Combined Alternative ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening
A1-1004	Extend streetcar to Arizona Mills and beyond Wild Horse Pass.	Refer to Valley Metro.	Backbone	New transit	Keep
A2-1015	Exclusive guideway transit: Southern Avenue/Central Phoenix – Phoenix Central Business District to Rural Road.	Central Phoenix Transportation Framework Study.	Backbone	New transit	Keep
A2-1017	Build automated guideway transit on 48th Street/SR-143 from Southern Avenue to Sky Harbor Boulevard.	Southeast Corridor Major Investment Study.	Backbone	New transit	Keep
A2-1018	Extend light rail from Central Avenue to Arizona Mills along the Western Canal.		Backbone	New transit	Keep
T-1005	High-capacity transit from Ahwatukee to downtown Phoenix via Tempe and Phoenix Sky Harbor International Airport (using UPRR ROW).	Related to A1-1009.	Backbone	New transit	Keep
T-1007	High-capacity transit to downtown Glendale.	Currently being studied.	Backbone	New transit	Keep
T-1008	High-capacity transit from Metrocenter to north.		Backbone	New transit	Keep
T-1009	High-capacity transit from Tempe to south.		Backbone	New transit	Keep
T-1011	Reversible bus lane on Broadway from 52nd Street to Central Avenue.		Backbone	New transit	Keep
A1-1009	Reconfigure/Repurpose UPRR spur line for transit purposes and buy out industrial land uses that use it.		Backbone	New transit	Keep
T-1019	Express bus from Pecos Park-and-Ride to Arizona State University (ASU).		Backbone	New transit	Keep
T-1027	ASU West potential light rail extensions from Metrocenter.		Backbone	New transit	Keep
I1-1003	Add DHOVs to South Mountain Freeway to I-10 (east to north and south to west).	Retain. Needs to be studied for geometric feasibility.	Backbone	System traffic interchange	Keep
I1-1004	Direct access from Pecos Park-and-Ride to I-10.	South Mountain Freeway (near-term improvement) will provide access to the Pecos Park-and-Ride lot with an interchange at 40th Street. This will allow access to SR-202L, which connects to I-10.	Backbone	System traffic interchange	Keep
I2-1024	Maintain three westbound US-60 lanes through Broadway Curve to past 40th Street.		Backbone	System traffic interchange	Keep
I1-1016	North to west, east to south Baseline Road/I-10 flyover with a median landing at Baseline.		Backbone	System traffic interchange	Keep
I2-1016	Reconfigure I-10/US-60 connection.	Several alts were developed. Need further study.	Backbone	System traffic interchange	Keep
I1-1015	New high-capacity interchange at Baseline Road.	Possible configurations include single-point urban interchange (SPUI), DDI, ParClo and three-level.	Backbone	System traffic interchange	Keep
I2-1018	Broadway Curve bypass. Extend SR-143 south then curve east to tie to US-60. As an option extend SR-143 south to Baseline Road.	Substantial neighborhood and land use impacts.	Backbone	System traffic interchange	Keep
I2-1029	Southbound SR-143 has numerous devices installed because of lack of signal visibility. Vertical curve needs to be reduced.	As an end-of-freeway condition, alternatives will be explored here to properly address this condition.	Backbone	System traffic interchange	Keep
I2-1000	Add DHOV to SR-143/I-10.	HOVs currently do not exist on SR-143. Nor are there currently plans to add them. I-10 Broadway Curve near-term improvements will force HOV users wanting to use SR-143 to cross the general purpose lanes much further upstream for both I-10 and US-60.	Backbone	System traffic interchange	Keep
I2-1010	Replace/Alter SR-143 and Broadway interchange; eliminate SR-143 loop ramp.	Multiple options exist and should be evaluated for this location.	Backbone	System traffic interchange	Keep
I2-1026	Add westbound Broadway to northbound SR-143 ramp.	Movement is currently served by the Broadway/48th Street intersection.	Backbone	System traffic interchange	Keep
I2-1030	Increase eastbound I-10/Broadway on-ramp capacity.		Supporting	System traffic interchange	Keep
I2-1005	Add DHOV to I-10/Broadway Road.		Backbone	System traffic interchange	Keep
I2-1013	I-10 realignment at the Split.		Backbone	System traffic interchange	Keep
I3-1006	Add DHOVs to Split.		Backbone	System traffic interchange	Keep

Table 4-1. Level 1 Screening

Combined Alternative ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening
I3-1005	Add DHOVs to Stack.		Backbone	System traffic interchange	Keep
I3-1019	The Stack southeastern quadrant, three concepts from previous I-17 study.	I-17 study.	Backbone	System traffic interchange	Keep
I3-1020	The Stack southwestern quadrant, three concepts from previous I-17 study.	I-17 study.	Backbone	System traffic interchange	Keep
I4-1054	The Stack northeastern quadrant, three concepts from previous I-17 study.	I-17 study.	Backbone	System traffic interchange	Keep
I4-1055	The Stack northwestern quadrant, two concepts from previous I-17 study.	I-17 study.	Backbone	System traffic interchange	Keep
I4-1024	Analyze which DHOV to build at North Stack.		Backbone	System traffic interchange	Keep
I4-1052	Fix the North Stack north to east and south to east movements.		Backbone	System traffic interchange	Keep
ITS-1001	Upgrade ramp metering.	Need more specifics.	Backbone	Technology	Keep
ITS-1003	Expand collection and dissemination of real-time traffic data/conditions within study area and/or Valley wide. Deploy real-time traffic movement and measuring devices (anonymous re-identification devices [ARID]).		Backbone	Technology	Keep
ITS-1005	Coordination on traffic incidents with ADOT and local jurisdictions.		Backbone	Technology	Keep
ITS-1006	Arterial management system (intelligent transportation system [ITS]) – surveillance, traffic control, parking managements, dynamic message signs (DMS), information dissemination and full integration. Including dedicated transit and parking ITS, adaptive traffic signals to adjust to traffic volumes and coordination between freeway and arterials at interchange signals.		Backbone	Technology	Keep
ITS-1007	Closed-circuit television (CCTV), traffic signal sharing responsibilities between agencies.		Backbone	Technology	Keep
ITS-1008	Add transit signal priority (TSP) for bus service on 35th Avenue to help maintain schedules due to frequent school zone crossings. Add TSP to 19th Avenue to help meet connections with light rail transit.		Backbone	Technology	Keep
ITS-1009	Consolidated Traffic Operations Center (TOC).		Backbone	Technology	Keep
ITS-1010	Connected vehicle integration (personal vehicles and freight).		Backbone	Technology	Keep
ITS-1011	Additional traffic operations staff and maintenance staff for City of Phoenix.		Backbone	Technology	Keep
ITS-1012	Better local jurisdiction coordination to close the gap, interconnect between cities.		Backbone	Technology	Keep
ITS-1014	Variable speed control on Interstate.		Backbone	Technology	Keep
ITS-1015	Lane control signals.		Backbone	Technology	Keep
ITS-1016	Active motorways, active management.	Already underway on I-17.	Backbone	Technology	Keep
ITS-1017	Dynamic HOV lane occupancy control.		Backbone	Technology	Keep
ITS-1018	Advance queue warning for northbound traffic on I-10 when approaching Broadway Curve.		Backbone	Technology	Keep
ITS-1019	Automate speed warning in advance of high crash frequency locations.		Backbone	Technology	Keep
S-1016	Interagency coordination for alternative routing during incidents.		Backbone	Technology	Keep
A3-1007	Incorporate TSM and operations into I-17 corridor including 19th and 35th avenues as synchronized alternatives.	This is part of the overarching goal of the I-17 ITS improvements.	Backbone	Technology	Keep
I3-1011	Signal timing for turning trucks at 19th Avenue/I-17.		Backbone	Technology	Keep
I4-1021	Upgrade signal operation at traffic interchanges to emphasize frontage road through movements to fully utilize frontage road capacity.		Backbone	Technology	Keep
ITS-1004	Way finding for emergency/alternative routes.		Backbone	Technology	Keep

Table 4-1. Level 1 Screening

Combined Alternative ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening
A2-1011	Use Rio Salado Parkway as reliever for east-to-west, serve as catalyst for land use change.		Supporting	Arterial modifications	Keep
A4-1000	Access management plans/frontage road system for crossroads between 19th and 35th avenues.		Supporting	Arterial modifications	Keep
S-1006	Add one additional general purpose lane in each direction to arterial corridors of interest.		Supporting	Arterial modifications	Keep
S-1023	Add more arterial bus pullouts.		Supporting	Arterial modifications	Keep
I3-1010	Coordination between ADOT and Valley Metro on Central Avenue/I-17 crossing.	This alternative may be rolled into the near-term improvements with the passage of Proposition 104.	Supporting	Arterial modifications	Keep
I4-1025	Add mid-mile crossing at Encanto Boulevard.		Supporting	Arterial modifications	Keep
I4-1026	Add mid-mile crossing at Osborn Road.		Supporting	Arterial modifications	Keep
I4-1027	Add mid-mile crossing at Campbell Avenue.		Supporting	Arterial modifications	Keep
I4-1028	Add mid-mile crossing at Missouri Avenue.		Supporting	Arterial modifications	Keep
I4-1029	Add mid-mile crossing at Orangewood Avenue.		Supporting	Arterial modifications	Keep
I4-1030	Add mid-mile crossing at Butler Road.		Supporting	Arterial modifications	Keep
I4-1047	Implement drainage solution for four arterials that flood.		Supporting	Arterial modifications	Keep
I4-1048	Eliminate four old pump stations – ADOT has a design on the shelf for this.		Supporting	Arterial modifications	Keep
A1-1001	Parallel corridor reconfiguration. Create parallel I-10 route on Kyrene and connect Kyrene and Mill Avenue between Baseline Road and US-60.		Supporting	Arterial modifications	Keep
A1-1006	Reversible lane on Kyrene Road.	Check directional splits on Kyrene for 2040.	Supporting	Arterial modifications	Keep
A1-1007	Convert Kyrene Road to an Arizona parkway.	Needs to be in conjunction with A1-1001 to realize the value of adding more capacity to Kyrene.	Supporting	Arterial modifications	Keep
A2-1001	Convert Broadway to a truck arterial (I-10 to SR-202L [South Mountain Freeway]), Southern to a transit corridor, Baseline to vehicular corridor and Alameda/Roeser and Western Canal to a pedestrian/bicycle corridor.		Supporting	Arterial modifications	Keep
A2-1002	Convert Baseline to an indirect left arterial (Arizona parkway).	Related to A2-1013.	Supporting	Arterial modifications	Keep
A2-1003	Access management plan on Southern Avenue.		Supporting	Arterial modifications	Keep
A2-1004	School zones traffic management plan. School zone student drop-off, traffic control, queuing planning and high-intensity activated crosswalk (HAWK) beacons to eliminate 15 miles per hour (mph) school zones.		Supporting	Arterial modifications	Keep
A2-1005	Widen 32nd Street to Baseline Road.		Supporting	Arterial modifications	Keep
A2-1006	If 24th Street closed, need connection between 24th and 16th streets (to not lose 24th Street river crossing).		Supporting	Arterial modifications	Keep
A2-1008	High average daily traffic intersection – consider grade separations.		Supporting	Arterial modifications	Keep
A2-1009	Make Southern Avenue, 16th Street and 7th Street use reversible lanes for peak hour travel. Connect Southern into US-60/I-10 interchange.		Supporting	Arterial modifications	Keep
A2-1010	Access control right-in, right-out only along Baseline Road between Pointe Parkway and Priest.		Supporting	Arterial modifications	Keep
A2-1012	Flatten profile of 32nd Street over I-10.		Supporting	Arterial modifications	Keep
A2-1016	Convert Southern Avenue (US-60 to SR-202L) to a parkway (6 general purpose + 2 BRT).	Southeast Corridor Major Investment Study.	Supporting	Arterial modifications	Keep

Table 4-1. Level 1 Screening

Combined Alternative ID	Description	Comments	Backbone/Supporting	Subcategory	Level 1 Screening
A3-1000	Provide intersection improvements to allow for diversion routes to/from I-17 for parallel routes (27th and 35th avenues), expand north-to-south arterials south of Northern to include 7th Avenue to east. North of Northern, include 7th Street, 43rd Avenue and 51st Avenue.		Supporting	Arterial modifications	Keep
A3-1001	School zones traffic management plan. School zone student drop-off, traffic control, queuing planning and HAWK beacons to eliminate 15 mph school zones.		Supporting	Arterial modifications	Keep
A3-1003	Grade separate 35th Avenue over BNSF/Grand to improve transit service.		Supporting	Arterial modifications	Keep
A3-1004	Convert 35th Avenue to an Arizona parkway with indirect left design.		Supporting	Arterial modifications	Keep
A3-1005	Convert 43rd Avenue to an Arizona parkway with indirect left design.	Outside of current study limits.	Supporting	Arterial modifications	Keep
A3-1008	Analyze intersection geometry to determine current and future traffic demands, check whether turning movement demands are served correctly.		Supporting	Arterial modifications	Keep
A3-1013	Convert 35th Avenue to reversible to provide extra capacity during the peak times.	Need to check directional split of traffic on 35th Avenue in 2040.	Supporting	Arterial modifications	Keep
A4-1003	Convert Northern Avenue to Arizona parkway.		Supporting	Arterial modifications	Keep
A4-1004	Convert Missouri Avenue to Arizona parkway from Grand Avenue to SR-51.		Supporting	Arterial modifications	Keep
A4-1012	School zones traffic management plan. School zone student drop-off, traffic control, queuing planning and HAWK beacons to eliminate 15 mph school zones.	within the Spine corridor study area.	Supporting	Arterial modifications	Keep
A4-1001	Convert Camelback Road to Arizona parkway.		Supporting	Arterial modifications	Keep
A4-1002	Convert Bell Road to Arizona parkway.		Supporting	Arterial modifications	Keep
A4-1014	Continuous-flow intersection at 35th/Camelback, Bell and Northern Avenue.		Supporting	Arterial modifications	Keep
A2-1013	Need detailed review on access on Baseline Road, signals, etc. on corridor.	Related to A2-1002.	Supporting	Arterial modifications	Keep
A2-1014	Access management plan on Baseline Road.		Supporting	Arterial modifications	Keep
A1-1002	Parallel corridor reconfiguration. Create parallel I-10 route on 48th Street. Convert to public street between Point Parkway and Arizona Grand Parkway. Consider converting stop signs into coordinated signal system.	Not consistent with local jurisdictions' land use and transportation plans.	Supporting	Arterial modifications	Keep
A4-1006	Make Encanto/Grand Canal a pedestrian/bicycle and local one lane/one lane roadway.		Supporting	Bicycle/Pedestrian	Keep
A4-1007	Make Campbell a pedestrian/bicycle and local one lane/one lane roadway.		Supporting	Bicycle/Pedestrian	Keep
A4-1008	Make Missouri a pedestrian/bicycle and local one lane/one lane roadway.		Supporting	Bicycle/Pedestrian	Keep
A4-1009	Make Oranewood a pedestrian/bicycle and local one lane/one lane roadway.		Supporting	Bicycle/Pedestrian	Keep
A4-1010	Make Butler a pedestrian/bicycle and local one lane/one lane roadway.		Supporting	Bicycle/Pedestrian	Keep
A4-1011	Make Sweetwater a pedestrian/bicycle and local one lane/one lane roadway.		Supporting	Bicycle/Pedestrian	Keep
A3-1002	Pedestrian overpass for all school and mid-block crossings along 35th, 19th and 27th avenues.	Identify potential locations.	Supporting	Bicycle/Pedestrian	Keep
BP-1000	Add bicycle lanes on Chandler Boulevard from 50th to 54th streets.		Supporting	Bicycle/Pedestrian	Keep
BP-1001	Add bicycle lanes on Ray Road from 50th to 54th streets.		Supporting	Bicycle/Pedestrian	Keep
BP-1002	Add bicycle lanes on Warner Road from 51st to Jewel streets.		Supporting	Bicycle/Pedestrian	Keep
BP-1003	Add bicycle lanes from Sky Harbor Circle to University Drive on 24th Street.	City of Phoenix <i>Comprehensive Bicycle Master Plan</i> . This may face a serious FAA hurdle.	Supporting	Bicycle/Pedestrian	Keep
BP-1004	Add bicycle lanes on Adams/Jefferson from 24th to 21st avenues.	City of Phoenix <i>Comprehensive Bicycle Master Plan</i> .	Supporting	Bicycle/Pedestrian	Keep
BP-1005	Improve bicycle/pedestrian infrastructure on 3rd Street.	City of Phoenix <i>Comprehensive Bicycle Master Plan</i> .	Supporting	Bicycle/Pedestrian	Keep
BP-1006	Improve bicycle/pedestrian infrastructure on 15th Avenue.		Supporting	Bicycle/Pedestrian	Keep

Table 4-1. Level 1 Screening

Combined Alternative ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening
BP-1007	Add bicycle lanes on Central Avenue from Apache to Watkins Street.	City of Phoenix <i>Comprehensive Bicycle Master Plan</i> .	Supporting	Bicycle/Pedestrian	Keep
BP-1008	Add bicycle lanes on Union Hills Drive from 27th Avenue to 24th Drive.	City of Phoenix <i>Comprehensive Bicycle Master Plan</i> .	Supporting	Bicycle/Pedestrian	Keep
BP-1009	Add bicycle lanes on Rose Garden Lane from 27th to 23rd avenues.		Supporting	Bicycle/Pedestrian	Keep
BP-1010	Add bicycle lanes on Deer Valley from 27th to 23rd avenues.		Supporting	Bicycle/Pedestrian	Keep
BP-1011	Use mid-mile roads as bicycle routes and electric single-occupancy vehicle routes and connect them to park-and-rides.		Supporting	Bicycle/Pedestrian	Keep
BP-1012	Bicycle routes to connect park-and-rides to access express buses.		Supporting	Bicycle/Pedestrian	Keep
BP-1013	Accentuate 15th Avenue bicycle corridor.		Supporting	Bicycle/Pedestrian	Keep
BP-1014	Consider 23rd Avenue as a bicycle corridor.		Supporting	Bicycle/Pedestrian	Keep
BP-1015	Connect east-to-west bicycle/pedestrian corridors across I-17.		Supporting	Bicycle/Pedestrian	Keep
BP-1016	Add bicycle lanes from 27th to 23rd avenues on Indian School Road, connect to existing bicycle lanes east of I-17.	City of Phoenix <i>Comprehensive Bicycle Master Plan</i> .	Supporting	Bicycle/Pedestrian	Keep
BP-1017	Extend pedestrian/bicycle path under/over I-10 along Western Canal.		Supporting	Bicycle/Pedestrian	Keep
BP-1018	Extend existing multiuse path in Tempe along the Salt River west as far as it will go.		Supporting	Bicycle/Pedestrian	Keep
BP-1019	Extend bicycle lanes on Southern between 48th and Priest Drive.	Could be a challenge under I-10.	Supporting	Bicycle/Pedestrian	Keep
BP-1020	Bicycle integration between 24th Street and Priest (dry crossing along southern bank of Salt River).	A bicycle path along the southern bank of the Salt River is mostly intact. Consider filling in the missing segments on that path instead.	Supporting	Bicycle/Pedestrian	Keep
BP-1021	Add bicycle lanes on Broadway Road from 48th to 55th streets, future connect to Tempe/Phoenix Master Plans.	City of Phoenix <i>Comprehensive Bicycle Master Plan</i> .	Supporting	Bicycle/Pedestrian	Keep
BP-1022	System-wide detection for pedestrians, bicycles and vehicles on arterials.		Supporting	Bicycle/Pedestrian	Keep
BP-1023	Bicycle/pedestrian crossing at Grand Canal, mid-mile crossings along designated bicycle/trail/multiuse path routes.	City of Phoenix <i>Comprehensive Bicycle Master Plan</i> .	Supporting	Bicycle/Pedestrian	Keep
BP-1024	Enhance bicycle infrastructure between Pecos and Baseline roads using 50th and 51st streets as much as possible to take bicycle traffic off 48th Street.		Supporting	Bicycle/Pedestrian	Keep
BP-1025	Bicycle/Pedestrian crossings at Knox.		Supporting	Bicycle/Pedestrian	Keep
BP-1026	Bicycle/Pedestrian crossings at Ray Road.	City of Phoenix <i>Comprehensive Bicycle Master Plan</i> .	Supporting	Bicycle/Pedestrian	Keep
BP-1027	Bicycle/Pedestrian crossings at Chandler Boulevard.		Supporting	Bicycle/Pedestrian	Keep
BP-1028	Bicycle/Pedestrian crossings at Warner Road.		Supporting	Bicycle/Pedestrian	Keep
BP-1029	Bicycle/Pedestrian crossings at Elliot Road.		Supporting	Bicycle/Pedestrian	Keep
BP-1031	Bicycle/Pedestrian crossing at Galveston Street/I-10.		Supporting	Bicycle/Pedestrian	Keep
BP-1032	Bicycle/Pedestrian crossing at Osborn/I-17.	City of Phoenix <i>Comprehensive Bicycle Master Plan</i> .	Supporting	Bicycle/Pedestrian	Keep
BP-1033	Bicycle/Pedestrian crossing at Missouri Avenue/I-17.		Supporting	Bicycle/Pedestrian	Keep
BP-1034	Bicycle/Pedestrian crossing at I-10 along Salt River/Rio Salado.		Supporting	Bicycle/Pedestrian	Keep
BP-1035	Bicycle/Pedestrian crossing at I-10 along Western Canal.		Supporting	Bicycle/Pedestrian	Keep
I1-1008	Frontage roads between Pecos Stack and US-60.		Backbone	Highway capacity	Keep
I1-1027	Create a frontage road system for I-10 between Elliot and Baseline for system redundancy.	Added on August 24, 2015.	Backbone	Highway capacity	Keep

Table 4-1. Level 1 Screening

Combined Alternative ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening
I2-1032	Get rid of the eastbound C-D pinch point at Fairmont. May require one more southbound I-10 lane.	This area is being altered with I-10 Broadway Curve Near-Term improvements project. May address this alternative.	Supporting	Highway capacity	Keep
I4-1006	Revise merge points on frontage roads.		Supporting	Highway capacity	Keep
I4-1018	Begin a "visual" transition of the ROW/lane widths to prepare drivers for transition to depressed roadway section.		Supporting	Highway capacity	Keep
I3-1014	North-to-south I-17, Durango Curve to Stack: Reconfigure all traffic interchanges to work as a system with frontage/connector roads. Eliminate all partial traffic interchanges.		Supporting	Service traffic interchange	Keep
S-1034	Alternate DHOV traffic interchanges on the inside at half miles with single-occupancy vehicle traffic interchanges at the full miles. This eliminates HOV travelers from merging across.		Supporting	Service traffic interchange	Keep
I1-1000	Add DHOVs to Galveston.		Supporting	Service traffic interchange	Keep
I1-1001	Add DHOVs to Carver.		Supporting	Service traffic interchange	Keep
I1-1002	Add DHOVs to Guadalupe.		Supporting	Service traffic interchange	Keep
I1-1011	New high-capacity interchange at Chandler Boulevard.	Possible configurations include SPUI, DDI, ParClo and three-level.	Supporting	Service traffic interchange	Keep
I1-1012	New high-capacity interchange at Ray Road.	Possible configurations include SPUI, DDI, ParClo and three-level.	Supporting	Service traffic interchange	Keep
I1-1013	New high-capacity interchange at Warner Road.	Possible configurations include SPUI, DDI, ParClo and three-level.	Supporting	Service traffic interchange	Keep
I1-1014	New high-capacity interchange at Elliot Road.	Possible configurations include SPUI, DDI, ParClo and three-level.	Supporting	Service traffic interchange	Keep
I1-1019	New high-capacity interchange at Chandler Boulevard.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I1-1020	Add two-lane (choice lane) exit ramps along I-10 westbound at Ray Road.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I1-1021	Add two-lane (choice lane) exit ramps along I-10 westbound at Warner Road.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I1-1022	Add two-lane (choice lane) exit ramps along I-10 westbound at Elliot Road.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I1-1023	Add two-lane (choice lane) exit ramps along I-10 eastbound at Chandler Boulevard.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I1-1024	Add two-lane (choice lane) exit ramps along I-10 eastbound at Ray Road.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I1-1025	Add two-lane (choice lane) exit ramps along I-10 eastbound at Warner Road.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I1-1026	Add two-lane (choice lane) exit ramps along I-10 eastbound at Elliot Road.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I2-1003	Add DHOV to Kyrene/US-60.		Supporting	Service traffic interchange	Keep
I2-1004	Add DHOV to Hardy/US-60.		Supporting	Service traffic interchange	Keep
I2-1012	Move 24th Street ramps to University for cargo access to Phoenix Sky Harbor International Airport, University traffic interchange instead of the 24th Street traffic interchange. Provide Interstate access to Tower Road.		Supporting	Service traffic interchange	Keep
I2-1034	New high-capacity traffic interchange at 32nd Street.		Supporting	Service traffic interchange	Keep
I2-1035	New high-capacity traffic interchange at 44th Street.		Supporting	Service traffic interchange	Keep
I2-1038	Add two-lane (choice lane) exit ramps along I-10 eastbound at 40th Street.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I2-1039	Add two-lane (choice lane) exit ramps along I-10 eastbound at 32nd Street.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I3-1007	Add DHOV at 7th Street with HOV lanes (split DHOV, BRT lane during peak period between Washington and I-17).		Supporting	Service traffic interchange	Keep
I3-1008	Add DHOVs to Adams/Jefferson couplet.		Supporting	Service traffic interchange	Keep
I3-1009	Add DHOVs to Van Buren.		Supporting	Service traffic interchange	Keep

Table 4-1. Level 1 Screening

Combined Alternative ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening
I3-1016	Make Adams/Jefferson couplet a standard split diamond configuration.		Supporting	Service traffic interchange	Keep
I3-1021	Add DHOV to Central Avenue.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I3-1022	Add DHOV to Washington Avenue.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I3-1023	Add DHOV to 15th Avenue.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I4-1001	Connect US-60 (Grand Avenue) to I-17, especially north to northwest and southeast to south movements.		Supporting	Service traffic interchange	Keep
I4-1007	Add DHOVs to Grand Avenue.	See A4-1007.	Supporting	Service traffic interchange	Keep
I4-1008	Add DHOVs to Missouri.		Supporting	Service traffic interchange	Keep
I4-1016	HOV bus ramp exit south of Grand Avenue/BNSF, then tying to new I-10/I-17 bus ramp inside the Stack on the existing southbound frontage road.	Would compete against alternative for HOV lanes on Grand Avenue and a DHOV between I-17 and Grand Avenue (see A4-1007).	Supporting	Service traffic interchange	Keep
I4-1019	Texas turnarounds on all interchanges north of the Stack.		Supporting	Service traffic interchange	Keep
I4-1020	Texas turnarounds on northern side of Camelback to serve Grand Canyon University.		Supporting	Service traffic interchange	Keep
I4-1023	Direct connections to Grand Canyon University at Colter.	Directional needs of this direct connection would need to be established (that is, connect to I-17 north, or connect to I-17 south, or both). Either way, a DHOV at a 1/4 mile crossing would be extremely expensive and challenging. Question whether this would be warranted for a private land use.	Supporting	Service traffic interchange	Keep
I4-1031	New high-capacity traffic interchange at McDowell Road.		Supporting	Service traffic interchange	Keep
I4-1032	New high-capacity traffic interchange at Thomas Road.		Supporting	Service traffic interchange	Keep
I4-1033	New high-capacity traffic interchange at Grand Avenue.		Supporting	Service traffic interchange	Keep
I4-1034	New high-capacity traffic interchange at Indian School Road.		Supporting	Service traffic interchange	Keep
I4-1035	New high-capacity traffic interchange at Camelback Road.		Supporting	Service traffic interchange	Keep
I4-1036	New high-capacity traffic interchange at Bethany Home Road.		Supporting	Service traffic interchange	Keep
I4-1037	New high-capacity traffic interchange at Glendale Avenue.		Supporting	Service traffic interchange	Keep
I4-1038	New high-capacity traffic interchange at Northern Avenue.		Supporting	Service traffic interchange	Keep
I4-1039	New high-capacity traffic interchange at Dunlap Avenue.		Supporting	Service traffic interchange	Keep
I4-1040	New high-capacity traffic interchange at Peoria Avenue.		Supporting	Service traffic interchange	Keep
I4-1041	New high-capacity traffic interchange at Cactus Road.		Supporting	Service traffic interchange	Keep
I4-1042	New high-capacity traffic interchange at Thunderbird Road.		Supporting	Service traffic interchange	Keep
I4-1043	New high-capacity traffic interchange at Bell Road.		Supporting	Service traffic interchange	Keep
I4-1044	New high-capacity traffic interchange at Union Hills Drive.		Supporting	Service traffic interchange	Keep
I4-1049	High-capacity connections at Thunderbird or a new high-capacity interchange.		Supporting	Service traffic interchange	Keep
I4-1050	High-capacity connections at Bell or a new high-capacity interchange.		Supporting	Service traffic interchange	Keep
I4-1056	Add DHOV to Mountain View.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I4-1057	Add DHOV to Paradise Lane.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I4-1058	Add DHOV to Yorkshire Drive/Utopia Road.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I4-1059	Add DHOV to Union Hills.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep

Table 4-1. Level 1 Screening

Combined Alternative ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening
I4-1060	Add two-lane (choice lane) exit ramps along I-17 southbound at Thomas Road.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I4-1061	Add two-lane (choice lane) exit ramps along I-17 southbound at Camelback Road.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I4-1062	Add two-lane (choice lane) exit ramps along I-17 southbound at Bethany Home Road.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I4-1063	Add two-lane (choice lane) exit ramps along I-17 southbound at Peoria Avenue.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I4-1064	Add two-lane (choice lane) exit ramps along I-17 northbound at Indian School Road.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I4-1065	Add two-lane (choice lane) exit ramps along I-17 northbound at Camelback Road.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I4-1066	Add two-lane (choice lane) exit ramps along I-17 northbound at Bethany Home Road.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I4-1067	Add two-lane (choice lane) exit ramps along I-17 northbound at Peoria Avenue.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
I4-1068	Add two-lane (choice lane) exit ramps along I-17 northbound at Union Hills Drive.	Central Phoenix Transportation Framework Study.	Supporting	Service traffic interchange	Keep
A4-1005	Grade separation of crossroad through movement through I-17 traffic interchanges.		Supporting	Service traffic interchange	Keep
A4-1013	Add HOV lanes on Grand Avenue between I-17 and downtown. Alternative includes a DHOV on I-17 at Grand Avenue to and from the north.	See I4-1004.	Supporting	Service traffic interchange	Keep
I2-1006	Add DHOV to I-10/Southern Avenue.	Issues attributable to proximity to I-10/US-60 DHOV ramp.	Supporting	Service traffic interchange	Keep
I2-1001	Add DHOV to I-10/Arizona Mills.	Issues attributable to proximity to I-10/US-60 traffic interchange.	Supporting	System traffic interchange	Keep
I2-1036	Add two-lane (choice lane) exit ramps along I-10 westbound at Broadway Road.	Central Phoenix Transportation Framework Study.	Supporting	System traffic interchange	Keep
I2-1037	Add two-lane (choice lane) exit ramps along I-10 westbound at SR-143 and 40th Street.	Central Phoenix Transportation Framework Study.	Supporting	System traffic interchange	Keep
S-1035	Make the HOV lanes a time of use managed lane: HOV only during the peak hours and truck/transit only during midday.		Supporting	TDM/TSM	Keep
I2-1014	Freeway rerouting plans on Broadway with way finding (south of Phoenix Sky Harbor International Airport).		Supporting	TDM/TSM	Keep
S-1002	Convert HOV to 3+ occupancy.		Supporting	TDM/TSM	Keep
S-1011	Enforcement of HOV.		Supporting	TDM/TSM	Keep
S-1012	General purpose/HOV restrictions (trucks, recreational vehicles).		Supporting	TDM/TSM	Keep
S-1013	Emphasize carpool/vanpool, incentivize HOV.		Supporting	TDM/TSM	Keep
S-1015	Parking management districts: Increase rates Downtown, amped-up TDM plan.		Supporting	TDM/TSM	Keep
S-1020	Restricted HOV buffer crossover and access points.		Supporting	TDM/TSM	Keep
S-1033	Increase freeway safety patrols.		Supporting	TDM/TSM	Keep
S-1036	End the alternate fuel vehicle HOV program to improve HOV operations.		Supporting	TDM/TSM	Keep
T-1031	Market travel choices to Ahwatukee residents.		Supporting	TDM/TSM	Keep
I1-1009	Integrated transit and freeway between Galveston and Carver.		Supporting	Transit enhancements	Keep
T-1000	Transit priority access on Baseline crossing I-10.		Supporting	Transit enhancements	Keep
T-1001	Limited stopped/more frequent transit between ASU, Tempe and Chandler.		Supporting	Transit enhancements	Keep
T-1002	Limited stopped/more frequent transit between downtown Capitol to Metrocenter, Deer Valley and Anthem.		Supporting	Transit enhancements	Keep
T-1003	Limited stopped/more frequent transit from Ahwatukee to Tempe (all day).		Supporting	Transit enhancements	Keep
T-1004	Limited stopped/more frequent transit from Ahwatukee to Phoenix (all day).		Supporting	Transit enhancements	Keep

Table 4-1. Level 1 Screening

Combined Alternative ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening
T-1010	Improve way finding to park-and-rides.		Supporting	Transit enhancements	Keep
T-1013	Increase peak period/more frequent RAPID/express bus along route.		Supporting	Transit enhancements	Keep
T-1014	New express bus routes.		Supporting	Transit enhancements	Keep
T-1015	Bike lockers with reservation systems at park-and-rides.		Supporting	Transit enhancements	Keep
T-1016	More bicycle capacity on RAPID buses.		Supporting	Transit enhancements	Keep
T-1017	Transit connection with ITS and DMS (real-time transit data).		Supporting	Transit enhancements	Keep
T-1018	Add new park-and-ride just north of SR-101L to relieve Bell Park-and-Ride.		Supporting	Transit enhancements	Keep
T-1020	Add park-and-rides/increased park-and-ride capacity.		Supporting	Transit enhancements	Keep
T-1021	New transit center on northeastern corner of Pecos Stack to serve commuter rail on UPRR spur and BRT on I-10.		Supporting	Transit enhancements	Keep
T-1022	Transit station at 48th Street and Broadway.		Supporting	Transit enhancements	Keep
T-1025	Expand Bell Road Park-and-Ride.		Supporting	Transit enhancements	Keep
T-1026	Move Metrocenter Park-and-Ride on east side of mall.		Supporting	Transit enhancements	Keep
T-1028	Paid park-and-ride incentives for long-term parking and/or add security and shade parking to encourage transit use to go to the airport.		Supporting	Transit enhancements	Keep
T-1029	Retrofit park-and-rides into "mobility hubs" (businesses like cafés, daycares, drycleaners, grocery stores, etc.), explore public-private partnership opportunities.		Supporting	Transit enhancements	Keep
T-1030	Variable transit fare pricing.		Supporting	Transit enhancements	Keep
T-1032	More frequent bus service.		Supporting	Transit enhancements	Keep
S-1029	Create downtown-to-downtown 10-minute headway transit service between all major Valley cities and education centers.		Supporting	Transit enhancements	Keep
S-1022	HOV ramp meter bypass.		Supporting	Transit enhancements	Keep
I4-1051	Develop optimal treatment for bus/HOV bypass lane at Dunlap traffic interchange to access southbound I-17 on-ramp. Near-term issue prior to construction of new DHOV at Mountain View.		Supporting	Transit enhancements	Keep
S-1032	Reverse ramps.	Alternative shifts the weave from mid-mile to under the mile bridges and creates a weave section on the frontage road. Alternative provides substantial on-ramp queuing storage without affecting the cross road, which could benefit dynamic ramp metering strategies.	Supporting	Weaves	Keep
I1-1017	Braid ramp weaves throughout segment.		Supporting	Weaves	Keep
I2-1031	Braid weave northbound I-10 on C-D road between Baseline Road and US-60.		Supporting	Weaves	Keep
I2-1021	Add HOV bypass to SR-202L/SR-101L eastbound to southbound—would alleviate traffic heading to East Valley.	Drop. Outside of the agreed-upon limits of the study.	Backbone	Highway capacity	Drop
I4-1045	Fully depress I-17 between the Stack and the ACDC.	Drop. Does not increase the capacity or improve travel times along the corridor. While the other alternatives may implement this alternative on sections of I-17, this alternative by itself does not contribute to addressing the purpose and need. Therefore, this alternative will not be further analyzed in the Level 2 screening.	Backbone	Highway capacity	Drop

Table 4-1. Level 1 Screening

Combined Alternative ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening
S-1019	Reversible/zipper lanes/reversible BRT lane.	Drop. Not reasonable or effective relative to cost as directional volumes are not that pronounced as time progresses so operational benefits would be minimal on the Interstate. This alternative for arterial streets is preserved in alternatives A1-1050, A2-1059, T-1026 and A3-1006. Therefore, this alternative will not be further analyzed in Level 2 screening.	Backbone	Highway capacity	Drop
I1-1005	Widen I-10 (beyond near-term widening).	Duplicate alternative. Addressed more specifically in alternatives S-1003 and S-1004. Therefore, this alternative will not be evaluated in the Level 2 screening.	Backbone	Highway capacity	Drop
I2-1019	Convert I-10 at Broadway Curve to a toll road.	Drop. Contrary to current federal regulation. The current surface transportation act has limited Interstate to toll conversions to three selected test corridors, and all three projects have already been defined.	Backbone	Highway capacity	Drop
I2-1022	Add HOV lane eastbound/westbound I-10 for a total of two lanes.	Drop. Addressed in S-1001. Outbound being studied now.	Backbone	Highway capacity	Drop
I2-1027	Reroute all HOV/managed lanes from I-10 between US-60 and I-17 (the overlap) by routing HOVs down Baseline, Broadway or Southern down 24th Street.	Drop. By rerouting HOV traffic down Baseline, Broadway or Southern, HOV travel times have a high probability of increasing compared with the no-build because of the arterial and traffic signal environment. As a result, HOV traffic would not use this route, making this strategy infeasible. In addition, not clear how this system would interconnect to I-10 at 24th Street when considering the FAA airspace issues at the Split interchange.	Backbone	Highway capacity	Drop
I2-1028	Reroute all HOV/managed lanes from I-10 between US-60 and I-17 (the overlap) by routing HOVs up SR-143 to SR-202L.	Drop. Would not reasonably reduce congestion or improve mobility for the region. This concept essentially relocates the current I-10 "overlap" to SR-202L, creating a new overlap section on that route instead.	Backbone	Highway capacity	Drop
I3-1001	Auxiliary lanes.	Included in no build. Near-term improvements, which are assumed to be in the no build option, include auxiliary lanes from 16th Street to 19th Avenue. Therefore, this alternative will not be further analyzed in Level 2 screening. North-south I-17 section is addressed in I3-1014.	Backbone	Highway capacity	Drop
I3-1017	Figuring out the hub – I-17 around Durango Curve (cannot expand in tunnel).	Duplicate and not specific alternative. Alternative does not offer enough specifics to assess. Other alternatives capture specific alternatives that can be assessed in the Level 2 screening (I3-1001, I3-1002, I4-1002, etc.). Therefore, this alternative will not be further analyzed in Level 2 screening.	Backbone	Highway capacity	Drop
I4-1012	Depress freeway main line and cantilever frontage roads over I-17.	Drop. The high order of magnitude cost and complexity of construction relative to the potential congestion reduction benefits are not in line with each other. Furthermore, the existing ramp functions would have to be replaced to retain current mobility, but cantilevered frontage roads make this next to impossible, geometrically, to accomplish. If some solution were possible, costs associated with doing this would be extreme, further diminishing any potential congestion reduction benefits.	Backbone	Highway capacity	Drop
I4-1013	Convert I-17 to 2-mile ramp spacing.	Drop. Not consistent with local jurisdictions' land use and transportation plans. This alternative would overwhelm the remaining on and off ramps and connecting arterial traffic interchanges, resulting in significant queuing.	Backbone	Highway capacity	Drop
I4-1014	Double deck I-17.	Drop. Unacceptable environmental impacts and extremely high order of magnitude cost and complexity of construction relative to the potential benefits realized.	Backbone	Highway capacity	Drop
I4-1022	Turn frontage roads into local roads.	Drop. Frontage roads between ramp gores are already City of Phoenix-owned roads today.	Backbone	Highway capacity	Drop
I4-1046	Convert west side I-17 frontage roads to multimodal mall (between Metrocenter and Happy Valley) – like 16th Street mall in Denver.	Drop. Does not address the study's purpose and need of reducing congestion and improving travel time reliability in the corridor.	Backbone	Highway capacity	Drop
I2-1020	Take I-10 HOV and US-60 HOV to new separate four-lane HOV express/bypass or new ROW. Follow US-60 to Western Canal to Salt River Project power line along 46th Street to SR-143 to new Durango Parkway/Rio Salado and to SR-202L into I-10.	Drop. Unreasonable and unacceptable environmental consequences.	Backbone	New route	Drop

Table 4-1. Level 1 Screening

Combined Alternative ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening
I3-1002	Relocate entire east-west I-17 segment to the south along the Salt River. Possibly integrate with an extended SR-30. Reconstruct existing east-west I-17 segment as an at-grade parkway/arterial.	Drop. This concept does appear to have merit as part of a larger regional mobility solution, but it does not meaningfully address this study's purpose and need and would likely not be feasible to implement within the study's time horizon. Because there is value in this concept for the region as a whole, this study recommends that MAG study this concept further to test how effective this concept is in relieving regional significant routes, most notably the I-10 inner loop and I-10 West (Papago Freeway). In addition, other community benefits may present themselves, such as restoration of the Salt River, and urban renewal through south central Phoenix.	Backbone	New route	Drop
I3-1003	Move I-17 east-to-west section to Buckeye.	Drop. Unreasonable and unacceptable environmental consequences. Major impacts on downtown Phoenix neighborhoods and Title VI of the Civil Rights Act of 1964 [Title VI] /environmental justice (EJ) communities.	Backbone	New route	Drop
I3-1013	North and South Marum Park. Convert 27th Avenue to the southbound general purpose lanes of I-17 from Dunlap to Durango "T". Retain HOV facilities on I-17 and provide 2 HOV each direction. Repurpose areas between 23rd Avenue and I-17 as a linear urban park.	Drop. Unreasonable and unacceptable environmental consequences. Substantial and disproportionate impacts on Title VI/EJ communities and neighborhoods. Likely Section 4(f) of the Department of Transportation Act of 1966 [Section 4(f)] impacts also, and impacts on the cemetery in the southwestern quadrant of the Stack. Finally, reconstruction of the Stack would be required, further increasing the level of impacts in that immediate area.	Backbone	New route	Drop
A3-1011	Punch through South Mountain.	Drop. Unreasonable and unacceptable environmental consequences. South Mountain park is a known Section 4(f) resource, and since alternatives exist to avoid affecting this resource, a Section 4(f) take would not be feasible.	Backbone	New route	Drop
A2-1000	Extend US-60 west to become Baseline Road and upgrade Baseline to limited access (after US-60 is extended into Baseline).	Drop. Substantial and unacceptable environmental impacts, especially related to community impacts, business access and land use compatibility.	Backbone	New route	Drop
S-1025	System-wide commuter rail.	Drop. Not feasible to implement within the timeframe of this study. Furthermore, various commuter rail studies around the Valley have been completed, so there is no need to redo that work.	Backbone	New transit	Drop
T-1006	High-capacity transit to Metrocenter.	Included in no build. Near-term improvements, which are assumed to be in the no build option, include high capacity to Metrocenter. Therefore, this alternative will not be further analyzed Level 2 screening.	Backbone	New transit	Drop
T-1012	Use Washington/Jefferson as transit corridor.	Drop. Washington and Jefferson are already a transit corridor east of downtown and are planned to become a transit corridor west of downtown to access I-10 west of the Stack. This alternative does not directly address increased capacity, travel time, travel time reliability or increased mobility on the Spine corridor. Elements of this alternative will be included in other alternatives that will be analyzed in Level 2; therefore, this alternative will be further analyzed in Level 2 screening.	Backbone	New transit	Drop
I2-1002	Add DHOV to SR-101L/US-60.	Drop. Outside of agreed-upon study limits. Pass concept to MAG.	Backbone	System traffic interchange	Drop
I2-1007	Add DHOV to SR-202L/SR-101L.	Drop. Outside of agreed-upon study limits. Pass concept to MAG.	Backbone	System traffic interchange	Drop
I2-1011	Depressing system ramps near Phoenix Sky Harbor International Airport.	Drop. This concept was studied during the previous I-10 study and was not found to be feasible because of changed FAA guidance. The Runway Protection Zone is a ground footprint issue and not an airspace issue and a section of the I-10 westbound main line falls within the Runway Protection Zone; therefore, the Stack issue will not be fixed by only depressing the system ramps.	Backbone	System traffic interchange	Drop
I2-1025	Grade-separate northbound SR-143/I-10/US-60 westbound to remove merge/weave.	Drop. Addressed with the I-10 Broadway Curve Near-term improvements.	Backbone	System traffic interchange	Drop
ITS-1000	Verify ITS infrastructure along I-10.	Drop. ITS will be analyzed as part of the backbone alternatives; however, this is not an alternative that can be analyzed in a Level 2 screening. The NAR has been verified to be correct.	Backbone	Technology	Drop

Table 4-1. Level 1 Screening

Combined Alternative ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening
ITS-1013	Variable speed limit signs between bars, restaurants (Friday night to Sunday morning) to reduce crashes.	Drop. This alternative does not increase capacity or improve travel time or travel time reliability.	Backbone	Technology	Drop
S-1014	Direct HOV-freeway/freeway, arterial/freeway.	Duplicate. General comment. Each of the possible DHOV locations has been identified in the list of alternatives under service traffic interchanges, so that they can be analyzed in the Level 2 screening based on their individual merits.	Backbone/ Supporting	System traffic interchange/Service traffic interchange	Drop
A1-1000	Fund access management plan for high traffic generators (Arizona Mills and Wild Horse Pass Casino); consider remote parking and shuttle access.	Drop. Would not reasonably reduce congestion or improve mobility relative to cost. Remote parking and shuttle service would detract from these destinations, negatively affecting commerce, economic growth and capital investments. Consequently, trip generation cannot be notably altered, thus access to these sites could not be dramatically changed.	Supporting	Arterial modifications	Drop
A1-1003	Parallel corridor reconfiguration. Create parallel and continuous I-10 route on Priest (Avenida del Yaqui).	Drop. This would have substantial and unacceptable environmental impacts on the downtown Guadalupe community because of EJ and Title VI issues.	Supporting	Arterial modifications	Drop
A2-1007	Phoenix Sky Harbor International Airport zone transportation analysis (and ASU and Arizona Mills and layering effect).	Drop. Not a specific-enough alternative to assess.	Supporting	Arterial modifications	Drop
A3-1006	Convert 19th Avenue to an Arizona parkway with indirect left design.	Drop. Arizona parkway is intended to be a high-capacity arterial for vehicles. 19th Avenue is intended to focus on transit-oriented development and use and emphasize nonmotorized transportation modes.	Supporting	Arterial modifications	Drop
A3-1010	Consider reducing capacity on 35th Avenue to create multiuse corridor (with reduced lane widths and bicycle lanes).	Drop. Not reasonably effective in meeting purpose and need because it would decrease the capacity of all vehicular modes of traffic and negatively affect travel times and increase duration of congestion.	Supporting	Arterial modifications	Drop
A3-1012	19th and 35th avenues – need better operations to support I-17.	Duplicate and not specific alternative. Alternative does not offer enough specifics to assess. Other alternatives (I3-1022, ITS-1006, ITS-1011, S-1001, S-1002, A3-1001, A3-1002, A3-1003, A3-1005, A3-1006) capture specific alternatives that can be assessed in the Level 2 screening. Therefore, this alternative will not be further analyzed in Level 2 screening.	Supporting	Arterial modifications	Drop
A1-1005	Enhance bicycle infrastructure on parallel arterials and encourage use of mid-mile streets.	Duplicate and not specific alternative. Alternative does not offer enough specifics to assess. Other alternatives (A4-1015, A4-1016, A4-1017, A4-1018, A4-1019, A4-1020, BP-1005, BP-1006, BP-1011, BP-1013, BP-1014) capture specific alternatives that can be assessed in the Level 2 screening. Therefore, this alternative will not be further analyzed in Level 2 screening.	Supporting	Bicycle/Pedestrian	Drop
BP-1036	Bicycle/Pedestrian crossing at I-10 along Alameda Drive.	Included in no build. Alameda pedestrian bridge will be built with the I-10 Broadway Curve Near-Term Improvements.	Supporting	Bicycle/Pedestrian	Drop
BP-1030	Bicycle/Pedestrian crossing at Guadalupe.	Included in no build. Guadalupe pedestrian bridge will be built with the I-10 Broadway Curve Near-Term Improvements.	Supporting	Bicycle/Pedestrian	Drop
I1-1006	Move ASU campus to Casa Grande.	Drop. Not reasonably feasible to implement and would not address purpose and need.	Supporting	Policy	Drop
I2-1009	Elongate (lengthen) Baseline Road bridge.	Drop. Assume “elongate” means to lengthen, which would require a full replacement of the I-10/Baseline Road bridge. If required, would be addressed in alternatives I1-1015 and I1-1016.	Supporting	Service traffic interchange	Drop
I4-1009	Consider converting single-occupancy vehicle traffic interchanges to DHOV traffic interchanges.	Drop. Does not improve corridors’ interconnections and would negatively affect commerce, economic growth and capital investment.	Supporting	Service traffic interchange	Drop
A1-1008	Connect Southern southbound to I-10 frontage roads (relieve Baseline).	Drop. Not reasonable or effective relative to cost. Frontage roads along I-10 north of Baseline are not feasible without major reconstruction of the I-10/US-60 interchange.	Supporting	Service traffic interchange	Drop
S-1028	Incentivize local travel with tax credits/incentives.	Drop. Does not meet purpose and need, tax credits have not been proven to improve traffic congestion	Supporting	TDM/TSM	Drop
S-1027	Convert Interstate to a toll road.	Drop. Does not meet purpose and need, toll conversion have not been proven to improve traffic congestion.	Supporting	TDM/TSM	Drop

Table 4-1. Level 1 Screening

Combined Alternative ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening
ITS-1002	Drone surveillance.	Drop. Does not reasonably address the purpose and need.	Supporting	TDM/TSM	Drop
S-1009	Add truck-only lanes to the arterial corridors of interest.	Drop. Not reasonably effective in meeting purpose and need since most of the corridors of interest do not have truck volumes that warrant special truck treatment.	Supporting	TDM/TSM	Drop
S-1017	Infill development in employment centers to reduce vehicle miles traveled (VMT).	Drop. MAG does not have the authority to control land use plans. This is the responsibility of the local jurisdictions, making it outside the scope of the Spine study.	Supporting	TDM/TSM	Drop
S-1024	Bring back photo radar on freeway systems.	Drop. Contrary to state policy and could not be effectively implemented with the current environment.	Supporting	TDM/TSM	Drop
S-1026	Educate motorists on insurance laws by providing flyers in Motor Vehicle Division renewals.	Drop. Not responsive to purpose and need because having or not having automobile insurance does not address the goals of the Spine study.	Supporting	TDM/TSM	Drop
I2-1008	Close/Relocate shipping operations from Phoenix Sky Harbor International Airport to Mesa Gateway.	Drop. Outside of the scope of the Spine study. In addition, this concept is not consistent with Sky Harbor's plans and would significantly affect the operations of several businesses that operate out of Phoenix Sky Harbor International Airport and that use the airport's central city location as a cargo hub.	Supporting	TDM/TSM	Drop
I2-1015	Separate truck detour routes from Broadway Curve.	Drop. Not a specific alternative, and no obvious solution is apparent.	Supporting	TDM/TSM	Drop
I3-1012	Restrict trucks from I-10 inner loop. Make I-10 inner loop a state highway.	Drop. Not reasonably feasible to fully implement. Would overstress system traffic interchange ramps at the Stack. Furthermore, some trucks would have origin or destinations more adequately served by the I-10 inner loop.	Supporting	TDM/TSM	Drop
A3-1009	Land uses of 35th Avenue and emerging land uses on 19th Avenue do not accommodate moving trips off of I-17.	Drop. Observation not an alternative. Will consider during alternative evaluation.	Supporting	TDM/TSM	Drop
T-1023	Light rail transit crossing along Mountain View alignment at Metrocenter.	Included in no build. Light rail transit crossing at Mountain View alignment at Metrocenter will be built with the I-10 Broadway Curve Near-Term Improvements.	Supporting	Transit enhancements	Drop
T-1024	Valley Metro is working on a project definition study for Phoenix West/Central Glendale corridor. Potential locations to cross I-17 include Camelback (north side) and Glendale Avenue.	Drop. Not an alternative. For information. Will coordinate with Valley Metro.	Supporting	Transit enhancements	Drop
S-1030	Performance measures of effectiveness (MOEs) of existing systems.	Drop. Not a specific enough comment to assess. Performance measures are current policy for evaluating the corridors.	Supporting	TDM/TSM	Drop
S-1018	Increased local funding for operations management and maintenance.	Drop as an alternative; however, recommend a separate study be performed to inform future funding initiatives. In addition, certain Spine recommendations may include an operations and maintenance funding component if it is critical to achieving the purpose and need.			Drop
I1-1007	Expand project limits to Queen Creek Road.	Drop. Falls far outside of the agreed-upon project limits.			Drop
I2-1017	Do nothing. See how South Mountain and/or near-term improvements will help.	Drop. This is part of the definition of the no build alternative. Drop as a build alternative.			Drop
I4-1010	Architectural treatment to I-17 (make more desirable to drive).	Parking lot. This alternative may be part of a larger solution but does not address purpose and need on its own as it does not increase capacity, improve travel time or mobility or promote economic growth.			Drop
I3-1015	Ask FCDMC how to get rid of Cave Creek Wash at I-17.	Drop. Not reasonably effective in meeting purpose and need.			Drop

4.3 Level 2 Screening

Of the original 349 alternatives from the Alternatives Development Workshop, 286 alternatives passed the Level 1 fatal flaw screening. Of the 286 alternatives, 92 were classified as backbone alternatives and 194 were classified as supporting alternatives.

The Management Partners and AEP developed guiding principles from which criteria would be developed for evaluating alternatives. Initially, four guiding principles (Figure 4-2) were developed and presented to the MAG Transportation Policy Committee. The committee approved the Spine guiding principles, and the fifth guiding principle of “Support Sustainability” was added for developing the evaluation criteria.

Figure 4-2. Guiding Principles for Alternatives



Once the Transportation Policy Committee approved the guiding principles, the Management Partners and AEP developed 19 criteria to evaluate projects across the five guiding principles. The evaluation criteria and associated guiding principles are shown in Table 4-2. These criteria were agreed upon at the AEP meeting on December 21, 2015. The Management Partners and AEP also prioritized and weighted the criteria with a paired comparison exercise. To streamline the Spine study process, it was decided to use the top 11 prioritized criteria, which accounted for 86.6 percent of the weighted evaluation.

Table 4-2. Level 2 Principles and Evaluation Criteria

Optimize	Expand/Modernize	Support Sustainability	Perform	Implement												
Use what is available before making any major physical improvement by engaging technology and practical design criteria.	Upgrade the transportation system to address the growth in trips and congestion beyond what system optimization can provide.	Propose improvements that protect, improve, enhance or restore the natural and built environment, emphasize energy efficiency and minimize life cycle costs.	Focus on meeting the demand for trips between the I-10/I-17 travel markets and system reliability for all travel choices.	Craft alternatives based on bundling principles that will meet service and performance criteria of a reliable I-10/I-17 corridor system.												
Enhances Existing System Utilization	Enhances Safety	Replaces Deficient Infrastructure	Improves Capacity (v/c)	Involves New ROW	Addresses Geometric Feasibility	Preserves the System	Addresses Community/Livability Factors	Protects Natural and Built Environments	Ensures Land Use Compatibility	Reduces Congestion Duration	Improves Travel Time (VMT/VHT)	Improves Travel Time Reliability	Receives Agency Support	Undergoes Benefit-Cost Analysis	Demonstrates Alternative Adaptability	Provides Programming Flexibility

The Level 2 screening was performed at MAG on April 14, 2016. The alternatives were then evaluated in a two-step process. A two-step evaluation process was used for the Level 2 screening, so that only viable backbone alternatives would be evaluated for implementation.

The first step, Level 2A, evaluated all of the alternatives that passed Level 1 screening based on criteria that fell under the guiding principles of Optimize, Perform, Expand/Modernize and Sustainability. All supporting alternatives that survived the Level 2A screening and backbone alternatives not classified as pure alternatives were placed in the “parking lot” and did not require the Level 2B evaluation.

The backbone alternatives that survived the Level 2A screening and were classified as pure alternatives were evaluated in Level 2B against the criteria under the Implement guiding principle.

4.3.1 Level 2A Screening

In Level 2A, the 92 backbone alternatives and 194 supporting alternatives were evaluated by the Management Partners based on the criteria outlined in Table 4-3. The alternatives were rated using a 5-point system, with 1 representing the worst performing and 5 representing the best performing, according to how the alternatives performed against the criteria.

Table 4-3. Level 2A Evaluation Criteria

Criteria	(1) Lower Score		Higher Score (5)	Summary
<i>Optimize: Enhances Existing System Utilization (18.5%)</i> Enhances, but does not expand on, existing infrastructure.	Alternative worsens the utilization of the existing system or necessitates expansion of system.	Alternative results in utilization comparable to "no build."	Alternative increases performance and utilization of existing system infrastructure.	Technological-based alternatives do well.
<i>Optimize: Enhances Safety (8.2%)</i> Ability of the alternative to enhance system safety.	Alternative compromises safety of users.	Alternative's impact on safety is comparable to "no build."	Alternative improves safety for users.	Alternatives that remedy known safety concerns do well.
<i>Perform: Improves Travel Time Reliability (7.8%)</i> Alternative's overall effect on the corridor's ability to move between two destinations.	Alternative substantially decreases travel time reliability compared to "no build."	Alternative is comparable to "no build" travel time reliability, assuming near-term improvements are in place.	Alternative substantially increases travel time reliability compared to "no build."	Alternatives that add capacity or resolve system conflicts (e.g., sight lines, accident areas) do well.
<i>Expand/Modernize: Replaces Deficient Infrastructure (4.6%)</i> Alternative's ability to improve or replace existing deficient infrastructure.	Alternative ignores infrastructure deficiencies and maintenance.	Alternative includes basic maintenance and is comparable to "no build."	Alternative replaces or fully rehabilitates outdated or deficient infrastructure.	Alternatives that replace or fully rehabilitate deficient infrastructure do well.
<i>Perform: Reduces Congestion Duration (4.4%)</i> Alternative's effect on congestion in 2040.	Alternative substantially increases the duration of congestion compared to "no build."	Alternative is comparable to "no build" effect on congestion duration, assuming near-term improvements are in place.	Alternative substantially reduces the duration of congestion compared to "no build."	Alternatives that measurably add capacity or resolve congestion-related conflicts (e.g., weaves, incident management) do well.
<i>Perform: Improves Travel Time (4.4%)</i> Alternative's effect to improve travel time across all modes.	Alternative substantially increases travel time as compared to "no build."	Alternative is comparable to "no build" effect on travel time, assuming near-term improvements are in place.	Alternative substantially decreases travel time as compared to "no build."	Alternatives that improve travel time in more than one mode do well.
<i>Sustainability: Disproportionate Impacts on Title VI, EJ Communities; Livability Factors (5.3%)</i> Disproportionally affects Title VI and EJ communities or negatively affects livability for neighboring communities.	Alternative disproportionately affects Title VI or EJ communities, or negatively affects adjacent communities relative to "no build."	Alternative is comparable to "no build," assuming near-term improvements are in place.	Alternative improves or has the ability to improve Title VI or EJ communities, or enhances adjacent communities relative to "no build."	Alternatives that are transit-based or improve modal choice do well.

Alternatives were then placed into one of the recommendation categories shown in Table 4-4. Alternatives were dropped only if fatal flaws were found during the Level 2 quantitative analysis. All surviving supporting alternatives from the Level 2A analysis were put in the parking lot (see Figure 4-2) to be evaluated as value-added components once the backbone alternatives had been evaluated. The surviving backbone alternatives were either carried forward to the Level 2B screening or added to the parking lot if they would not work as an overall backbone alternative.

MAG and ADOT scored and categorized all of the backbone and supporting alternatives in Level 2A. Once the scoring and categorization was completed, the Management Partners reviewed the Level 2A screening.

Table 4-4. Level 2A Recommendation Categories

Recommendation	Comment/Notes
Alternative	Reflects the backbone or core alternative concepts.
Alternative Feature	Reflects an element or feature to be added to or considered as part of a backbone/core alternative(s).
Impact Remedy	Reflects elements or concepts that can be considered as an alternative implementation impact remedy.
Policy Option	Reflects concepts that can be considered upon an agency policy change or legislative solution.
Study Option	Reflects concepts that can be considered upon further study.
Parking Lot	Reflects all concepts classified as an alternative feature, impact remedy, policy option or study option. Parking lot ideas will not receive any further analysis in Level 2B or Level 3 screening and will be revisited once the preferred alternative is selected.
Underway	Reflects concepts that are already being implemented and therefore exempt from future consideration.
Drop	Reflects concepts that are recommended to be eliminated from further consideration.

Nine backbone alternatives were carried forward to the next level of screening. See Tables 4-5 and 4-6 for the detailed Level 2A analysis. Table 4-7 documents the justification for the Level 2A scoring.

Table 4-5. Level 2A Screening – Backbone

Row No.	Category	Alt. ID	Weights:								Weighted Score	2A Rank	Recommendation	Notes/Comments
			0.185	0.082	0.078	0.046	0.044	0.044	0.053	Description				
			Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities					
1	Highway capacity	S-1000	Construct HOT lanes or convert HOV to HOT lanes (at grade or elevated). Rated as converted only.	4	3	5	3	3	3	3	3.641	22	Alternative	Consider as an overall backbone alternative.
2	Highway capacity	S-1038	Create a striped express/local lane system.	4	3	4	3	3	3	3	3.494	25	Alternative	Consider as an overall backbone alternative.
3	Highway capacity	I4-1000	Widen I-17 to full design standards (12-foot lanes and full shoulders).	2	5	4	4	3	4	2	3.177	31	Alternative	Consider as an overall backbone alternative.
4	Highway capacity	I3-1004	Replace I-17 in kind with current standards to replace the aging infrastructure. Will redesign to reflect the high truck percentages in this segment corridor.	2	3	4	5	3	2	3	2.889	37	Alternative	Merge with number 18 as an overall backbone alternative.
5	Highway capacity	S-1037	Add a second 2+ HOV lane with extra wide inside shoulders (16-foot) for enforcement purposes and to provide the necessary width for future managed lanes conversion.	1	5	5	3	4	3	2	2.889	37	Alternative	The 16-foot inside median design requires additional pavement that does not necessarily improve travel time; however, it does enhance safety and improve travel time reliability. Carry to the Level 2B screening.
6	Highway capacity	S-1001	Add a second 2+ HOV lane.	1	3	5	3	4	3	2	2.581	57	Alternative	Would not significantly improve travel time or travel time reliability for all users but would improve travel time and travel time reliability for HOV users. Carry to Level 2B screening.
7	Highway capacity	S-1008	Add truck-only lanes to the Interstate. Rated as an add lane.	1	4	3	3	3	3	3	2.459	68	Alternative	Poor score; commercial vehicle volumes do not warrant the need for separate lanes throughout the entire corridor. Requires additional lane as it is not a HOV lane conversion. Carry to Level 2B screening.
8	Highway capacity	S-1010	Add bus/BRT-only lanes to the Interstate, heavily using park-and-rides. Rated as an add lane.	1	3	3	3	3	3	4	2.404	76	Alternative	Poor score; public transportation demand does not warrant the need for separate lanes throughout the entire corridor. Requires additional lane as it is not a HOV lane conversion. Carry to Level 2B screening.
9	Highway capacity	I4-1018	Begin a "visual" transition of the ROW/lane widths to prepare drivers for transition to depressed roadway section.	4	4	4	3	3	3	3	3.648	21	Alternative Feature	Design-specific; add as a global recommendation for the design development phase of the project.
10	Highway capacity	I4-1006	Revise merge points on frontage roads (potential for X-ramps).	4	4	3	3	3	3	3	3.502	24	Alternative Feature	Consider as an overall backbone alternative feature.

Table 4-5. Level 2A Screening – Backbone

Row No.	Category	Alt. ID	Weights:								Weighted Score	2A Rank	Recommendation	Notes/Comments
			0.185	0.082	0.078	0.046	0.044	0.044	0.053	Description				
			Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities					
11	Highway capacity	S-1021	Hard shoulder running.	5	1	3	3	3	3	3	3.387	28	Alternative Feature	Hard shoulder running works well on freeway corridors without auxiliary lanes. Presently, 81% of the corridor mileage has auxiliary lanes, making this concept difficult to implement.
12	Highway capacity	I4-1011	Flatten S-curve near Metrocenter. Evaluate vertical profile; develop crash map to find cause of accidents.	2	4	4	5	3	3	3	3.126	33	Alternative Feature	Design-specific; add to all build alternatives for improving safety along this portion of I-17.
13	Highway capacity	I4-1015	Where I-17 frontage roads are more than one lane, reduce the frontage road to one lane to widen I-17.	2	2	3	3	4	3	3	2.581	57	Alternative Feature	Poor score; reduces effectiveness of the overall frontage road system, creates access issues on and off of the Interstate, and would push more vehicles onto I-17.
14	Highway capacity	I1-1018	C-D roads between Pecos Stack and US-60.	1	4	4	3	4	4	1	2.571	59	Alternative Feature	Poor score; concept has a high disproportionate impact on Title VI and EJ communities and is not warranted for better operations along most of that segment of I-10.
15	Highway capacity	I3-1018	Extend HOV lanes throughout entire I-17.	1	4	3	3	4	3	3	2.541	61	Alternative Feature	Recommended in the MAG RTP; incorporate into alternative other than no-build.
16	Highway capacity	I4-1002	Extend HOV lanes through the Stack interchange.	1	4	3	3	4	3	3	2.541	61	Alternative Feature	Recommended in the MAG RTP; incorporate into alternative other than no-build.
17	Highway capacity	I4-1003	Eliminate frontage roads to widen I-17 within existing ROW. Will require buying out properties that lose access if frontage road provided only access point.	2	2	3	3	4	3	2	2.481	67	Drop	Poor score; eliminates access to many businesses, disproportionate impacts on Title VI and EJ communities, creates access issues on and off of the Interstate at the interchanges, and would push more vehicles onto I-17.
18	Highway capacity	I2-1023	Reevaluate the 1988 C-D system plan, which was a smaller footprint than the EIS terminated recently. Potentially review 1988 plan to route C-D roads south of the Split to connect with I-17 and avoid Phoenix Sky Harbor International Airport issues. Limit trucks to local lane section of C-D system.	1	2	4	5	4	4	1	2.436	73	Drop	Poor score; Part of the concept is being implemented through the near-term improvements (Broadway Curve Project) and the remainder of the concept has a high disproportionate impact on Title VI and EJ communities.

Table 4-5. Level 2A Screening – Backbone

Row No.	Category	Alt. ID	Weights:								Weighted Score	2A Rank	Recommendation	Notes/Comments
			0.185	0.082	0.078	0.046	0.044	0.044	0.053	Description				
			Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities					
19	Highway capacity	S-1004	Add two additional general purpose lanes in each direction to Interstate.	1	3	4	3	4	4	1	2.417	74	Drop	Poor score; considerable impacts to land uses along I-17; two additional lanes do not enhance existing system utilization, would require the replacement of existing infrastructure that is not deficient and have disproportionate impacts on EJ and Title VI communities..
20	Highway capacity	S-1005	Add three or more additional general purpose lanes in each direction to Interstate.	1	2	5	3	4	4	1	2.410	75	Drop	Poor score; considerable impacts to land uses along I-17; two additional lanes do not enhance existing system utilization, would require the replacement of existing infrastructure that is not deficient and have disproportionate impacts on EJ and Title VI communities..
21	Highway capacity	I2-1033	Restore HOV balance.	1	4	3	3	4	3	3	2.541	61	Impact Remedy	Incorporate, if appropriate, after the backbone recommendation is made for the overall corridor master plan.
22	Highway capacity	I1-1027	Create a frontage road system for I-10 between Elliot and Baseline roads for system redundancy.	1	4	3	3	3	3	3	2.459	68	Impact Remedy	Incorporate, if appropriate, within the existing ROW, after the backbone recommendation is made for the overall corridor master plan.
23	Highway capacity	S-1003	Add one additional general purpose lane in each direction to Interstate.	1	3	3	3	4	3	3	2.387	80	Alternative	Similar to add second +2 HOV lane (S-1001) with different operational results. Carry forward as a parallel alternative.
24	Highway capacity	I4-1004	Add frontage roads lanes/capacity.	1	3	3	3	3	3	2	2.205	86	Impact Remedy	Incorporate, if appropriate, after the backbone recommendation is made for the overall corridor master plan.
25	Highway capacity	I1-1008	Frontage roads between Pecos Stack and US-60.	1	3	3	3	3	3	1	2.105	87	Impact Remedy	Incorporate, if appropriate, within the existing ROW, after the backbone recommendation is made for the overall corridor master plan.
26	Highway capacity	I1-1010	Free express lanes from SR-202L to Broadway Curve.	3	3	4	3	3	3	3	3.147	32	Merge with Concept 8	Merge with concept 8 as an overall backbone alternative. (No shoulders are assumed.)
27	Highway capacity	S-1031	Create barrier-separated express/local lane system.	2	4	4	3	4	4	3	3.118	34	Merge with Concept 8	Can evaluate at the same time as concept 8 (striped express/local lane system)
28	Highway capacity	I4-1053	Access management plans/frontage road system.	5	5	3	3	3	3	2	3.904	15	Policy Option	Design-specific; add as a global policy recommendation for the design development phase of the project.

Table 4-5. Level 2A Screening – Backbone

Row No.	Category	Alt. ID	Weights:								Weighted Score	2A Rank	Recommendation	Notes/Comments
			0.185	0.082	0.078	0.046	0.044	0.044	0.053	Description				
			Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities					
29	Highway capacity	I3-1000	Access management for north-to-south frontage roads.	5	5	3	3	3	3	2	3.904	15	Policy Option	Design-specific; add as a global policy recommendation for the design development phase of the project.
30	Highway capacity	I4-1005	Limit frontage road access.	5	4	3	3	3	3	2	3.750	17	Policy Option	Design-specific; add as a global policy recommendation for the design development phase of the project.
31	Highway capacity	I2-1032	Get rid of the eastbound C-D pinch point at Fairmont. May require one more southbound I-10 lane.								-	88	Underway	Will be addressed during the near-term improvement strategy.
32	New transit	T-1019	Express bus from Pecos park-and-ride to ASU.	5	3	3	3	3	3	3	3.695	19	Alternative Feature	Design-specific; add to all build alternatives as background for alternative evaluation.
33	New transit	A1-1009	Reconfigure/Repurpose UPRR spur line for transit purposes, buy out industrial land uses that use it.	4	3	3	3	3	3	4	3.447	26	Alternative Feature	Poor score; takes away an economic base in the southern portions of Tempe.
34	New transit	S-1039	Heavy transit rail within Interstate ROW for the length of the Spine corridor.	1	3	4	3	4	4	5	2.816	46	Alternative Feature	Poor score; does not enhance existing system utilization; would improve travel times for rail users; it is cost-prohibitive.
35	New transit	A2-1018	Extend light rail from Central Avenue to Arizona Mills along the Western Canal.	1	4	3	3	3	3	5	2.658	56	Alternative Feature	Enhances light rail safety by keeping the light rail corridor outside of the roadway corridor; would serve Title VI and EJ communities.
36	New transit	A2-1017	Build automated guideway transit on 48th Street/SR-143 from Southern Avenue to Sky Harbor Boulevard.	1	3	3	3	3	3	5	2.504	64	Alternative Feature	Poor score; high cost; Sky Train is a system intended for Phoenix Sky Harbor International Airport use only. A new line to serve outside the airport use would minimize its envisioned overall operation.
37	New transit	A1-1004	Extend streetcar to Arizona Mills mall and beyond Wild Horse.	1	2	3	3	3	3	5	2.350	82	Drop	Poor score; high cost; does not fit into Tempe's overall plans for high-capacity transit per Tempe's <i>General Plan</i> ; not a high travel demand for this concept.
38	New transit	A2-1015	Exclusive guideway transit: Southern Avenue/Central Phoenix – Phoenix Central Business District to Rural Road.	1	3	4	3	4	4	5	2.816	46	Drop	Low score; potential spot improvement; will pass along for transit planning efforts between Phoenix and Tempe.
39	New transit	S-1010	Add bus/BRT-only lanes to the arterial corridors of interest.	1	3	4	3	4	4	4	2.716	49	Drop	Low score; recommendation is too broad to consider as the corridors of interest are not identified. Phoenix is evaluating arterials within the Spine study area for BRT through T2050.

Table 4-5. Level 2A Screening – Backbone

Row No.	Category	Alt. ID	Weights:								Weighted Score	2A Rank	Recommendation	Notes/Comments
			0.185	0.082	0.078	0.046	0.044	0.044	0.053	Description				
			Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities					
40	New transit	T-1011	Reversible bus lane on Broadway from 52nd Street to Central Avenue	1	2	3	3	3	3	5	2.350	82	Drop	Low score; potential spot improvement; will pass along for transit planning efforts between Phoenix and Tempe.
41	New transit	I4-1017	Reconsider commuter rail services on Grand Avenue to Central Business District.	1	3	3	3	3	3	5	2.504	64	Study Option	Commuter rail planning along this corridor is under consideration.
42	New transit	T-1008	High-capacity transit from Metrocenter to north.	1	3	3	3	3	3	5	2.504	64	Study Option	Planning for the ASU West light rail transit extension is under study.
43	New transit	T-1027	ASU West potential light rail extensions from Metrocenter.	1	3	3	3	3	3	4	2.404	76	Study Option	Planning for the ASU West light rail transit extension is under study.
44	New transit	T-1009	High-capacity transit from Tempe to south.	1	3	3	3	3	3	4	2.404	76	Study Option	Commuter rail planning along this corridor is under consideration.
45	New transit	T-1005	High-capacity transit from Ahwatukee to downtown Phoenix via Tempe and Phoenix Sky Harbor International Airport (using UPRR ROW).	1	3	3	3	3	3	3	2.305	84	Study Option	Commuter rail planning along this corridor is under consideration.
46	New transit	T-1007	High-capacity transit to downtown Glendale.								—	88	Underway	Planning for the Glendale West light rail transit extension is underway.
47	System traffic interchange	I1-1015	New high-capacity interchange at Baseline Road.	1	5	4	4	4	4	3	3.011	35	Alternative Feature	Add to all build alternatives to mitigate existing deficiency.
48	System traffic interchange	I2-1010	Replace/Alter SR-143 and Broadway interchange, eliminate SR-143 loop ramp.	1	5	4	4	4	4	3	3.011	35	Alternative Feature	Add to all build alternatives to mitigate existing deficiency.
49	System traffic interchange	I1-1016	North-to-west and east-to-south Baseline/I-10 flyover with a median landing at Baseline Road.	1	4	4	3	4	4	4	2.870	39	Alternative Feature	Location-specific; modifications to the I-10/Baseline Road traffic interchange will be added to all build alternatives to mitigate existing deficiency.
50	System traffic interchange	I3-1005	Add DHOVs to Stack.	1	5	4	3	4	3	3	2.842	43	Alternative Feature	Construction is difficult given the current geometrics of the I-10/I-17 Stack interchange and the pending construction of the bus ramp on the west side of the interchange. Carry forward to Level 2B screening.
51	System traffic interchange	I3-1006	Add DHOVs to Split.	1	5	4	3	4	3	3	2.842	43	Alternative Feature	Construction is difficult; however, the geometrics are possible. High cost.

Table 4-5. Level 2A Screening – Backbone

Row No.	Category	Alt. ID	Weights:								Weighted Score	2A Rank	Recommendation	Notes/Comments
			0.185	0.082	0.078	0.046	0.044	0.044	0.053	Description				
				Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities				
52	System traffic interchange	I2-1013	I-10 realignment at the Split.	1	4	4	5	4	3	2	2.761	48	Alternative Feature	Realignment does not enhance existing system utilization and is only needed if future designs invade the Phoenix Sky Harbor International Airport air spaces. Has a poor score on Enhances Existing System Utilization. Carry forward to Level 2 screening.
53	System traffic interchange	I2-1029	Southbound SR-143 has numerous devices installed because of lack of signal visibility. Vertical curve needs to be reduced.	1	5	3	4	3	3	3	2.699	50	Alternative Feature	Similar to number 57; add to all build alternatives to mitigate existing deficiency.
54	System traffic interchange	I1-1003	Add DHOVs to South Mountain Freeway to I-10 (east to north and south to west).	1	4	4	3	4	3	3	2.688	55	Alternative Feature	Has a poor score on Enhances Existing System Utilization. While it is possible, the alignment would affect Pecos Park (primary function is a retention basin) and some vertical alignment issues. Carry forward to Level 2B screening.
55	System traffic interchange	I1-1004	Direct access from Pecos park-and-ride to I-10.	1	4	3	3	3	3	3	2.459	68	Alternative Feature	Has a poor score on Enhances Existing System Utilization. Pecos park-and-ride is located at SR-202L/40th Street traffic interchange; better solution is to move the park-and-ride to I-10 and Galveston; concept would also require a DHOV at I-10/SR-202L. Carry forward to Level 2B screening (dependent on concept 47; I1-1031).
56	System traffic interchange	I3-1019	The Stack traffic interchange southeastern quadrant, three concepts from previous I-17 study.	1	3	4	5	4	4	2	2.690	51	Drop	Concept from the I-17 Corridor Study does not enhance existing system utilization and has a disproportionate impact to Title VI and EJ communities.
57	System traffic interchange	I3-1020	The Stack traffic interchange southwestern quadrant, three concepts from previous I-17 study.	1	3	4	5	4	4	2	2.690	51	Drop	Concept from the I-17 Corridor Study does not enhance existing system utilization and has a disproportionate impact to Title VI and EJ communities.
58	System traffic interchange	I4-1054	The Stack traffic interchange northeastern quadrant, three concepts from previous I-17 study.	1	3	4	5	4	4	2	2.690	51	Drop	Concept from the I-17 Corridor Study does not enhance existing system utilization and has a disproportionate impact to Title VI and EJ communities.
59	System traffic interchange	I4-1055	The Stack traffic interchange northwestern quadrant, two concepts from previous I-17 study.	1	3	4	5	4	4	2	2.690	51	Drop	Concept from the I-17 Corridor Study does not enhance existing system utilization and has a disproportionate impact to Title VI and EJ communities.

Table 4-5. Level 2A Screening – Backbone

Row No.	Category	Alt. ID	Weights:								Weighted Score	2A Rank	Recommendation	Notes/Comments
			0.185	0.082	0.078	0.046	0.044	0.044	0.053	Description				
			Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities					
60	System traffic interchange	I2-1018	Broadway Curve bypass. Extend SR-143 south then curve east to tie to US-60. As an option extend SR-143 south to Baseline.	1	4	4	3	4	4	1	2.571	59	Drop	Considered as an early alternative for the I-10 Corridor Study EIS; dropped due to considerable impacts to the land uses and Title VI and EJ communities adjacent to I-10. Has a poor score on Enhances Existing System Utilization.
61	System traffic interchange	I2-1005	Add DHOV to I-10/Broadway Road.	1	3	3	3	3	3	4	2.404	76	Drop	Substandard weave would be introduced between DHOV at I-10/Broadway and the I-10/US-60/SR-143.
62	System traffic interchange	I2-1036	Add two-lane (choice lane) exit ramps along I-10 westbound at Broadway Road.	1	4	4	3	4	4	4	2.870	39	Impact Remedy	Incorporate, if appropriate, after the backbone recommendation is made for the overall corridor master plan.
63	System traffic interchange	I2-1037	Add two-lane (choice lane) exit ramps along I-10 westbound at SR-143 and 40th Street.	1	4	4	3	4	4	4	2.870	39	Impact Remedy	Incorporate, if appropriate, after the backbone recommendation is made for the overall corridor master plan.
64	System traffic interchange	I4-1024	Analyze which DHOV to build at North Stack.	1	5	4	3	4	3	3	2.842	43	Impact Remedy	Study for identifying the DHOV on SR-101L on the west to/from I-17 on the south was completed in 2003; incorporate, if appropriate, after the recommendation is made for the overall corridor master plan.
65	System traffic interchange	I2-1026	Add westbound Broadway to northbound SR-143 ramp.	1	3	4	3	3	3	3	2.451	71	Impact Remedy	This movement is already accounted for at the Broadway Road/48th Street intersection; however, determine whether a free-flow right-turn lane is needed and feasible to accommodate this movement.
66	System traffic interchange	I2-1030	Increase eastbound I-10/Broadway on-ramp capacity.	1	3	4	3	3	3	3	2.451	71	Impact Remedy	Incorporate, if appropriate, after the backbone recommendation is made for the overall corridor master plan.
67	System traffic interchange	I2-1000	Add DHOV to SR 143/I-10.	1	3	3	3	4	3	3	2.387	80	Impact Remedy	Incorporate, if appropriate, after the backbone recommendation is made for the overall corridor master plan.

Table 4-5. Level 2A Screening – Backbone

Row No.	Category	Alt. ID	Weights:								Weighted Score	2A Rank	Recommendation	Notes/Comments
			0.185	0.082	0.078	0.046	0.044	0.044	0.053	Description				
			Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities					
68	System traffic interchange	I2-1001	Add DHOV to I-10/Arizona Mills mall.	1	3	3	3	3	3	3	2.305	84	Impact Remedy	Due to space constraints, associated with dropping a DHOV into Arizona Mills parking lot. Possible legality issue with dropping a DHOV onto a street owned by Arizona Mills. Constructibility issues due to the proximity to I-10/US-60/SR-143 interchange. Does not appear to be a high HOV demand for Arizona Mills. It is also not open during the AM peak. Add to parking lot as Impact Remedy to be evaluated after preferred alternative is selected.
69	System traffic interchange	I2-1016	Reconfigure I-10/US-60 connection.	1	4	4	5	4	4	2	2.844	42	Underway	Will be addressed during the near-term improvement strategy.
70	System traffic interchange	I2-1024	Maintain three westbound US-60 lanes through Broadway Curve to past 40th Street.								-	88	Underway	Recommended in the near-term improvement strategy.
71	System traffic interchange	I4-1052	Fix the North Stack north to east and south to east movements.								-	88	Underway	Pending SR-101L widening project between I-17 and SR-51 will address this matter.
72	Technology	ITS-1001	Upgrade ramp metering.	5	5	5	3	4	4	3	4.462	2	Alternative Feature	Add to all build alternatives, where ramp lengths permit, to mitigate existing deficiency.
73	Technology	I3-1011	Signal timing for turning trucks at 19th Avenue/I-17.	5	5	3	3	4	3	4	4.186	9	Alternative Feature	Add as a near-term study recommendation for the master plan.
74	Technology	ITS-1015	Lane control signals.	4	5	5	3	4	4	3	4.115	10	Alternative Feature	Part of a comprehensive Managed Motorways application; meets recommendations from MAG Managed Lanes Network Development Strategy – Phase I study.
75	Technology	ITS-1016	Active motorways, active management.	4	5	5	3	4	4	3	4.115	10	Alternative Feature	Add to all build alternatives; meets recommendations from MAG Managed Lanes Network Development Strategy – Phase I study.
76	Technology	A3-1007	Incorporate transportation systems management and operations (TSMO) into I-17 corridor including 19th and 35th avenues as synchronized alternatives.	4	5	4	3	4	4	4	4.068	12	Alternative Feature	Although not a specific concept, identifies the need for a coordinated TSMO approach to be incorporated into all alternatives.

Table 4-5. Level 2A Screening – Backbone

Row No.	Category	Alt. ID	Weights:								Weighted Score	2A Rank	Recommendation	Notes/Comments
			0.185	0.082	0.078	0.046	0.044	0.044	0.053	Description				
			Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities					
77	Technology	ITS-1014	Variable speed control on Interstate.	4	4	5	3	4	4	3	3.961	14	Alternative Feature	Part of a comprehensive Managed Motorways application; meets recommendations from MAG Managed Lanes Network Development Strategy – Phase I study.
78	Technology	ITS-1019	Automated speed warning in advance of high crash frequency locations.	4	5	3	3	4	3	3	3.739	18	Alternative Feature	Part of a comprehensive Managed Motorways application; meets recommendations from MAG Managed Lanes Network Development Strategy – Phase I study.
79	Technology	ITS-1008	Add TSP for bus service on 35th Avenue to help maintain schedules due to frequent school zone crossings. Add TSP to 19th Avenue to help meet connections with light rail transit.	3	4	4	3	2	4	4	3.400	27	Impact Remedy	Policy recommendation for incorporation, as appropriate, after the backbone recommendation is identified for the corridor master plan.
80	Technology	ITS-1011	Additional traffic operations staff and maintenance staff for City of Phoenix.	5	5	4	3	4	4	3	4.316	4	Policy Option	Recommendation needs policy discussion between regional TSMO partners, MAG, and the City of Phoenix.
81	Technology	I4-1021	Upgrade signal operation at traffic interchanges to emphasize frontage road through movements to fully utilize frontage road capacity.	5	3	2	3	2	2	3	3.383	29	Policy Option	Policy recommendation for incorporation, as appropriate, after the backbone recommendation is identified for the corridor master plan.
82	Technology	ITS-1017	Dynamic HOV lane occupancy control.	4	3	3	3	3	3	3	3.348	30	Policy Option	Requires policy change at from the state government governing the application of HOV lanes.
83	Technology	S-1016	Interagency coordination for alternate routing during incidents.	5	5	4	3	4	4	3	4.316	4	Study Option	Overall corridor master plan recommendation; separate follow-up study and plan.
84	Technology	ITS-1009	Consolidated TOC.	5	4	5	3	4	4	3	4.308	7	Study Option	MAG developing Systems Management and Operations plan for identifying techniques to deploy this technology.
85	Technology	ITS-1006	Arterial management system (ITS) – surveillance, traffic control, parking management, DMS, information dissemination and full integration. Including dedicated transit and parking ITS, adaptive traffic signals to adjust to traffic volumes and coordination between freeway and arterials at interchange signals.	4	5	5	3	4	5	3	4.197	8	Study Option	MAG developing Systems Management and Operations plan for identifying techniques to deploy this technology.

Table 4-5. Level 2A Screening – Backbone

Row No.	Category	Alt. ID	Weights:								Weighted Score	2A Rank	Recommendation	Notes/Comments
			0.185	0.082	0.078	0.046	0.044	0.044	0.053	Description				
			Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities					
86	Technology	ITS-1010	Connected vehicle integration (personal vehicles and freight).	4	5	4	3	4	4	3	3.968	13	Study Option	Difficult to implement presently as the connected/autonomous vehicle data needs are not known at this time.
87	Technology	ITS-1004	Way finding for emergency/alternate routes.	4	5	3	3	3	3	3	3.656	20	Study Option	MAG developing Systems Management and Operations plan for identifying techniques to deploy this technology.
88	Technology	ITS-1005	Coordination on traffic incidents with ADOT and local jurisdictions.	5	5	5	3	5	4	3	4.545	1	Underway	ADOT/DPS continue to improve incident communication.
89	Technology	ITS-1003	Expand collection and dissemination of real-time traffic data/conditions within study area and/or Valley wide. Deploy real-time traffic movement and measuring devices (ARID).	5	5	5	3	4	4	3	4.462	2	Underway	Part of the long-term TSMO plan for the metropolitan area; MAG developing Systems Management and Operations plan for identifying regional goals for deploying the collected data.
90	Technology	ITS-1012	Better local jurisdiction coordination to close the gap, interconnect between cities.	5	5	4	3	4	4	3	4.316	4	Underway	Regional Community Network throughout the metropolitan area is underway; future planning to incorporate potential software modifications as technology warrants.
91	Technology	ITS-1018	Advance queue warning for northbound traffic on I-10 when approaching Broadway Curve.	4	5	3	3	4	3	2	3.639	23	Underway	System presently in place with network of travel time data along the freeway main line.
92	Technology	ITS-1007	CCTV, traffic signal sharing responsibilities between agencies.								-	88	Underway	System presently in place.

Table 4-6. Level 2A Screening – Supporting Concepts

Combined Alt. ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening	Level 2 Screening
I4-1047	Implement drainage solution for four arterials that flood.	Add to cost opinions in the rehab/reconstruct alternatives.	Supporting	Arterial modifications	Keep	Alternative Feature
I4-1048	Eliminate 4 old pump stations - ADOT has a design on the shelf for this.	Add to cost opinions in the rehab/reconstruct alternatives.	Supporting	Arterial modifications	Keep	Alternative Feature
A1-1006	Reversible lane on Kyrene Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand. Impacts to adjacent land-uses may be considerable.	Supporting	Arterial modifications	Keep	Alternative Feature
A2-1002	Convert Baseline to an indirect left arterial (Arizona parkway).	Roadway considered in Central Phoenix Framework Study as potential for an Urban Arizona parkway (with reduced footprint); however, study cites significant ROW needs to accommodate a six-lane facility. Only consider, where appropriate, after the backbone recommendation is made.	Supporting	Arterial modifications	Keep	Alternative Feature
A1-1002	Parallel corridor reconfiguration. Create parallel I-10 route on 48th Street. Convert to public street between Point Pkwy and Arizona Grand Pkwy. Consider converting stop signs into coordinated signal system.		Supporting	Arterial modifications	Keep	Alternative Feature
A2-1011	Use Rio Salado Parkway as reliever for E/W, serve as catalyst to land-use change.	Policy behind concept is outside of the goals for this Corridor Master Plan.	Supporting	Arterial modifications	Keep	Drop
I4-1025	Add mid-mile crossing at Encanto Boulevard. (all modes)	Location studied as part of Central Phoenix Framework Study; mid-mile crossing at this location was not recommended due to neighborhood impacts and costs (Assessment of Alternative Improvement Strategies technical memo).	Supporting	Arterial modifications	Keep	Drop
I4-1026	Add mid-mile crossing at Osborn Road. (all modes)	Location studied as part of Central Phoenix Framework Study; mid-mile crossing at this location was not recommended due to neighborhood impacts and costs (Assessment of Alternative Improvement Strategies technical memo).	Supporting	Arterial modifications	Keep	Drop
I4-1027	Add mid-mile crossing at Campbell Avenue. (all modes)	Location studied as part of Central Phoenix Framework Study; mid-mile crossing at this location was not recommended due to neighborhood impacts and costs (Assessment of Alternative Improvement Strategies technical memo).	Supporting	Arterial modifications	Keep	Drop
I4-1028	Add mid-mile crossing at Missouri Avenue. (all modes)	Location studied as part of Central Phoenix Framework Study; mid-mile crossing at this location was not recommended due to neighborhood impacts and costs (Assessment of Alternative Improvement Strategies technical memo).	Supporting	Arterial modifications	Keep	Drop
I4-1029	Add mid-mile crossing at Orangewood Avenue. (all modes)	Location studied as part of Central Phoenix Framework Study; mid-mile crossing at this location was not recommended due to neighborhood impacts and costs (Assessment of Alternative Improvement Strategies technical memo).	Supporting	Arterial modifications	Keep	Drop
I4-1030	Add mid-mile crossing at Butler Road. (all modes)	Location studied as part of Central Phoenix Framework Study; mid-mile crossing at this location was not recommended due to neighborhood impacts and costs (Assessment of Alternative Improvement Strategies technical memo).	Supporting	Arterial modifications	Keep	Drop
A1-1001	Parallel corridor reconfiguration. Create parallel I-10 route on Kyrene and connect Kyrene and Mill Avenue between Baseline and US-60.	There would be considerable impact to adjacent land uses and upon the Town of Guadalupe if this concept was constructed along Kyrene Road.	Supporting	Arterial modifications	Keep	Drop
A1-1007	Convert Kyrene to an Arizona parkway.	Not studied in the Central Phoenix Framework Study; however, ROW needs and impact to adjacent land uses would be significant.	Supporting	Arterial modifications	Keep	Drop
A2-1006	If 24th Street closed, need connection between 24th and 16th Street (to not lose 24th Street river crossing).	No recommendation has been made by FAA to Phoenix Aviation to close 24th Street.	Supporting	Arterial modifications	Keep	Drop
A4-1004	Convert Missouri Avenue to Arizona parkway from Grand Avenue to SR-51.	Not studied in the Central Phoenix Framework Study; however, ROW needs and impact to adjacent land uses would be significant because Missouri Avenue is a smaller collector road with mainly surrounded with residential land use.	Supporting	Arterial modifications	Keep	Drop

Table 4-6. Level 2A Screening – Supporting Concepts

Combined Alt. ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening	Level 2 Screening
S-1006	Add one additional general purpose lane in each direction to arterial corridors of interest.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Arterial modifications	Keep	Impact Remedy
S-1023	Add more arterial bus pullouts.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Arterial modifications	Keep	Impact Remedy
A2-1005	Widen 32nd St to Baseline Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Arterial modifications	Keep	Impact Remedy
A2-1008	High average daily traffic intersection – consider grade separations.	The Central Phoenix Framework Study considered more than 35 intersections where volumes exceeded 80,000 vehicles per day (roughly the point of LOS failure). Of those locations, only five locations (83rd Avenue/Bell Road), 19th Avenue/Indian School Road, 7th Avenue/Indian School Road, 7th St/McDowell Road, and 16th St/Glendale Avenue) were identified with good benefit-cost ratios for future consideration. ROW is of a concern. Incorporate, where appropriate, after the backbone recommendation is made for mitigation purposes.	Supporting	Arterial modifications	Keep	Impact Remedy
A2-1009	Make Southern Avenue, 16th Street and 7th Street use reversible lanes for peak hour travel. Connect Southern into US-60/I-10 interchange.	Roadway considered in Central Phoenix Framework Study as potential for an Urban Arizona parkway (with reduced footprint); however, study cites significant ROW needs to accommodate a six-lane facility. Only consider, where appropriate, after the backbone recommendation is made. In addition, traffic interchange between Southern Avenue and I-10 is not feasibility due to the US-60 system interchange.	Supporting	Arterial modifications	Keep	Impact Remedy
A2-1012	Flatten profile of 32nd St over I-10.	Incorporate, if appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Arterial modifications	Keep	Impact Remedy
A2-1016	Convert Southern Avenue (US-60 to SR-202L) to a parkway (6 general purpose +2 BRT).	Roadway considered in Central Phoenix Framework and Southeast Major Investment Studies as potential for an Urban Arizona parkway (with reduced footprint) and Transit-Oriented Parkway, respectively; however, study cites significant ROW needs to accommodate a six-lane facility. Only consider, where appropriate, after the backbone recommendation is made.	Supporting	Arterial modifications	Keep	Impact Remedy
A3-1000	Provide intersection improvements to allow for diversion routes to/from I-17 for parallel routes (27th and 35th), expand north-to-south arterials south of Northern to include 7th Avenue to East. North of Northern, include 7th Street, 43rd Avenue, and 51st Avenue.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Arterial modifications	Keep	Impact Remedy
A3-1004	Convert 35th Avenue to an Arizona parkway with indirect left design.	Roadway considered in Central Phoenix Framework Study as potential for an Urban Arizona parkway (with reduced footprint); however, study cites significant ROW needs to accommodate a six-lane facility. Only consider, where appropriate, after the backbone recommendation is made.	Supporting	Arterial modifications	Keep	Impact Remedy
A3-1005	Convert 43rd Avenue to an Arizona parkway with indirect left design.	Roadway considered in Central Phoenix Framework Study as potential for an Urban Arizona parkway (with reduced footprint); however, study cites significant ROW needs to accommodate a six-lane facility. Only consider, where appropriate, after the backbone recommendation is made.	Supporting	Arterial modifications	Keep	Impact Remedy
A3-1008	Analyze intersection geometry to current and future traffic demands, check if turning movement demands are serviced correctly.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Arterial modifications	Keep	Impact Remedy
A3-1013	Convert 35th avenue to reversible to provide extra capacity during the peak times.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand. Impacts to adjacent land-uses may be considerable.	Supporting	Arterial modifications	Keep	Impact Remedy

Table 4-6. Level 2A Screening – Supporting Concepts

Combined Alt. ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening	Level 2 Screening
A4-1003	Convert Northern Avenue to Arizona parkway.	Roadway considered in Central Phoenix Framework Study as potential for an Urban Arizona parkway (with reduced footprint); however, study cites significant ROW needs to accommodate a six-lane facility. Only consider, where appropriate, after the backbone recommendation is made.	Supporting	Arterial modifications	Keep	Impact Remedy
A4-1001	Convert Camelback to Arizona parkway.	Roadway considered in Central Phoenix Framework Study as potential for an Urban Arizona parkway (with reduced footprint); however, study cites significant ROW needs to accommodate a six-lane facility. Only consider, where appropriate, after the backbone recommendation is made.	Supporting	Arterial modifications	Keep	Impact Remedy
A4-1002	Convert Bell Road to Arizona parkway.	Roadway considered in Central Phoenix Framework Study as potential for an Urban Arizona parkway (with reduced footprint); however, study cites significant ROW needs to accommodate a six-lane facility. Only consider, where appropriate, after the backbone recommendation is made.	Supporting	Arterial modifications	Keep	Impact Remedy
A4-1014	Continuous-flow intersection at 35th/ Camelback, Bell, Northern.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Arterial modifications	Keep	Impact Remedy
A4-1000	Access management plans/frontage road system for crossroads between 19th Avenue and 35th Avenue.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Arterial modifications	Keep	Policy Option
A2-1001	Convert Broadway to a truck arterial (I-10 to SR-202L South Mountain Freeway), Southern to a transit corridor, Baseline to vehicular corridor and Alameda/Roeser and western canal to pedestrian/bicycle corridor.	Considerable policy and enforcement needs would be necessary to implement this concept.	Supporting	Arterial modifications	Keep	Policy Option
A2-1003	Access Management plan on Southern Avenue.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Arterial modifications	Keep	Policy Option
A2-1004	School zones traffic management plan. School zone student drop-off, traffic control, queuing planning, and HAWK beacons to eliminate 15 mph school zones.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Arterial modifications	Keep	Policy Option
A2-1010	Access control right in right out only along Baseline Road between Pointe Parkway and Priest.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Arterial modifications	Keep	Policy Option
A3-1001	School zones traffic management plan. School zone student drop-off, traffic control, queuing planning, and HAWK beacons to eliminate 15 mph school zones.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Arterial modifications	Keep	Policy Option
A4-1012	School zones traffic management plan. School zone student drop-off, traffic control, queuing planning, and HAWK beacons to eliminate 15 mph school zones.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Arterial modifications	Keep	Policy Option
A2-1014	Access Management plan on Baseline Road.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Arterial modifications	Keep	Policy Option
A2-1013	Need detailed review on access on Baseline Road, signals, etc. on corridor.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Arterial modifications	Keep	Study Option
I3-1010	Coordination between ADOT and Valley Metro on Central Avenue/I-17 crossing.	Coordination underway for construction of new I-17 overcrossing of Central Avenue prior to 2021 construction of South Central Light Rail Transit line.	Supporting	Arterial modifications	Keep	Underway
A3-1003	Grade separate 35th over BNSF/Grand to improve transit service.	Reconstruction of US-60/35th Avenue/Indian School Road grade separation recommended in the US-60 COMPASS project.	Supporting	Arterial modifications	Keep	Underway
BP-1012	Bike routes to connect park-and-rides to access express buses.	Consider, in conjunction with the City of Phoenix plans and their non-motorized transportation plans.	Supporting	Bicycle/Pedestrian	Keep	Alternative Feature
BP-1015	Connect East/West bicycle/pedestrian corridors across I-17.	Consider, in conjunction with the City of Phoenix plans and their non-motorized transportation plans.	Supporting	Bicycle/Pedestrian	Keep	Alternative Feature
BP-1017	Extend pedestrian/bicycle path under/over I-10 along Western canal.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Alternative Feature

Table 4-6. Level 2A Screening – Supporting Concepts

Combined Alt. ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening	Level 2 Screening
BP-1018	Extend existing multi use path in Tempe along the Salt River west as far as it will go.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Alternative Feature
BP-1023	Bicycle/Pedestrian crossing at Grand Canal, mid-mile crossings, along designated bicycle/trail/multiuse path routes.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Alternative Feature
BP-1025	Bicycle/Pedestrian Crossings at Knox.	Consider, in conjunction with the City of Phoenix plans and their non-motorized transportation plans.	Supporting	Bicycle/Pedestrian	Keep	Alternative Feature
BP-1026	Bicycle/Pedestrian Crossings at Ray Road.	Incorporate bicycle/pedestrian recommendation at all service interchanges that may be identified for reconstruction as part of the corridor master plan.	Supporting	Bicycle/Pedestrian	Keep	Alternative Feature
BP-1027	Bicycle/Pedestrian Crossings at Chandler Boulevard.	Incorporate bicycle/ pedestrian recommendation at all service interchanges that may be identified for reconstruction as part of the corridor master plan.	Supporting	Bicycle/Pedestrian	Keep	Alternative Feature
BP-1028	Bicycle/Pedestrian Crossings at Warner Road.	Incorporate bicycle/pedestrian recommendation at all service interchanges that may be identified for reconstruction as part of the corridor master plan.	Supporting	Bicycle/Pedestrian	Keep	Alternative Feature
BP-1029	Bicycle/Pedestrian Crossings at Elliot Road.	Incorporate bicycle/pedestrian recommendation at all service interchanges that may be identified for reconstruction as part of the corridor master plan.	Supporting	Bicycle/Pedestrian	Keep	Alternative Feature
BP-1031	Bicycle/Pedestrian crossing Galveston Street/I-10.	Potential new DHOV interchange; consider, in conjunction with the Cities of Chandler and Phoenix plans and their non-motorized transportation plans.	Supporting	Bicycle/Pedestrian	Keep	Alternative Feature
BP-1032	Bicycle/Pedestrian crossing Osborn/I-17.	Consider, in conjunction with the City of Phoenix plans and their non-motorized transportation plans.	Supporting	Bicycle/Pedestrian	Keep	Alternative Feature
BP-1033	Bicycle/Pedestrian crossings Missouri Avenue/I-17.	Consider, in conjunction with the City of Phoenix plans and their non-motorized transportation plans.	Supporting	Bicycle/Pedestrian	Keep	Alternative Feature
BP-1034	Bicycle/Pedestrian crossing at I-10 along Salt River/Rio Salado.	Consider, in conjunction with the City of Phoenix plans and their non-motorized transportation plans.	Supporting	Bicycle/Pedestrian	Keep	Alternative Feature
A3-1002	Pedestrian overpass for all school and mid-block crossings along 35th, 19th Avenue, and 27th Avenue.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/17 Corridor; and only if warranted due to a traffic mitigation needed along these city streets.	Supporting	Bicycle/Pedestrian	Keep	Impact Remedy
BP-1035	Bicycle/Pedestrian crossing at I-10 along Western Canal.	Same as concept number 152.	Supporting	Bicycle/Pedestrian	Keep	Merge with Concept BP-1017
A4-1006	Make Encanto/Grand Canal a pedestrian/bicycle and local one lane/one lane roadway.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
A4-1007	Make Campbell a pedestrian/bicycle and local one lane/one lane roadway.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
A4-1008	Make Missouri a pedestrian/bicycle and local one lane/one lane roadway.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
A4-1009	Make Orangewood a pedestrian/bicycle and local one lane/one lane roadway.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
A4-1010	Make Butler a pedestrian/bicycle and local one lane/one lane roadway.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
A4-1011	Make Sweetwater a pedestrian/bicycle and local one lane/one lane roadway.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option

Table 4-6. Level 2A Screening – Supporting Concepts

Combined Alt. ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening	Level 2 Screening
BP-1000	Add bicycle lanes on Chandler Boulevard from 50th to 54th Street.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1001	Add bicycle lanes on Ray Road from 50th to 54th Street.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1002	Add bicycle lanes on Warner Road from 51st Street to Jewel Street.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1003	Add bicycle lanes from Sky Harbor Circle to University Drive on 24th Street.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1004	Add bicycle lanes on Adams/Jefferson from 24th to 21st Avenue.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1005	Improve Bicycle/Pedestrian infrastructure on 3rd Street.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1006	Improve Bicycle/Pedestrian infrastructure on 15th Avenue.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1007	Add bicycle lanes on Central Avenue from Apache to Watkins Street.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1008	Add bicycle lanes on Union Hills Drive from 27th Avenue to 24th Drive.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1009	Add bicycle lanes on Rose Garden Lane from 27th to 23rd Avenue.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1010	Add bicycle lanes on Deer Valley from 27th to 23rd Avenue.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1011	Utilize mid-mile roads as bicycle routes and electric single-occupancy vehicle route and connect them to park-and-rides.	Potential policy recommendation for cities to consider as local thoroughfare plans are considered.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1013	Accentuate 15th Avenue bicycle corridor.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1014	Consider 23rd Avenue as a bicycle corridor.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1016	Add bicycle lanes from 27th to 23rd Avenue on Indian School Road, connect to existing bicycle lanes east of I-17.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1019	Extend bicycle lanes on Southern between 48th and Priest Drive.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1020	Bike integration between 24th Street and Priest (dry crossing along south bank of Salt River).	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1021	Add bicycle lanes on Broadway Road from 48th to 55th Street, future connect to Tempe/Phoenix Master Plans.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1024	Enhance bicycle infrastructure between Pecos Road and Baseline Road using 50th and 51st streets as much as possible to take bicycle traffic off of 48th Street.	Recommendation for cities to consider for all arterials meeting I-10/I-17 Corridor; planning underway for these concepts as part of the SR-202L/South Mountain Freeway trail construction.	Supporting	Bicycle/Pedestrian	Keep	Policy Option
BP-1022	System wide detection for pedestrian, bicycle and vehicles on arterials.	Continuing improvement for cities to consider; also part of TSMO planning for the region.	Supporting	Bicycle/Pedestrian	Keep	Underway

Table 4-6. Level 2A Screening – Supporting Concepts

Combined Alt. ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening	Level 2 Screening
I3-1014	North-South I-17, Durango Curve to Stack: Reconfigure all traffic interchanges to work as a system with frontage/connector roads. Eliminate all partial traffic interchanges.	Effort studied and recommended as part of CRAVE assessing near-term improvements to I-17 between 16th St and 19th Avenue; incorporate into the third backbone alternative, Adaptive Access, for remaining segment.	Supporting	Service traffic interchange	Keep	Alternative Feature
S-1034	Alternate DHOV traffic interchanges on the inside at half miles with single-occupancy vehicle traffic interchanges at the full miles. This eliminates HOV travelers from merging across.	Spine will analyze which DHOVs are appropriate on the Spine corridor. The Central Phoenix Framework Study considered more than 90 DHOV locations on all freeway corridors within SR-101L and identified 11 new locations, including 6 locations along the corridor.	Supporting	Service traffic interchange	Keep	Alternative Feature
I1-1000	Add DHOVs to Galveston.	Recommended in the Southeast Corridor Major Investment and Central Phoenix Framework Studies; work with public transportation providers to identify how the infrastructure can be incorporated into existing and future transit services.	Supporting	Service traffic interchange	Keep	Alternative Feature
I1-1001	Add DHOVs to Carver.	Recommended in the Southeast Corridor Major Investment and Central Phoenix Framework Studies; work with public transportation providers to identify how the infrastructure can be incorporated into existing and future transit services.	Supporting	Service traffic interchange	Keep	Alternative Feature
I3-1008	Add DHOVs to Adams/Jefferson Couplet.	Recommended in the Southeast Corridor Major Investment and Central Phoenix Framework Studies; work with public transportation providers to identify how the infrastructure can be incorporated into existing and future transit services.	Supporting	Service traffic interchange	Keep	Alternative Feature
I3-1022	Add DHOV to Washington Avenue.	Recommended in the Southeast Corridor Major Investment and Central Phoenix Framework Studies; work with public transportation providers to identify how the infrastructure can be incorporated into existing and future transit services.	Supporting	Service traffic interchange	Keep	Alternative Feature
I4-1023	Direct connections to Grand Canyon University at Colter.	After the backbone recommendation is made for the overall I-10/I-17 Corridor, it will be important to appropriately plan for the reconstruction needs of the I-17/Camelback Road interchange to accommodate a projected 30,000 student population; effort is underway in continuing Valley Metro/MAG/ADOT/Stakeholder discussions.	Supporting	Service traffic interchange	Keep	Alternative Feature
I4-1056	Add DHOV to Mountain View.	Recommended in the Central Phoenix Framework Study; has been identified in the long-term needs by the City of Phoenix.	Supporting	Service traffic interchange	Keep	Alternative Feature
I4-1057	Add DHOV to Paradise Lane.	Recommended in the Central Phoenix Framework Study; work with public transportation providers to identify how infrastructure can be incorporated into existing and future transit services.	Supporting	Service traffic interchange	Keep	Alternative Feature
I1-1002	Add DHOVs to Guadalupe.	Studied in the Southeast Corridor Major Investment and Central Phoenix Framework Studies; dropped from recommendation due to impacts on Title VI communities.	Supporting	Service traffic interchange	Keep	Drop
I2-1003	Add DHOV to Kyrene/US-60.	Studied in the Southeast Corridor Major Investment and Central Phoenix Framework Studies; dropped from recommendation due to lack of support from public transportation providers and potential construction expenses.	Supporting	Service traffic interchange	Keep	Drop
I2-1004	Add DHOV to Hardy/US-60.	Studied in the Southeast Corridor Major Investment and Central Phoenix Framework Studies; dropped from recommendation due to lack of support from public transportation providers and potential construction expenses.	Supporting	Service traffic interchange	Keep	Drop
I3-1007	Add DHOV at 7th Street with HOV lanes (Split DHOV, BRT lane during peak period between Washington and I-17).	Studied in the Southeast Corridor Major Investment and Central Phoenix Framework Studies; dropped from recommendation due to lack of support from public transportation providers and potential construction expenses.	Supporting	Service traffic interchange	Keep	Drop
I3-1009	Add DHOVs to Van Buren.	Studied in the Southeast Corridor Major Investment and Central Phoenix Framework Studies; dropped from recommendation due to lack of support from public transportation providers and potential construction expenses.	Supporting	Service traffic interchange	Keep	Drop

Table 4-6. Level 2A Screening – Supporting Concepts

Combined Alt. ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening	Level 2 Screening
I3-1021	Add DHOV to Central Avenue.	Selection of Central Avenue as HCT corridor for South Central project prohibits this construction.	Supporting	Service traffic interchange	Keep	Drop
I3-1023	Add DHOV to 15th Avenue.	Studied in the Southeast Corridor Major Investment and Central Phoenix Framework Studies; dropped from recommendation due to lack of support from public transportation providers and potential construction expenses.	Supporting	Service traffic interchange	Keep	Drop
I4-1008	Add DHOVs to Missouri.	Studied in the Southeast Corridor Major Investment and Central Phoenix Framework Studies; dropped from recommendation due to lack of support from public transportation providers and potential construction expenses.	Supporting	Service traffic interchange	Keep	Drop
I4-1016	HOV bus ramp exit south of Grand Avenue/BNSF, then tying to new I-10/I-17 bus ramp inside the Stack on the existing southbound frontage road.	The proposed design for the I-10/Van Buren St bus ramp is meant to ultimately carry Light Rail Transit vehicles for the West line; once this conversion is made, a bus type of connection would not be appropriate.	Supporting	Service traffic interchange	Keep	Drop
I4-1058	Add DHOV to Yorkshire Drive/Utopia Road.	Studied in the Central Phoenix Framework Study; dropped from recommendation due to lack of support from public transportation providers and potential construction expenses.	Supporting	Service traffic interchange	Keep	Drop
I4-1059	Add DHOV to Union Hills.	Studied in the Central Phoenix Framework Study; dropped from recommendation due to lack of support from public transportation providers and potential construction expenses.	Supporting	Service traffic interchange	Keep	Drop
A4-1013	Add HOV lanes on Grand Avenue between I-17 and downtown. Alternative includes a DHOV on I-17 at Grand Avenue to and from the north.	HOV Lanes were dropped from consideration in the US-60 COMPASS project due to ROW restrictions; DHOV recommended and consistent with number 206.	Supporting	Service traffic interchange	Keep	Drop
I1-1011	New high-capacity interchange at Chandler Boulevard.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I1-1012	New high-capacity interchange at Ray Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I1-1013	New high-capacity interchange at Warner Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I1-1014	New high-capacity interchange at Elliot Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I1-1019	New high-capacity interchange at Chandler Boulevard.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I1-1020	Add two-lane (choice lane) exit ramps along I-10 westbound at Ray Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I1-1021	Add two-lane (choice lane) exit ramps along I-10 westbound at Warner Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I1-1022	Add two-lane (choice lane) exit ramps along I-10 westbound at Elliot Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I1-1023	Add two-lane (choice lane) exit ramps along I-10 eastbound at Chandler Boulevard.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I1-1024	Add two-lane (choice lane) exit ramps along I-10 westbound at Ray Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I1-1025	Add two-lane (choice lane) exit ramps along I-10 eastbound at Warner Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I1-1026	Add two-lane (choice lane) exit ramps along I-10 eastbound at Elliot Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy

Table 4-6. Level 2A Screening – Supporting Concepts

Combined Alt. ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening	Level 2 Screening
I2-1012	Move 24th Street ramps to University for cargo access to Phoenix Sky Harbor International Airport, University traffic interchange instead of the 24th Street traffic interchange. Provide interstate access to Tower Road.	Identified as a potential mitigation measure for accommodating a DHOV ramp between I-17 and I-10 to/from the east; incorporate, where appropriate, after the backbone recommendation is made for the corridor.	Supporting	Service traffic interchange	Keep	Impact Remedy
I2-1034	New high-capacity traffic interchange at 32nd Street.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I2-1035	New high-capacity traffic interchange at 44th Street.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I2-1038	Add two-lane (choice lane) exit ramps along I-10 eastbound at 40th Street.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I2-1039	Add two-lane (choice lane) exit ramps along I-10 eastbound at 32nd Street.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I3-1016	Make Adams/Jefferson couplet a standard split diamond configuration.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1001	Connect US-60 (Grand Avenue) to I-17, especially north to northwest and southeast to south movements.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1007	Add DHOVs to Grand Avenue.	Recommended in the US-60/Grand Avenue COMPASS Study; work with public transportation providers to identify how the infrastructure can be incorporated into existing and future transit services.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1019	Texas turnarounds on all interchanges north of the Stack.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1020	Texas turnarounds on north side of Camelback to serve Grand Canyon University.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1031	New high-capacity traffic interchange at McDowell.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1032	New high-capacity traffic interchange at Thomas.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1033	New high-capacity traffic interchange at Grand Avenue.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1034	New high-capacity traffic interchange at Indian School.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1035	New high-capacity traffic interchange at Camelback Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1036	New high-capacity traffic interchange at Bethany Home Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1037	New high-capacity traffic interchange at Glendale Avenue.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1038	New high-capacity traffic interchange at Northern Avenue.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1039	New high-capacity traffic interchange at Dunlap Avenue.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy

Table 4-6. Level 2A Screening – Supporting Concepts

Combined Alt. ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening	Level 2 Screening
I4-1040	New high-capacity traffic interchange at Peoria Avenue.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1041	New high-capacity traffic interchange at Cactus Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1042	New high-capacity traffic interchange at Thunderbird Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1043	New high-capacity traffic interchange at Bell Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1044	New high-capacity traffic interchange at Union Hills Drive.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1049	High capacity connections at Thunderbird or a new high-capacity interchange.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1050	High capacity connections at Bell or a new high-capacity interchange.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1060	Add two-lane (choice lane) exit ramps along I-17 southbound at Thomas Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1061	Add two-lane (choice lane) exit ramps along I-17 southbound at Camelback Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1062	Add two-lane (choice lane) exit ramps along I-17 southbound at Bethany Home Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1063	Add two-lane (choice lane) exit ramps along I-17 southbound at Peoria Avenue.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1064	Add two-lane (choice lane) exit ramps along I-17 northbound at Indian School Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1065	Add two-lane (choice lane) exit ramps along I-17 northbound at Camelback Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1066	Add two-lane (choice lane) exit ramps along I-17 northbound at Bethany Home Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1067	Add two-lane (choice lane) exit ramps along I-17 northbound at Peoria Avenue.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I4-1068	Add two-lane (choice lane) exit ramps along I-17 northbound at Union Hills Drive.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
A4-1005	Grade separation of crossroad through movement through I-17 traffic interchanges.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	Service traffic interchange	Keep	Impact Remedy
I2-1036	Add two-lane (choice lane) exit ramps along I-10 westbound at Broadway Road.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	System traffic interchange	Keep	Impact Remedy
I2-1037	Add two-lane (choice lane) exit ramps along I-10 westbound at SR-143 and 40th Street.	Incorporate, where appropriate, after the backbone recommendation is made for the overall I-10/I-17 Corridor to meet 2040 travel demand.	Supporting	System traffic interchange	Keep	Impact Remedy
S-1020	Restricted HOV buffer crossover and access points.	Strategy under consideration as a corridor master plan alternative.	Supporting	TDM/TSM	Keep	Alternative Feature

Table 4-6. Level 2A Screening – Supporting Concepts

Combined Alt. ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening	Level 2 Screening
I2-1014	Freeway re-routing plans on Broadway with way finding (south of Phoenix Sky Harbor International Airport).	Alternate alignments of I-10 and I-17 are not consistent with the guiding criteria for developing this Corridor Master Plan.	Supporting	TDM/TSM	Keep	Drop
S-1035	Make the HOV lanes a time of use managed lane: HOV only during the peak hours and truck/transit only during mid-day.	Action requires legislative change; promise of Managed Motorways application as an initial consideration may lessen the need for stricter HOV lane controls.	Supporting	TDM/TSM	Keep	Policy Option
S-1002	Convert HOV to 3+ occupancy.	Action requires legislative change; promise of Managed Motorways application as an initial consideration may lessen the need for stricter HOV lane controls.	Supporting	TDM/TSM	Keep	Policy Option
S-1012	General purpose/HOV restrictions (trucks, recreational vehicles).	Would require legislative action.	Supporting	TDM/TSM	Keep	Policy Option
S-1015	Parking management districts: Increase rates Downtown, amped up TDM plan.	Action requires policy change for the City of Phoenix; will impact land-use decisions and could be detrimental to the long-term goals for Downtown redevelopment.	Supporting	TDM/TSM	Keep	Policy Option
S-1036	End the alternate fuel vehicle HOV program to improve HOV operations.	Decision for the next-generation RTP to address; requires administrative/legislative change.	Supporting	TDM/TSM	Keep	Policy Option
S-1011	Enforcement of HOV.	ADOT/DPS implementing plans for stricter HOV enforcement underway.	Supporting	TDM/TSM	Keep	Underway
S-1013	Emphasize carpool/vanpool, incentivize HOV.	Continuing recommendation under consideration and development by the region's public transportation providers.	Supporting	TDM/TSM	Keep	Underway
S-1033	Increase freeway safety patrols.	Recommendation is consistent with long-term RTP policies for the program.	Supporting	TDM/TSM	Keep	Underway
T-1000	Transit priority access on Baseline crossing I-10.	Explore concept with public transportation providers to identify if this recommendation supports or enhances existing and future transit services.	Supporting	Transit enhancements	Keep	Alternative Feature
T-1018	Add new park-and-ride just north of SR-101L to relieve Bell park-and-ride.	Explore concept with public transportation providers to identify if this recommendation supports or enhances existing and future transit services.	Supporting	Transit enhancements	Keep	Alternative Feature
S-1029	Create downtown-to-downtown 10 minute headway transit service between all major valley cities and education centers.	Continuing recommendation under consideration and development by the region's public transportation providers; potential policy recommendation from this study.	Supporting	Transit enhancements	Keep	Alternative Feature
S-1022	HOV ramp meter bypass.	Requires additional infrastructure; may not be needed given the promise of a Managed Motorways application.	Supporting	Transit enhancements	Keep	Alternative Feature
I1-1009	Integrated transit and freeway between Galveston and Carver.	Direct HOV interchanges have been recommended by previous studies and will be considered in this Corridor Master Plan if it supports existing and future public transportation service needs; this concept does not have enough definition.	Supporting	Transit enhancements	Keep	Drop
I4-1051	Develop optimal treatment for bus/HOV bypass lane at Dunlap traffic interchange to access southbound I-17 on-ramp. Near-term issue prior to construction of new DHOV at Mountain View.	A near-term strategy that could take time to implement and not permit a focused efforts on developing the I-17/Mountain View DHOV traffic interchange.	Supporting	Transit enhancements	Keep	Drop
T-1010	Improve way finding to park-and-rides.	Policy recommendation from this study.	Supporting	Transit enhancements	Keep	Policy Option
T-1013	Increase peak period/more frequent RAPID/express bus along route.	As no specific RAPID/express routes are identified, consider their implementation as an overall policy recommendation from this study for continuing planning with public transportation providers.	Supporting	Transit enhancements	Keep	Policy Option
T-1015	Bike lockers with reservation systems at park-and-rides.	Potential policy recommendation from this study.	Supporting	Transit enhancements	Keep	Policy Option
T-1016	More bicycle capacity on RAPID buses.	Potential policy recommendation from this study.	Supporting	Transit enhancements	Keep	Policy Option
T-1017	Transit connection with ITS and DMS (real-time transit data).	Potential policy recommendation from this study.	Supporting	Transit enhancements	Keep	Policy Option

Table 4-6. Level 2A Screening – Supporting Concepts

Combined Alt. ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening	Level 2 Screening
T-1028	Paid park-and-ride incentives for long term parking and/or add security and shade parking to encourage transit use to go to the airport.	Continuing recommendation under consideration and development by the region's public transportation providers; potential policy recommendation from this study.	Supporting	Transit enhancements	Keep	Policy Option
T-1029	Retrofit park-and-rides into "mobility hubs" (businesses like cafés, daycares, drycleaners, grocery stores, etc.), explore P3 opportunities.	Continuing recommendation under consideration and development by the region's public transportation providers; potential policy recommendation from this study.	Supporting	Transit enhancements	Keep	Policy Option
T-1030	Variable transit fare pricing.	Continuing recommendation under consideration and development by the region's public transportation providers.	Supporting	Transit enhancements	Keep	Policy Option
T-1032	More Frequent bus service.	Continuing recommendation under consideration and development by the region's public transportation providers.	Supporting	Transit enhancements	Keep	Policy Option
T-1001	Limited stopped/more frequent transit between ASU, Tempe and Chandler.	Explore concept with public transportation providers to identify if this recommendation supports or enhances existing and future transit services.	Supporting	Transit enhancements	Keep	Study Option
T-1002	Limited stopped/more frequent transit between downtown capitol to Metrocenter, Deer Valley, and Anthem.	Explore concept with public transportation providers to identify if this recommendation supports or enhances existing and future transit services.	Supporting	Transit enhancements	Keep	Study Option
T-1003	Limited stopped/more frequent transit from Ahwatukee to Tempe (all day).	Explore concept with public transportation providers to identify if this recommendation supports or enhances existing and future transit services.	Supporting	Transit enhancements	Keep	Study Option
T-1004	Limited stopped/more frequent transit from Ahwatukee to Phoenix (all day).	Explore concept with public transportation providers to identify if this recommendation supports or enhances existing and future transit services.	Supporting	Transit enhancements	Keep	Study Option
T-1014	New express bus routes.	As no specific express routes are identified, consider their implementation as an overall policy recommendation from this study for continuing planning with public transportation providers.	Supporting	Transit enhancements	Keep	Study Option
T-1020	Add park-and-rides/Increased park-and-ride capacity.	Continuing recommendation under consideration and development by the region's public transportation providers.	Supporting	Transit enhancements	Keep	Study Option
T-1021	New transit center northeast corner of Pecos Stack to serve commuter rail on UPRR spur and BRT on I-10.	Explore concept with public transportation providers to identify if this recommendation supports or enhances existing and future transit services; long-term recommendation that needs further study when decisions are made about commuter rail operations in metropolitan Phoenix.	Supporting	Transit enhancements	Keep	Study Option
T-1022	Transit station at 48th Street and Broadway.	Explore concept with public transportation providers to identify if this recommendation supports or enhances existing and future transit services.	Supporting	Transit enhancements	Keep	Study Option
T-1025	Expand Bell Road park-and-ride.	Explore concept with public transportation providers to identify if this recommendation supports or enhances existing and future transit services.	Supporting	Transit enhancements	Keep	Study Option
T-1026	Move Metrocenter park-and-ride on east side of mall.	Land-use decision for land owner and Phoenix Public Transportation; under study by Valley Metro for consideration with the Light Rail Extension and Mountain View DHOV efforts.	Supporting	Transit enhancements	Keep	Underway
S-1032	Reverse Ramps.	Added to the third backbone alternative, Adaptive Access, identified for the overall Corridor Master Plan.	Supporting	Weaves	Keep	Alternative Feature
I1-1017	Braid ramp weaves throughout segment.	Incorporate, where needed, in the third backbone alternative, Adaptive Access, for the overall Corridor Master Plan.	Supporting	Weaves	Keep	Impact Remedy
I2-1031	Braid weave northbound I-10 on C-D road between Baseline and US-60.	Part of the Near-Term Improvement Strategy.	Supporting	Weaves	Keep	Underway
A1-1000	Fund access management plan for high traffic generators (Arizona Mills and Wild Horse Pass Casino) Consider remote parking and shuttle access.	Outside the scope of this Corridor Master Plan.	Supporting	Arterial modifications	Drop	Not applicable
A1-1003	Parallel corridor reconfiguration. Create parallel and continuous I-10 route on Priest (Avenida del Yaqui).	Not compatible with Town of Guadalupe Master Plan.	Supporting	Arterial modifications	Drop	Not applicable

Table 4-6. Level 2A Screening – Supporting Concepts

Combined Alt. ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening	Level 2 Screening
A2-1007	Phoenix Sky Harbor International Airport zone transportation analysis (and ASU and Arizona Mills and layering effect).	Not specific enough of an alternative to incorporate into the Corridor Master Plan.	Supporting	Arterial modifications	Drop	Not applicable
A3-1006	Convert 19th Avenue to an Arizona parkway with indirect left design.	Not compatible with City of Phoenix Master Plan.	Supporting	Arterial modifications	Drop	Not applicable
A3-1010	Consider reducing capacity on 35th Avenue to create multiuse corridor (with reduced lane widths and bicycle lanes).	Not compatible with City of Phoenix Master Plan.	Supporting	Arterial modifications	Drop	Not applicable
A3-1012	19th and 35th avenues - need better operations to support I-17.	Not specific enough of an alternative to incorporate into the Corridor Master Plan.	Supporting	Arterial modifications	Drop	Not applicable
A1-1005	Enhance bicycle infrastructure on parallel arterials and encourage use of mid-mile streets.	Not specific enough of an alternative to incorporate into the Corridor Master Plan. Incorporating other specific mid-mile crossings.	Supporting	Bicycle/Pedestrian	Drop	Not applicable
BP-1036	Bicycle/Pedestrian crossing at I-10 along Alameda Drive.	Incorporated in the No-Build Alternative.	Supporting	Bicycle/Pedestrian	Drop	Not applicable
BP-1030	Bicycle/Pedestrian Crossings at Guadalupe.	Incorporated in the No-Build Alternative.	Supporting	Bicycle/Pedestrian	Drop	Not applicable
I1-1006	Move ASU campus to Casa Grande.	Outside the scope of this Corridor Master Plan.	Supporting	Policy	Drop	Not applicable
I2-1006	Add DHOV to I-10/Southern Avenue.	Not feasible because of the proximity of I-10/US-60 system interchange.	Supporting	Service traffic interchange	Drop	Not applicable
I2-1009	Elongate (lengthen) Baseline Road bridge.	Incorporated in the alternative to reconstruct Baseline Road.	Supporting	Service traffic interchange	Drop	Not applicable
I4-1009	Consider converting single-occupancy vehicle traffic interchanges to DHOV traffic interchanges.		Supporting	Service traffic interchange	Drop	Not applicable
A1-1008	Connect Southern, South Bound to I-10 frontage roads (relieve Baseline).	Not feasible because of the proximity of I-10/US-60 system interchange.	Supporting	Service traffic interchange	Drop	Not applicable
S-1014	Direct HOV-freeway/freeway, arterial/freeway	Not specific enough of an alternative to incorporate into the Corridor Master Plan.	Supporting	System traffic interchange/Service traffic interchange	Drop	Not applicable
T-1031	Market travel choices to Ahwatukee residents.	Not specific enough of an alternative to incorporate into the Corridor Master Plan.	Supporting	TDM/TSM	Drop	Not applicable
S-1028	Incentivize local travel with tax credits/incentives.	Outside the scope of this Corridor Master Plan.	Supporting	TDM/TSM	Drop	Not applicable
S-1027	Convert Interstate to a toll road.	Requires an act of Congress to convert an Interstate to a toll road.	Supporting	TDM/TSM	Drop	Not applicable
ITS-1002	Drone surveillance.	Outside the scope of this Corridor Master Plan.	Supporting	TDM/TSM	Drop	Not applicable
S-1009	Add truck only lanes to the arterial corridors of interest.	Not compatible with City of Phoenix Master Plan.	Supporting	TDM/TSM	Drop	Not applicable
S-1017	Infill development in employment centers to reduce VMT.	Outside the scope of this Corridor Master Plan.	Supporting	TDM/TSM	Drop	Not applicable
S-1024	Bring back photo radar on freeway systems.	Outside the scope of this Corridor Master Plan.	Supporting	TDM/TSM	Drop	Not applicable

Table 4-6. Level 2A Screening – Supporting Concepts

Combined Alt. ID	Description	Comments	Backbone/ Supporting	Subcategory	Level 1 Screening	Level 2 Screening
S-1026	Educate motorists on insurance laws by providing flyers in MVD renewals.	Outside the scope of this Corridor Master Plan.	Supporting	TDM/TSM	Drop	Not applicable
I2-1008	Close/Relocate shipping operations from Phoenix Sky Harbor International Airport to Mesa Gateway.	Outside the scope of this Corridor Master Plan.	Supporting	TDM/TSM	Drop	Not applicable
I2-1015	Separate truck detour routes from Broadway Curve.	Not specific enough of an alternative to incorporate into the Corridor Master Plan.	Supporting	TDM/TSM	Drop	Not applicable
I3-1012	Restrict trucks from I-10 inner loop. Make I-10 inner loop a state highway.	Outside the scope of this Corridor Master Plan.	Supporting	TDM/TSM	Drop	Not applicable
A3-1009	Land uses of 35th avenue and emerging land uses on 19th avenue don't accommodate moving trips off of I-17.	Outside the scope of this Corridor Master Plan.	Supporting	TDM/TSM	Drop	Not applicable
S-1030	Performance MOEs of existing systems.	Not specific enough of an alternative to incorporate into the Corridor Master Plan.	Supporting	TDM/TSM	Drop	Not applicable
T-1023	Light rail transit crossing along Mountain View alignment at Metrocenter.	Referred to Valley Metro.	Supporting	Transit enhancements	Drop	Not applicable
T-1024	Valley Metro is working on a project definition study for Phoenix west/Central Glendale corridor. Potential locations to cross I-17 include Camelback (north side) and Glendale Avenue.	Referred to Valley Metro.	Supporting	Transit enhancements	Drop	Not applicable
S-1018	Increased local funding for operations management and maintenance.	Outside the scope of this Corridor Master Plan.	Supporting		Drop	Not applicable
I1-1007	Expand project limits to Queen Creek Road.	Outside the scope of this Corridor Master Plan.	Supporting		Drop	Not applicable
I2-1017	Do nothing – see how South Mountain and/or near-term improvements will help.	No-build alternative.	Supporting		Drop	Not applicable
I4-1010	Architectural treatment to I-17 (make more desirable to drive).	Not specific enough of an alternative to incorporate into the Corridor Master Plan.	Supporting		Drop	Not applicable
I3-1015	Ask FCDMC how to get rid of Cave Creek Wash at I-17.	Outside the scope of this Corridor Master Plan.	Supporting		Drop	Not applicable

Table 4-7. Level 2A Screening – Scoring Justification

Row No.	Alt. ID	Category	Weights:		0.185	0.082	0.078	0.046	0.044	0.044	0.053
			Description	Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities	
1	S-1000	Highway capacity	Construct HOT lanes or convert HOV to HOT lanes (at grade or elevated). Rated as converted only.	4 – Rated for converting HOV lane to HOT lane and not for adding a lane.	3 – Safety would not improve when compared to no build.	5 – Would improve travel time reliability for users of HOT lanes.	3 – Does not replace deficient infrastructure.	3 – HOT lanes would not reduce congestion duration for the overall corridor.	3 – Would only improve travel time for HOT users and not measurably improve travel time for the entire corridor.	3 – Minimal to moderate impacts to 4(f)/Section 6(f) of the Land and Water Conservation Act [Section 6(f)]; same or similar to No-Build for EJ.	
2	S-1001	Highway capacity	Add a second 2+ HOV lane.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	5 – Would improve travel time reliability for users of HOV lanes.	3 – Does not replace deficient infrastructure.	4 – A second HOV lane throughout the interstate corridor would reduce HOV congestion duration.	3 – Would only improve travel time for HOV users and not measurably improve travel time for the entire corridor.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	
3	S-1003	Highway capacity	Add one additional general purpose lane in each direction to Interstate.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	3 – Would not measurably improve travel time reliability for corridor users.	3 – Does not replace deficient infrastructure.	4 – One additional general purpose lane would measurably reduce congestion duration.	3 – Would not measurably improve travel time for the entire corridor.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
4	S-1004	Highway capacity	Add two additional general purpose lanes in each direction to Interstate.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	4 – Would improve travel time reliability for users of general purpose lanes.	3 – Does not replace deficient infrastructure.	4 – Two additional general purpose lane would measurably reduce congestion duration.	4 – Would moderately improve travel time for the entire corridor.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	
5	S-1005	Highway capacity	Add three additional general purpose lanes in each direction to Interstate.	1 – Rated 1 because it adds new pavement.	2 – Safety is decreased when compared to no build because of increased weaves.	5 – Would improve travel time reliability for users of general purpose lanes.	3 – Does not replace deficient infrastructure.	4 – Three additional general purpose lane would measurably reduce congestion duration.	4 – Would moderately improve travel time for the entire corridor.	1 – Negatively affects EJ; high impacts on 4(f) and 6(f) properties.	
6	S-1031	Highway capacity	Create barrier separated express/local lane system.	2 – Enhances existing system utilization but expands existing system and infrastructure.	4 – Safety is increased when compared to no build because it decreases weaving.	4 – Would improve travel time reliability by separating out the local weaving from the express lanes.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by separating out the local traffic and eliminating the weaves.	4 – Would moderately improve travel time for the entire corridor by separating the local traffic from express traffic.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
7	S-1037	Highway capacity	Add a second 2+ HOV lane with extra wide inside shoulders (16') for enforcement purposes and to provide the necessary width for future managed lanes conversion.	1 – Rated 1 because it adds new pavement.	5 – Safety for HOV traffic and DPS enforcement would significantly increase when compared to no build.	5 – Would improve travel time reliability for HOV users by adding an additional lane extra wide shoulders.	3 – Does not replace deficient infrastructure.	4 – A second HOV lane throughout the interstate corridor would reduce HOV congestion duration.	3 – Would only improve travel time for HOV users and not measurably improve travel time for the entire corridor.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	

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Row No.	Alt. ID	Category	Weights:		0.185	0.082	0.078	0.046	0.044	0.044	0.053
			Description	Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities	
8	S-1038	Highway capacity	Create a striped express/local lane system.	4 – Enhances existing system utilization with small infrastructure changes and without expanding existing system.	3 – Safety would not improve when compared to no build.	4 – Would improve travel time reliability by separating out the local weaving from the express lanes (stripe only).	3 – Does not replace deficient infrastructure.	3 – Express/local lanes would not reduce congestion duration because it adds no new capacity.	3 – Would not improve travel time for the entire corridor because local and express traffic is only separated by a stripe.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
9	I1-1008	Highway capacity	Frontage roads between Pecos stack and US 60.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration because it does not add enough capacity to the interstate corridor to make a measurable difference.	3 – Would not measurably improve travel time for that segment of the corridor.	1 – Negatively affects EJ; high impacts on 4(f) and 6(f) properties.	
10	I1-1010	Highway capacity	Free express lanes from SR-202L to Broadway curve.	3 – Enhances existing system utilization but changes existing system.	3 – Safety would not improve when compared to no build.	4 – Would improve travel time reliability for the express lane users by removing the weaving movements.	3 – Does not replace deficient infrastructure.	3 – Express/local lanes would not reduce congestion duration because it adds no new capacity.	3 – Would not measurably improve travel time for that segment of the corridor.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
11	I1-1027	Highway capacity	Create a frontage road system for I-10 between Elliot and Baseline for system redundancy.	1 – Rated 1 because it adds new pavement.	4 – Safety is increased when compared to no build because would remove some local traffic from I-10 and provide a parallel route to I-10.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration because it does not add enough capacity to the interstate corridor to make a measurable difference.	3 – Would not measurably improve travel time for that segment of the corridor.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ. (Rating changed because it can all be completed within ADOT ROW.)	
12	I2-1023	Highway capacity	Reevaluate the 1988 C-D system plan, which was a smaller footprint than the EIS terminated recently. Potentially review 1988 plan to route C-D roads south of Split to connect with I-17 and avoid Phoenix Sky Harbor International Airport issues. Limit trucks to local lane section of C-D system.	1 – Rated 1 because it adds new pavement.	4 – Safety is increased when compared to no build because would remove some local traffic from I-10 and provide a parallel route to I-10.	4 – Would improve travel time reliability by removing the weaving movements.	5 – Replaces deficient infrastructure in project area.	4 – Would reduce congestion duration by separating out the local traffic and eliminating the weaves.	4 – Would moderately improve travel time for the entire corridor by separating the local traffic from express traffic.	1 – Negatively affects EJ; high impacts on 4(f) and 6(f) properties.	
13	I2-1032	Highway capacity	Get rid of the eastbound C-D pinch point at Fairmont. May require 1 more southbound I-10 lane.	Dropped by evaluation team – addressed by near term improvement strategy.							
14	I2-1033	Highway capacity	Restore HOV balance.	1 – Rated 1 because it adds new pavement.	4 – Increases safety when compared to no build by providing HOV balance within the corridor.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	4 – A second HOV lane to restore the HOV balance would reduce HOV congestion duration.	3 – Would only improve travel time for HOV users and not measurably improve travel time for the entire corridor.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	

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Row No.	Alt. ID	Category	Weights:		0.185	0.082	0.078	0.046	0.044	0.044	0.053
			Description	Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities	
15	I3-1000	Highway capacity	Access management for north-south frontage roads.	5 – Enhances existing system utilization without expanding the existing system and infrastructure.	5 – Safety would be significantly increase on the frontage roads with access management.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration because it does not add enough capacity to the interstate corridor to make a measurable difference.	3 – Would not measurably improve travel time for that segment of the corridor.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	
16	I3-1004	Highway capacity	Replace I-17 in kind with current standards to replace the aging infrastructure. Will redesign to reflect the high truck percentages in this segment corridor.	2 – Rated 2 because it expands existing system but stays within existing ROW.	5 – Significantly increases safety when compared to no build because it brings the entire corridor up to standards.	4 – Would improve travel time reliability by bringing the segment to current standards and replacing all deficient infrastructure.	5 – Replaces all deficient infrastructure within project area.	3 – Would not reduce congestion duration because it does not add enough capacity to the interstate corridor to make a measurable difference.	4 – Would improve travel times by bringing the interstate corridor up to standard. Infrastructure would be able to better handle incident management.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
17	I3-1018	Highway capacity	Extend HOV lanes throughout entire I-17.	1 – Rated 1 because it adds new pavement.	4 – Increases safety when compared to no build by eliminating HOV discontinuity.	3 – Would not measurably improve travel time reliability.	3 – Does not replace deficient infrastructure.	4 – Would reduce HOV congestion duration.	3 – Would not measurably improve travel time for that segment of the corridor.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
18	I4-1000	Highway capacity	Widen I-17 to full design standards (12' lanes and full shoulders).	2 – Rated 2 because it expands existing system but stays within existing ROW.	5 – Significantly increases safety when compared to no build because it brings lanes and shoulders up to standards.	4 – Would improve travel time reliability by bringing the segment to current standards.	4 – Replaces some deficient infrastructure within project area.	3 – Would not reduce congestion duration because it does not add enough capacity to the interstate corridor to make a measurable difference.	4 – Would improve travel times by bringing the interstate corridor up to standard. Infrastructure would be able to better handle incident management.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	
19	I4-1002	Highway capacity	Extend HOV lanes through the Stack interchange.	1 – Rated 1 because it adds new pavement.	4 – Increases safety when compared to no build by eliminating HOV discontinuity.	3 – Would not measurably improve travel time reliability.	3 – Does not replace deficient infrastructure.	4 – Would reduce HOV congestion duration.	3 – Would not measurably improve travel time for that segment of the corridor.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
20	I4-1003	Highway capacity	Eliminate frontage roads to widen I-17 within existing ROW.	2 – Rated 2 because it moves pavement from frontage road to interstate but stays within existing ROW.	2 – Decreases safety by moving the local traffic that uses frontage roads to I-17 mainline and increases weaving.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by adding capacity to I-17.	3 – Would not measurably improve travel time for that segment of the corridor. All local traffic would move local traffic to I-17.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	

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21	I4-1004	Highway capacity	Add frontage roads lanes/capacity.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration because it does not add enough capacity to the interstate corridor to make a measurable difference.	3 – Would not measurably improve travel time for that segment of the corridor.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	
22	I4-1005	Highway capacity	Limit frontage road access.	5 – Enhances existing system utilization without expanding the existing system and infrastructure.	4 – Safety would increase on the frontage roads with access management.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration because it does not add enough capacity to the interstate corridor to make a measurable difference.	3 – Would not measurably improve travel time for that segment of the corridor.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	
23	I4-1006	Highway capacity	Revise merge points on frontage roads.	4 – Enhances existing system utilization with small infrastructure changes and without expanding existing system.	4 – Revising merge points would increase safety on frontage roads because it would help solve weaving issues.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration because it does not add enough capacity to the interstate corridor to make a measurable difference.	3 – Would not measurably improve travel time for that segment of the corridor.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
24	I4-1011	Highway capacity	Flatten S-curve near Metrocenter. Evaluate vertical profile; develop crash map to find cause of accidents.	2 – Realignment would go outside of ROW and add new pavement but would not expand existing system.	4 – Safety would increase because it would increase sight distance and provide a better transition between the elevated and depressed sections of I-17.	4 – Would improve travel time reliability by fixing a section in the interstate corridor that has a high crash frequency.	5 – Replaces all deficient infrastructure within project area.	3 – Would not reduce congestion duration because it does not add enough capacity to the interstate corridor to make a measurable difference.	3 – Would not measurably improve travel time for that segment of the corridor.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
25	I4-1015	Highway capacity	Reduce frontage road to one lane to widen I-17.	2 – Rated 2 because it moves pavement from frontage road to interstate but stays within existing ROW.	2 – Decreases safety by moving some of the local traffic that uses frontage roads to I-17 mainline and increases weaving.	3 – Would not improve travel time reliability. Same as adding one lane to the interstate.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by adding capacity to I-17.	3 – Would not measurably improve travel time for that segment of the corridor.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
26	I4-1018	Highway capacity	Begin a "visual" transition of the ROW/lane widths to prepare drivers for transition to depressed roadway section.	4 – Enhances existing system utilization without adding new pavement or track and only minimal infrastructure upgrades.	4 – Safety would increase because it would prepare drivers	4 – Would improve travel time reliability by fixing a section in the interstate corridor that has a high crash frequency.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration because it does not add enough capacity to the interstate corridor to make a measurable difference.	3 – Would not measurably improve travel time for that segment of the corridor.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	

Table 4-7. Level 2A Screening – Scoring Justification

Row No.	Alt. ID	Category	Weights:		0.185	0.082	0.078	0.046	0.044	0.044	0.053
			Description	Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities	
27	I4-1053	Highway capacity	Access management plans/frontage road system.	5 – Enhances existing system utilization without expanding the existing system and infrastructure.	5 – Safety would be significantly increase on the frontage roads with access management.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration because it does not add enough capacity to the interstate corridor to make a measurable difference.	3 – Would not measurably improve travel time for that segment of the corridor.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	
28	I1-1018	Highway capacity	C-D roads between Pecos Stack and US-60.	1 – Rated 1 because it adds new pavement.	4- Safety would increase because weaving would be separated from I-10 mainline.	4 – Would improve travel time reliability by removing the weaving movements.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by separating out the local traffic and eliminating the weaves.	4 – Would improve travel times by separating out the local traffic and eliminating the weaves.	1 – Negatively affects EJ; high impacts on 4(f) and 6(f) properties.	
29	S-1007	Highway capacity	Add bus/BRT-only lanes to the Interstate, heavily using park-and-rides.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration because it does not add enough capacity or encourage a large enough mode shift on the interstate corridor to make a measurable difference.	3 – Would not measurably improve travel time for all the users of the corridor.	4 – Potential to improve EJ; minimal impact on 4(f) and 6(f) properties.	
30	S-1008	Highway capacity	Add truck-only lanes to the Interstate.	1 – Rated 1 because it adds new pavement.	4 – Safety increases by keeping the trucks in one lane.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration because it does not add enough capacity on the interstate corridor to make a measurable difference.	3 – Would not measurably improve travel time for all the users of the corridor.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
31	S-1021	Highway capacity	Hard shoulder running.	5 – Enhances existing system utilization without expanding the existing system and infrastructure.	1 – Safety would decrease especially in sections that have auxiliary lanes.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration because it does not add enough capacity on the interstate corridor to make a measurable difference.	3 – Would not measurably improve travel time of the corridor.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	

Table 4-7. Level 2A Screening – Scoring Justification

Row No.	Alt. ID	Category	Weights:		0.185	0.082	0.078	0.046	0.044	0.044	0.053
			Description	Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities	
32	S-1010	New transit	Add bus/BRT-only lanes to the arterial corridors of interest.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	4 – Would improve travel time reliability to the Spine corridor by removing a significant number of vehicle users from the corridor and giving transit users a reliable travel mode.	3 – Does not replace deficient infrastructure.	4 – Would moderately reduce congestion duration on the arterials by improving bus operations and eliminating the in street bus stops that block a lane of traffic.	4 – Would moderately improve the travel time of the arterials by improving bus operations and eliminating the in street bus stops that block a lane of traffic.	4 – Potential to improve EJ; minimal impact on 4(f) and 6(f) properties.	
33	S-1039	New transit	Heavy transit rail within Interstate ROW for the length of the Spine corridor.	1 – Rated 1 because it adds new track.	3 – Safety would not improve when compared to no build.	4 – Would improve travel time reliability to the Spine corridor by removing a significant number of vehicle users from the corridor and giving transit users a reliable travel mode.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration because it adds capacity and would encourage a large mode shift on the interstate corridor to make a measurable difference.	4 – Would moderately improve the travel time of the interstate because enough interstate users would switch transportation mode.	5 – Potential to improve EJ and Title VI communities; avoids all impacts to 4(f) and 6(f) properties.	
34	I4-1017	New transit	Reconsider commuter rail services on Grand Avenue to Central Business District.	1 – Rated 1 because it adds new track.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability to the Spine corridor.	3 – Does not replace deficient infrastructure.	3 – Would not measurably reduce congestion duration of the corridor.	3 – Would not measurably improve travel time of the corridor.	5 – Potential to improve EJ and Title VI communities; avoids all impacts to 4(f) and 6(f) properties.	
35	A1-1004	New transit	Extend streetcar to Arizona Mills mall and beyond Wild Horse.	1 – Rated 1 because it adds new track.	2 – Safety would decrease because the street car would be on a major arterial and have more conflict points between vehicles and the street car.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not measurably reduce congestion of duration of the corridor as not enough users would switch modes of transportation. Street car would rely on existing arterials.	3 – Would not measurably improve travel time of the corridor as not enough users would switch modes of transportation. Street car would rely on existing arterials.	5 – Potential to improve EJ and Title VI communities; avoids all impacts to 4(f) and 6(f) properties.	
36	A2-1015	New transit	Exclusive guideway transit: Southern Avenue/Central Phoenix – Phoenix Central Business District to Rural Road.	1 – Rated 1 because it adds new track.	3 – Safety would not improve when compared to no build.	4 – Would improve travel time reliability to the Spine corridor by removing a significant number of vehicle users from the corridor and giving transit users a reliable travel mode.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration because it adds capacity and would encourage a large mode shift on the corridor to make a measurable difference.	4 – Would moderately improve the travel time of the interstate because enough interstate users would switch transportation mode.	5 – Potential to improve EJ and Title VI communities; avoids all impacts to 4(f) and 6(f) properties.	

Table 4-7. Level 2A Screening – Scoring Justification

Row No.	Alt. ID	Category	Weights:		0.185	0.082	0.078	0.046	0.044	0.044	0.053
			Description	Enhances Existing System Utilization	Enhances Safety	Improves Travel Time Reliability	Replaces Deficient Infrastructure	Reduces Congestion Duration	Improves Travel Time	Disproportionate Impacts on Title VI and EJ Communities	
37	A2-1017	New transit	Build automated guideway transit on 48th Street/SR-143 from Southern Avenue to Sky Harbor Boulevard.	1 – Rated 1 because it adds new track.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not improve travel time reliability.	3 – Would not improve travel time.	5 – Potential to improve EJ and Title VI communities; avoids all impacts to 4(f) and 6(f) properties.	
38	A2-1018	New transit	Extend light rail from Central Avenue to Arizona Mills along the Western Canal.	1 – Rated 1 because it adds new track.	4 – Removes LTR from conflict with traffic down the middle of an arterial.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not improve travel time reliability.	3 – Would not improve travel time.	5 – Potential to improve EJ and Title VI communities; avoids all impacts to 4(f) and 6(f) properties.	
39	T-1005	New transit	High-capacity transit from Ahwatukee to downtown Phoenix via Tempe and Phoenix Sky Harbor International Airport (using UPRR ROW).	1 – Rated 1 because it adds new track.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not improve travel time reliability.	3 – Would not improve travel time.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
40	T-1007	New transit	High-capacity transit to downtown Glendale.	Dropped by evaluation team – unclear how this would benefit travel along I-17/currently being addressed by Valley Metro studies pursuant to project recommendation by the RTP.							
41	T-1008	New transit	High-capacity transit from Metrocenter to north.	1 – Rated 1 because it adds new track.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not improve travel time reliability.	3 – Would not improve travel time.	5 – Potential to improve EJ and Title VI communities; avoids all impacts to 4(f) and 6(f) properties.	
42	T-1009	New transit	High-capacity transit from Tempe to south.	1 – Rated 1 because it adds new track.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not improve travel time reliability.	3 – Would not improve travel time.	4 – Potential to improve EJ; minimal impact on 4(f) and 6(f) properties.	
43	T-1011	New transit	Reversible bus lane on Broadway from 52nd Street to Central Avenue	1 – Rated 1 because it adds new pavement.	2 – Safety would decrease if there are bus stops between 52nd St and Central Ave.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not improve travel time reliability.	3 – Would not improve travel time.	5 – Potential to improve EJ and Title VI communities; avoids all impacts to 4(f) and 6(f) properties.	
44	A1-1009	New transit	Reconfigure/Repurpose UPRR spur line for transit purposes, buy out industrial land uses that use it.	4 – Uses existing railroad track and does not require new track to be laid.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not improve travel time reliability.	3 – Would not improve travel time.	4 – Potential to improve EJ; minimal impact on 4(f) and 6(f) properties.	
45	T-1019	New transit	Express bus from Pecos park-and-ride to ASU.	5 – Enhances existing system utilization without expanding the existing system and infrastructure.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not improve travel time reliability.	3 – Would not improve travel time.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	

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46	T-1027	New transit	ASU West potential light rail extensions from Metrocenter.	1 – Rated 1 because it adds new track.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not improve travel time reliability.	3 – Would not improve travel time.	4 – Potential to improve EJ; minimal impact on 4(f) and 6(f) properties.	
47	I1-1003	System traffic interchange	Add DHOVs to South Mountain Freeway to I-10 (east to north and south to west).	1 – Rated 1 because it adds new pavement.	4 – Safety would increase because it would eliminate HOV weaving.	4 – Would improve travel time reliability for HOV users by eliminating the need to weave for system movements.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration for HOV users by eliminating the need to weave for the system movement.	3 – Would improve travel time only for HOV users and not for all corridor users.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
48	I1-1004	System traffic interchange	Direct access from Pecos park-and-ride to I-10.	1 – Rated 1 because it adds new pavement.	4 – Safety would increase because it would eliminate HOV weaving.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration.	3 – Would not improve travel time for all corridor users.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
49	I2-1024	System traffic interchange	Maintain three westbound US-60 lanes through Broadway Curve to past 40th Street.	Dropped by evaluation team – addressed by near term improvement strategy.							
50	I1-1016	System traffic interchange	North-to-west and east-to-south Baseline/I-10 flyover with a median landing at Baseline Road.	1 – Rated 1 because it adds new pavement.	4 – Safety would increase because conflict points would be eliminated at the intersection.	4 – Would improve travel time reliability by bypassing the I-10/Baseline Rd traffic interchange.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration because it significantly increases the interchange capacity.	4 – Would improve travel time by increasing the capacity of the interchange and removing the bottleneck.	4 – Potential to improve EJ; minimal impact on 4(f) and 6(f) properties.	
51	I2-1016	System traffic interchange	Reconfigure I-10/US-60 connection.	1 – Rated 1 because it adds new pavement.	4 – Safety would increase because it is assumed that weaves would be improved and any deficient infrastructure would be replaced.	4 – Would improve travel time reliability by increasing the capacity of the interchange and improving weaves.	5 – Replaces all deficient infrastructure within project area.	4 – Would reduce congestion duration by increasing the capacity of the interchange and improving weaves.	4 – Would improve travel time by increasing the capacity of the interchange and improving weaves.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	
52	I1-1015	System traffic interchange	New high-capacity interchange at Baseline Road.	1 – Rated 1 because it adds new pavement.	5 – Improvement in safety is inherent in replacing the interchange.	4 – Would improve travel time reliability by increasing the capacity of the interchange and removing the bottleneck.	4 – Replaces some deficient infrastructure within project area.	4 – Would reduce congestion duration because it significantly increases the interchange capacity.	4 – Would improve travel time by increasing the capacity of the interchange and removing the bottleneck.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
53	I2-1001	System traffic interchange	Add DHOV to I-10/Arizona Mills mall.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration.	3 – Would not improve travel time for all corridor users.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	

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54	I2-1018	System traffic interchange	Broadway Curve bypass. Extend SR-143 south then curve east to tie to US-60. As an option extend SR-143 south to Baseline.	1 – Rated 1 because it adds new pavement.	4 – Safety would increase because it would eliminate weaves and major conflict points.	4 – Would improve travel time reliability by providing more capacity with a parallel route at the Broadway curve segment.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by providing more capacity with a parallel route at the Broadway curve segment.	4 – Would improve travel time by providing more capacity with a parallel route at the Broadway curve segment.	1 – Negatively affects EJ; high impacts on 4(f) and 6(f) properties.	
55	I2-1029	System traffic interchange	Southbound SR-143 has numerous devices installed because of lack of signal visibility. Vertical curve needs to be reduced.	1 – Rated 1 because it adds new pavement.	5 – Purpose of alt is to improve safety	3 – Would not improve travel time reliability.	4 – Replaces some deficient infrastructure within project area.	3 – Would not reduce congestion duration.	3 – Would not improve travel time for all corridor users.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
56	I2-1000	System traffic interchange	Add DHOV to SR-143/I-10.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration for HOV users by eliminating the need to weave for the system movement.	3 – Would not improve travel time for all corridor users.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
57	I2-1010	System traffic interchange	Replace/Alter SR-143 and Broadway interchange, eliminate SR-143 loop ramp.	1 – Rated 1 because it adds new pavement.	5 – Improvement in safety is inherent in replacing the interchange.	4 – Would improve travel time reliability by increasing the capacity of the interchange, removing the bottleneck of the loop, and eliminating weaves.	4 – Replaces some deficient infrastructure within project area.	4 – Would reduce congestion duration by increasing the capacity of the interchange, removing the bottleneck of the loop, and eliminating weaves.	4 – Would improve travel time by increasing the capacity of the interchange, removing the bottleneck of the loop, and eliminating weaves.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
58	I2-1026	System traffic interchange	Add westbound Broadway to northbound SR-143 ramp.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration.	3 – Would not improve travel time for all corridor users.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
59	I2-1030	System traffic interchange	Increase eastbound I-10/Broadway on-ramp capacity.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	4 – Would improve travel time reliability by increasing the capacity of the exit ramp.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by increasing the capacity of the exit ramp.	4 – Would improve travel time by increasing the capacity of the exit ramp.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
60	I2-1005	System traffic interchange	Add DHOV to I-10/Broadway Road.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration.	3 – Would not improve travel time for all corridor users.	4 – Potential to improve EJ; minimal impact on 4(f) and 6(f) properties.	
61	I2-1036	System traffic interchange	Add two-lane (choice lane) exit ramps along I-10 westbound at Broadway Road.	1 – Rated 1 because it adds new pavement.	4 – Safety would increase when compared to no build and reduce the chance of the ramp backing up on the interstate.	4 – Would improve travel time reliability by increasing the capacity of the exit ramp.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by increasing the capacity of the exit ramp.	4 – Would improve travel time by increasing the capacity of the exit ramp.	4 – Potential to improve EJ; minimal impact on 4(f) and 6(f) properties.	

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62	I2-1037	System traffic interchange	Add two-lane (choice lane) exit ramps along I-10 westbound at SR-143 and 40th Street.	1 – Rated 1 because it adds new pavement.	4 – Safety would increase when compared to no build and reduce the chance of the ramp backing up on the interstate.	4 – Would improve travel time reliability by increasing the capacity of the exit ramp.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by increasing the capacity of the exit ramp.	4 – Would improve travel time by increasing the capacity of the exit ramp.	4 – Potential to improve EJ; minimal impact on 4(f) and 6(f) properties.	
63	I2-1013	System traffic interchange	I-10 realignment at the Split.	1 – Rated 1 because it adds new pavement.	4 – Improvement in safety is inherent in replacing the interchange.	4 – Would improve travel time reliability by improving sight distance issues and reducing incidents.	5 – Replaces all deficient infrastructure within project area.	4 – It is assumed that a realignment of the Split would improve system weaves.	3 – Would not measurably improve travel time because the purpose of realigning the Split is only to move it outside of the Sky Harbor RPZ. There are not capacity issues at the Split.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	
64	I3-1006	System traffic interchange	Add DHOVs to Split.	1 – Rated 1 because it adds new pavement.	5 – Safety would increase because it would eliminate HOV weaving.	4 – Would improve travel time reliability for HOV users by eliminating the need to weave for the system movement.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration for HOV users by eliminating the need to weave for the system movement.	3 – Would not improve travel time for all corridor users.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
65	I3-1005	System traffic interchange	Add DHOVs to Stack.	1 – Rated 1 because it adds new pavement.	5 – Safety would increase because it would eliminate HOV weaving.	4 – Would improve travel time reliability for HOV users by eliminating the need to weave for the system movement.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration for HOV users by eliminating the need to weave for the system movement.	3 – Would not improve travel time for all corridor users.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
66	I3-1019	System traffic interchange	The Stack traffic interchange southeastern quadrant, three concepts from previous I-17 study.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	4 – Would improve travel time reliability by increasing capacity and separating out the weave movements.	5 – Replaces all deficient infrastructure within project area.	4 – Would improve congestion duration by increasing capacity and separating out the weave movements.	4 – Would improve travel time by increasing capacity and separating out the weave movements.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	
67	I3-1020	System traffic interchange	The Stack traffic interchange southwestern quadrant, three concepts from previous I-17 study.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	4 – Would improve travel time reliability by increasing capacity and separating out the weave movements.	5 – Replaces all deficient infrastructure within project area.	4 – Would improve congestion duration by increasing capacity and separating out the weave movements.	4 – Would improve travel time by increasing capacity and separating out the weave movements.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	
68	I4-1054	System traffic interchange	The Stack traffic interchange northeastern quadrant, three concepts from previous I-17 study.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	4 – Would improve travel time reliability by increasing capacity and separating out the weave movements.	5 – Replaces all deficient infrastructure within project area.	4 – Would improve congestion duration by increasing capacity and separating out the weave movements.	4 – Would improve travel time by increasing capacity and separating out the weave movements.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	

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69	I4-1055	System traffic interchange	The Stack traffic interchange northwestern quadrant, two concepts from previous I-17 study.	1 – Rated 1 because it adds new pavement.	3 – Safety would not improve when compared to no build.	4 – Would improve travel time reliability by increasing capacity and separating out the weave movements.	5 – Replaces all deficient infrastructure within project area.	4 – Would improve congestion duration by increasing capacity and separating out the weave movements.	4 – Would improve travel time by increasing capacity and separating out the weave movements.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	
70	I4-1024	System traffic interchange	Analyze which DHOV to build at North Stack.	5 – Enhances existing system utilization without expanding the existing system and infrastructure.	5 – Safety would increase because it would eliminate HOV weaving.	4 – Would improve travel time reliability for HOV users by eliminating the need to weave for the system movement.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration for HOV users by eliminating the need to weave for the system movement.	3 – Would not improve travel time for all corridor users.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
71	I4-1052	System traffic interchange	Fix the North Stack north to east and south to east movements.	Dropped by evaluation team – addressed with the SR-101L/Pima, I-17 to SR-51 add lanes project.							
72	ITS-1001	Tech	Upgrade ramp metering.	5 – Rated 5 because it will theoretically significantly increase interstate capacity and travel time reliability with only upgrading ramp meters.	5 – Safety would increase because it would introduce smart metering to the interstate.	5 – Would improve travel time reliability by controlling the rate of vehicles entering the interstate corridor.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by controlling the rate of vehicles entering the interstate corridor.	4 – Would improve travel time by controlling the rate of vehicles entering the interstate corridor.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
73	ITS-1003	Tech	Expand collection and dissemination of real-time traffic data/conditions within study area and/or Valley wide. Deploy real-time traffic movement and measuring devices (ARID).	5 – Enhances existing system utilization without expanding the existing system and infrastructure.	5 – Safety would improve when compared to no build.	5 – Would improve travel time reliability by giving users better information on traffic so that users can adjust their route to underutilized corridors.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by giving users better information on traffic so that users can adjust their route to underutilized corridors.	4 – Would improve travel time by giving users better information on traffic so that users can adjust their route to underutilized corridors.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
74	ITS-1005	Tech	Coordination on traffic incidents with ADOT and local jurisdictions.	5 – Enhances existing system utilization without expanding the existing system and infrastructure.	5 – Safety would improve when compared to no build.	5 – Would improve travel time reliability by improving incident management.	3 – Does not replace deficient infrastructure.	5 – Would reduce congestion duration by improving incident management.	4 – Would improve travel time by improving incident management.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
75	ITS-1006	Tech	Arterial management system (ITS) – surveillance, traffic control, parking management, DMS, information dissemination and full integration. Including dedicated transit and parking ITS, adaptive traffic signals to adjust to traffic volumes and coordination between freeway and arterials at interchange signals.	4 – Enhances existing system utilization without adding new pavement or track and only minimal infrastructure upgrades.	5 – Safety would improve when compared to no build.	5 – Would improve travel time reliability.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration.	5 – Would improve travel time.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	

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76	ITS-1007	Tech	CCTV, traffic signal sharing responsibilities between agencies.	Dropped by evaluation team – effort presently underway through the Regional Community Network.							
77	ITS-1008	Tech	Add TSP for bus service on 35th Avenue to help maintain schedules due to frequent school zone crossings. Add TSP to 19th Avenue to help meet connections with light rail transit.	3 – Only enhances transit system at the detriment of the arterial system.	4 – Safety would improve for transit services when compared to no build.	4 – Would improve travel time reliability for transit users.	3 – Does not replace deficient infrastructure.	2 – Would not reduce congestion duration on the arterials for the majority of the arterial users.	4 – Would improve travel time for transit users.	4 – Potential to improve EJ; minimal impact on 4(f) and 6(f) properties.	
78	ITS-1009	Tech	Consolidated TOC.	5 – Enhances existing system utilization without expanding the existing system and infrastructure.	4 – Safety would improve when compared to no build.	5 – Would improve travel time reliability by improving agency coordination.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by improving agency coordination.	4 – Would improve travel time by improving agency coordination.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
79	ITS-1010	Tech	Connected vehicle integration (personal vehicles and freight).	4 – Enhances existing system utilization without adding new pavement or track and only minimal infrastructure upgrades.	5 – Safety would improve when compared to no build.	4 – Would improve travel time reliability by utilizing the technology built into connected vehicle that will increase corridor capacity.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by utilizing the technology built into connected vehicle that will increase corridor capacity.	4 – Would improve travel time by utilizing the technology built into connected vehicle that will increase corridor capacity.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
80	ITS-1011	Tech	Additional traffic operations staff and maintenance staff for City of Phoenix.	5 – Enhances existing system utilization without expanding the existing system and infrastructure.	5 – Safety would improve when compared to no build.	4 – Would improve travel time reliability by providing Phoenix with more staff resources.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by providing Phoenix with more staff resources.	4 – Would improve travel time by providing Phoenix with more staff resources.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
81	ITS-1012	Tech	Better local jurisdiction coordination to close the gap, interconnect between cities.	5 – Enhances existing system utilization without expanding the existing system and infrastructure.	5 – Safety would improve when compared to no build.	4 – Would improve travel time reliability by increasing agency coordination.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by increasing agency coordination.	4 – Would improve travel time by increasing agency coordination.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
82	ITS-1014	Tech	Variable speed control on Interstate.	4 – Enhances existing system utilization without adding new pavement or track and only minimal infrastructure upgrades.	4 – Safety would improve when compared to no build.	5 – Would improve travel time reliability by giving agencies the ability set speed appropriate to conditions.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by mitigating shock waves through the system caused by incidents and preventing secondary incidents.	4 – Would improve travel time by mitigating shock waves through the system caused by incidents.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	

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83	ITS-1015	Tech	Lane control signals.	4 – Enhances existing system utilization without adding new pavement or track and only minimal infrastructure upgrades.	5 – Safety would improve when compared to no build.	5 – Would improve travel time reliability by providing information to corridor users.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by providing information to corridor users.	4 – Would improve travel time by providing information to corridor users.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
84	ITS-1016	Tech	Active motorways, active management.	4 – Enhances existing system utilization without adding new pavement or track and only minimal infrastructure upgrades.	5 – Safety would improve when compared to no build.	5 – Would improve travel time reliability by allowing agencies to actively manage the corridor.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by allowing agencies to actively manage the corridor.	5 – Would improve travel time by allowing agencies to actively manage the corridor.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
85	ITS-1017	Tech	Dynamic HOV lane occupancy control.	4 – Enhances existing system utilization without adding new pavement or track and only minimal infrastructure upgrades.	3 – Safety would not improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration for HOV users.	3 – Would not improve travel time for all corridor users.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
86	ITS-1018	Tech	Advance queue warning for northbound traffic on I-10 when approaching Broadway Curve.	4 – Enhances existing system utilization without adding new pavement or track and only minimal infrastructure upgrades.	5 – Safety would improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by allowing interstate users to find alternate routes earlier.	3 – Would not improve travel time for all corridor users.	2 – Could affect 4(f)/6(f) properties; minor EJ impacts.	
87	ITS-1019	Tech	Automated speed warning in advance of high crash frequency locations.	4 – Enhances existing system utilization without adding new pavement or track and only minimal infrastructure upgrades.	5 – Safety would improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by mitigating shock waves through the system caused by incidents and preventing secondary incidents.	3 – Would not improve travel time for all corridor users.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
88	S-1016	Tech	Interagency coordination for alternate routing during incidents.	5 – Enhances existing system utilization without expanding the existing system and infrastructure.	5 – Safety would improve when compared to no build.	4 – Would improve travel time reliability by improving agency coordination and incident management.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by improving agency coordination and incident management.	4 – Would improve travel time by improving agency coordination and incident management.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	

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89	A3-1007	Tech	Incorporate TSMO into I-17 corridor including 19th and 35th avenues as synchronized alternatives.	4 – Enhances existing system utilization without adding new pavement or track and only minimal infrastructure upgrades.	5 – Safety would improve when compared to no build.	4 – Would improve travel time reliability by improving agency coordination and incident management.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion duration by improving agency coordination and incident management.	4 – Would improve travel time by improving agency coordination and incident management.	4 – Potential to improve EJ; minimal impact on 4(f) and 6(f) properties.	
90	I3-1011	Tech	Signal timing for turning trucks at 19th Avenue/I-17.	5 – Enhances existing system utilization without expanding the existing system and infrastructure.	5 – would reduce queues	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	4 – Would reduce congestion and queues at 19th Ave/I-17	3 – Would not improve travel time for all corridor users.	4 – Potential to improve EJ; minimal impact on 4(f) and 6(f) properties.	
91	I4-1021	Tech	Upgrade signal operation at traffic interchanges to emphasize frontage road through movements to fully utilize frontage road capacity.	5 – Enhances existing system utilization without expanding the existing system and infrastructure.	3 – Safety would not improve when compared to no build.	2 – Would decrease travel time reliability for the crossing arterials at the traffic interchanges.	3 – Does not replace deficient infrastructure.	2 – Would increase congestion duration on crossing arterials at the traffic interchanges.	2 – Would increase travel time for the crossing arterials at the traffic interchanges.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	
92	ITS-1004	Tech	Way finding for emergency/alternate routes.	4 – Enhances existing system utilization without adding new pavement or track and only minimal infrastructure upgrades.	5 – Safety would improve when compared to no build.	3 – Would not improve travel time reliability.	3 – Does not replace deficient infrastructure.	3 – Would not reduce congestion duration for all corridor users.	3 – Would not improve travel time for all corridor users.	3 – Minimal to moderate impacts to 4(f)/6(f); same or similar to No-Build for EJ.	

4.3.2 Level 2B Screening

The Level 2B screening focused only on the ability to implement the nine backbone alternatives that came out of the Level 2A screening. The implementation criteria and the associated scoring weighting were established by the Management Partners at the outset of the Level 2 screening. The surviving backbone alternatives and percentages were evaluated against the implementation criteria, which are listed in Table 4-8. Backbone alternatives moved to the next level of screening if they received a high implementation score and addressed the project’s purpose and need. Backbone alternatives were dropped only if the alternatives did not improve corridor capacity and reliability or addressed only a narrow segment of corridor users, such as adding truck-only lanes and bus/BRT-only lanes.

Five backbone alternatives survived and advanced to the Level 3 screening. The five backbone alternatives included:

- Rehabilitating and rebuilding I-17 to full standards.
- Adding a general purpose lane in each direction.
- Adding an additional HOV lane in each direction.
- Converting the existing HOV lanes into HOT lanes.
- Converting the existing HOV lanes into striped express local lanes.

It was decided to create two additional backbone alternatives that were variations of converting the existing HOV lanes to either HOT or striped express/local lanes. Because the conversion options did not add capacity by providing an additional lane, such as the options to add a general purpose or an HOV lane, two options were added that converted the existing HOV lanes to a HOT or an express/local lane and also added a second HOT or express/local lane. This was done so that the HOT and express/local lanes options would not be at a capacity disadvantage in the Level 3 screening. See Table 4-9 for the Level 2B screening results and Table 4-10 for the Level 2B screening scoring justification.

Table 4-8. Spine Level 2B Screening

Criteria	(1) Lower Score		Higher Score (5)	Summary
Implement: Practicability (11.7%) <i>Based on cost, logistics and operation, how easy/hard is this to implement.</i>	Alternative’s magnitude of cost, constructibility and/or reliance on technological advancement pose a considerable challenge.	Alternative’s magnitude of cost, constructibility and/or reliance on technological advancement pose a moderate challenge.	Alternative has a low magnitude of cost, has ease of constructibility and/or relies on existing technology.	Alternatives that promote operational enhancements do well.
Implement: Agency Support (11.7%) <i>What levels of support exist or what are the anticipated impacts (e.g., ROW takes).</i>	Alternative would have little or no agency and stakeholder support.	Alternative would have moderate or mixed agency and stakeholder support.	Alternative would have considerable or full agency and stakeholder support.	Alternatives that can be implemented with little disruption or have existing support do well.
Implement: Alternative Adaptability (5%) <i>Alternative’s ability to adapt to changing demographics.</i>	Alternative cannot be easily modified or changed (e.g., relies on physical infrastructure improvements).	Alternative has moderate flexibility for modification (e.g., lane conversions, signs).	Alternative can easily be modified (e.g., technology).	Alternatives that are technology-based do well.
Implement: Programming Flexibility (5%) <i>Alternative’s ability to be phased or segmented.</i>	Alternative is not easily phased or segmented (e.g., unable to break into segments of independent utility).	Alternative has moderate flexibility for phasing or segmentation.	Alternative can easily be phased or segmented or has flexibility in implementation.	Alternatives that can be phased or are spot improvements do well.

Table 4-9. Level 2B Screening – Backbone

Row No.	Category	Alt. ID	Weights ->				Weighted Score	2B Rank	Recommendation	Notes/Comments	
			0.117 Practicability	0.117 Agency Support	0.05 Alternative Adaptability	0.05 Programming Flexibility					
1	Highway capacity	I4-1000	Widen I-17 to full design standards (12-foot lanes and full shoulders).	3	4	3	4	3.500	1	Alternative	Carry forward to Level 3 screening.
2	Highway capacity	S-1001	Add a second 2+ HOV lane.	2	3	4	4	2.949	2	Alternative	Carry forward to Level 3 screening.
3	Highway capacity	S-1038	Create a striped express/local lane system.	4	2	3	2	2.850	3	Alternative	Carry forward to Level 3 screening.
4	Highway capacity	S-1037	Add a second 2+ HOV lane with extra-wide inside shoulders (16-foot) for enforcement purposes and to provide the necessary width for future managed lanes conversion.	1	3	4	4	2.599	4	Make an Alternative Feature	Similar to S-1001 and would work operationally the same. Make this an alternative feature that will be considered after S-1001 is evaluated.
5	Highway capacity	S-1000	Construct HOT lanes or convert HOV to HOT lanes (at grade or elevated). Rated as converted only.	3	2	3	2	2.500	5	Alternative	Carry forward to Level 3 screening.
6	Highway capacity	S-1003	Add one additional general purpose lane in each direction to Interstate.	2	3	2	3	2.500	5	Alternative	Carry forward to Level 3 screening.
7	Highway capacity	S-1008	Add truck-only lanes to the Interstate. Rated as an add lane.	2	3	3	1	2.350	7	Drop	Poor score; commercial vehicle volumes do not warrant the need for separate lanes throughout the entire corridor. Requires additional lane as it is not an HOV lane conversion.
8	Highway capacity	S-1010	Add bus/BRT-only lanes to the Interstate, heavily using park-and-rides. Rated as an add lane.	2	2	3	2	2.150	8	Drop	Poor score; public transportation demand does not warrant the need for separate lanes throughout the entire corridor. Requires additional lane as it is not an HOV lane conversion.
9	Highway capacity	I3-1004	Replace I-17 in kind with current standards to replace the aging infrastructure. Will redesign to reflect the high truck percentages in this segment corridor.	2	2	1	1	1.701	9	Drop	Major reconstruction requires full standards on the Interstate.

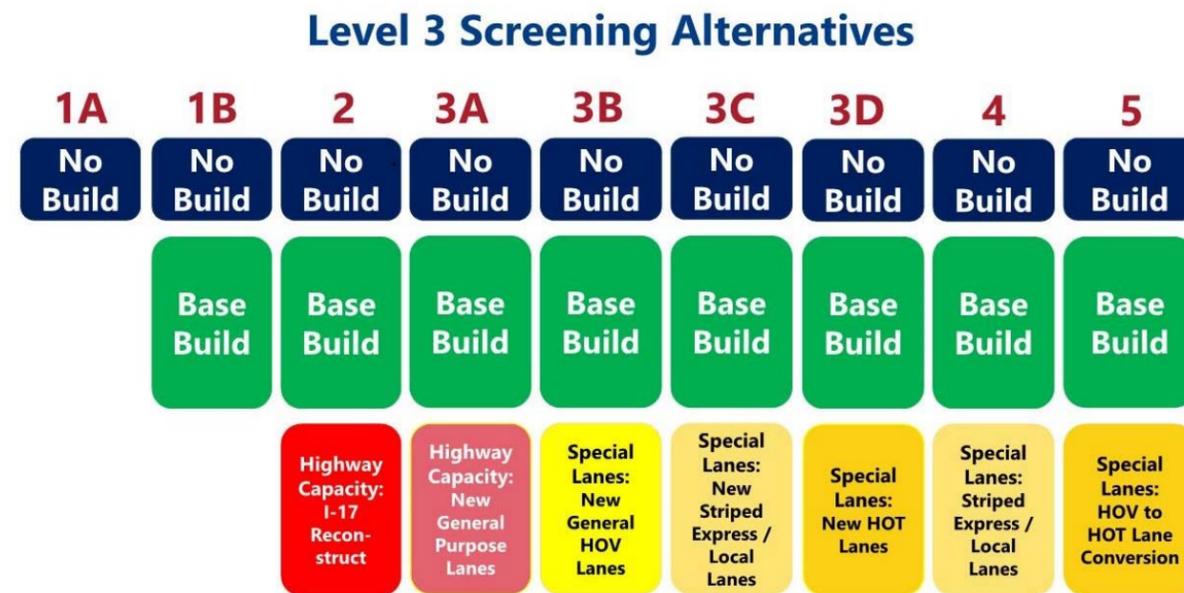
Table 4-10. Level 2B Scoring Justification

Row No.	Category	Alt. ID	Weights ->		0.117	0.117	0.050	0.050
			Description	Practicability				
1	Highway capacity	I4-1000	Widen I-17 to full design standards (12-foot lanes and full shoulders).	3 – Moderate order of magnitude of cost when compared to other alternatives.	4 – Majority of support to replace I-17 since it is old and many infrastructure components are deficient. Cost and maintenance of traffic during construction detract from support.	3 – Can be partially modified (converted) to adapt to changing demographics due to added pavement.	4 – Has some programming flexibility (phase funding and termini).	
2	Highway capacity	S-1001	Add a second 2+ HOV lane.	2 – Higher order of magnitude cost due to adding an additional lane	2 – Does not have broad support at this time because it is a restricted lane.	4 – Can be partially modified (converted) to adapt to changing demographics.	4 – Has moderate programming flexibility (phase funding, and termini).	
3	Highway capacity	S-1038	Create a striped express/local lane system.	4 – Lower order of magnitude cost than other alternatives that provide similar function. The logistics of construction are deemed feasible.	2 – Low support because of unknowns regarding how well it would work as a solution.	3 – Can be partially modified (converted) to adapt to changing demographics.	3 – Has moderate programming flexibility (phase funding and termini).	
4	Highway capacity	S-1037	Add a second 2+ HOV lane with extra-wide inside shoulders (16-foot) for enforcement purposes and to provide the necessary width for future managed lanes conversion.	1 – Much higher order of magnitude cost than other alternatives that provide similar function. The logistics of construction are deemed infeasible due to the needed ROW and the extra pavement needed for shoulders.	3 – Mixed support due to ROW requirements, the cost of adding the additional pavement throughout the entire corridor and because it is a restricted lane.	4 – Can be partially modified (converted) to adapt to changing demographics.	4 – Has moderate programming flexibility (phase funding and termini).	
5	Highway capacity	S-1000	Construct HOT lanes or convert HOV to HOT lanes (at grade or elevated). Rated as converted only.	3 – Moderate order of magnitude of cost when compared to other alternatives.	2 – Does not have broad support at this time because they are restricted lanes.	3 – Can be partially modified (converted) to adapt to changing demographics.	2 – Has some programming flexibility (phase funding and termini).	
6	Highway capacity	S-1003	Add one additional general purpose lane in each direction to Interstate.	2 – Higher order of magnitude cost due to adding an additional lane.	3 – Has mixed support due to possible ROW requirements and the cost of adding a lane throughout the entire corridor.	2 – Can be modified to adapt to changing demographics with some difficulty due to politics.	3 – Has moderate programming flexibility (phase funding and termini).	
7	Highway capacity	S-1008	Add truck-only lanes to the Interstate. Rated as an add lane.	2 – Higher order of magnitude cost than other alternatives that provide similar function. The logistics of operations are deemed possibly infeasible.	3 – Would have mixed support due to ROW requirements and the cost.	3 – Can be partially modified (converted) to adapt to changing demographics.	1 – Little or no flexibility due to location/length of project.	
8	Highway capacity	S-1010	Add bus/BRT-only lanes to the Interstate, heavily using park-and-rides. Rated as an add lane.	2 – Higher order of magnitude cost than other alternatives that provide similar function. The logistics of construction are deemed possibly infeasible due to needed ROW.	3 – Mixed support due to additional ROW needs.	3 – Can be partially modified (converted) to adapt to changing demographics.	3 – Has moderate programming flexibility (phase funding and termini).	
9	Highway capacity	I3-1004	Replace I-17 in kind with current standards to replace the aging infrastructure. Will redesign to reflect the high truck percentages in this segment corridor.	2 – Higher order of magnitude cost than other alternatives that provide similar function.	2 – Would have minimal support due to not bringing the corridor up to current standards and fixing existing issues.	1 – Cannot be easily modified to address changing demographics (once given, cannot be easily removed).	1 – Little or no flexibility due to location/length of project.	

4.4 Level 3 Screening

Level 3 screening qualitatively and quantitatively analyzed the seven backbone alternatives that survived the Level 2B screening and compared them against each other, the base build and the no build alternatives. Each of the backbone alternatives from the Level 2B screening was assumed to include the base build option, which included the no build condition. All of the Level 3 alternatives were assigned an alphanumeric identifier for organizational purposes. See Figure 4-3 for the organization of Level 3 alternatives.

Figure 4-3. Level 3 Alternatives Organization



The Base Build Alternative was created by assembling a group of spot improvements from the supporting alternatives that were placed in parking lot (Figure 4-1). The spot improvement projects were selected with input from the Management Partners and AEP and would improve the corridor in the areas of technology, access, transit, bicycles and pedestrians, and Interstate weaving sections.

Two elements in the Base Build Alternative required separate analysis: service interchanges and weaving sections. In the NAR, the service interchanges were analyzed and prioritized based on environmental factors, operational factors, safety factors, infrastructure condition, economic factors and public feedback. See Table 4-11 for the prioritized service interchange list. The top 10 service interchanges were identified to be included in the Base Build Alternative. In addition to the top 10 interchanges, 4 other service interchanges were identified as having significant east-to-west traffic and regional east-to-west connectivity. These service interchanges are Glendale Avenue, Bell Road, Northern Avenue and Indian School Road and were ranked 11th, 12th, 13th and 17th, respectively. While these additional interchanges on the significant east-to-west connector arterials did not fall within the 10 worst interchanges, they were close to 10 worst interchanges and clearly demonstrate a need. The identified service interchanges and all of the weaving segments were analyzed based on operations, safety and infrastructure.

All of the supporting alternatives included in the Base Build Alternative were compatible with all of the other Level 3 alternatives; therefore, the Base Build Alternative was included as part of all the other Level 3 alternatives.

Table 4-11. Prioritized Service Interchanges

Rank	Interchange	Total Weighted Score	Environmental Score	Operations Score	Safety Score	Infrastructure Score	Economic Score	Public Feedback Score
1	Peoria Avenue traffic interchange	158	233	150	122	180	133	160
2	Baseline Road traffic interchange	172	250	146	178	175	167	120
3	Dunlap Avenue traffic interchange	179	267	165	133	225	133	160
4	48th Street traffic interchange	179	250	169	233	125	100	140
5	19th Avenue traffic interchange	181	233	208	189	125	133	220
6	Thunderbird Road traffic interchange	185	233	192	156	180	233	200
7	Thomas Road traffic interchange	187	217	196	167	220	100	160
8	Camelback Road traffic interchange	188	250	192	167	200	167	160
9	7th Avenue traffic interchange	189	200	212	200	175	100	180
10	Cactus Road traffic interchange	199	233	200	200	180	167	220
11	Glendale Avenue traffic interchange	203	200	181	189	250	200	180
12	Bell Road traffic interchange	204	267	204	178	220	167	200
13	Northern Avenue traffic interchange	205	233	192	167	260	200	180
14	Greenway Road traffic interchange	205	250	150	244	180	233	200
15	24th Street traffic interchange	207	250	242	244	150	100	180
16	Grant Street traffic interchange	208	200	222	300	100	167	200
17	Indian School Road traffic interchange	209	267	204	144	280	167	200
18	16th Street traffic interchange	212	217	200	233	220	100	200
19	Bethany Home Road traffic interchange	212	217	196	189	250	200	220
20	Central Avenue grade separation	212	150	300	256	160	133	140
21	7th Street traffic interchange	213	167	212	244	225	133	180
22	Elliot Road traffic interchange	217	250	208	200	250	167	200
23	32nd Street/University Drive traffic interchange	218	217	158	244	250	133	220
24	Jefferson/Adams Street traffic interchange	220	150	235	289	200	100	160
25	Broadway Road traffic interchange	221	250	196	278	220	133	120
26	Van Buren Street grade separation	222	233	300	278	140	133	140
27	Buckeye Road traffic interchange	225	183	252	267	200	133	200
28	McDowell Road traffic interchange	225	233	238	222	275	100	140
29	Ray Road traffic interchange	230	250	177	256	250	200	200
30	40th Street traffic interchange	230	250	212	289	175	133	260
31	Southern Avenue grade separation	239	267	300	278	200	133	120

Table 4-11. Prioritized Service Interchanges

Rank	Interchange	Total Weighted Score	Environmental Score	Operations Score	Safety Score	Infrastructure Score	Economic Score	Public Feedback Score
32	Grand Avenue grade separation	247	233	300	267	250	100	160
33	Warner Road traffic interchange	248	283	235	267	250	167	220
34	Chandler Boulevard traffic interchange	251	267	250	256	300	133	160
35	Union Hills Drive traffic interchange	254	200	226	278	300	200	200
36	Utopia Road traffic interchange	264	267	300	300	250	133	180
37	Guadalupe Road grade separation	273	233	300	300	250	300	220

4.4.1 Service Interchange Analyses

4.4.1.1 Operational

Various MOEs were defined relative to the operations at service traffic interchanges to assist in the prioritization of traffic interchange needs within the Spine corridor. Data were derived from MAG’s TransCAD model for the following MOEs:

- Peak period arterial cross street and ramp volumes
- Peak period volume-to-capacity (v/c) ratios
- Ramp turn ratios

Peak Period Arterial Cross Street and Ramp Volumes

Traffic volumes were extracted from the MAG TransCAD model for both the AM and PM peak periods at locations on the freeway on-ramps, freeway off-ramps, arterial cross-street approaches and between ramp termini to identify those locations experiencing the highest level of traffic demand.

Peak Period Volume to Capacity Ratios

Volume-to-capacity ratios were derived by comparing each of the extracted volumes to the model capacities for each interchange for the AM and PM peak periods. The resulting congestion indices provided insight as to those locations requiring additional ramp capacities as well as cross-street capacity.

Ramp Turn Ratios

Based on the extracted peak period volumes at the interchange ramps and arterial cross streets, an estimate of the percentage of turning traffic (versus through traffic) was derived at each ramp termini. This MOE provided insight as to the role arterial cross-traffic played in the overall interchange performance relative to freeway access.

4.4.1.2 Safety

All of the crash data for the traffic interchanges were available from the NAR. To determine the most frequent location and type of crash, crash diagrams were drawn for each of the identified service interchanges. These exhibits provided a tool to assess what types of accidents were the most common and where those accidents occurred. The exhibits allowed the Spine study team to speculate on the potential root causes of those crashes. The figures are in Appendix E and are summarized in Table 4-12.

Table 4-12. Collision Data Summary

Traffic Interchange	2011–2013									Comments
	Total Crashes	Fatal	Injury	Rear End	Angle	Left Turn	Sideswipe	Pedestrian	Bicycle	
I-10/Baseline Road	273	0	57	149	8	42	58	3	1	Primarily eastbound rear-end crashes
I-10/SR-143/48th Street and I-10/Broadway Road	77	0	36	8	5	60	4	0	0	Primarily westbound left turns hitting eastbound through
I-17/7th Avenue	82	0	38	44	8	9	16	1	1	Primarily rear-end crashes on northbound traffic interchange
I-17/19th Avenue	109	0	36	32	17	40	11	0	0	Primarily left-turn crashes on northbound traffic interchange
I-17/Adams Street	37	0	12	7	19	2	7	0	0	Primarily westbound to northbound/southbound angle crashes
I-17/Jefferson Street	68	0	11	6	18	3	35	0	0	Primarily eastbound sideswipe crashes
I-17/Thomas Road	112	0	37	45	14	22	17	4	0	Primarily left-turn/angle crashes northbound traffic interchange
I-17/Camelback Road	132	0	34	73	14	7	23	1	2	Primarily westbound rear ends
I-17/Dunlap Avenue	177	0	56	70	11	21	49	1	5	Primarily eastbound to westbound crashes (lefts and head-on)
I-17/Peoria Avenue	198	1	58	81	13	45	33	1	5	Primarily left-turn crashes on northbound traffic interchange
I-17/Cactus Road	112	0	31	55	14	12	18	1	1	No obvious crash pattern
I-17/Thunderbird Road	190	0	58	104	22	24	26	0	2	Primarily southbound rear-end crashes

The problem areas identified in the service interchange operations and crash analysis are graphically represented in Figure 4-4 to Figure 4-7. These exhibits show the relationship between capacity needs and high-crash locations.

Figure 4-4. Interchange Needs Summary: Baseline Road and Interstate 10, 7th Avenue and Interstate 17

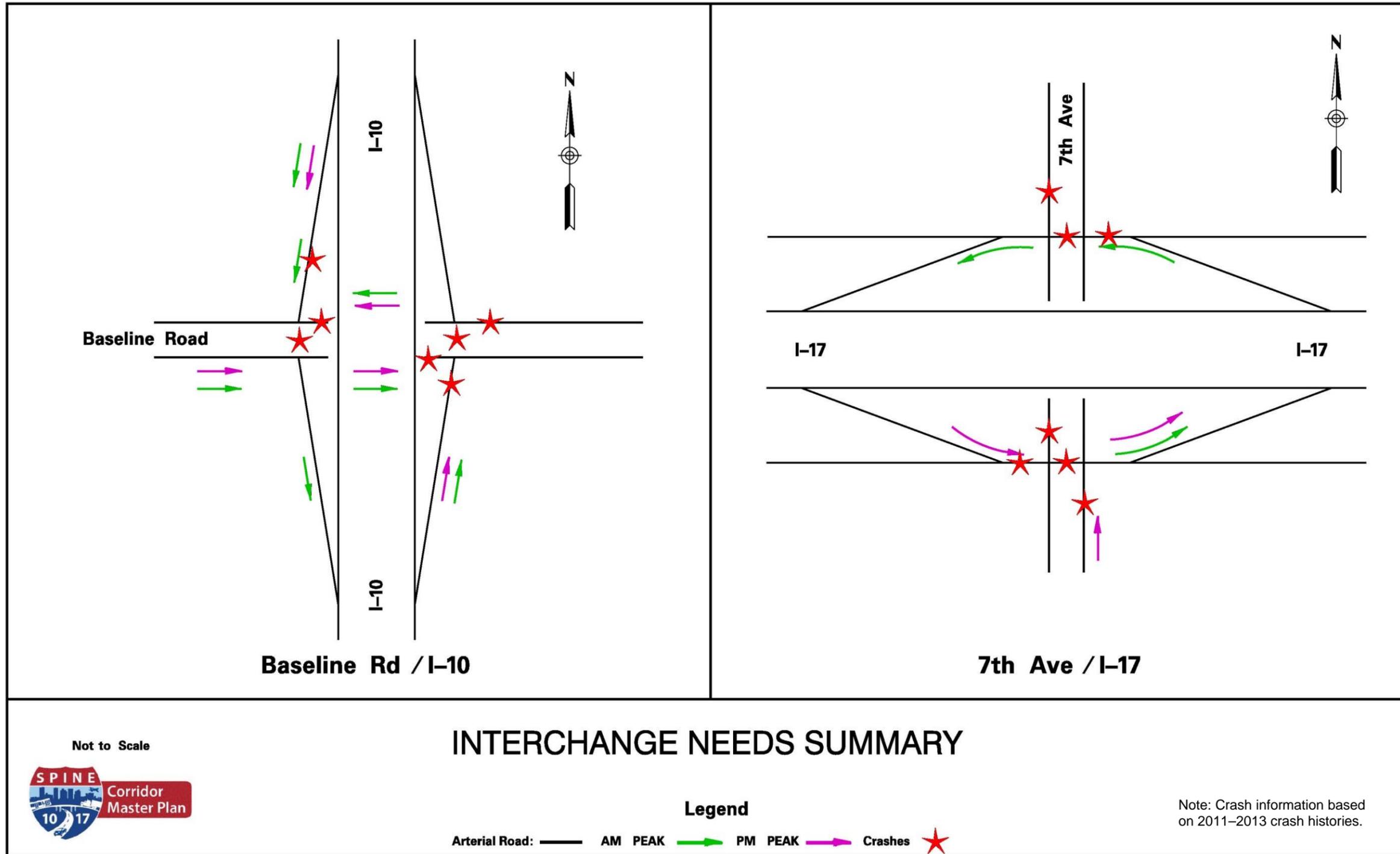


Figure 4-5. Interchange Needs Summary: 19th Avenue and Interstate 17, Thomas Road and Interstate 17

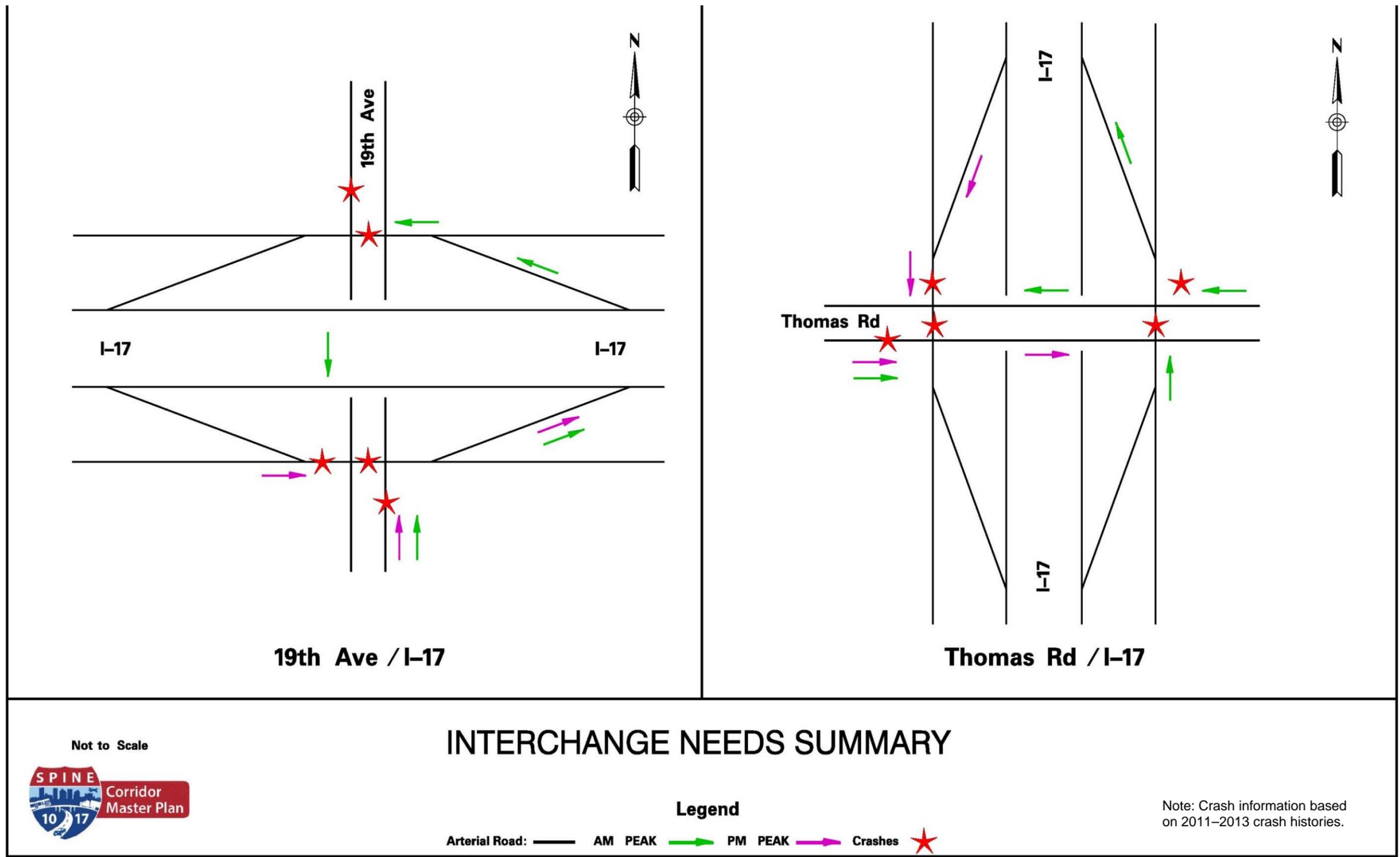


Figure 4-6. Interchange Needs Summary: Dunlap Avenue and Interstate 17; Peoria Avenue and Interstate 17

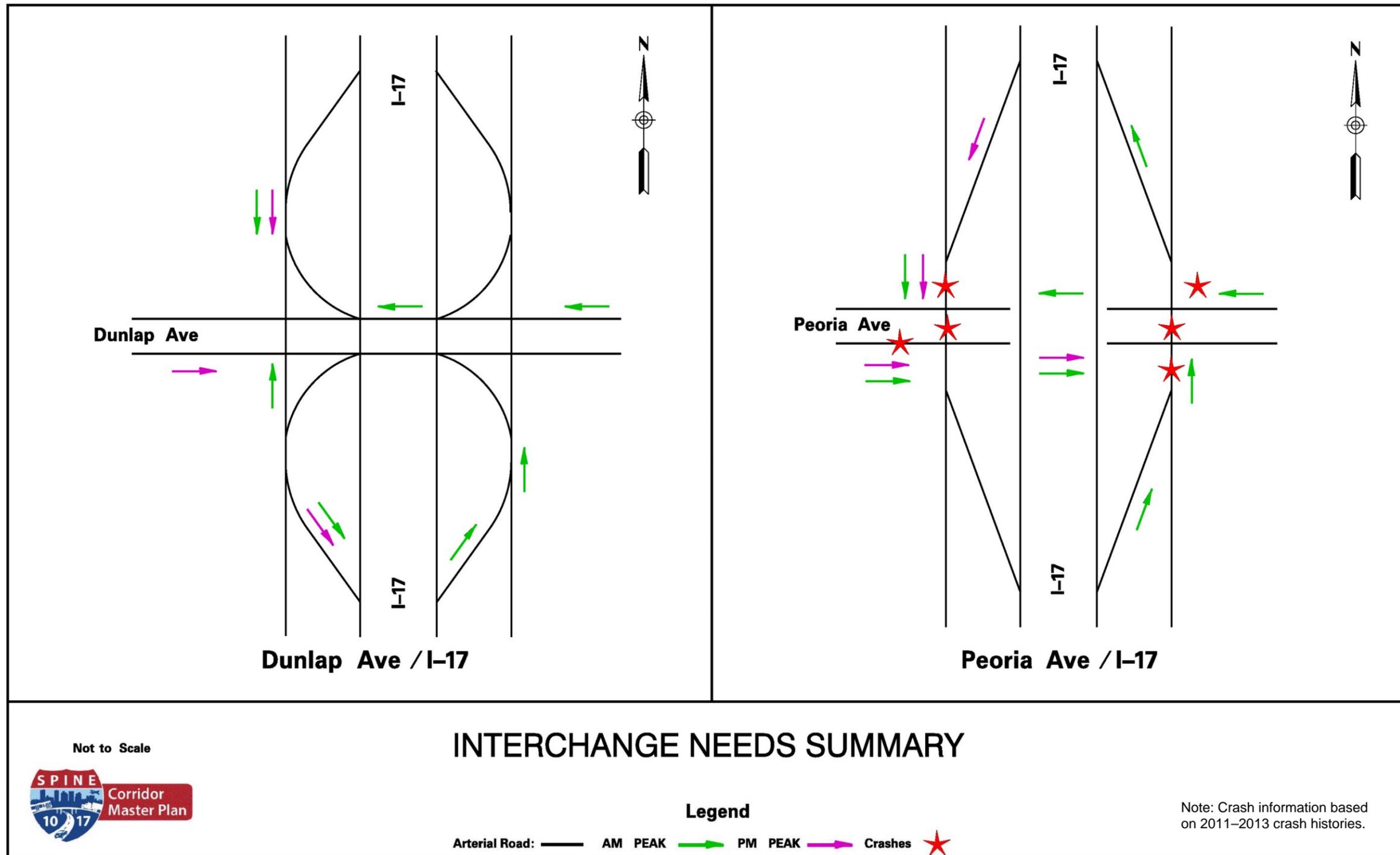
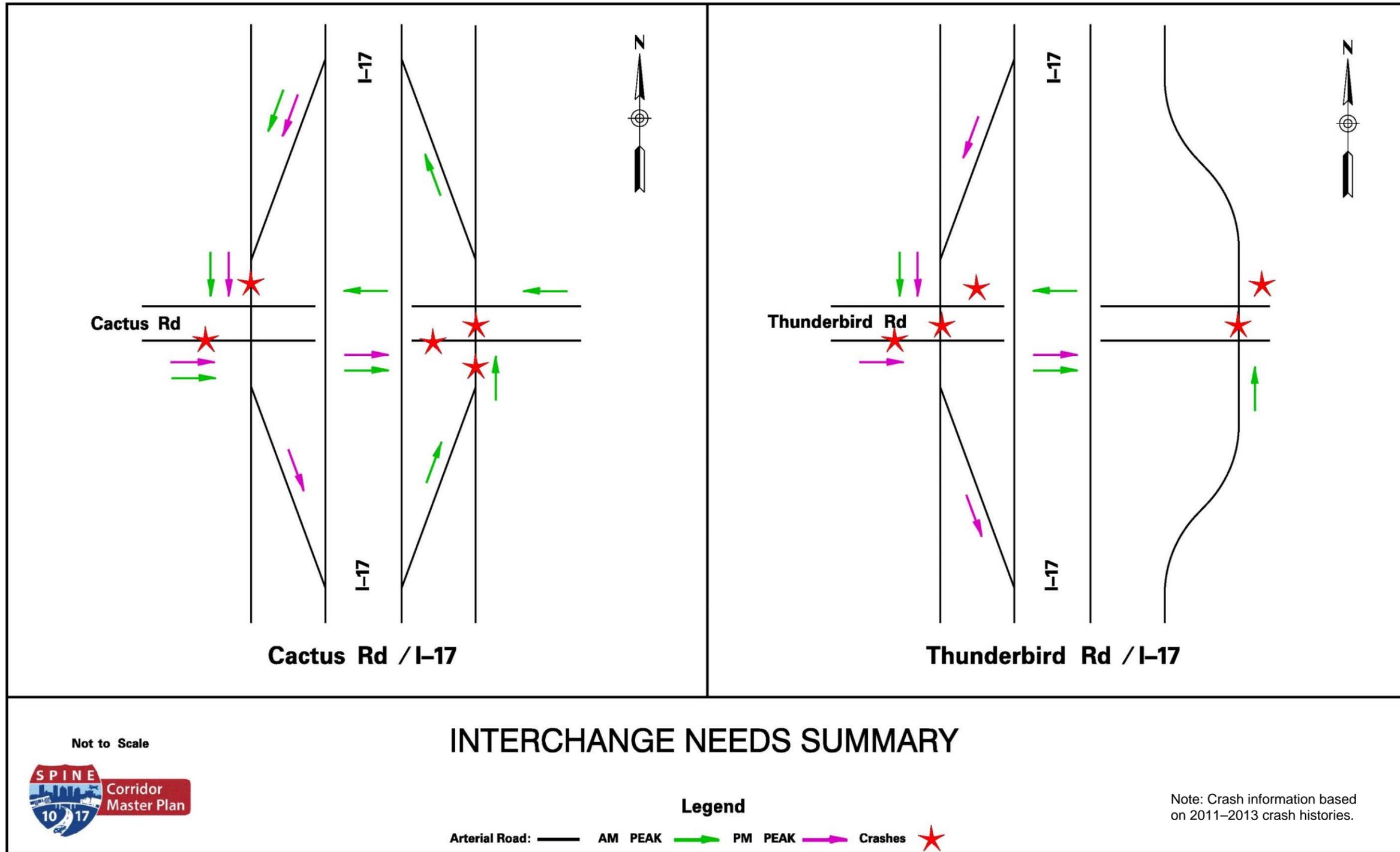


Figure 4-7. Interchange Needs Summary: Cactus Road and Interstate 17; Thunderbird Road and Interstate 17



4.4.1.3 Service Interchange Infrastructure

The infrastructure at each of the identified service interchanges was analyzed to determine which improvements were needed. Google Earth and Google Earth Street View were used for each of the interchanges to complete a quick infrastructure inventory and identify the areas of improvement including visual sight lines, vertical and horizontal clearances, lane reductions, availability of bicycle/pedestrian facilities and lighting levels. The infrastructure improvements for the interchanges and the associated east-to-west arterials included in the Base Build Alternative are summarized in Table 4-13. The concept-level 5 percent horizontal layout design plans are in Appendix F.

Table 4-13. Infrastructure Improvements Included in the Base Build Alternative

Interchange or Arterial	Infrastructure Improvements
I-10/Baseline Road traffic interchange	<ul style="list-style-type: none"> Reconfigure interchange to a DDI. Realign Wendler Drive to align with Arizona Grand Parkway. May cause a total take with Frys. Reconfigure interchange to a DDI with a northbound to westbound flyover that drops into the median of Baseline Road. Realign Wendler Drive to align with Arizona Grand Parkway. May cause a total take with Frys. Reconfigure interchange by adding a loop ramp to the southbound to westbound movement. Realign the southbound on ramp to be aligned with Wendler Drive. Concept eliminates one traffic signal. Reconfigure interchange with a half cloverleaf to the south, with ramp terminals at Wendler and Arizona Mills. Concept eliminates two traffic signals.
I-10/Broadway Road/SR-143 traffic interchange	<ul style="list-style-type: none"> See KMZ layouts.
I-17/7th Avenue traffic interchange ^a	<ul style="list-style-type: none"> Add third through lane in each direction on the arterial. Eliminate driveway on frontage road ramp gore and terminal. Place stop sign on frontage road prior to off ramp merge. Make on ramps dual lane metered.
I-17/19th Avenue traffic interchange ^a	<ul style="list-style-type: none"> Add third through lane on 19th Avenue in both directions through traffic interchange. Optimize signal pair. Implement dual left southbound-eastbound movement. Implement dual lane eastbound on-ramp. Relocate Durango Street/19th Avenue intersection north. Lengthen westbound off ramp. Extend all three lanes farther west for eastbound frontage road terminal. Implement triple left for eastbound to northbound.
I-17/Jefferson-Adams traffic interchange	<ul style="list-style-type: none"> Reconfigure interchange to a split diamond. Reconstruct Van Buren to be up in the air as high as possible for clearance. Reconstruct UPRR bridge to the south.

Table 4-13. Infrastructure Improvements Included in the Base Build Alternative

Interchange or Arterial	Infrastructure Improvements
I-17/Thomas Road traffic interchange	<ul style="list-style-type: none"> Extend third eastbound through lane to 23rd Avenue. Eliminate Verde Lane access off of the southbound off-ramp. Add right-turn lanes to eastbound and westbound Thomas Road approach on-ramps. Explore eliminating driveway access along Thomas Road and on frontage roads between crossroad and ramp gores. Consider triple left on southbound to eastbound movement. Note that three-level traffic interchange configuration is not viable due to Grand Avenue flyover. Also, cannot widen Thomas Road under the Grand Avenue flyover bridge. Possible frontage road compatible DDI concept—large ROW takes required, but ROW takes would eliminate some problematic driveway access points along Thomas Road and frontage road.
I-17/Indian School Road traffic interchange	<ul style="list-style-type: none"> Convert to a three-level traffic interchange. Third level would be Indian School Road through movement. Majority of widening would occur to the north side of Indian School Road. Second highest east-to-west demand in the I-17 corridor. Complements the east-to-west flyover of Indian School Road over the Grand/UPRR corridor.
I-17/Camelback Road traffic interchange	<ul style="list-style-type: none"> Convert to a three-level traffic interchange. Third level would be Camelback Road through movement. Majority of widening would occur to the north side of Camelback Road. Have light rail transit share the east-to-west flyover. Concept in development now.
I-17/Northern Avenue traffic interchange	<ul style="list-style-type: none"> Most logical location for three-level traffic interchange to handle major east-to-west flows. Connectivity using Northern Parkway over to SR-303L and east to SR-51. Northeastern quadrant access may be problematic.
I-17/Dunlap Road traffic interchange	<ul style="list-style-type: none"> Not an ideal candidate for a three-level traffic interchange. Intense land use in area will make it challenging, including access to Metrocenter, hotels and the wastewater treatment plant. In addition, Dunlap will include light rail transit from 19th Avenue to 25th Avenue, further deteriorating Dunlap performance for east-to-west vehicular travel. Keep as a SPUI or convert to a tight diamond. Converting back to a tight diamond may not sacrifice much capacity (if at all), but would likely address many of the safety problems. Extend left-turn storage for westbound to southbound movement along Dunlap. Restrict access points along Dunlap between 29th and 25th avenues. Add a third westbound lane from 19th Avenue to 25th Avenue. Consider adding a third westbound lane between 3rd and 25th avenues. Need to coordinate with light rail transit work. Townley Avenue has access off of the northbound off ramp. Multiple driveway access points off of all ramps and within the arterial control of access.
I-17 Peoria Avenue traffic interchange	<ul style="list-style-type: none"> Upgrade to three through lanes and dual lefts with no shared lanes between the ramp terminals. Add a third westbound through lane between I-17 and 19th Avenue. Evaluate establishing limited access between 28th Drive and I-17 If keeping as a tight diamond, replace bridges to improve sight lines (intersection and signal heads). Raise I-17 profile to improve vertical clearance and consider raising it to 18 to 20 feet to open up sight lines to traffic signal heads. Also, consider replacing the bridges with a 10- to 20-foot open median to allow light through to further eliminate the tunnel effect. Upgrade drainage system.

Table 4-13. Infrastructure Improvements Included in the Base Build Alternative

Interchange or Arterial	Infrastructure Improvements
I-17/Cactus Road traffic interchange	<ul style="list-style-type: none"> • Upgrade southbound off ramp to two lane exit (drop lane + option lane). • Replace bridges to improve sight lines (intersection and signal heads). Raise I-17 profile to improve vertical clearance and consider raising it to 18 to 20 feet to open up sight lines to traffic signal heads. Also, consider replacing the bridges with a 10- to 20-foot open median to allow light through to further eliminate the tunnel effect. • Upgrade drainage system. • Add a third westbound through lane on Cactus. Do this by shifting the centerline of Cactus south 12 feet at the traffic interchange. Any widening would be done to the south, but would also make use of the large raised and painted islands in Cactus.
I-17/Thunderbird Road traffic interchange	<ul style="list-style-type: none"> • Replace I-17 bridges to increase sight lines at southbound intersection and to signal heads. Also, widen Thunderbird between the ramp terminals to three through lanes each direction, and dual lefts in both directions. Raise I-17 profile to improve vertical clearance and consider raising it to 18 to 20 feet to open up sight lines to traffic signal heads. Also, consider replacing the bridges with a 10- to 20-foot open median to allow light through to further eliminate the tunnel effect. • Reprofile I-17 (raise 10 feet) to help with sight distance, mitigate drainage issues, simplify maintenance of traffic. • Widen Thunderbird by one lane on the north side between Cave Creek Wash and 20th Lane. Then restripe a full seven-lane section on Thunderbird. • Widen Thunderbird to the south side between 34th and 30th avenues. Restripe to a full seven-lane section. Requires acquisition of two residences. • Convert Thunderbird to a three-level traffic interchange with the lowest level being Thunderbird through, middle level being ramp platform and top level being I-17. Restrict access points between 30th Avenue and southbound ramp terminal to right in/right out.
I-17/Greenway Road traffic interchange	<ul style="list-style-type: none"> • If keeping as a tight diamond, replace bridges to improve sight lines (intersection and signal heads). Raise I-17 profile to improve vertical clearance and consider raising it to 18 to 20 feet to open up sight lines to traffic signal heads. Also, consider replacing the bridges with a 10- to 20-foot open median to allow light through to further eliminate the tunnel effect. • Upgrade drainage system. • Add a third westbound through lane on Greenway from 19th Avenue to just west of the traffic interchange. Would likely require taking about 12 homes and 1 or 2 businesses. To accomplish this, the alignment of Greenway would have to be skewed slightly through the traffic interchange so that the retaining walls in the northeastern and southwestern quadrants are not affected (these are very expensive secant retaining walls). Therefore, most widening would occur in the northwestern and southeastern quadrants.
I-17/Bell Road traffic interchange	<ul style="list-style-type: none"> • If keeping as a diamond, replace old bridges and raise I-17 to achieve proper vertical clearance. • Upgrade Bell between ramp terminals to side-by-side dual left turns instead of back-to-back dual left turns.

^a 7th and 19th avenues need to be treated as a system when reconfiguring (along with 11th and 15th avenues, which do not have access).

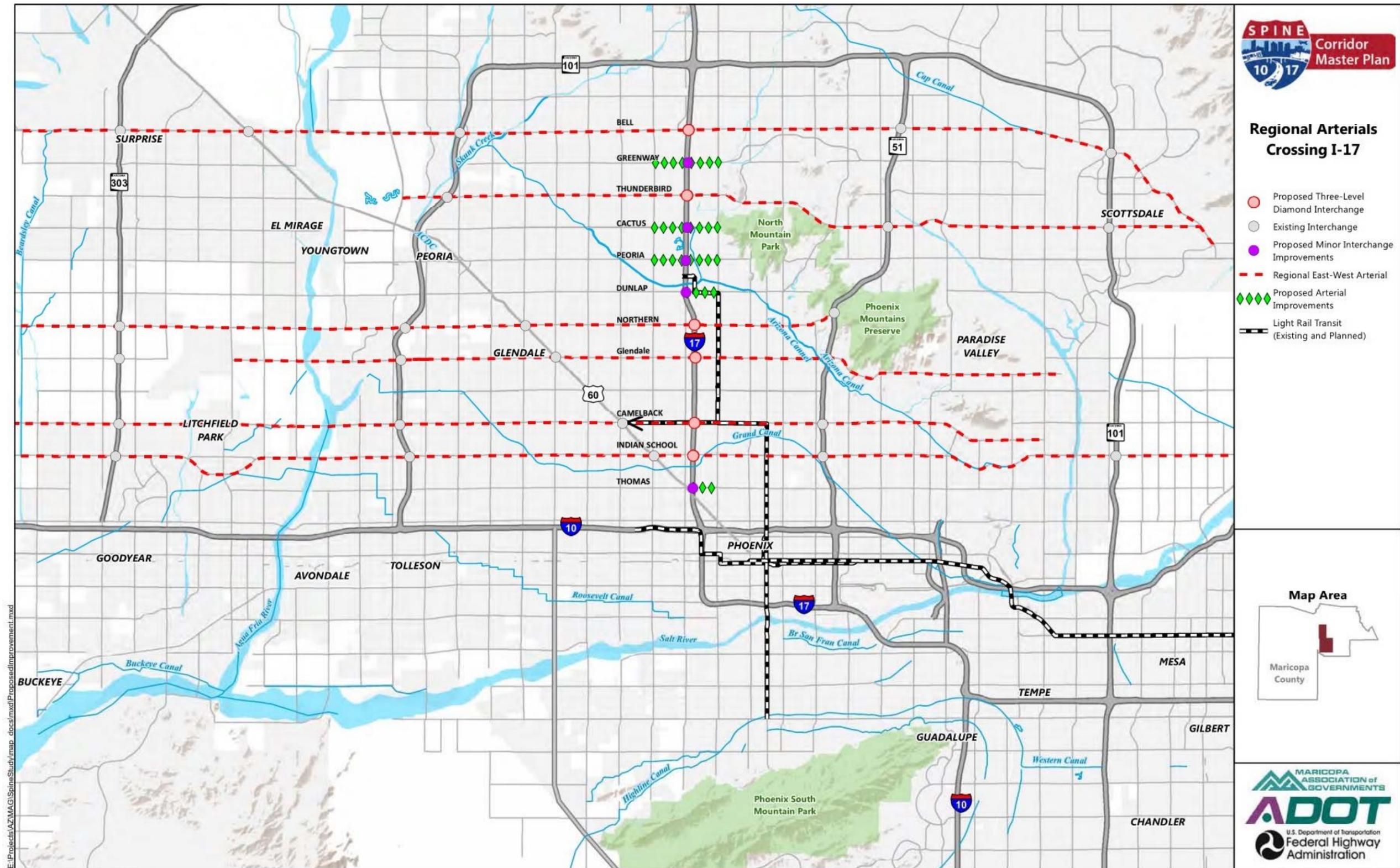
4.4.1.4 Service Interchange Conclusion

At the conclusion of the safety, operations and engineering assessments at each of the 14 service interchange locations, recommendations for improvements were prepared for each location. In some cases, the service interchange recommendations were for total interchange reconstruction, but more common recommendations were for relatively simple infrastructure replacement elements and arterial capacity upgrades.

As this evaluation unfolded, the interchange needs between the Stack and the North Stack revealed a unique issue not present in the rest of the Spine corridor. One of the major common problems with these interchanges was the very high demand of east-to-west traffic flow crossing over I-17. Because there are no mid-mile crossings of I-17 in this area, all east-to-west traffic trying to cross I-17 must pass through the service interchanges. Due to the traffic volumes, the through movement significantly degrades the operational performance of the interchange. As a result of this discovery, it was concluded that the best way to improve many of these interchanges was to provide additional I-17 crossings to relieve the interchanges. Unfortunately, adding mid-mile crossings was not a feasible recommendation because of business or neighborhood impacts. This led to the realization that these east-to-west relief roadways had to occur within the interchange locations.

Because I-17 includes one-way frontage roads between the Stack and the North Stack, the only feasible option to add capacity to the east-to-west relief roadways was to add an east-west flyover structure either over or under the interchange (depending on the current geometry). Because the cost of adding a flyover would be very expensive, it was decided that if the flyovers were placed every few miles along the Spine corridor on arterials with regional east-to-west connectivity, it would significantly relieve the pressure on the other adjacent interchanges. Furthermore, not all of the interchange locations were physically suited for such an upgrade. Consequently, the Spine study team looked closely at every interchange along I-17 between the Stack and the North Stack to find suitable locations for this modified interchange type, called a three-level traffic interchange. Five interchange locations were identified that could reasonably be modified to include this new east-to-west connection, and one location was identified through agency input. Those locations included Indian School Road, Camelback Road, Glendale Avenue, Northern Avenue, Thunderbird Road and Bell Road. The map that resulted from this analysis is shown in Figure 4-8. The map also shows all the other interchange recommendations as related to upgrading east-to-west capacities.

Figure 4-8. Regional Arterials Crossing I-17



E:\Projects\AZ\MA\G\Spine\Study\map_docs\mxd\ProposedImprovement.mxd

Source: ADOT, ALRIS, FEMA

4.4.2 Main Line Weaving Analysis

Because the NAR had not inventoried any of the Interstate weaving segments, all of the weaving segments had to be analyzed to determine which segments should be included in the Base Build Alternative. The weaving segments were considered from the basis of infrastructure and operations because the safety data did not provide enough detail to isolate the crashes that occurred only due to weaving movements. The weave length was analyzed for the infrastructure for each of the weaves. It was found that the weave lengths varied from 929 to 8,610 feet within the Spine corridor. The operations were analyzed and the density and LOS of each weave was determined. The summary of the results of the weave analysis are in Figure 4-9.

4.4.2.5 Weave Analysis Methodology

As indicated in the *Highway Capacity Manual 2010* (HCM 2010), a weave analysis is a qualitative assessment of the critical lane-changing activity between closely located merge and diverge segments such as freeway on- and off-ramps. Lane-changing movements represent the unique operational feature of a weaving segment and are affected by geometric characteristics such as length, width and configuration—as well as free-flow speed and demand flow rates for each movement within a weaving segment. The HCM 2010 defines a range of LOS parameters representing varying operating conditions at weave segments and the driver’s perception of these conditions.

Like all freeway analysis, LOS in a weave segment is related to density; however, according to HCM 2010, “density thresholds in weaving segments are somewhat higher than those for similar basic freeway segments as it is believed that drivers will tolerate higher densities in an area where lane-changing turbulence is expected.”

Table 4-14 details the LOS criteria for weaving segments on uninterrupted segments of multilane surface facilities, including freeway segments and C-D roadways.

Table 4-14. Level of Service for Weave Analysis

Level of Service	Freeway Weaving Segments (pc/mile/lane)	Weaving Segments on Multilane Highways or C-D Roadways (pc/mile/lane)
A	≤10.0	≤12.0
B	>10.0 and ≤20.0	>12.0 and ≤24.0
C	>20.0 and ≤28.0	>24.0 and ≤32.0
D	>28.0 and ≤35.0	>32.0 and ≤36.0
E	>35.0	>36.0
F	Demand exceeds capacity	

Source: Transportation Research Board, 2010, *Highway Capacity Manual*, Washington, D.C.

LOS associated with weave segments is derived through an operations analysis that measures many variables including geometric design, weaving and non-weaving volumes and volume adjustments, the segment’s free-flow speed, lane change characteristics, segment capacity, lane-changing rates and the average speeds of weaving and non-weaving vehicles. Collectively, these inputs were used to make calculated estimates of the capacity and LOS of weaving segments in the Spine corridor.

After completing this analysis, the conclusion was that, in general, operational problems and safety problems did not coexist within the same segments. It was determined that this is because when weave sections fail, cars must slow significantly to navigate through the weave. This slower speed reduces crash rates. The opposite is true as well; as vehicles navigate a weave at a high speed, it results in a higher likelihood of crashes. As a result of these findings, the Spine study team concluded that expensive weave section fixes (e.g., braiding ramps, C-D roads or ramp eliminations) were not viable recommendations, especially on I-17 where the majority of the operational problems exist. This is because I-17 already includes frontage roads and the existence of these frontage roads makes it more challenging to implement the typical weave fixes. Upgrading the exit ramp gores to a dual-lane exit and increasing substandard weaving segments where practical was instead recommended corridor-wide to be a low-cost, low-impact incremental upgrade that would help in most locations.

The only exception to this weave recommendation is along I-10 between Baseline and Elliot roads. This section was found to have a high number of crashes relative to the other weaving segments, possibly due to it being twice as long as most of the other weaving segments. No frontage roads currently exist along I-10 at this location and other regional operational issues exist within this 2-mile stretch, such as the lack of parallel arterial routes, except for Priest Road/Avenida del Yaqui on the east and 48th Street/Point Parkway on the west. Both of these arterials will never be able to handle significant traffic volumes and, as a result, this 2-mile stretch of I-10 is unique in the Spine corridor for not having parallel arterial relief in the event of a freeway incident. It was recommended to upgrade the weave section in this 2-mile section by extending the existing C-D roadways that exist north of Baseline Road to the south down to the Elliot Road interchange. These separated roadways would provide a much-needed relief valve for incident management, help mitigate the high accident rates in that weave section and help relieve pass-through traffic through the Point Parkway and Guadalupe neighborhoods.

Figure 4-9. Spine Corridor Weave Analysis

Spine Corridor Weave Analysis											
AM						PM					
Direction	On-Ramp	Off-Ramp	Weave Length (ft)	Density	LOS	Direction	On-Ramp	Off-Ramp	Weave Length (ft)	Density	LOS
Southbound						Southbound					
SB I-17	Union Hills Drive	Bell Road	2070	39.5	E	SB I-17	Union Hills Drive	Bell Road	2070	35.9	F
SB I-17	Bell Road	Greenway Road	2619	47.7	E	SB I-17	Bell Road	Greenway Road	2619	45.1	E
SB I-17	Greenway Road	Thunderbird Road	2624	57.0	F	SB I-17	Greenway Road	Thunderbird Road	2624	54.9	F
SB I-17	Thunderbird Road	Cactus Road	2593	66.3	F	SB I-17	Thunderbird Road	Cactus Road	2593	57.8	F
SB I-17	Cactus Road	Peoria Road	1733	69.1	F	SB I-17	Cactus Road	Peoria Road	1733	56.8	F
SB I-17	Peoria Road	Dunlap Road	1611	66.7	F	SB I-17	Peoria Road	Dunlap Road	1611	60.7	F
SB I-17	Dunlap Road	Northern Avenue	2211	62.7	F	SB I-17	Dunlap Road	Northern Avenue	2211	61.4	F
SB I-17	Northern Avenue	Glendale Avenue	2970	58.9	F	SB I-17	Northern Avenue	Glendale Avenue	2970	56.6	F
SB I-17	Glendale Avenue	Bethany Home Road	3075	62.9	F	SB I-17	Glendale Avenue	Bethany Home Road	3075	56.4	F
SB I-17	Bethany Home Road	Camelback Road	2980	56.8	F	SB I-17	Bethany Home Road	Camelback Road	2980	53.9	F
SB I-17	Camelback Road	Indian School	2961	59.0	F	SB I-17	Camelback Road	Indian School	2961	56.7	F
SB I-17	Indian School	Thomas Road	2973	46.7	F	SB I-17	Indian School	Thomas Road	2973	53.1	F
SB I-17	Thomas Road	McDowell	1774	35.2	E	SB I-17	Thomas Road	McDowell	1774	39.5	E
SB I-17*	Thomas Road	I-10	3480	42.9	F	SB I-17*	Thomas Road	I-10	3480	42.9	F
SB I-17	19th Avenue	7th Avenue	2949	32.3	D	SB I-17	19th Avenue	7th Avenue	2949	42.5	F
SB I-17	7th Avenue	7th Street	3084	36.1	E	SB I-17	7th Avenue	7th Street	3084	43.7	E
SB I-17	7th Street	16th Street	2878	37.7	E	SB I-17	7th Street	16th Street	2878	49.1	F
SB I-10	University Drive	40th Street	929	41.1	E	SB I-10	University Drive	40th Street	929	64.5	F
SB I-10	40th Street	48th Street	2184	31.6	D	SB I-10	40th Street	48th Street	2184	53.7	E
SB I-10	40th Street	48th Street	2184	31.7	D	SB I-10	40th Street	48th Street	2184	54.2	F
SB I-10*	48th Street	US 60	3842	31.6	D	SB I-10*	48th Street	US 60	3842	57.5	F
SB I-10*	Broadway Road	US 60	4960	27.6	C	SB I-10*	Broadway Road	US 60	4960	63.4	F
SB I-10*	US 60	Elliot	8610	22.5	C	SB I-10*	US 60	Elliot	8610	48.9	E
SB I-10	Baseline	Elliot	7664	23.2	C	SB I-10	Baseline	Elliot	7664	60.5	F
SB I-10	Elliot	Warner	2606	22.9	C	SB I-10	Elliot	Warner	2606	59.2	F
SB I-10	Warner	Ray	1752	21.6	C	SB I-10	Warner	Ray	1752	61.0	F
SB I-10	Ray	Chandler	2111	16.1	B	SB I-10	Ray	Chandler	2111	45.7	E
Northbound						Northbound					
NB I-10	Chandler	Ray	2011	11.3	B	NB I-10	Chandler	Ray	2011	13.4	B
NB I-10	Ray	Warner	2700	33.5	D	NB I-10	Ray	Warner	2700	37.9	F
NB I-10	Warner	Elliot	2171	34.2	D	NB I-10	Warner	Elliot	2171	41.5	E
NB I-10	Elliot	Baseline	7579	37.9	F	NB I-10	Elliot	Baseline	7579	51.2	F
NB I-10*	Elliot	US 60	8559	31.4	D	NB I-10*	Elliot	US 60	8559	38.0	F
NB I-10	Broadway	40th Street	3551	36.1	E	NB I-10	Broadway	40th Street	3551	48.6	F
NB I-10	48th Street (SR 143)	40th Street	2712	39.4	E	NB I-10	48th Street (SR 143)	40th Street	2712	56.0	F
NB I-17	16th Street	7th Street	2826	27.2	C	NB I-17	16th Street	7th Street	2826	58.2	F
NB I-17	7th Street	7th Avenue	2755	28.7	D	NB I-17	7th Street	7th Avenue	2755	69.9	F
NB I-17	7th Avenue	19th Avenue	2698	24.4	C	NB I-17	7th Avenue	19th Avenue	2698	63.1	F
NB I-17*	Adams Street	I-10	1057	24.9	C	NB I-17*	Adams Street	I-10	1057	71.0	F
NB I-17*	I-10 (&McDowell)	Thomas Road	1603	28.4	D	NB I-17*	I-10 (&McDowell)	Thomas Road	1603	85.8	F
NB I-17	Thomas Road	Indian School	2965	31.1	D	NB I-17	Thomas Road	Indian School	2965	91.8	F
NB I-17	Indian School	Camelback Road	2663	31.2	D	NB I-17	Indian School	Camelback Road	2663	94.1	F
NB I-17	Camelback Road	Bethany Home Road	2910	30.0	D	NB I-17	Camelback Road	Bethany Home Road	2910	84.0	F
NB I-17	Bethany Home Road	Glendale Avenue	3077	30.7	D	NB I-17	Bethany Home Road	Glendale Avenue	3077	91.7	F
NB I-17	Glendale Avenue	Northern Avenue	2831	35.0	D	NB I-17	Glendale Avenue	Northern Avenue	2831	108.2	F
NB I-17	Northern Avenue	Dunlap Road	2659	38.8	E	NB I-17	Northern Avenue	Dunlap Road	2659	147.5	F
NB I-17	Dunlap Road	Peoria Road	1857	34.0	D	NB I-17	Dunlap Road	Peoria Road	1857	133.6	F
NB I-17	Peoria Road	Cactus Road	1817	31.1	D	NB I-17	Peoria Road	Cactus Road	1817	138.5	F
NB I-17	Cactus Road	Thunderbird Road	2525	29.6	D	NB I-17	Cactus Road	Thunderbird Road	2525	99.4	F
NB I-17	Thunderbird Road	Greenway Road	2657	32.3	D	NB I-17	Thunderbird Road	Greenway Road	2657	118.3	F
NB I-17	Greenway Road	Bell Road	1821	28.9	D	NB I-17	Greenway Road	Bell Road	1821	74.7	F
NB I-17	Bell Road	Union Hills Drive	2771	28.3	D	NB I-17	Bell Road	Union Hills Drive	2771	90.4	F

* Indicates System Interchange

Level of Service (LOS)	
Density of Weaving Segments	
A	0 - 10
B	> 10 - 20
C	> 20 - 28
D	> 28 - 35
E	> 35
F	Demand Exceeds Capacity

4.4.3 Arterial Network Analysis

After screening the Interstate alternatives and service interchanges, the arterial network crossing I-17 was analyzed to determine which arterials would best promote east-to-west movement across I-17. Drawing from the arterial analysis performed in the NAR, missing infrastructure components were identified, with the focus on the regional east-to-west arterials as shown in Figure 4-8. The missing arterial infrastructure identified included lane discontinuities between 35th and 19th avenues, service traffic interchange configurations not matching the projected traffic patterns and missing bicycle and pedestrian facilities. Supporting alternatives that proposed improvements for the crossing arterials were also evaluated for inclusion in the arterial improvement recommendation. As Figure 4-8 demonstrates, Valley Metro's light rail transit along Camelback Road and Dunlap Avenue was also taken into account for the Spine recommendations.

Once the analysis was completed for the I-17 east-to-west crossing arterials, the arterial improvements were incorporated into the Base Build Alternative. The I-17 east-to-west crossing arterials identified for improvements, which included traffic interchange improvements, are:

- Thomas Road
- Indian School Road
- Camelback Road
- Glendale Avenue
- Northern Avenue
- Dunlap Avenue
- Peoria Avenue
- Cactus Road
- Thunderbird Road
- Greenway Avenue
- Bell Road

4.4.4 Level 3 Alternatives

The Level 3 screening evaluated each of the alternatives in the categories of engineering, safety, public acceptance, operations and cost. For the purposes of evaluation, the Spine corridor was divided into five segments, similar to the segmentation used in the Alternative Development Workshop:

- I-10: SR-202L to Southern Avenue
- I-10: Southern Avenue to 24th Street
- I-17: 24th Street to McDowell Road
- I-17: McDowell Road to Dunlap Avenue
- I-17: Dunlap Avenue to SR-101L

The following sections describe each of the Level 3 screening criteria.

4.4.4.1 No-Build (Alternative 1A)

The No-Build Alternative consists of the corridor’s existing conditions as of December 2014 with routine maintenance and with the City of Chandler, City of Tempe and City of Phoenix Capital Improvement Programs (CIPs) and Transportation Master Plans, three Valley Metro light rail transit lines listed in Figure 4-10 and a group of projects within the Interstate corridor known as the near-term improvements. The near-term improvement projects were included in the No-Build Alternative because they had been approved for design and construction prior to December 2014. The No-Build Alternative was assumed to be included with all other Level 3 alternatives. See Figure 4-10 for the full list of projects included in the No-Build Alternative.

Figure 4-10. Alternatives and Project Assumptions for Level 3 Screening: Alternative 1A

Category	Projects	Notes and Comments
Alternative 1A – No-Build		
RTP	2035 RTP	All regionally modal projects, including South Central, Phoenix West, Glendale Downtown light rail transit lines. Improvements identified in the RTP for I-10 and I-17 omitted, except for Near-Term Strategy: +1 general purpose lane, southbound I-10, I-17 Split and US-60; C-D lanes and ramp braids, SR-143 and US-60; +1 general purpose lane, I-10, US-60 to Ray Road; Bicycle/pedestrian crossings at Alameda and Guadalupe
RTP	Phoenix CIP	Local projects not accounted for in RTP
RTP	Phoenix Transportation 2050	Project list to be determined
RTP	Tempe CIP	Local projects not accounted for in RTP
RTP	Chandler CIP	Local projects not accounted for in RTP
Maintenance	Routine Maintenance	Signing, striping, drainage, electrical, landscaping, etc.
TDM/TSM	ADOT TSMO Division Rollout	System operations and safety, incident response
TDM/TSM	Trip Reduction Program	Run by the Maricopa County Air Quality Department

4.4.4.2 Base Build (Alternative 1B)

The Base Build Alternative is a conglomeration of supporting alternatives from the Level 2 screening and the No-Build Alternative. The Management Partners and AEP evaluated all of the supporting alternatives that passed the Level 2 screening and determined which alternatives would be included in the Base Build Alternative for Level 3 screening. The projects included in the Base Build Alternative fit into one of the following categories:

- Technology
- Access
- Transit
- Bicycle/pedestrian
- Weave

See Figure 4-11 for a complete list of projects included in the Base Build Alternative.

Figure 4-11. Alternatives and Project Assumptions for Level 3 Screening: Alternative 1B

Category	Projects	Notes and Comments
Alternative 1B – Base Build (includes No-Build Alternative)		
Technology	Freeway Technology Package	Need to identify credit to take in the travel demand modeling evaluation; projects/strategies identified for freeways, arterials, driver/traveler/jurisdictional information, and connected/autonomous vehicles.
Technology	System Operations and Maintenance Staffing	
Access	I-10/Baseline Road	Traffic interchange #2 priority – Proposing a DDI, but looked at a flyover/ParClo concept as well (see Appendix H).
Access	I-10/SR-143/48th Street I-10/Broadway	Traffic interchange #4 priority - three concepts developed (see Appendix H): Replace southbound SR-143 loop ramp to eastbound I-10; braided ramps along SR-143 between I-10 and University; replace SR-143/48th Street and Broadway bridges over I-10; add a DHOV connector between SR-143 and I-10 to/from the south
Access	I-10/40th Street	Traffic interchange #30 priority – If mainline widening configurations below warrant, consider reconfiguring the traffic interchange to a standard diamond to eliminate the loop ramp to maximize the span under the bridge and/or to minimize new ROW. Needs further investigation based on selected alternative.
Access	I-17/7th Avenue	Traffic interchange #9 priority – Widened tight diamond with additional arterial through lanes and other operational upgrades
Access	I-17/19th Avenue	Traffic interchange #5 priority – Widened tight diamond with additional arterial through lanes and other operational upgrades
Access	I-17/Jefferson/ Adams	Traffic interchange #24 priority – Convert to a more standard split diamond and incorporate bicycle/pedestrian elements
Access	I-17/Thomas Road	Traffic interchange #7 priority – Extend third Thomas Road eastbound lane to 23rd Avenue and other operational upgrades
Access	I-17/Indian School Road	Traffic interchange #17 priority – Convert to three-level diamond traffic interchange to accommodate very large east-to-west regional flows
Access	I-17/Camelback Road	Traffic interchange #8 priority – Convert to three-level diamond traffic interchange to accommodate very large east-to-west regional flows and light rail transit
Access	I-17/Northern Avenue	Traffic interchange #13 priority – Convert to three-level diamond traffic interchange to accommodate very large east-to-west regional flows
Access	I-17/Dunlap Road	Traffic interchange #3 priority – Upgrade current configuration with operational improvements, and extend third westbound lane (19th Avenue to 3rd Avenue)
Access	I-17/Peoria Avenue	Traffic interchange #1 priority – Widened tight diamond with additional arterial through lanes, bicycle/pedestrian accommodations and other operational upgrades. Upgrade drainage system.
Access	I-17/Cactus Road	Traffic interchange #10 priority – Upgrade current configuration with operational improvements, and extend third westbound lane. Upgrade drainage system.

Figure 4-11. Alternatives and Project Assumptions for Level 3 Screening: Alternative 1B

Category	Projects	Notes and Comments
Access	I-17/Thunderbird Road	Traffic interchange #6 priority – Convert to a three-level diamond traffic interchange to accommodate very large east-to-west regional flows, incorporate bicycle/pedestrian elements, widen Thunderbird to a seven-lane section between 20th Lane and 34th Avenue, and upgrade drainage system
Access	I-17/Greenway Road	Traffic interchange #14 priority – Upgrade current configuration with operational improvements and extend third westbound lane to 19th Avenue. Upgrade drainage system.
Access	I-17/Bell Road	Traffic interchange #12 priority – Convert to three-level diamond traffic interchange to accommodate very large east-to-west regional flows. Expand park-and-ride lot in southwestern quadrant.
Transit	I-10/Galveston DHOV	Taken from the SE Corridor MIS recommendation; requested advancement by Chandler.
Transit	I-17/Central Avenue Light Rail Transit Crossing	Presently in RTP; I-17 bridge replacement and reprofiling required
Transit	I-17/Van Buren Light Rail Transit Crossing	Presently in RTP; Van Buren bridge over I-17 to be replaced and raised to better accommodate the split diamond and Jefferson/Adams
Transit	I-10/I-17 Stack Bus Ramps	Bus ramps from median of I-10 west of the Stack and then routed along the existing southbound frontage road on I-17 south to Van Buren Road. Southbound frontage road would be closed.
Transit	I-17/Camelback Light Rail Transit Crossing	Presently in RTP; included in the three-level diamond traffic interchange concept noted above
Transit	I-17/Mountain View Light Rail Transit Crossing	Presently in RTP; I-17 needs to reserve space for this future crossing over the Interstate
Transit	I-17/Bell Road Park-and-Ride Lot Expansion	Expand lot in conjunction with the Bell Road three-level diamond traffic interchange concept above
Bicycle/Pedestrian	Bicycle/Pedestrian Crossing - I-10/Chandler Blvd	Proposed bicycle/pedestrian crossing to connect Ahwatukee to Chandler across I-10
Bicycle/Pedestrian	Traffic interchange Upgrades - I-10/Warner Road	From Tempe 2015 Transportation Master Plan
Bicycle/Pedestrian	Bicycle/Pedestrian Crossing - I-10/Highline Canal	Just south of Baseline; Spine recommendation to connect Phoenix, Tempe and Guadalupe and to discourage bicycles from using the Baseline traffic interchange
Bicycle/Pedestrian	Bicycle/Pedestrian Crossing - I-10/Western Canal	North of Baseline at Arizona Mills Mall; from Tempe 2015 Transportation Master Plan and Phoenix Bike Plan Priority #33 – connects Tempe and Phoenix bicycle routes
Bicycle/Pedestrian	Traffic Interchange Upgrades - I-10/32nd Street	From Phoenix Bike Plan, noted as an identified barrier
Bicycle/Pedestrian	Traffic interchange Upgrades - I-10/24th Street	From Phoenix Bike Plan, Priority #2

Figure 4-11. Alternatives and Project Assumptions for Level 3 Screening: Alternative 1B

Category	Projects	Notes and Comments
Bicycle/Pedestrian	Traffic interchange Upgrades - I-17/Jefferson/Adams	From Phoenix Bike Plan, Priority #8
Bicycle/Pedestrian	Bicycle/Pedestrian Crossing - I-17/Osborn Road/Grand Canal	Just south of Indian School - Phoenix Bike Plan, Priority #5/15
Bicycle/Pedestrian	Bicycle/Pedestrian Crossing - I-17/Missouri Ave	Mid-mile between Camelback and Bethany Home (supports Grand Canyon University) – from Phoenix Bike Plan, Priority #17
Bicycle/Pedestrian	Bicycle/Pedestrian Crossing - I-17/Maryland Ave	Existing bicycle/pedestrian crossing at mid-mile between Bethany Home and Glendale. To remain, or to be replaced if affected by freeway widening.
Bicycle/Pedestrian	Bicycle/Pedestrian Crossing - I-17/Arizona Canal	Existing bicycle/pedestrian crossing just north of Dunlap. To remain, or to be replaced if affected by freeway widening.
Bicycle/Pedestrian	Traffic interchange Upgrades - I-17/Northern	Bicycle/pedestrian crash hot spot; solution integrated into traffic interchange reconstruction
Bicycle/Pedestrian	Traffic interchange Upgrades - I-17/Peoria	Bicycle/pedestrian crash hot spot; solution integrated into traffic interchange modernization
Bicycle/Pedestrian	Traffic interchange Upgrades - I-17/Thunderbird	From Phoenix Bike Plan, noted as an identified barrier; bicycle/pedestrian crash hot spot; solution integrated into traffic interchange reconstruction
Bicycle/Pedestrian	Traffic interchange Upgrades - I-17/Greenway	From Phoenix Bike Plan, noted as an identified barrier
Bicycle/Pedestrian	Bicycle/Pedestrian Crossing - I-17/Paradise Lane-Grandview	From Phoenix Bike Plan, noted as an identified barrier; mid-mile between Greenway and Bell
Bicycle/Pedestrian	Traffic interchange Upgrades - I-17/Union Hills Drive	From Phoenix Bike Plan, Priority #21
Weave	Dual Lane Exit Ramp Conversions	Convert exit ramps with exit only from auxiliary lanes to a two-lane exit (option + drop lane) throughout corridor where feasible.
Weave	I-10; Elliot to Baseline	Extend the US-60 C-D road system south from Baseline Road to Elliot Road to improve the safety of this weave, to provide a barrier-separated roadway for system redundancy where no good arterial redundancy exists today, and to aid in ramp storage length for both of the south side Baseline Road ramps.

4.4.4.3 I-17 Reconstruction (Alternative 2)

The I-17 Reconstruction Alternative consists of the No-Build Alternative, Base Build Alternative and reconstructing the I-17 main line to full design standards. For a complete description of the I-17 Reconstruction Alternative, see Figure 4-12.

Figure 4-12. Alternatives and Project Assumptions for Level 3 Screening: Alternative 2

Category	Projects	Notes and Comments
Alternative 2 – I-17 Reconstruction (includes No-Build and Base Build Alternatives)		
Highway Capacity	I-17, I-10 Split to I-10 Stack	Reconstruct pavements, bridges, interchanges, drainage to full standards with added auxiliary lanes. Design exceptions may be needed in spot areas and will be looked at on a case-by-case basis. Consider provisions for an SR-30 connection at Durango Curve, particularly when constructing new bridges, both in terms of location and clearances.
Highway Capacity	I-17, I-10 Stack to Peoria Ave	Reconstruct pavements, bridges (where appropriate), drainage to full standards. Design exceptions may be needed in spot areas and will be looked at on a case-by-case basis.
Highway Capacity	I-17, Peoria Ave to SR-101L	Reconstruct bridges (where appropriate) and drainage to full standards. Design exceptions may be needed in spot areas and will be looked at on a case-by-case basis.

4.4.4.4 New General Purpose Lanes (Alternative 3A)

The New General Purpose Lanes Alternative consists of the No-Build Alternative, Base Build Alternative and adding one general purpose lane in each direction along the entire Spine corridor. For a complete description of the New General Purpose Lanes Alternative, see Figure 4-13.

Figure 4-13. Alternatives and Project Assumptions for Level 3 Screening: Alternative 3A

Category	Projects	Notes and Comments
Alternative 3A – Add General Purpose Lanes, widening to match existing standards (includes No-Build and Base Build Alternatives)		
Highway Capacity	I-10, Pecos Stack to Split	Add one general purpose lane in each direction.
Highway Capacity	I-17, Split to Stack	Add one general purpose lane in each direction.
Highway Capacity	I-17, Stack to North Stack	Add one general purpose lane in each direction.

4.4.4.5 New HOV Lanes (Alternative 3B)

The New HOV Lanes Alternative consists of the No-Build Alternative, Base Build Alternative and adding one HOV lane in each direction along the entire Spine corridor. For a complete description of the New HOV Lanes Alternative, see Figure 4-14.

Figure 4-14. Alternatives and Project Assumptions for Level 3 Screening: Alternative 3B

Category	Projects	Notes and Comments
Alternative 3B – Add HOV Lanes, widening and restoring full standards where applicable (includes No-Build and Base Build Alternatives)		
Special Lanes	I-10, Pecos Stack to Split	Add a second HOV lane (2+ occupancy) in each direction.
Special Lanes	I-10/I-17 Split Interchange	Add a two-way DHOV connector between I-17 and I-10 to the east.
Special Lanes	I-17, Split to Stack	Alternative 2 + Add an HOV lane (2+ occupancy) on I-17 each direction.
Special Lanes	I-17, Stack to North Stack	Alternative 2 + Add a second HOV lane (2+ occupancy) each direction.

4.4.4.6 Dual Express Lanes (Alternative 3C)

The Dual Express Lanes Alternative consists of the No-Build Alternative, Base Build Alternative and creating a stripe-separated dual express lane system in each direction along the entire Spine corridor. This alternative requires the conversion of the existing HOV system to an express lane system and the construction of a second express lane. For a complete description of the Dual Express Lanes Alternative, see Figure 4-15.

Figure 4-15. Alternatives and Project Assumptions for Level 3 Screening: Alternative 3C

Category	Projects	Notes and Comments
Alternative 3C – Dual Express Lanes, widening and restoring full standards where applicable (includes No-Build and Base Build Alternatives)		
Special Lanes	I-10, Pecos Stack to Split	Add one new lane and then restripe all existing general purpose lanes and new lane into two express lanes and all others as local lanes. Ingress and egress points to be determined. Maintain single HOV.
Special Lanes	I-17, Stack to North Stack	Add one new lane and then restripe all existing general purpose lanes and new lane into two express lanes and all others as local lanes. Ingress and egress points to be determined. Maintain single HOV.

4.4.4.7 Dual HOT Lanes (Alternative 3D)

The Dual HOT Lanes Alternative consists of the No-Build Alternative, Base Build Alternative and creating a stripe-separated dual HOT lane system in each direction along the entire Spine corridor. This alternative requires the conversion of the existing HOV system to a HOT lane system and the construction of a second HOT lane. For a complete description of the Dual HOT Lanes Alternative, see Figure 4-16.

Figure 4-16. Alternatives and Project Assumptions for Level 3 Screening: Alternative 3D

Category	Projects	Notes and Comments
Alternative 3D – Dual HOT Lanes, widening and restoring full standards where applicable (includes No-Build and Base Build Alternatives)		
Special Lanes	I-10, Pecos Stack to Split	Convert existing HOV to HOT and add a second HOT lane in each direction.
Special Lanes	I-10/I-17 Split Interchange	Add a two-way DHOT connector between I-17 and I-10 to the east.
Special Lanes	I-17, Split to Stack	Alternative 2 + Add a HOT lane on I-17 each direction.
Special Lanes	I-17, Stack to North Stack	Convert existing HOV to HOT and add a second HOT lane each direction.

4.4.4.8 Striped Express/Local Lanes (Alternative 4)

The Striped Express/Local Lanes Alternative consists of the No-Build Alternative, Base Build Alternative and creating a stripe-separated express lane system in each direction along the entire Spine corridor. This alternative is similar to the Dual Express Lanes Alternative because it converts of the existing HOV system to an express lane system; however, it does not construct a second express lane, leaving the express lane system a single-lane system. For a complete description of the Striped Express/Local Lanes Alternative, see Figure 4-17.

Figure 4-17. Alternatives and Project Assumptions for Level 3 Screening: Alternative 4

Category	Projects	Notes and Comments
Alternative 4 – Express/Local Lanes (includes No-Build and Base Build Alternatives)		
Special Lanes	I-10, Pecos Stack to Split	Restripe all existing general purpose lanes into one express lane and all others as local lanes. Ingress and egress points to be determined. Maintain HOV in lane 1.
Special Lanes	I-17, Stack to North Stack	Restripe all existing general purpose lanes into one express lane and all others as local lanes. Ingress and egress points to be determined. Maintain HOV in lane 1.

4.4.4.9 HOT Lane Conversion (Alternative 5)

The HOT Lane Conversion Alternative consists of the No-Build Alternative, Base Build Alternative and creating a stripe-separated HOT lane system in each direction along the entire Spine corridor. This alternative is similar to the Dual HOT Lanes Alternative because it converts of the existing HOV system to a HOT lane system; however, it does not construct a second HOT lane, leaving the HOT lane system a single-lane system. For a complete description of the HOT Lane Conversion Alternative, see Figure 4-18.

Figure 4-18. Alternatives and Project Assumptions for Level 3 Screening: Alternative 5

Category	Projects	Notes and Comments
Alternative 5 – HOT Lanes (HOV Conversion, includes No-Build and Base Build Alternatives)		
Special Lanes	I-10, Pecos Stack to Split	Converts existing HOV lanes to HOT lanes to implement lane pricing. Ingress and egress points to be determined.
Special Lanes	I-17, Stack to North Stack	Converts existing HOV lanes to HOT lanes to implement lane pricing. Ingress and egress points to be determined.

4.4.5 Level 3 Screening

4.4.5.1 Infrastructure Analysis

Because the Level 3 screening had a quantitative component, concept layouts were required for all of the build alternatives. The first iteration of the concept layouts were lane line diagrams to achieve consensus on what the build alternatives consisted of and to provide a guide for creating networks for the travel demand model, which would be used to analyze each of the alternatives. Once the lane line diagrams were finalized and approved on July 14, 2016, full-concept 5 percent horizontal layout design plans were drawn for each of the build alternatives. The 5 percent design plans were used to determine whether the concepts met design standards and replaced old infrastructure and to determine the quantity of new ROW required and cost of the improvements.

4.4.5.2 Safety Analysis

Each of the alternatives was evaluated based on safety factors identified by the crash modification factors (CMFs) developed for ADOT's corridor profile studies and developed by the CMF Clearinghouse. Seventeen CMF items were identified as applicable to the Spine study alternatives and are summarized in Figure 4-19. Because of the level of design, the safety analysis completed for the alternatives was only qualitative in nature and considered the alternatives by segment rather than evaluating crash hot spots. A more detailed safety analysis was completed on the service traffic interchanges and can be reviewed in Appendix E.

Figure 4-19. Level 3 and 4 Screening – Safety Assessment Summary

I-10/I-17 Corridor Master Plan Level 3 and 4 Screening - Safety Assessment Summary

Improvement	CMF*	Crash Reduction %	SPINE ALTERNATIVES																																																																
			1A					1B					2					3A					3B					3C					3D					4					5																								
Segments			1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5																				
Widen Lane	1	0%											X	X	X								X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X						
Widen Shoulder (>=4')	0.64	36%											X	X	X								X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X						
Rehabilitate Shoulder	0.72	28%											X	X	X								X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X						
Rehabilitate Pavement	0.7	30%											X	X	X			X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X						
Rehabilitate Bridge	0.95	5%											X	X	X			X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X						
Construct Auxillary Lanes	0.78	22%											X										X																																												
Construct High-Occupancy Vehicle (HOV) Lane	0.95	5%																					X	X	X	X							X	X	X	X																															
Construct New General Purpose Lane	0.9	10%	X					X					X					X	X	X	X		X					X	X	X	X		X					X					X					X					X					X									
Add Freeway Collector-Distributor roads	0.9	10%		X				X	X				X	X				X	X				X	X				X	X				X	X				X	X				X	X				X	X				X	X				X	X								
Widen and modify Entry/Exit Ramps	0.21	79%						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					
Convert continuous access HOV to limited access	1.54	-54%																										N	N	N	N							N	N	N	N																										
Convert HOV lanes to high occupancy Toll (HOT) lanes	0.95	5%																															X	X	X	X							X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X						
Increase lane width from 11 feet to 12 feet	0.95	5%											X	X									X	X									X	X																																	
DHOV (eliminates weave and reduces conflict points)		+						X					X					X					X	X	X			X	X	X			X	X	X			X	X	X			X	X	X			X	X	X			X	X	X												
ITS for ATM	0.8	20%						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X										
ITS for Incident Management	0.85	15%	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X										
Install Pedestrian Bridge ¹	0.1	90%	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X										

* Crash Modification Factor (CMF) — multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure
 Source: CMF's developed for ADOT Corridor profile studies, HSM, CMF Clearing house, and other state and national resources.
¹ Pedestrian only crash benefit

Segment Definition

1	I-10; Pecos Stack to Southern Ave
2	I-10; Southern Ave to Split
3	I-17; Split to Grand Ave
4	I-17; Grand Ave to Dunlap Ave
5	I-17; Dunlap Ave to North Stack

4.4.5.3 Scoring Against Public Priorities (Prior to Public Involvement Effort)

During the three public meetings held on February 25, February 26, and March 4, 2015, supporting the NAR for this study, the public prioritized eight corridor improvement strategies to indicate how it would like to see the Spine study solve the issues within the Spine corridor. The public prioritized the following criteria accordingly:

- Improve commute – 19.10 percent
- Add travel choices – 13.12 percent
- Protect the environment – 12.07 percent
- Increase connections – 11.75 percent
- Promote neighborhoods – 11.65 percent
- Improve commerce – 11.23 percent
- Minimize cost – 10.60 percent
- Emphasize jobs – 10.49 percent

Each of the alternatives was evaluated by segment on how well it implemented each of these improvement strategies, with a rating of 1 indicating significantly worse than today's corridor, 5 indicating the same as today's corridor and 10 indicating significantly better than today's corridor. The scoring process was qualitative. Figures 4-20 to 4-24 summarize how the alternatives scored against public priorities for the Level 3 screening.

Figure 4-20. Level 3 Screening Summary of Findings – Public Input Score: Freeway Segment I-10, SR-202L to US-60

Alternative		Improve Commute	Add Travel Choices	Protect the Environment	Increase Connections	Promote Neighborhoods	Improve Commerce	Minimize Cost	Emphasize Jobs	Total Score (Higher = Better)
Public Weighting		19.10%	13.12%	12.07%	11.75%	11.65%	11.23%	10.60%	10.49%	
Today	Northbound/Westbound	5	5	5	5	5	5	5	5	5.00
Today	Southbound/Eastbound	5	5	5	5	5	5	5	5	5.00
1A	Northbound/Westbound	7	5	6	8	4	7	4	5	5.86
1A	Southbound/Eastbound	7	5	6	8	4	7	4	5	5.86
1B	Northbound/Westbound	7	7	4	9	4	7	4	5	6.00
1B	Southbound/Eastbound	7	7	4	9	4	7	4	5	6.00
2	Northbound/Westbound	7	7	4	9	4	7	4	5	6.00
2	Southbound/Eastbound	7	7	4	9	4	7	4	5	6.00
3A	Northbound/Westbound	9	7	3	9	3	8	1	5	5.93
3A	Southbound/Eastbound	9	7	3	9	3	8	2	5	6.04
3B	Northbound/Westbound	7	9	5	10	3	7	2	6	6.27
3B	Southbound/Eastbound	7	9	5	10	3	7	2	6	6.27
3C	Northbound/Westbound	9	7	5	9	3	9	2	5	6.39
3C	Southbound/Eastbound	9	7	5	9	3	9	2	5	6.39
3D	Northbound/Westbound	8	8	5	9	3	9	2	6	6.44
3D	Southbound/Eastbound	8	8	5	9	3	9	2	6	6.44
4	Northbound/Westbound	8	7	4	9	4	8	4	5	6.30
4	Southbound/Eastbound	8	7	4	9	4	8	4	5	6.30
5	Northbound/Westbound	7	8	4	9	4	8	2	6	6.13
5	Southbound/Eastbound	7	8	4	9	4	8	2	6	6.13

Notes: 1 = significantly worse than today; 5 = same as today; 10 = significantly better than today

Figure 4-21. Level 3 Screening Summary of Findings – Public Input Score: Freeway Segment I-10, US-60 to I-17 Split

Alternative		Improve Commute	Add Travel Choices	Protect the Environment	Increase Connections	Promote Neighborhoods	Improve Commerce	Minimize Cost	Emphasize Jobs	Total Score (Higher = Better)
Public Weighting		19.10%	13.12%	12.07%	11.75%	11.65%	11.23%	10.60%	10.49%	
Today	Northbound/Westbound	5	5	5	5	5	5	5	5	5.00
Today	Southbound/Eastbound	5	5	5	5	5	5	5	5	5.00
1A	Northbound/Westbound	5	5	5	5	5	5	5	5	5.00
1A	Southbound/Eastbound	7	5	6	5	4	7	5	5	5.61
1B	Northbound/Westbound	7	6	4	9	5	7	4	6	6.09
1B	Southbound/Eastbound	8	6	5	9	4	9	4	6	6.51
2	Northbound/Westbound	7	6	4	9	5	7	4	6	6.09
2	Southbound/Eastbound	8	6	5	9	4	9	4	6	6.51
3A	Northbound/Westbound	8	6	3	9	4	8	2	6	5.94
3A	Southbound/Eastbound	9	6	4	9	3	10	3	6	6.47
3B	Northbound/Westbound	7	8	4	10	4	7	1	7	6.14
3B	Southbound/Eastbound	8	8	5	10	3	9	1	7	6.56
3C	Northbound/Westbound	9	6	4	9	4	9	1	6	6.26
3C	Southbound/Eastbound	7	6	5	9	3	10	1	6	5.99
3D	Northbound/Westbound	9	7	4	9	4	9	1	7	6.49
3D	Southbound/Eastbound	10	7	5	9	3	10	1	7	6.80
4	Northbound/Westbound	8	6	4	9	5	8	4	6	6.39
4	Southbound/Eastbound	6	6	5	9	4	9	4	6	6.12
5	Northbound/Westbound	8	7	4	9	5	8	3	7	6.52
5	Southbound/Eastbound	9	7	5	9	4	9	3	7	6.83

Notes: 1 = significantly worse than today; 5 = same as today; 10 = significantly better than today

Figure 4-22. Level 3 Screening Summary of Findings – Public Input Score: Freeway Segment I-17, I-10 Split to Stack

Alternative		Improve Commute	Add Travel Choices	Protect the Environment	Increase Connections	Promote Neighborhoods	Improve Commerce	Minimize Cost	Emphasize Jobs	Total Score (Higher = Better)
Public Weighting		19.10%	13.12%	12.07%	11.75%	11.65%	11.23%	10.60%	10.49%	
Today	Northbound/Westbound	5	5	5	5	5	5	5	5	5.00
Today	Southbound/Eastbound	5	5	5	5	5	5	5	5	5.00
1A	Northbound/Westbound	5	5	5	5	5	5	5	5	5.00
1A	Southbound/Eastbound	5	5	5	5	5	5	5	5	5.00
1B	Northbound/Westbound	5	5	5	6	4	7	4	6	5.22
1B	Southbound/Eastbound	5	5	5	6	4	7	4	6	5.22
2	Northbound/Westbound	6	5	4	6	4	9	2	6	5.31
2	Southbound/Eastbound	7	5	4	6	4	9	2	6	5.50
3A	Northbound/Westbound	8	5	3	6	3	9	1	6	5.35
3A	Southbound/Eastbound	7	5	3	6	3	9	1	6	5.16
3B	Northbound/Westbound	7	8	2	8	2	9	1	7	5.65
3B	Southbound/Eastbound	6	8	2	8	2	9	1	7	5.46
3C	Northbound/Westbound	9	5	2	6	2	8	1	6	5.19
3C	Southbound/Eastbound	7	5	2	6	2	8	1	6	4.81
3D	Northbound/Westbound	5	6	2	6	2	8	1	7	4.66
3D	Southbound/Eastbound	6	6	2	6	2	8	1	7	4.85
4	Northbound/Westbound	8	5	5	6	4	7	4	6	5.80
4	Southbound/Eastbound	6	5	5	6	4	7	4	6	5.42
5	Northbound/Westbound	4	6	5	6	4	7	3	7	5.16
5	Southbound/Eastbound	5	6	5	6	4	7	3	7	5.35

Notes: 1 = significantly worse than today; 5 = same as today; 10 = significantly better than today

Figure 4-23. Level 3 Screening Summary of Findings – Public Input Score: Freeway Segment I-17, Stack to Dunlap

Alternative		Improve Commute	Add Travel Choices	Protect the Environment	Increase Connections	Promote Neighborhoods	Improve Commerce	Minimize Cost	Emphasize Jobs	Total Score (Higher = Better)
Public Weighting		19.10%	13.12%	12.07%	11.75%	11.65%	11.23%	10.60%	10.49%	
Today	Northbound	5	5	5	5	5	5	5	5	5.00
Today	Southbound	5	5	5	5	5	5	5	5	5.00
1A	Northbound	5	5	5	5	5	5	5	5	5.00
1A	Southbound	5	5	5	5	5	5	5	5	5.00
1B	Northbound	5	7	4	7	4	8	4	8	5.81
1B	Southbound	5	7	4	7	4	8	4	8	5.81
2	Northbound	5	7	3	7	3	8	2	8	5.36
2	Southbound	5	7	3	7	3	8	2	8	5.36
3A	Northbound	6	7	2	7	2	9	1	9	5.42
3A	Southbound	8	7	2	7	2	9	1	9	5.80
3B	Northbound	5	8	1	7	1	8	2	8	5.01
3B	Southbound	5	8	1	7	1	8	2	8	5.01
3C	Northbound	7	7	1	7	1	10	2	7	5.38
3C	Southbound	8	7	1	7	1	10	2	7	5.58
3D	Northbound	7	8	1	7	1	10	2	8	5.62
3D	Southbound	6	8	1	7	1	10	2	8	5.43
4	Northbound	6	7	4	7	4	9	4	7	6.00
4	Southbound	7	7	4	7	4	9	4	7	6.20
5	Northbound	6	8	4	7	4	9	3	8	6.13
5	Southbound	5	8	4	7	4	9	3	8	5.94

Notes: 1 = significantly worse than today; 5 = same as today; 10 = significantly better than today

Figure 4-24. Level 3 Screening Summary of Findings – Public Input Score: Freeway Segment I-17, Dunlap to SR-101L

Alternative		Improve Commute	Add Travel Choices	Protect the Environment	Increase Connections	Promote Neighborhoods	Improve Commerce	Minimize Cost	Emphasize Jobs	Total Score (Higher = Better)
Public Weighting		19.10%	13.12%	12.07%	11.75%	11.65%	11.23%	10.60%	10.49%	
Today	Northbound	5	5	5	5	5	5	5	5	5.00
Today	Southbound	5	5	5	5	5	5	5	5	5.00
1A	Northbound	5	5	5	5	5	5	5	5	5.00
1A	Southbound	5	5	5	5	5	5	5	5	5.00
1B	Northbound	5	7	4	7	4	8	4	8	5.81
1B	Southbound	5	7	4	7	4	8	4	8	5.81
2	Northbound	5	7	3	7	3	8	1	8	5.25
2	Southbound	5	7	3	7	3	8	1	8	5.25
3A	Northbound	7	7	2	7	2	9	1	9	5.61
3A	Southbound	7	7	2	7	2	9	1	9	5.61
3B	Northbound	5	8	1	7	1	8	2	8	5.01
3B	Southbound	5	8	1	7	1	8	2	8	5.01
3C	Northbound	7	7	1	7	1	10	2	7	5.38
3C	Southbound	7	7	1	7	1	10	2	7	5.38
3D	Northbound	6	8	1	7	1	10	2	8	5.43
3D	Southbound	6	8	1	7	1	10	2	8	5.43
4	Northbound	6	7	4	7	4	9	4	7	6.00
4	Southbound	6	7	4	7	4	9	4	7	6.00
5	Northbound	5	8	4	7	4	9	3	8	5.94
5	Southbound	5	8	4	7	4	9	3	8	5.94

Notes: 1 = significantly worse than today; 5 = same as today; 10 = significantly better than today

4.4.5.4 Operations Analyses

The Level 3 screening consisted of identifying a variety of MOEs that provided a quantitative comparison of the relative effects of each alternative on traffic operations in the Spine corridor. Data was derived from MAG's TransCAD Regional Travel Demand Model for the following MOEs:

- General purpose and HOV lane travel times
- Person trips
- General purpose and HOV lane v/c ratio
- Freeway duration of congestion
- VMT and percent congested VMT
- VHT and percent congested VHT
- Travel speed

The following describes the methodology used to derive each of these MOEs. A summary of these resulting MOEs for each of the alternatives is provided in Figures 4-25 through 4-29 and Figures 4-31 through 4-35.

General Purpose and High Occupancy Vehicle Lanes Travel Times

This summary analysis was completed by extracting the travel times in the general purpose lanes and the HOV lanes in the TransCAD model for every specified segment of the Spine corridor in the PM peak hour for each of the alternatives. Results are presented in minutes.

Person Trips

This analysis provides an estimate of the number of persons traveling through the Spine corridor in the PM peak hour. Highway general purpose and HOV lanes (and HOT lanes in some alternatives) were identified for each of the segments and the respective traffic volumes for each facility type were then obtained from the TransCAD model. General purpose lanes and HOV lanes were given distinct multipliers to account for the average person count in each trip occurring within the Spine corridor; a multiplier was not applied to HOT trips due to a lack of trend data in the Phoenix metropolitan area. Transit trips were derived from passenger counts along transit routes for each segment of the Spine corridor. The total person trips is the sum of the general purpose lanes person count, HOV/HOT lanes person count and the transit trips count.

General Purpose and High Occupancy Vehicle Lanes Volume-to-Capacity Ratio

These figures were obtained by conducting a cutline analysis using ArcGIS software. Cut lines are used to gauge traffic flow and network characteristics of the links that cross the cutline. Thirteen cut lines were used to evaluate levels of traffic congestion for both general purpose and HOV lanes, with at least two cut lines in each of the segments. The cut lines identified the facility type for each lane of traffic, the capacity for each lane and the traffic flows at each link crossing the cut line. The resulting v/c ratios represent the average level of congestion across cut lines in each of the summarized segments during the PM peak hour.

Freeway Duration of Congestion

For purposes of this analysis, congestion was defined as a condition when speeds dropped below 45 mph. ADOT Freeway Management System (FMS) data were reviewed to define a per-lane volume threshold for each segment above which speeds historically dropped below 45 mph. Network characteristics and traffic volume data were extracted from the TransCAD model for each analysis period: AM, midday, PM, and nighttime. Levels of congestion were determined using the model volumes in conjunction with the established per-lane capacity threshold for each segment. For periods where the model-generated volume exceeded the established segment capacity threshold, the excess volume was assigned to adjacent periods until volumes no longer surpassed the per-lane capacity threshold for each time period.

Vehicle Miles Traveled and Percent Congested Vehicle Miles Traveled

This analysis focused on collecting the VMT for each of the freeway segments as well as the surface streets adjacent to each of the respective segments. Total VMT was summarized as well as congested VMT, or VMT occurring only on network links that experienced a v/c ratio greater than 0.84. The total VMT and congested VMT values were then used to determine the percentage of VMT occurring on congested roadways. This analysis was done using ArcGIS software.

Vehicle Hours Traveled and Percent Congested Vehicle Hours Traveled

This analysis focuses on collecting the VHT for each of the freeway segments as well as the surface streets adjacent to each of the respective segments. Total VHT was summarized as well as congested VHT, or VHT occurring only on network links that experienced a v/c ratio greater than 0.84. The total VHT and constrained VHT values were then used to determine the percentage of VHT occurring during roadway congestion. This analysis was done using ArcGIS software.

Travel Speed

This analysis was conducted using the results from the VMT and VHT analyses. The average speed in each of the segments was derived by dividing the total VMT by the VHT, resulting in average speed in mph.

4.4.5.5 Conclusions

Once the analysis for Level 3 was completed, it was compiled and presented to the Management Partners on October 24, 2016. The results of the analysis were presented as shown in Figures 4-25 to 4-29.

At the conclusion of the Level 3 screening, it became apparent that a single Level 3 alternative did not best serve all of the segments within the Spine corridor. The Management Partners and AEP decided that a Level 4 screening should be completed on two hybrid alternatives that combined the best parts of the alternatives in the Level 3 screening.

Figure 4-25. Level 3 Screening Summary of Findings: Freeway Segment I-10, SR-202L to Southern Ave

Alternative		Cost Opinion (2016 \$M)	Net New ROW (Acres)	Public Input Score	Replaces Old Infrastructure	Full Design Standards	VMT	% VMT Congested	VHT	% VHT Congested	VMT/VHT (mph)	General Purpose Travel Time (Minutes, 2-6pm Peak)	HOV Travel Time (Minutes, 2-6pm Peak)	Person-Trips ^a	Avg. General Purpose v/c	Avg. HOV v/c	Freeway Duration of Congestion (Hours)
Today	Northbound/Westbound	\$0.0	0.0	5.00	N/A	Yes	911,139	40.7%	26,216	45.6%	34.8	5.74	4.09	29,782	0.71	0.35	3.25
Today	Southbound/Eastbound	\$0.0	0.0	5.00	N/A	Yes						10.13	5.49	38,896	1.02	0.51	2.50
No-Build	Northbound/Westbound	\$0.0	0.0	5.86	N/A	Yes	1,103,239	38.6%	32,110	45.3%	34.4	5.25	4.28	32,195	0.76	0.40	0.50
No-Build	Southbound/Eastbound	\$0.0	0.0	5.86	N/A	Yes						7.71	5.87	43,078	1.11	0.53	0.00
1B	Northbound/Westbound	\$111.5	0.9	6.00	N/A	Yes	1,110,984	38.5%	32,388	45.3%	34.3	5.28	4.36	32,639	0.77	0.42	0.50
1B	Southbound/Eastbound	\$123.7	9.5	6.00	N/A	Yes						7.79	6.11	43,776	1.12	0.56	0.00
2	Northbound/Westbound	\$111.5	0.9	6.00	N/A	Yes	1,110,476	38.6%	32,411	45.4%	34.3	5.28	4.32	32,430	0.76	0.41	0.50
2	Southbound/Eastbound	\$123.7	9.5	6.00	N/A	Yes						7.79	6.06	43,659	1.11	0.55	0.00
3A	Northbound/Westbound	\$125.6	2.2	5.93	N/A	Yes	1,155,579	38.3%	32,595	44.0%	35.5	4.74	4.33	35,656	0.72	0.41	0.00
3A	Southbound/Eastbound	\$137.9	9.7	6.04	N/A	Yes						6.73	5.97	47,927	1.07	0.54	0.00
3B	Northbound/Westbound	\$130.1	2.2	6.27	N/A	Yes	1,127,593	37.8%	32,349	44.9%	34.9	5.30	3.97	34,292	0.78	0.27	0.50
3B	Southbound/Eastbound	\$139.8	9.7	6.27	N/A	Yes						7.71	4.97	46,696	1.11	0.40	0.00
3C	Northbound/Westbound	\$136.0	2.2	6.39	N/A	Yes	1,073,724	40.7%	32,656	48.4%	32.9	4.90	3.90	27,118	0.70	0.11	0.00
3C	Southbound/Eastbound	\$145.7	9.7	6.39	N/A	Yes						7.30	4.50	37,440	1.04	0.16	0.00
3D	Northbound/Westbound	\$142.0	2.2	6.44	N/A	Yes	1,157,201	26.8%	32,605	36.9%	35.5	4.50	4.30	34,011	0.65	0.43	0.00
3D	Southbound/Eastbound	\$151.6	9.7	6.44	N/A	Yes						6.00	6.10	44,499	1.00	0.60	0.00
4	Northbound/Westbound	\$119.4	0.9	6.30	N/A	Yes	1,112,285	41.6%	32,545	47.5%	34.2	5.35	4.22	32,031	0.81	0.39	0.50
4	Southbound/Eastbound	\$130.6	9.6	6.30	N/A	Yes						7.96	5.81	43,565	1.15	0.56	0.00
5 ^b	Northbound/Westbound	\$127.2	0.9	6.13	N/A	Yes	1,096,973	37.4%	32,376	44.5%	33.9	5.05	4.71	30,633	0.73	0.53	0.25
5 ^b	Southbound/Eastbound	\$138.5	9.6	6.13	N/A	Yes						7.31	7.32	40,806	1.08	0.68	0.00

^a Person-trips includes HOV, general purpose and transit trips.

^b For Alternative 5, all HOT (HOV) travel times are based on fixed pricing, not congestion pricing.

Figure 4-26. Level 3 Screening Summary of Findings: Freeway Segment I-10, Southern Ave to 24th Street

Alternative		Cost Opinion (2016 \$M)	Net New ROW (Acres)	Public Input Score	Replaces Old Infrastructure	Full Design Standards	VMT	% VMT Congested	VHT	% VHT Congested	VMT/VHT (mph)	General Purpose Travel Time (Minutes, 2-6pm Peak)	HOV Travel Time (Minutes, 2-6pm Peak)	Person-Trips ^a	Avg. General Purpose v/c	Avg. HOV v/c	Freeway Duration of Congestion (Hours)
Today	Northbound/Westbound	\$0.0	0.0	5.00	No	No	1,323,101	42.1%	40,440	43.8%	32.7	8.24	6.57	51,547	0.94	0.57	4.25
Today	Southbound/Eastbound	\$0.0	0.0	5.00	No	Yes						10.27	7.86	48,585	1.10	0.67	4.25
No-Build	Northbound/Westbound	\$0.0	0.0	5.00	No	No	1,476,599	55.5%	54,810	58.1%	26.9	8.83	6.79	58,490	0.95	0.56	9.00
No-Build	Southbound/Eastbound	\$0.0	0.0	5.61	No	No						9.02	7.46	51,086	1.01	0.64	11.25
1B	Northbound/Westbound	\$170.4	1.5	6.09	Yes	No	1,481,941	55.2%	54,588	58.2%	27.1	8.77	6.83	57,965	0.95	0.58	8.50
1B	Southbound/Eastbound	\$166.7	3.1	6.51	Yes	No						8.86	7.36	48,858	0.99	0.64	9.75
2	Northbound/Westbound	\$170.4	1.5	6.09	Yes	No	1,486,229	55.7%	55,144	59.0%	27.0	9.00	6.81	59,170	0.96	0.57	9.50
2	Southbound/Eastbound	\$166.7	3.1	6.51	Yes	No						9.03	7.42	49,550	1.00	0.63	11.00
3A	Northbound/Westbound	\$185.7	5.7	5.94	Yes	No	1,525,293	54.6%	55,038	57.8%	27.7	7.79	6.63	62,586	0.89	0.56	5.50
3A	Southbound/Eastbound	\$163.7	0.1	6.47	Yes	No						8.21	7.42	53,445	0.93	0.62	4.00
3B	Northbound/Westbound	\$206.0	5.7	6.14	Yes	Yes	1,513,748	53.9%	54,815	57.7%	27.6	9.00	5.65	63,681	0.95	0.53	7.00
3B	Southbound/Eastbound	\$197.4	0.1	6.56	Yes	Yes						9.01	6.55	53,074	1.00	0.51	8.25
3C	Northbound/Westbound	\$206.3	5.7	6.26	Yes	Yes	1,472,237	54.1%	56,798	60.0%	25.9	10.80	5.40	54,477	0.88	0.30	5.00
3C	Southbound/Eastbound	\$179.3	0.1	5.99	Yes	Yes						7.20	5.60	44,942	0.92	0.28	2.00
3D	Northbound/Westbound	\$213.6	5.7	6.49	Yes	Yes	1,541,729	42.7%	54,663	51.4%	28.2	7.30	6.00	60,239	0.83	0.62	3.75
3D	Southbound/Eastbound	\$204.8	0.1	6.80	Yes	Yes						7.30	7.10	51,439	0.89	0.63	1.50
4	Northbound/Westbound	\$174.9	1.5	6.39	Yes	No	1,482,932	55.1%	54,819	58.4%	27.1	9.10	6.20	57,496	1.00	0.50	8.50
4	Southbound/Eastbound	\$171.1	3.1	6.12	Yes	No						8.88	7.07	48,653	1.05	0.59	10.25
5 ^b	Northbound/Westbound	\$180.5	1.5	6.52	Yes	No	1,476,847	54.4%	55,434	59.4%	26.6	8.27	6.86	53,778	0.91	0.60	5.00
5 ^b	Southbound/Eastbound	\$176.7	3.1	6.83	Yes	No						8.70	8.66	46,985	0.98	0.58	8.00

^a Person-trips includes HOV, general purpose and transit trips.

^b For Alternative 5, all HOT (HOV) travel times are based on fixed pricing, not congestion pricing.

Figure 4-27. Level 3 Screening Summary of Findings: Freeway Segment I-17, 24th Street to McDowell Road

Alternative		Cost Opinion (2016 \$M)	Net New ROW (Acres)	Public Input Score	Replaces Old Infrastructure	Full Design Standards	VMT	% VMT Congested	VHT	% VHT Congested	VMT/VHT (mph)	General Purpose Travel Time (Minutes, 2-6pm Peak)	HOV Travel Time (Minutes, 2-6pm Peak)	Person-Trips ^a	Avg. General Purpose v/c	Avg. HOV v/c	Freeway Duration of Congestion (Hours)
Today	Northbound/Westbound	\$0.0	0.0	5.00	No	No	1,345,668	39.1%	46,077	38.5%	29.2	13.87	10.50	25,609	1.14	N/A	4.25
Today	Southbound/Eastbound	\$0.0	0.0	5.00	No	No						9.40	9.13	17,072	0.84	N/A	4.50
No-Build	Northbound/Westbound	\$0.0	0.0	5.00	No	No	1,585,619	53.4%	66,877	57.2%	23.7	17.89	13.99	26,549	1.09	N/A	6.75
No-Build	Southbound/Eastbound	\$0.0	0.0	5.00	No	No						10.40	10.40	19,005	0.74	N/A	6.00
1B	Northbound/Westbound	\$164.6	0.0	5.22	No	No	1,582,217	52.7%	66,715	56.6%	23.7	17.74	13.96	26,875	1.08	N/A	7.25
1B	Southbound/Eastbound	\$155.4	0.0	5.22	No	No						10.32	10.32	18,757	0.74	N/A	6.00
2	Northbound/Westbound	\$216.0	1.3	5.31	Yes	Yes	1,591,498	51.9%	66,181	55.6%	24.0	16.99	13.98	29,372	1.15	N/A	9.50
2	Southbound/Eastbound	\$208.7	0.3	5.50	Yes	Yes						9.53	9.53	20,400	0.78	N/A	6.75
3A	Northbound/Westbound	\$203.8	0.2	5.35	No	No	1,635,872	52.9%	66,565	55.9%	24.6	16.18	13.25	34,374	1.04	N/A	5.00
3A	Southbound/Eastbound	\$200.2	0.0	5.16	No	No						8.94	8.94	23,205	0.69	N/A	5.75
3B	Northbound/Westbound	\$240.5	2.0	5.65	Yes	Yes	1,620,082	50.6%	65,914	55.0%	24.6	17.34	8.00	36,356	0.97	0.74	6.00
3B	Southbound/Eastbound	\$271.9	0.8	5.46	Yes	Yes						10.01	6.27	24,104	0.68	0.39	5.50
3C	Northbound/Westbound	\$241.6	2.0	5.19	Yes	Yes	1,603,466	47.6%	63,651	52.5%	25.2	13.20	13.10	32,977	0.91	N/A	4.00
3C	Southbound/Eastbound	\$238.3	0.8	4.81	Yes	Yes						8.20	8.20	21,435	0.60	N/A	5.50
3D	Northbound/Westbound	\$248.3	2.0	4.66	Yes	Yes	1,679,854	47.2%	66,058	53.1%	25.4	12.70	11.90	33,405	0.95	1.03	1.00
3D	Southbound/Eastbound	\$279.7	0.8	4.85	Yes	Yes						7.90	7.30	22,122	0.60	0.73	2.50
4	Northbound/Westbound	\$173.6	0.0	5.80	No	No	1,582,783	52.8%	66,753	56.9%	23.7	17.70	13.83	26,901	0.98	N/A	7.25
4	Southbound/Eastbound	\$165.6	0.0	5.42	No	No						10.30	10.30	18,747	0.68	N/A	6.00
5 ^b	Northbound/Westbound	\$172.5	0.0	5.16	No	No	1,586,366	54.3%	67,896	58.8%	23.4	17.54	12.72	28,306	0.97	N/A	6.25
5 ^b	Southbound/Eastbound	\$164.4	0.0	5.35	No	No						9.91	9.91	20,275	0.66	N/A	6.00

^a Person-trips includes HOV, general purpose and transit trips.

^b For Alternative 5, all HOT (HOV) travel times are based on fixed pricing, not congestion pricing.

Figure 4-28. Level 3 Screening Summary of Findings: Freeway Segment I-17, McDowell Road to Dunlap Avenue

Alternative		Cost Opinion (2016 \$M)	Net New ROW (Acres)	Public Input Score	Replaces Old Infrastructure	Full Design Standards	VMT	% VMT Congested	VHT	% VHT Congested	VMT/VHT (mph)	General Purpose Travel Time (Minutes, 2-6pm Peak)	HOV Travel Time (Minutes, 2-6pm Peak)	Person-Trips ^a	Avg. General Purpose v/c	Avg. HOV v/c	Freeway Duration of Congestion (Hours)
Today	Northbound/Westbound	\$0.0	0.0	5.00	No	No	1,151,262	49.3%	38,737	51.2%	29.7	12.17	6.74	35,467	1.18	0.57	3.75
Today	Southbound/Eastbound	\$0.0	0.0	5.00	No	No						8.31	6.20	21,188	0.96	0.42	3.75
No-Build	Northbound/Westbound	\$0.0	0.0	5.00	No	No	1,320,490	65.3%	56,416	69.4%	23.4	15.44	7.78	38,525	1.46	0.75	5.50
No-Build	Southbound/Eastbound	\$0.0	0.0	5.00	No	No						10.16	7.01	28,615	1.09	0.54	3.25
1B	Northbound/Westbound	\$210.9	10.0	5.81	No	No	1,335,828	65.5%	57,241	69.5%	23.3	15.42	7.82	38,689	1.45	0.76	5.75
1B	Southbound/Eastbound	\$211.0	10.9	5.81	No	No						10.35	7.05	28,951	1.09	0.55	3.25
2	Northbound/Westbound	\$286.1	17.7	5.36	Yes	Yes	1,324,039	64.3%	56,015	67.9%	23.6	15.40	7.69	38,553	1.45	0.74	5.50
2	Southbound/Eastbound	\$286.8	18.7	5.36	Yes	Yes						10.27	7.01	28,739	1.09	0.54	3.25
3A	Northbound/Westbound	\$257.8	15.3	5.42	No	No	1,415,175	65.0%	57,016	68.1%	24.8	14.14	7.68	47,228	1.36	0.75	4.50
3A	Southbound/Eastbound	\$264.8	17.8	5.80	No	No						8.76	6.83	34,281	0.99	0.54	2.75
3B	Northbound/Westbound	\$288.6	24.9	5.01	Yes	Yes	1,356,692	59.2%	55,418	65.5%	24.5	15.21	6.36	45,038	1.23	0.61	4.00
3B	Southbound/Eastbound	\$288.2	26.5	5.01	Yes	Yes						10.10	5.66	35,102	0.98	0.37	1.00
3C	Northbound/Westbound	\$294.6	24.9	5.38	Yes	Yes	1,274,438	53.7%	53,979	62.8%	23.6	7.10	5.30	31,230	1.03	0.30	0.00
3C	Southbound/Eastbound	\$294.1	26.5	5.58	Yes	Yes						6.60	5.50	25,943	0.81	0.11	0.00
3D	Northbound/Westbound	\$296.5	24.9	5.62	Yes	Yes	1,479,879	60.2%	58,002	66.4%	25.5	12.20	10.70	44,982	1.30	0.96	2.25
3D	Southbound/Eastbound	\$296.0	26.5	5.43	Yes	Yes						7.70	6.60	31,803	0.89	0.65	1.50
4	Northbound/Westbound	\$216.9	10.0	6.00	No	No	1,319,995	64.4%	55,996	67.9%	23.6	15.41	7.10	37,531	1.32	0.69	5.50
4	Southbound/Eastbound	\$217.0	10.9	6.20	No	No						10.33	6.55	28,265	1.03	0.52	3.00
5 ^b	Northbound/Westbound	\$218.8	10.0	6.13	No	No	1,355,958	69.0%	59,078	72.1%	23.0	14.64	12.71	35,057	1.24	1.01	3.25
5 ^b	Southbound/Eastbound	\$218.6	10.9	5.94	No	No						9.71	8.11	30,100	0.95	0.75	4.00

^a Person-trips includes HOV, general purpose and transit trips.

^b For Alternative 5, all HOT (HOV) travel times are based on fixed pricing, not congestion pricing.

Figure 4-29. Level 3 Screening Summary of Findings: Freeway Segment I-17, Dunlap Avenue to SR-101L

Alternative		Cost Opinion (2016 \$M)	Net New ROW (Acres)	Public Input Score	Replaces Old Infrastructure	Full Design Standards	VMT	% VMT Congested	VHT	% VHT Congested	VMT/VHT (mph)	General Purpose Travel Time (Minutes, 2-6pm Peak)	HOV Travel Time (Minutes, 2-6pm Peak)	Person-Trips ^a	Avg. General Purpose v/c	Avg. HOV v/c	Freeway Duration of Congestion (Hours)
Today	Northbound/Westbound	\$0.0	0.0	5.00	No	No	1,003,857	31.5%	28,573	31.7%	35.1	11.81	7.69	35,783	1.02	0.47	2.25
Today	Southbound/Eastbound	\$0.0	0.0	5.00	No	No						7.02	5.46	27,394	0.87	0.36	2.50
No-Build	Northbound/Westbound	\$0.0	0.0	5.00	No	No	1,213,005	45.0%	40,251	49.0%	30.1	16.21	10.55	41,260	1.27	0.69	5.25
No-Build	Southbound/Eastbound	\$0.0	0.0	5.00	No	No						8.37	6.26	31,309	1.07	0.50	4.75
1B	Northbound/Westbound	\$238.6	3.7	5.81	No	No	1,218,234	44.9%	40,238	49.0%	30.3	16.32	10.56	41,191	1.28	0.70	5.25
1B	Southbound/Eastbound	\$237.4	4.9	5.81	No	No						8.35	6.24	31,254	1.07	0.50	4.75
2	Northbound/Westbound	\$301.0	3.6	5.25	Yes	Yes	1,217,909	44.5%	40,201	48.4%	30.3	16.37	10.62	41,402	1.28	0.70	5.25
2	Southbound/Eastbound	\$300.3	4.1	5.25	Yes	Yes						8.38	6.27	31,361	1.07	0.50	4.75
3A	Northbound/Westbound	\$264.8	6.0	5.61	No	No	1,287,080	44.3%	40,511	47.6%	31.8	14.02	10.32	49,320	1.22	0.69	4.50
3A	Southbound/Eastbound	\$263.7	7.6	5.61	No	No						7.24	6.19	36,236	0.99	0.49	4.00
3B	Northbound/Westbound	\$329.4	7.2	5.01	Yes	Yes	1,244,659	43.2%	40,263	47.6%	30.9	16.18	7.97	46,662	1.27	0.61	4.50
3B	Southbound/Eastbound	\$320.0	7.2	5.01	Yes	Yes						8.43	5.48	33,951	1.07	0.40	4.00
3C	Northbound/Westbound	\$332.4	7.2	5.38	Yes	Yes	1,167,327	39.4%	39,410	46.5%	29.6	8.60	6.30	32,468	1.08	0.42	0.00
3C	Southbound/Eastbound	\$323.0	7.2	5.38	Yes	Yes						6.20	5.20	23,844	0.91	0.27	0.00
3D	Northbound/Westbound	\$337.3	7.2	5.43	Yes	Yes	1,311,589	36.0%	40,537	40.4%	32.4	12.50	11.70	46,228	1.17	0.69	3.75
3D	Southbound/Eastbound	\$327.9	7.2	5.43	Yes	Yes						6.70	6.00	34,125	0.93	0.46	3.00
4	Northbound/Westbound	\$241.6	3.7	6.00	No	No	1,216,743	43.7%	40,118	47.8%	30.3	16.11	9.93	40,468	1.35	0.67	5.00
4	Southbound/Eastbound	\$240.3	4.9	6.00	No	No						8.15	6.03	30,791	1.12	0.47	4.75
5 ^b	Northbound/Westbound	\$246.5	3.7	5.94	No	No	1,216,893	47.5%	40,638	51.0%	29.9	15.60	15.23	38,953	1.25	0.78	4.00
5 ^b	Southbound/Eastbound	\$245.2	4.9	5.94	No	No						7.85	7.54	28,752	1.01	0.59	3.00

^a Person-trips includes HOV, general purpose and transit trips.

^b For Alternative 5, all HOT (HOV) travel times are based on fixed pricing, not congestion pricing.

Results of the analysis and backup documentation showed that the expanded HOV lane options and the HOT lane options both notably improved the Spine corridor over the other alternatives. Consensus was reached by the Management Partners to carry a draft recommendation forward for an enhanced managed lane solution. When comparing the HOV and HOT lane alternatives, the differences were negligible, so the group could not conclude which of the two was best. As a result, the recommendation carried into the Level 4 screening would be to build out the enhanced HOV lane system between US-60 and the North Stack, and to only build Alternative 1B (Base Build) between the Pecos Stack and US-60. If, in the future, a HOT lane system is pursued in the Valley, the enhanced HOV lane system is easily convertible to a HOT lane system and so the recommendation maintains flexibility for the future.

This recommendation was called the Highest Performing Alternative (HPA). While consensus was achieved on the strategy of managed lanes, there were several variations on details within the recommended alternative, HPA. The Management Partners decided at the October 24, 2016, meeting that two versions of the HPA should be carried forward into a more detailed Level 4 screening, and the alternative that came out of Level 4 would be the recommended alternative.

4.5 Level 4 Screening

The Level 4 screening evaluated two hybrid alternatives: HPA1 and HPA2. The hybrid alternatives consisted of the No-Build Alternative, the Base Build Alternative and the additional HOV lane alternative. Several additional service DHOV ramps were also included in the HPA options. Three significant differences between HPA1 and HPA2 were:

- Between US-60 and the Split, HPA1 would add one additional HOV lane and HPA2 would add one additional HOV lane and one additional general purpose lane.
- The HPA1 ramp configuration between the Split and the Durango Curve would be the existing ramp configuration, and the HPA2 ramp configuration between the Split and the Durango Curve would be a reverse ramp configuration.
- HPA1 would have a DHOV at I-17 and 7th Street. HPA2 would have a DHOV at I-10 and North Sky Harbor Circle.

All the differences between HPA1 and HPA2 are shown in Figure 4-30.

4.5.1 Highest Performing Alternative 1 Description

HPA1 consisted of the No-Build Alternative, Base Build Alternative and combining the two Level 3 alternatives to add HOV lanes and general purpose lanes. This alternative would convert the HOV system into a managed lane system and would add an additional managed lane from the I-10/US-60 system interchange to the North Stack. In addition to adding another managed lane to the system, HPA1 would add DHOVs at:

- I-10 and Galveston (half DHOV to the north)
- I-10 and SR-143 (half DHOV to the south)

- I-10 and I-17 Split
- I-17 and 7th Street (half DHOV to the east)
- I-17 and Grand Avenue (half DHOV to the north)
- I-17 and SR-101L

For a complete description of HPA1, see Figure 4-30.

4.5.2 Highest Performing Alternative 2 Description

HPA2 consisted of the No-Build Alternative, Base Build Alternative and combining two Level 3 alternatives to add HOV lanes and general purpose lanes. This alternative would convert the HOV system into a managed lane system and would add an additional managed lane in each direction from the I-10/US-60 system interchange to the North Stack. It also would add another general purpose lane in each direction from the I-10/US-60 system traffic interchange to the I-10/I-17 Split and would change the ramp configuration between the I-10/I-17 Split to the I-17 Durango Curve to reverse ramps. HPA2 would also supplement its managed lane system by adding DHOVs at:

- I-10 and Galveston (half DHOV to the north)
- I-10 and SR-143 (half DHOV to the south)
- I-10 and I-17 Split
- I-10 and North Sky Harbor Circle (half DHOV to the south)
- I-17 and 7th Street (half DHOV to the east)
- I-17 and Grand Avenue (half DHOV to the north)
- I-17 and SR-101L

For a complete description of HPA2, see Figure 4-30.

Figure 4-30. Alternatives and Project Assumptions for Fourth Level Screening

Category	Projects	Notes and Comments
Alternative 1A – No-Build		
RTP	2035 RTP	All regionally modal projects, including South Central, Phoenix West, Glendale Downtown light rail transit lines. Improvements identified in the RTP for I-10 and I-17 omitted, except for Near-Term Strategy: +1 general purpose lane, southbound I-10, I-17 Split and US-60; C-D lanes and ramp braids, SR-143 and US-60; +1 general purpose Lane, I-10, US-60 to Ray Road; Bicycle/pedestrian crossings at Alameda and Guadalupe
RTP	Phoenix CIP	Local projects not accounted for in RTP
RTP	Phoenix Transportation 2050	Project list to be determined
RTP	Tempe CIP	Local projects not accounted for in RTP
RTP	Chandler CIP	Local projects not accounted for in RTP
Maintenance	Routine Maintenance	Signing, striping, drainage, electrical, landscaping, etc.
TDM/TSM	ADOT TSMO Division Rollout	System operations and safety, incident response
TDM/TSM	Trip Reduction Program	Run by the Maricopa County Air Quality Department

Alternative 1B – Base Build (includes No-Build Alternative)

Technology	Freeway Technology Package	Need to identify credit to take in the travel demand modeling evaluation; projects/strategies identified for freeways, arterials, driver/traveler/jurisdictional information, and connected/autonomous vehicles
Technology	System Operations and Maintenance Staffing	
Access	I-10/Baseline Road	Traffic interchange #2 priority – Proposing a DDI, but looked at a flyover/ParClo concept as well
Access	I-10/SR-143/48th Street I-10/Broadway	Traffic interchange #4 priority – three concepts developed Replace southbound SR-143 loop ramp to eastbound I-10; braided ramps along SR-143 between I-10 and University; replace SR-143/48th Street and Broadway bridges over I-10; add a DHOV connector between SR-143 and I-10 to/from the south
Access	I-10/40th Street	Traffic interchange #30 priority – If mainline widening configurations below warrant, consider reconfiguring the traffic interchange to a standard diamond to eliminate the loop ramp to maximize the span under the bridge and/or to minimize new ROW. Needs further investigation based on selected alternative.
Access	I-17/7th Avenue	Traffic interchange #9 priority – Widened tight diamond with additional arterial through lanes and other operational upgrades
Access	I-17/19th Avenue	Traffic interchange #5 priority – Widened tight diamond with additional arterial through lanes and other operational upgrades
Access	I-17/Jefferson/Adams	Traffic interchange #24 priority – Convert to a more standard split diamond and incorporate bicycle/pedestrian elements
Access	I-17/Thomas Rd	Traffic interchange #7 priority – Extend third Thomas Road eastbound lane to 23rd Avenue and other operational upgrades
Access	I-17/Indian School Road	Traffic interchange #17 priority – Convert to three-level diamond traffic interchange to accommodate very large east-to-west regional flows

Figure 4-30. Alternatives and Project Assumptions for Fourth Level Screening

Category	Projects	Notes and Comments
Access	I-17/Camelback Road	Traffic interchange #8 priority – Convert to three-level diamond traffic interchange to accommodate very large east-to-west regional flows and light rail transit
Access	I-17/Northern Avenue	Traffic interchange #13 priority – Convert to three-level diamond traffic interchange to accommodate very large east-to-west regional flows
Access	I-17/Dunlap Road	Traffic interchange #3 priority – Upgrade current configuration with operational improvements, and extend third westbound lane (19th Avenue to 3rd Avenue)
Access	I-17/Peoria Avenue	Traffic interchange #1 priority – Widened tight diamond with additional arterial through lanes, bicycle/pedestrian accommodations and other operational upgrades. Upgrade drainage system.
Access	I-17/Cactus Road	Traffic interchange #10 priority – Upgrade current configuration with operational improvements, and extend third westbound lane. Upgrade drainage system.
Access	I-17/Thunderbird Road	Traffic interchange #6 priority – Convert to a three-level diamond traffic interchange to accommodate very large east-to-west regional flows, incorporate bicycle/pedestrian elements, widen Thunderbird to a seven-lane section between 20th Lane and 34th Avenue, and upgrade drainage system
Access	I-17/Greenway Road	Traffic interchange #14 priority – Upgrade current configuration with operational improvements, and extend third westbound lane to 19th Avenue. Upgrade drainage system.
Access	I-17/Bell Road	Traffic interchange #12 priority – Convert to three-level diamond traffic interchange to accommodate very large east-to-west regional flows. Expand park-and-ride lot in southwestern quadrant.
Transit	I-10/Galveston DHOV	Taken from the SE Corridor MIS recommendation; requested advancement by Chandler
Transit	I-17/Central Avenue Light Rail Transit Crossing	Presently in RTP; I-17 bridge replacement and reprofiling required
Transit	I-17/Van Buren Light Rail Transit Crossing	Presently in RTP; Van Buren bridge over I-17 to be replaced and raised to better accommodate the Split diamond and Jefferson/Adams
Transit	I-10/I-17 Stack Bus Ramps	Bus ramps from median of I-10 west of the Stack and then routed along the existing southbound frontage road on I-17 south to Van Buren Road. Southbound frontage road would be closed.
Transit	I-17/Camelback Light Rail Transit Crossing	Presently in RTP; included in the three-level diamond traffic interchange concept noted above
Transit	I-17/Mountain View Light Rail Transit Crossing	Presently in RTP; I-17 needs to reserve space for this future crossing over the Interstate
Transit	I-17/Bell Road Park-and-Ride Lot Expansion	Expand lot in conjunction with the Bell Road three-level diamond traffic interchange concept above
Bicycle/Pedestrian	Bicycle/Pedestrian Crossing – I-10/Chandler Boulevard	Proposed bicycle/pedestrian crossing to connect Ahwatukee to Chandler across I-10
Bicycle/Pedestrian	Traffic interchange Upgrades – I-10/Warner Road	From Tempe 2015 Transportation Master Plan
Bicycle/Pedestrian	Bicycle/Pedestrian Crossing – I-10/Highline Canal	Just south of Baseline; Spine recommendation to connect Phoenix, Tempe and Guadalupe and to discourage bikes from using the Baseline traffic interchange
Bicycle/Pedestrian	Bicycle/Pedestrian Crossing – I-10/Western Canal	North of Baseline at Arizona Mills Mall; from Tempe 2015 Transportation Master Plan and Phoenix Bike Plan Priority #33 - Connects Tempe and Phoenix bicycle routes

Figure 4-30. Alternatives and Project Assumptions for Fourth Level Screening

Category	Projects	Notes and Comments
Bicycle/ Pedestrian	Traffic interchange upgrades – I-10/32nd Street	From Phoenix Bike Plan, noted as an identified barrier
Bicycle/ Pedestrian	Traffic interchange upgrades - I-10/24th Street	From Phoenix Bike Plan, Priority #2
Bicycle/ Pedestrian	Traffic interchange upgrades - I-17/Jefferson/Adams	From Phoenix Bike Plan, Priority #8
Bicycle/ Pedestrian	Bicycle/Pedestrian Crossing – I-17/Osborn Road/Grand Canal	Just south of Indian School - Phoenix Bike Plan, Priority #5/15
Bicycle/ Pedestrian	Bicycle/Pedestrian Crossing – I-17/Missouri Ave	Mid-mile between Camelback and Bethany Home (supports Grand Canyon University) – from Phoenix Bike Plan, Priority #17
Bicycle/ Pedestrian	Bicycle/Pedestrian Crossing – I-17/Maryland Ave	Existing bicycle/pedestrian crossing at mid-mile between Bethany Home and Glendale. To remain, or to be replaced if affected by freeway widening.
Bicycle/ Pedestrian	Bicycle/Pedestrian Crossing – I-17/Arizona Canal	Existing bicycle/pedestrian crossing just north of Dunlap. To remain, or to be replaced if affected by freeway widening.
Bicycle/ Pedestrian	Traffic interchange upgrades - I-17/Northern	Bicycle/pedestrian crash hot spot, solution integrated into traffic interchange reconstruction
Bicycle/ Pedestrian	Traffic interchange upgrades - I-17/Peoria	Bicycle/pedestrian crash hot spot, solution integrated into traffic interchange modernization
Bicycle/ Pedestrian	Traffic interchange upgrades - I-17/Thunderbird	From Phoenix Bike Plan, noted as an identified barrier; bicycle/pedestrian crash hot spot, solution integrated into traffic interchange reconstruction
Bicycle/ Pedestrian	Traffic interchange upgrades - I-17/Greenway	From Phoenix Bike Plan, noted as an identified barrier
Bicycle/ Pedestrian	Bicycle/Pedestrian Crossing – I-17/Paradise Lane-Grandview	From Phoenix Bike Plan, noted as an identified barrier; mid-mile between Greenway and Bell
Bicycle/ Pedestrian	Traffic interchange upgrades - I-17/Bell Road	From Phoenix Bike Plan, noted as an identified barrier
Bicycle/ Pedestrian	Traffic interchange upgrades - I-17/Union Hills Drive	From Phoenix Bike Plan, Priority #21
Weave	Dual Lane Exit Ramp Conversions	Convert exit ramps with exit only from auxiliary lanes to a two-lane exit (option + drop lane) throughout corridor where feasible.
Weave	I-10; Elliot to Baseline	Extend the US-60 C-D road system south from Baseline Road to Elliot Road to improve the safety of this weave, to provide a barrier-separated roadway for system redundancy where no good arterial redundancy exists today, and to aid in ramp storage length for both of the south side Baseline Road ramps.

Highest Performing Alternative (HPA) 1 – Managed Lane Addition (includes No-Build and Base Build Alternatives)

Special Lanes	I-10, Pecos Stack to US-60	Limit improvements to Alternative 1B (Base Build) only.
Special Lanes	US-60 to Split	Add a second HOV lane (2+ occupancy) each direction, using DHOVs at either end to terminate second HOV lane.
Special Lanes	I-10/I-17 Split Interchange	Add a two-way DHOV connector between I-17 and I-10 to the east.

Figure 4-30. Alternatives and Project Assumptions for Fourth Level Screening

Category	Projects	Notes and Comments
Special Lanes	I-17, Split to Grand Avenue	Alternative 2 + Add an HOV lane (2+ occupancy) on I-17 each direction, but using width design exceptions as appropriate to minimize ROW and Stack interchange impacts from the Durango Curve to Grand Avenue.
Special Lanes	I-10, Sky Harbor Circle North	Add a two-way DHOV connector in the median of I-10 to/from Sky Harbor Circle North to/from the south.
Special Lanes	I-17, Stack	Add a bus ramp to the I-10 median at the Stack interchange from Van Buren via the existing frontage road. The bus ramp will ultimately be used for the light rail transit route planned down the median of I-10.
Special Lanes	I-17, Grand Avenue to Peoria	Alternative 2 + Add a second HOV lane (2+ occupancy) each direction, but using width design exceptions as appropriate to minimize ROW impacts.
Special Lanes	I-17, Grand Avenue	Add a two-way DHOV connector in the median of I-17 to/from Grand Avenue/Thomas Road to/from the north. This is the south terminus of the second HOV lane going north on I-17.
Special Lanes	I-17, Peoria to North Stack	Alternative 2 + Add a second HOV lane (2+ occupancy) each direction.
Special Lanes	I-17, North Stack	Add a two-way DHOV connector between I-17 on the south leg and SR-101L on the west leg. This would be the northern terminus of the second HOV lane on I-17 to the south.

Highest Performing Alternative (HPA) 2 – Same as HPA1, but with the following modifications

Special Lanes	I-10, Pecos Stack to US-60	Same as HPA1
Special Lanes	US-60 to Split	In addition to HPA1, add one additional general purpose lane each direction, creating a 6+2+Auxiliary section.
Special Lanes	I-10/I-17 Split Interchange	Same as HPA1
Special Lanes	I-17, Split to Grand Avenue	Same as HPA1, except that a reverse ramp configuration will be considered between 16th and 7th Streets, and between 7th and 19th Avenues.
Special Lanes	I-17, 7th Street	Add a two-way DHOV connector in the median of I-17 to/from 7th Street to/from the east.
Special Lanes	I-10, Sky Harbor Circle North	No DHOV connector at Sky Harbor Circle North is included in HPA2.
Special Lanes	I-17, Stack	Add a bus ramp to the I-10 median at the Stack interchange from Van Buren via the existing frontage road. The bus ramp will ultimately be used for the light rail transit route planned down the median of I-10.
Special Lanes	I-17, Grand Avenue to Peoria	Same as HPA1
Special Lanes	I-17, Grand Avenue	Same as HPA1
Special Lanes	I-17, Peoria to North Stack	Same as HPA1
Special Lanes	I-17, North Stack	Same as HPA1

4.5.3 Level 4 Screening Criteria

The Level 4 screening consisted of the same criteria as Level 3: infrastructure, safety, operations and cost. See Figures 4-31 to 4-35 for a summary of the Level 4 HPA results for infrastructure, operations and cost, and see Figure 4-36 for a summary of the Level 4 safety analysis.

Environmental impacts were also analyzed in the Level 4 screening. The environmental analysis of the HPA alternative identified any impacts to the priority resources identified in the NAR as well as impacts to both commercial and residential properties. These impacts were quantified by overlaying the new ROW shapes for HPA1 and HPA2 on the priority resource layers as well as the commercial and residential property layers in GIS and calculating the area/number of impacts. Figure 4-37 summarizes the environmental impacts for HPA1 and HPA2.

4.5.4 Level 4 Screening Results

The results of the Level 4 screening were presented at the December 2, 2016, AEP meeting, and general consensus was reached to move forward with preliminarily recommending a variation of HPA2. The additional general purpose lane between US-60 and the I-10/I-17 Split and the reversed ramp configuration between the I-10/I-17 Split and the Durango Curve provided additional benefit and value, such that the AEP decided it was worth the additional cost. Traffic models showed that the DHOV at North Sky Harbor Circle did not attract the anticipated demand, so it was removed from the recommended alternative and was replaced with the DHOV at 7th Street on I-17. The final alternative that emerged from the Level 4 screening is referred to as the preliminary recommended alternative.

4.5.5 Conclusions

Once the Level 4 screening was completed and a preliminary recommended alternative was identified, the Level 4 screening results and the subsequent documentation from Level 1 through Level 4 were taken to the public to review. Four public meetings were held throughout the Spine corridor over a period of 8 days. Chapter 5 documents the public outreach and public meetings held to inform the public of the Spine recommendation and of the alternatives screening process. Chapter 6 documents the final Spine recommended alternative.

Figure 4-31. Level 4 Screening Summary of Findings: Freeway Segment I-10, SR-202L to Southern Avenue

Alternative		Cost Opinion (2016 \$M)	Net New ROW (Acres)	Public Input Score	Replaces Old Infrastructure	Full Design Standards	VMT	% VMT Congested	VHT	% VHT Congested	VMT/VHT (mph)	General Purpose Travel Time (Minutes, 2-6pm Peak)	HOV Travel Time (Minutes, 2-6pm Peak)	Person-Trips ^a	Avg. General Purpose v/c	Avg. HOV v/c	Freeway Duration of Congestion (Hours)
Today	Northbound/Westbound	\$0.0	0.0	5.00	N/A	Yes	911,139	40.7%	26,216	45.6%	34.8	5.74	4.09	29,782	0.71	0.35	3.3
Today	Southbound/Eastbound	\$0.0	0.0	5.00	N/A	Yes						10.13	5.49	38,896	1.02	0.51	2.5
No-Build	Northbound/Westbound	\$0.0	0.0	5.86	N/A	Yes	1,103,239	38.6%	32,110	45.3%	34.4	5.25	4.28	32,195	0.76	0.40	0.5
No-Build	Southbound/Eastbound	\$0.0	0.0	5.86	N/A	Yes						7.71	5.87	43,078	1.11	0.53	0.0
HPA1	Northbound/Westbound	\$188.3	2.2	6.00	N/A	Yes	1,125,373	34.0%	32,155	42.1%	35.0	4.79	4.41	29,365	0.83	0.47	0.0
HPA1	Southbound/Eastbound	\$198.1	5.4	6.00	N/A	Yes						7.24	6.10	39,191	1.12	0.58	0.0
HPA2	Northbound/Westbound	\$188.3	2.2	6.00	N/A	Yes	1,132,320	34.0%	32,437	42.2%	34.9	4.84	4.41	29,753	0.84	0.46	0.0
HPA2	Southbound/Eastbound	\$198.1	5.4	6.00	N/A	Yes						7.32	6.15	39,562	1.12	0.59	0.0

^a Person-trips includes HOV, general purpose and transit trips.

Figure 4-32. Level 4 Screening Summary of Findings: Freeway Segment I-10, Southern Avenue to 24th Street

Alternative		Cost Opinion (2016 \$M)	Net New ROW (Acres)	Public Input Score	Replaces Old Infrastructure	Full Design Standards	VMT	% VMT Congested	VHT	% VHT Congested	VMT/VHT (mph)	General Purpose Travel Time (Minutes, 2-6pm Peak)	HOV Travel Time (Minutes, 2-6pm Peak)	Person-Trips ^a	Avg. General Purpose v/c	Avg. HOV v/c	Freeway Duration of Congestion (Hours)
Today	Northbound/Westbound	\$0.0	0.0	5.00	No	No	1,323,101	42.1%	40,440	43.8%	32.7	8.24	6.57	51,547	0.94	0.57	4.3
Today	Southbound/Eastbound	\$0.0	0.0	5.00	No	Yes						10.27	7.86	48,585	1.10	0.67	4.3
No-Build	Northbound/Westbound	\$0.0	0.0	5.00	No	No	1,476,599	55.5%	54,810	58.1%	26.9	8.83	6.79	58,490	0.95	0.56	9.0
No-Build	Southbound/Eastbound	\$0.0	0.0	5.61	No	No						9.02	7.46	51,086	1.01	0.64	11.3
HPA1	Northbound/Westbound	\$219.9	8.4	6.14	Yes	Yes	1,514,956	53.5%	55,056	57.6%	27.5	6.40	3.63	62,794	0.95	0.51	6.8
HPA1	Southbound/Eastbound	\$219.0	0.0	6.56	Yes	Yes						6.16	4.02	53,245	1.02	0.48	1.8
HPA2	Northbound/Westbound	\$222.8	8.5	6.32	Yes	Yes	1,531,734	49.0%	54,615	54.8%	28.0	5.60	3.62	64,703	0.93	0.51	3.5
HPA2	Southbound/Eastbound	\$219.1	0.0	6.74	Yes	Yes						5.69	4.01	55,365	0.94	0.47	0.5

^a Person-trips includes HOV, general purpose and transit trips.

Figure 4-33. Level 4 Screening Summary of Findings: Freeway Segment I-17, 24th Street to McDowell Road

Alternative		Cost Opinion (2016 \$M)	Net New ROW (Acres)	Public Input Score	Replaces Old Infrastructure	Full Design Standards	VMT	% VMT Congested	VHT	% VHT Congested	VMT/VHT (mph)	General Purpose Travel Time (Minutes, 2-6pm Peak)	HOV Travel Time (Minutes, 2-6pm Peak)	Person-Trips ^a	Avg. General Purpose v/c	Avg. HOV v/c	Freeway Duration of Congestion (Hours)
Today	Northbound/Westbound	\$0.0	0.0	5.00	No	No	1,345,668	39.1%	46,077	38.5%	29.2	13.87	10.50	25,609	1.14	N/A	4.3
Today	Southbound/Eastbound	\$0.0	0.0	5.00	No	No						9.40	9.13	17,072	0.84	N/A	4.5
No-Build	Northbound/Westbound	\$0.0	0.0	5.00	No	No	1,585,619	53.4%	66,877	57.2%	23.7	17.89	13.99	26,549	1.09	N/A	6.8
No-Build	Southbound/Eastbound	\$0.0	0.0	5.00	No	No						10.40	10.40	19,005	0.74	N/A	6.0
HPA1	Northbound/Westbound	\$264.0	10.4	5.65	Yes	Yes	1,615,075	51.0%	66,054	55.3%	24.5	17.26	7.87	29,039	1.07	0.71	6.0
HPA1	Southbound/Eastbound	\$294.3	5.7	5.46	Yes	Yes						8.80	5.73	21,082	0.74	0.39	5.5
HPA2	Northbound/Westbound	\$276.5	6.2	5.77	Yes	Yes	1,614,787	50.4%	66,174	54.8%	24.4	17.12	7.69	30,540	1.11	0.68	0.0
HPA2	Southbound/Eastbound	\$307.7	11.2	5.58	Yes	Yes						8.70	5.70	22,273	0.77	0.36	5.8

^a Person-trips includes HOV, general purpose and transit trips.

Figure 4-34. Level 4 Screening Summary of Findings: Freeway Segment I-17, McDowell Road to Dunlap Avenue

Alternative		Cost Opinion (2016 \$M)	Net New ROW (Acres)	Public Input Score	Replaces Old Infrastructure	Full Design Standards	VMT	% VMT Congested	VHT	% VHT Congested	VMT/VHT (mph)	General Purpose Travel Time (Minutes, 2-6pm Peak)	HOV Travel Time (Minutes, 2-6pm Peak)	Person-Trips ^a	Avg. General Purpose v/c	Avg. HOV v/c	Freeway Duration of Congestion (Hours)
Today	Northbound	\$0.0	0.0	5.00	No	No	1,151,262	49.3%	38,737	51.2%	29.7	12.17	6.74	35,467	1.18	0.57	3.8
Today	Southbound	\$0.0	0.0	5.00	No	No						8.31	6.20	21,188	0.96	0.42	3.8
No-Build	Northbound	\$0.0	0.0	5.00	No	No	1,320,490	65.3%	56,416	69.4%	23.4	15.44	7.78	38,525	1.46	0.75	5.5
No-Build	Southbound	\$0.0	0.0	5.00	No	No						10.16	7.01	28,615	1.09	0.54	3.3
HPA1	Northbound/Westbound	\$313.8	26.3	5.38	Yes	Yes	1,368,074	60.0%	56,601	66.6%	24.2	15.24	6.75	45,175	1.43	0.59	4.0
HPA1	Southbound/Eastbound	\$318.3	30.8	5.38	Yes	Yes						10.10	6.00	26,496	1.09	0.38	1.0
HPA2	Northbound/Westbound	\$313.8	26.3	5.38	Yes	Yes	1,367,523	60.0%	56,535	66.5%	24.2	15.24	6.73	45,098	1.43	0.59	4.0
HPA2	Southbound/Eastbound	\$318.3	30.8	5.38	Yes	Yes						10.13	6.00	26,540	1.09	0.37	1.0

^a Person-trips includes HOV, general purpose and transit trips.

Figure 4-35. Level 4 Screening Summary of Findings: Freeway Segment I-17, Dunlap Avenue to SR-101L

Alternative		Cost Opinion (2016 \$M)	Net New ROW (Acres)	Public Input Score	Replaces Old Infrastructure	Full Design Standards	VMT	% VMT Congested	VHT	% VHT Congested	VMT/VHT (mph)	General Purpose Travel Time (Minutes, 2-6pm Peak)	HOV Travel Time (Minutes, 2-6pm Peak)	Person-Trips ^a	Avg. General Purpose v/c	Avg. HOV v/c	Freeway Duration of Congestion (Hours)
Today	Northbound	\$0.0	0.0	5.00	No	No	1,003,857	31.5%	28,573	31.7%	35.1	11.81	7.69	35,783	1.02	0.47	2.3
Today	Southbound	\$0.0	0.0	5.00	No	No						7.02	5.46	27,394	0.87	0.36	2.5
No-Build	Northbound	\$0.0	0.0	5.00	No	No	1,213,005	45.0%	40,251	49.0%	30.1	16.21	10.55	41,260	1.27	0.69	5.3
No-Build	Southbound	\$0.0	0.0	5.00	No	No						8.37	6.26	31,309	1.07	0.50	4.8
HPA1	Northbound/Westbound	\$346.5	14.3	5.38	Yes	Yes	1,244,817	43.7%	40,278	48.5%	30.9	16.16	7.99	46,178	1.22	0.61	4.5
HPA1	Southbound/Eastbound	\$301.5	6.4	5.38	Yes	Yes						8.41	5.48	34,024	1.07	0.40	4.0
HPA2	Northbound/Westbound	\$346.5	14.3	5.38	Yes	Yes	1,245,486	43.7%	40,320	48.5%	30.9	16.18	7.99	46,208	1.22	0.61	4.5
HPA2	Southbound/Eastbound	\$301.5	6.4	5.38	Yes	Yes						8.43	5.48	34,055	1.07	0.40	4.0

^a Person-trips includes HOV, general purpose and transit trips.

Figure 4-36. Level 4 Safety Analysis

Improvement	CMF ^a	Crash Reduction %	Study Alternatives											
			HPA1					HPA2						
			1	2	3	4	5	1	2	3	4	0		
Segments														
Widen lane	1	0%		X	X	X	X		X	X	X	X	X	
Widen shoulder (≥4 feet)	0.64	36%		X	X	X	X		X	X	X	X	X	
Rehabilitate shoulder	0.72	28%		X	X	X	X		X	X	X	X	X	
Rehabilitate pavement	0.7	30%		X	X	X	X		X	X	X	X	X	
Rehabilitate bridge	0.95	5%		X	X	X	X		X	X	X	X	X	
Construct auxiliary lanes	0.78	22%			X					X				
Construct HOV lane	0.95	5%		X	X	X	X		X	X	X	X	X	
Construct new general purpose lane	0.9	10%	X					X	X					
Add freeway C-D roads	0.9	10%	X	X				X	X					
Widen and modify entry/exit ramps	0.21	79%	X	X	X	X	X	X	X	X	X	X	X	
Convert continuous access HOV to limited access	1.54	-54%	N	N	N	N	N	N	N	N	N	N	N	
Convert HOV lanes to HOT lanes	0.95	5%												
Increase lane width from 11 to 12 feet	0.95	5%			X	X				X	X			
DHOV (eliminates weave and reduces conflict points)		+	X	X	X	X	X	X	X	X	X	X	X	
ITS for ATM	0.8	20%	X	X	X	X	X	X	X	X	X	X	X	
ITS for incident management	0.85	15%	X	X	X	X	X	X	X	X	X	X	X	
Install pedestrian bridge ^b	0.1	90%	X	X		X	X	X	X		X	X	X	

Sources: CMFs developed for ADOT Corridor Profile Studies, HSM, CMF Clearinghouse, and other state and national resources

^a Crash Modification Factor – multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure

^b Pedestrian-only crash benefit

Segment Definition

- I-10, Pecos Stack to Southern Avenue
- I-10, Southern Avenue to Split
- I-17, Split to Grand Avenue
- I-17, Grand Avenue to Dunlap Avenue
- I-17, Dunlap Avenue to North Stack

Figure 4-37. Environmental Impacts Summary

Limits	Name	Hazardous Waste Site (Resource Conservation and Recovery Act)		Leaking Underground Storage Tanks		Priority One Underground Storage Tanks		Underground Storage Tanks		Section 4(f) Schools		Section 4(f) Parks (Green Valley Park, Acres)		Section 4(f) Historic Properties (Acres)		Section 6(f) Properties (Acres)	
		HPA1	HPA2	HPA1	HPA2	HPA1	HPA2	HPA1	HPA2	HPA1	HPA2	HPA1	HPA2	HPA1	HPA2	HPA1	HPA2
Segment 1	Pecos Stack to Southern Avenue																
Segment 2	Southern Avenue to 24th Street																
Segment 3	24th Street to I-10/I-17 Stack	1	1		1		1		1				0.04	0.03	0.53		
Segment 4.1	I-10/I-17 Stack to Indian School	2	2	4	4			6	6					0.38	0.39		
Segment 4.2	Indian School to Dunlap Avenue	1	1	3	3	1	1	3	3					0.18	0.18		
Segment 5	Dunlap Avenue to North Stack	1	1														
Total		5	5	7	8	1	2	9	10	0	0	0.00	0.04	0.59	1.10	0.00	0.00

Limits	Name	Water Resource		Minority Population 50-100% (Acres)		Below Poverty Population 40-100% (Acres)		Commercial – Office (Acres)		Commercial – Retail (Acres)		Residential (Acres)		Commercial – Office (Number of Parcels)		Commercial – Retail (Number of Parcels)		Residential (Number of Parcels)	
		HPA1	HPA2	HPA1	HPA2	HPA1	HPA2	HPA1	HPA2	HPA1	HPA2	HPA1	HPA2	HPA1	HPA2	HPA1	HPA2	HPA1	HPA2
Segment 1	Pecos Stack to Southern Avenue			0.45	0.45			0.53	0.53	2.80	2.80			3	3	10	10		
Segment 2	Southern Avenue to 24th Street			0.08	0.10	5.64	5.78	0.24	0.24	0.28	0.28			4	5	3	3		
Segment 3	24th Street to I-10/I-17 Stack			3.21	4.50	6.46	12.87	0.05	0.01	2.12	2.20	0.39	0.57	2	1	22	29	15	26
Segment 4.1	I-10/I-17 Stack to Indian School			10.40	10.76	11.59	11.95	1.51	1.51	2.14	2.15	5.86	5.80	8	8	19	23	41	41
Segment 4.2	Indian School to Dunlap Avenue			30.98	30.98	20.06	20.06	3.60	3.60	10.40	10.40	17.17	17.17	35	35	104	104	146	146
Segment 5	Dunlap Avenue to North Stack			0.77	0.77			1.34	1.34	2.89	2.89	3.72	3.72	15	15	38	38	90	90
Total		0.00	0.00	45.90	47.56	43.75	50.65	7.26	7.23	20.62	20.72	27.14	27.26	67	67	196	207	292	303

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5 Agency and Public Involvement

The Spine study’s public involvement program was designed to obtain diverse engagement and thorough investigation of issues to best inform study outcomes. This chapter describes the methods, strategies and outcomes of the second round of engagement, which focused on soliciting feedback on draft recommendations. The first round of engagement occurred in support of the Spine NAR in February and March 2015 and is documented in Chapter 10 of that document.

5.1 Overview of Agency and Public Involvement Goals, Process and Strategies

From January 4 to February 17, 2017, the study team held stakeholder and public information meetings, attended various community events to educate and engage members of the community, and solicited comments through a variety of techniques. The following sections describe the information and materials provided during this outreach process and summarize comments received during the comment period, which ended on February 17, 2017.

5.2 Agency and Public Involvement and Outreach Components

5.2.1 Study Website

The study team used the study webpage on MAG’s website to share information with the public. The webpage, at spine.azmag.gov, contained information related to the study purpose and history and a section dedicated to public outreach. The public outreach section included links to collateral materials, comment submission information, online comment form, interactive map viewer and public meeting locations and times.

5.2.2 Agency Scoping Letters

Agency scoping letters were sent to 218 agency representatives on January 4, 2017. The letters included a description of the purpose and need for the study, an invitation to the four public meetings and a request for comments by February 17, 2017. A copy of the scoping letter and a list of recipients are provided in Appendix C.

5.2.3 Media Relations

A press release (Appendix C) announcing the public meetings, online comment form and map viewer was distributed on January 11, 2017, to the MAG media contact list. Prior to the first public meeting on January 24, numerous media interviews were conducted with Spine study project manager Bob Hazlett and MAG transportation director Eric Anderson. Table 5-1 summarizes the media interviews.

Local news coverage included KJZZ, KTAR, KTVK Channel 3 (independent television station), CBS affiliate KPHO Channel 5, FOX affiliate KSAZ Channel 10 and the local news division of Arizona PBS, Cronkite News.

Table 5-1. Media Interviews

Date	Media	Channel/Station
January 11, 2017	KJZZ, Morning Edition, The Show	Radio – 91.5 FM
January 13, 2017	KTVK, independent television station	Television – Channel 3
January 13, 2017	KPHO	Television – Channel 5, CBS
January 23, 2017	KJZZ	Radio – 91.5 FM
January 24, 2017	KJZZ	Radio – 91.5 FM
January 24, 2017	KAET	Television – Arizona PBS Cronkite News
January 24, 2017	KTAZ	Television – Telemundo (Spanish)

5.2.4 E-Blasts and E-Newsletters

On January 9 and 17, 2017, MAG sent an invitation to the meetings (Appendix C) to the study’s stakeholder database. Additionally, ADOT forwarded the invitation to the agency’s database of more than 21,968 Maricopa County subscribers. The MAG newsletter, “MAGazine,” featured the study in the February 2017–April 2017 issue (Vol. 22: No. 1), which was printed for in-person distribution and posted on the MAG website. Partner agencies also assisted in sharing information about the meetings and public comment period with their various stakeholders. Table 5-2 provides an overview of outreach as reported by partner agencies.

Table 5-2. Partner Agency Outreach

Date	Type of Outreach	Agency	Reach
January 4, 2017	Twitter post	City of Phoenix	4,000 followers
January 11, 2017	Facebook post	Sustainable Communities Collaborative	775 followers
January 14, 2017	Facebook post	LISC Phoenix	220 followers
January 17, 2017	E-blast ListServ	ADOT	21,968 Maricopa County subscribers
January 17, 2017	E-blast ListServ	City of Tempe	Three listservs, totaling 1,702
January 17, 2017	E-blast (Streets) ListServ	City of Chandler	605 Chandler households
January 17, 2017	E-News Update blast	City of Chandler	903 Chandler households
January 17, 2017	Nextdoor Posting	City of Chandler	23,772 Chandler households
January 20, 2017	R/T via @PHXstreettrans	City of Phoenix	4,000 followers
January 23, 2017	Email blast – WPCG list	Valley Metro	717 email addresses
January 23, 2017	Nextdoor Posting	City of Phoenix	Citywide; did not specify
January 23, 2017	Email blast – NWII list	Valley Metro	312 email addresses
January 23, 2017	R/T via @PHXstreettrans	City of Phoenix	4,000 followers
January 23, 2017	R/T via @CityofPhoenixAZ	City of Phoenix	16,000 followers
January 23, 2017	Social media	Valley Metro	211
February 15, 2017	Social media	Valley Metro	58
February 15, 2017	Social media	Valley Metro	209
February 15, 2017	Social media	Valley Metro	286

5.2.5 Social Media

MAG used the agency’s Facebook and Twitter social media accounts to share public meeting information, online feedback form and interactive map viewer details throughout the comment period. The accounts have 600 page likes and 2,461 followers, respectively. Table 5-3 presents social media post messaging and feedback.

Table 5-3. Social Media Posts

Date	Website	Number of Shares/Retweets	Message
January 17, 2017	Facebook/ Twitter	2/1	What is the Spine Study? To learn more, complete a survey or attend a meeting visit, http://bit.ly/MAGSpine .
January 17, 2017	Facebook/ Twitter	2/1	Spine Study public meetings Jan 24, 25, & 31st. Find a meeting location near you & join us to learn more, http://bit.ly/MAGSpine .
January 17, 2017	Twitter	0/4	I-10 and I-17 Spine Corridor Master Plan Public Comment Period Begins https://lnks.gd/2/36r5Dz , more info at http://bit.ly/MAGSpine .
January 18, 2017	Twitter	0/1	We need your input! To learn more & complete a survey visit, http://bit.ly/MAGSpine .
January 18, 2017	Facebook/ Twitter	1/0	Spine Study public meetings Jan 24th, 25th, & 31st. To learn more, find a meeting location near you & join us, http://bit.ly/MAGSpine .
January 18, 2017	Facebook/ Twitter	0/4	Spine Study recommendations are out for public input. Take our survey to tell us what you think, http://bit.ly/MAGSpine !
January 19, 2017	Facebook/ Twitter	1/0	40% of daily freeway traffic uses the I-10/I-17 "Spine" Corridor! Attend a public meeting to learn more, http://bit.ly/MAGSpine .
January 19, 2017	Facebook/ Twitter	0/0	Spine Study public meetings Jan 24th, 25th, & 31st. To learn more, find a meeting location near you & join us, http://bit.ly/MAGSpine .
January 20, 2017	Facebook/ Twitter	0/0	349 Ideas ? Evaluation ? Strategies ? Evaluation = Recommendations. Get more info & complete a survey at http://bit.ly/MAGSpine .
January 20, 2017	Facebook/ Twitter	0/4	Spine Study public meetings Jan 24th, 25th, & 31st. To learn more, find a meeting location near you & join us, http://bit.ly/MAGSpine .
January 21, 2017	Twitter	0/2	Take the Spine Study survey to help us improve your commute along the I-10/I-17 corridor, http://bit.ly/MAGSpine !
January 23, 2017	Facebook	0/0	DYK: 2x more traffic crosses OVER the I-17 than uses it! Help us improve your commute by completing a comment form, http://bit.ly/MAGSpine .

Table 5-3. Social Media Posts

Date	Website	Number of Shares/Retweets	Message
January 23, 2017	Facebook	1/0	Spine Study public meeting TOM. in PHX! Pick one of two mtgs. to attend, 11:30 am to 1pm or 6 to 7:30 pm at MAG, http://bit.ly/MAGSpine .
January 24, 2017	Twitter	0/0	DYK: 2x more traffic crosses OVER the I-17 than uses it! Help us improve your commute by completing a comment form, http://bit.ly/MAGSpine .
January 24, 2017	Twitter	0/2	Spine Study public meeting TOM. in the Town of Guadalupe! Join us at 6pm at the Mercado to learn more, http://bit.ly/MAGSpine .
January 24, 2017	Facebook/ Twitter	0/3	Spine Study public meetings TODAY at MAG! Join us at 11:30am or 6pm to learn more & give feedback, http://bit.ly/MAGSpine .
January 24, 2017	Facebook/ Twitter	0/1	Spine Study recommendations are out for public input. Attend a mtg. or take our survey to tell us what you think, http://bit.ly/MAGSpine !
January 25, 2017	Facebook/ Twitter	0/1	Spine Study public meeting TODAY in the Town of Guadalupe! Join us at 6pm at the Mercado to learn more, http://bit.ly/MAGSpine .
January 26, 2017	Facebook	0/0	Haven't attended a Spine Study public meeting? Don't worry, the last meeting is scheduled for Jan 31st in PHX, http://bit.ly/MAGSpine .
January 27, 2017	Twitter	0/0	Haven't attended a Spine Study public meeting? Don't worry, the last meeting is scheduled for Jan 31st in PHX, http://bit.ly/MAGSpine .
January 30, 2017	Facebook/ Twitter	2/1	Spine Study public meeting TOMORROW in PHX! Join us at 6pm at the Washington Activity Center to learn more, http://bit.ly/MAGSpine .
January 31, 2017	Facebook	1/1	Spine Study public meeting TODAY in #PHX! Join us at 6pm at the Washington Activity Center to learn more, http://bit.ly/MAGSpine .
January 31, 2017	Facebook/ Twitter	1/0	DYK: 2x more traffic crosses OVER the I-17 than uses it! The Spine Study is looking to address this reality. Visit us online to learn more and tell us what you think about the recommendations, http://bit.ly/MAGSpine .
February 1, 2017	Facebook/ Twitter	0/3	Spine Study recommendations are out for public input. Tell us what you think, visit http://bit.ly/MAGSpine & take the survey!

Table 5-3. Social Media Posts

Date	Website	Number of Shares/Retweets	Message
February 2, 2017	Facebook/ Twitter	1/0	349 Ideas ? Evaluation ? Strategies ? Evaluation = Recommendations. Get more info & complete a survey at http://bit.ly/MAGSpine .
February 3, 2017	Facebook	5/1	Didn't attended a Spine Study public meeting? Don't worry, you can learn more & complete a comment form online at http://bit.ly/MAGSpine .
February 6, 2017	Facebook/ Twitter	7/0	40% of daily freeway traffic uses the I-10/I-17 "Spine" Corridor! To learn more & complete a survey visit, http://bit.ly/MAGSpine .
February 7, 2017	Facebook/ Twitter	0/0	Didn't attended a Spine Study public meeting? Don't worry, you can learn more & complete a comment form online at http://bit.ly/MAGSpine .
February 7, 2017	Twitter	0/0	IT'S NOT TOO LATE: I-10/I-17 Spine Corridor Master Plan Public Comment Period Ends February 17, 2017, more info at http://bit.ly/MAGSpine .
February 8, 2017	Facebook/ Twitter	3/0	Spine Study recommendations are out for public input. Learn more & tell us what you think by visiting http://bit.ly/MAGSpine !
February 10, 2017	Facebook/ Twitter	0/1	It's not too late to participate, take our Spine Study survey today & help us plan your future commute, http://bit.ly/MAGSpine .
February 13, 2017	Facebook/ Twitter	0/0	349 Ideas ? Evaluation ? Strategies ? Evaluation = Recommendations. Get more info & complete a survey at http://bit.ly/MAGSpine .
February 14, 2017	Facebook/ Twitter	8/1	It's Valentine's day: help us, help you LOVE your commute! Take our Spine Survey today at http://bit.ly/MAGSpine .
February 15, 2017	Facebook/ Twitter	5/0	DYK, 40% of daily freeway traffic uses the I-10/I-17 "Spine" Corridor! To learn more & complete a survey visit, http://bit.ly/MAGSpine .
February 16, 2017	Facebook/ Twitter	3/0	Tom.'s the last day for comments RE: I-10/I-17 Spine Study. Don't delay & complete an online comment form today, http://bit.ly/MAGSpine .
February 17, 2017	Facebook/ Twitter	5/1	Spine Study public input ends TODAY (02/17). Take a moment to complete the online comment form at http://bit.ly/MAGSpine before 5 p.m.
Total		48/33	

5.2.6 Newspaper Display Notices

Five quarter-page-size ads were placed in local newspapers to communicate the January 2017 public meetings. The ads included information about the study purpose, public meetings, online comment form, interactive map viewer and the study team’s contact details. They were printed in general-circulation publications (Table 5-4).

Table 5-4. Public Meeting Newspaper Display Notices

Publication	Publication Date
<i>Ahwatukee Foothills News</i>	January 11, 2017
<i>Arizona Informant</i>	January 4, 2017
<i>Arizona Republic</i>	January 5, 2017
<i>East Valley Tribune</i>	January 15, 2017
<i>Prensa Hispana</i>	January 5, 2017

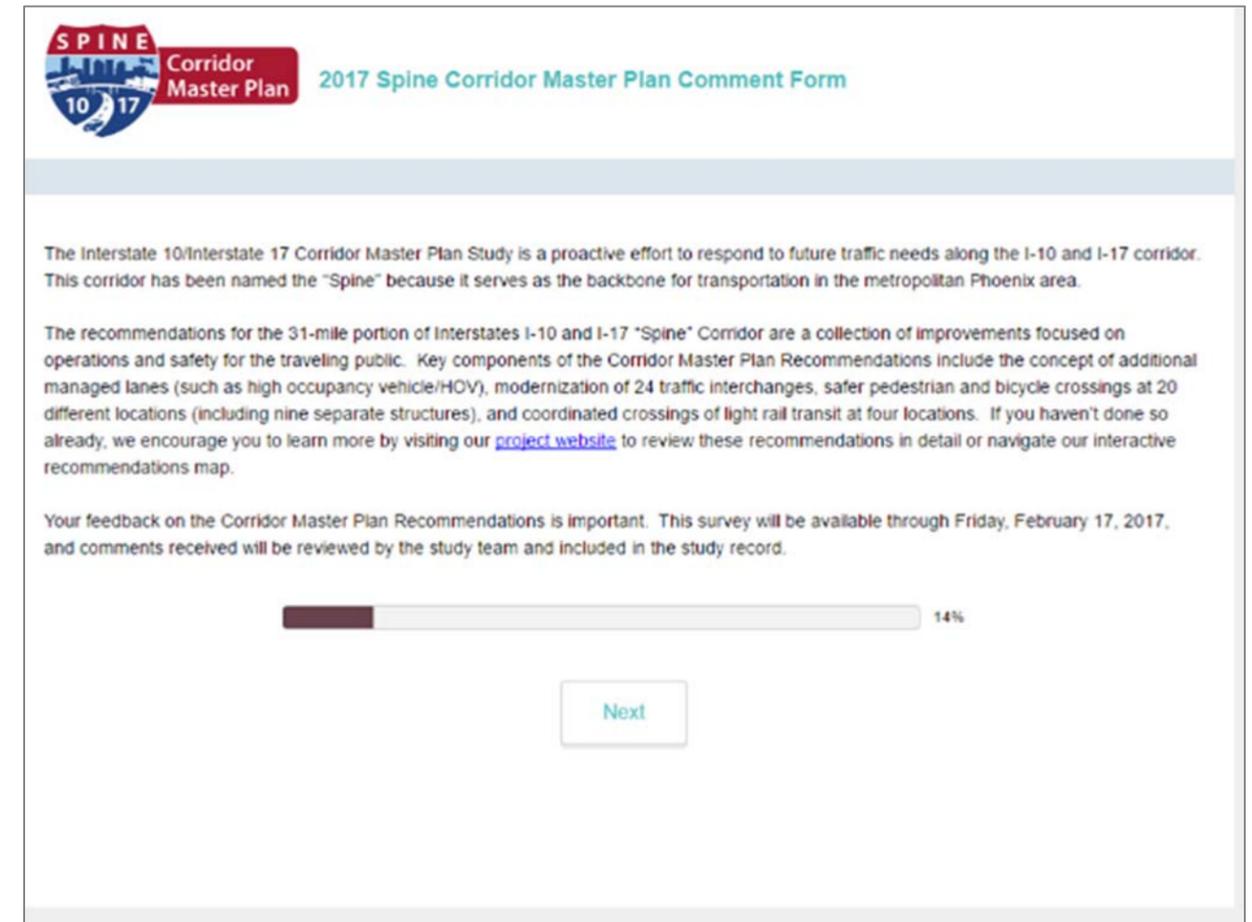
Copies of the advertisements are included in Appendix C.

5.2.7 Online Comment Form

On January 10, 2017, the study team launched an online comment form. The online, mobile-compatible comment form featured seven pages mirroring the comment form distributed at the public meetings. Both English and Spanish versions of the comment form were available to online users.

Page 1 served as a welcome screen and provided an introduction to the study purpose and goal of the comment form (Figure 5-1).

Figure 5-1. Online Comment Form – Welcome Screen



Page 2 introduced the managed lane concept (Figure 5-2). A rating screen with a comment box asked respondents to rate their thoughts on a managed lane concept. This screen provided information on the concept and featured an illustrated example of double managed lanes.

Figure 5-2. Online Comment Form – Managed Lanes Screen

Page 3 asked participants for their feedback on designated entrance and exit points for the managed lanes strategy (Figure 5-3). A rating screen instructed respondents to provide their thoughts on the strategy and to provide comments, if desired. This screen also featured an illustrated example of a designated access-managed lane.

Figure 5-3. Online Comment Form – Designated Entrance and Exit Points of Managed Lanes Screen

Page 4 asked respondents whether they support the acquisition of some properties along the corridor to improve traffic operations and safety (Figure 5-4). A comment box was provided to allow respondents to add additional details to their ratings.

Figure 5-4. Online Comment Form – Property Acquisition Screen

3. The Corridor Master Plan Recommendations would likely require acquisition (purchasing) of some right of way (properties) along the corridor. Do you support taking some properties along the corridor in order to improve traffic operations and safety?

Strongly agree Agree Neutral/Don't know Disagree Strongly disagree

Comments:

57%

Prev Next

Page 5 asked respondents to provide feedback on any of the other recommended strategies, including bicycle and pedestrian improvements, traffic interchange upgrades and other recommended improvements (Figure 5-5).

Figure 5-5. Online Comment Form – Feedback Regarding Other Improvements Screen

4. The Corridor Master Plan Recommendations include a variety of other strategies, including bicycle and pedestrian crossings and traffic interchange modifications. What feedback do you have regarding these other improvements recommended as part of this strategy?

71%

Prev Next

Page 6 provided respondents the opportunity to share any additional feedback regarding the Corridor Master Plan recommendations (Figure 5-6).

Figure 5-6. Online Comment Form – Feedback Regarding Recommendations Screen

Page 7 asked for participant information (Figure 5-7).

Figure 5-7. Online Comment Form – Demographic Screen

Although a February 17, 2017, comment deadline was identified in printed materials, the comment form remained online through the weekend of February 21, 2017. The comments received are summarized in Section 5.4.

5.2.8 Interactive Map Viewer

As part of the agency and public involvement effort, MAG also developed an online interactive map viewer. The map viewer provided the public with specific information regarding the proposed recommendations in a dynamic, geospatial format. Users could zoom in and out of the map, clicking on icons to learn more about specific recommended improvements (Figures 5-8 and 5-9). The map viewer was prominently accessible through the study website at: spine.azmag.gov.

Figure 5-8. Interactive Map Viewer – Landing Page

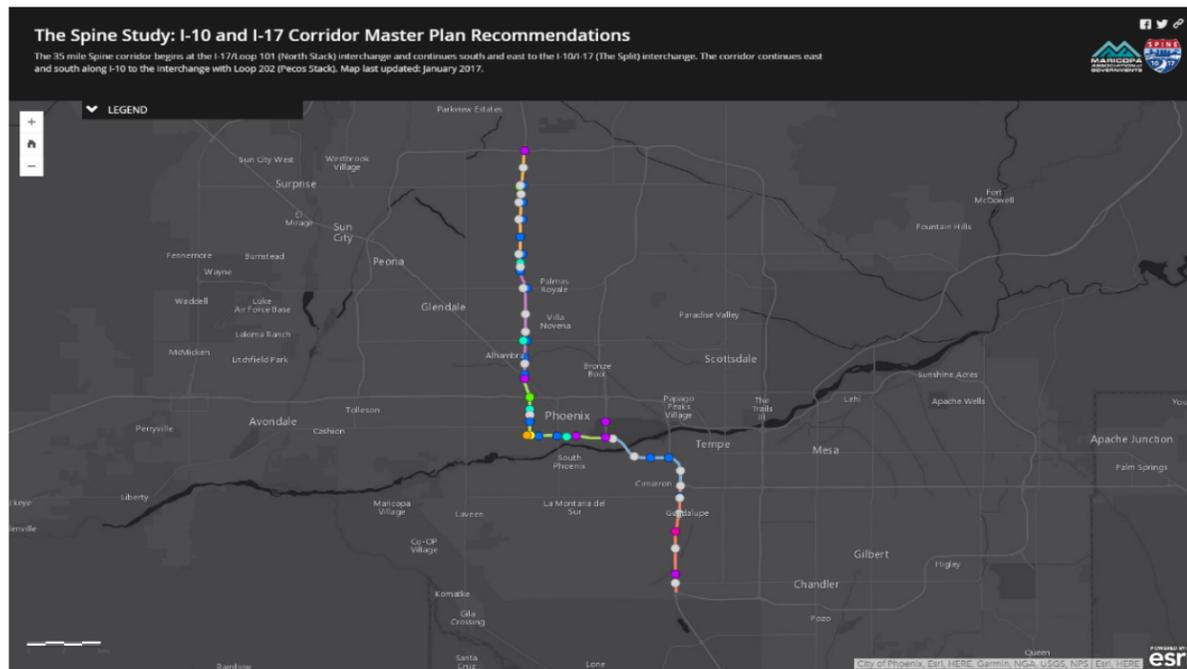
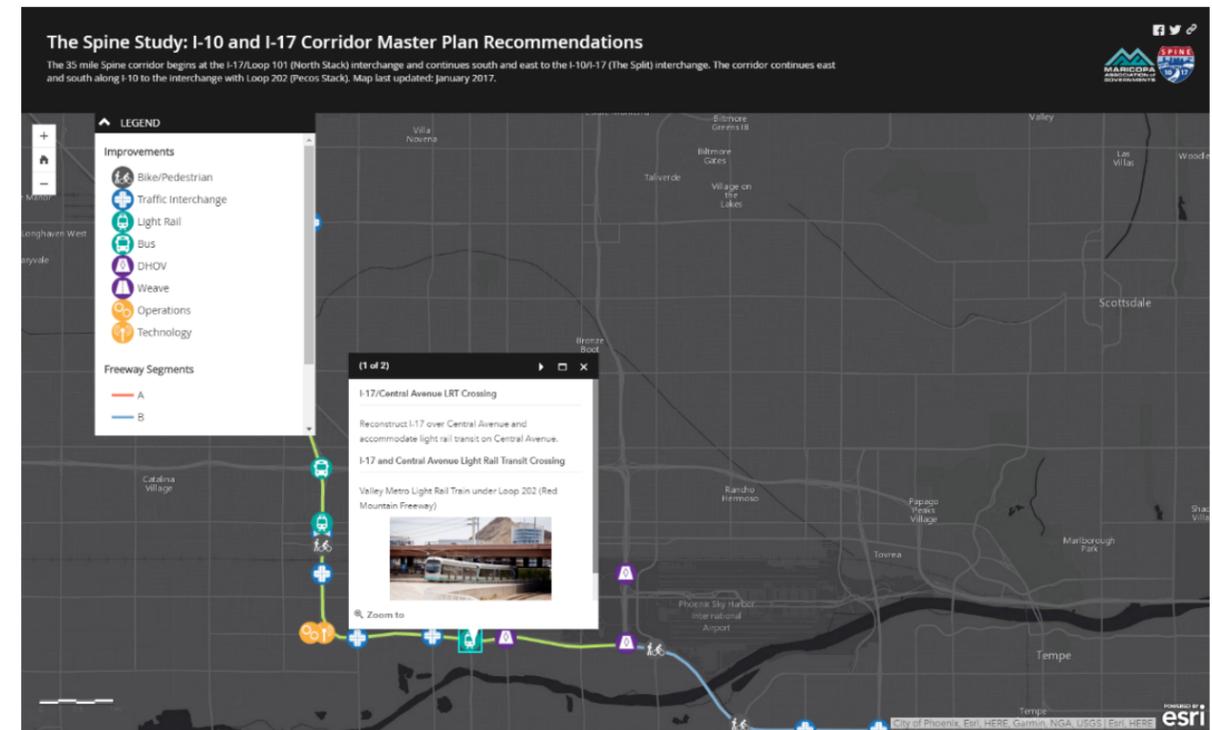


Figure 5-9. Interactive Map Viewer – Example Improvement Selection



5.3 Meetings

5.3.1 Stakeholder Presentations and Event Attendance

MAG staff attended several stakeholder LRT and agency meetings and special events. Table 5-5 reports the meetings attended during the comment period.

Table 5-5. Stakeholder Presentations and Events

Date	Agency/Event
January 10, 2017	City of Tempe Transportation Commission, Tempe
January 16, 2017	Martin Luther King, Jr. March and Festival, Phoenix
January 20, 2017	Four Southern Tribes Cultural Resources Working Group, Ak-Chin Indian Community, Maricopa
January 26, 2017	Westwood Village and Estates Neighborhood Association, Phoenix
February 14, 2017	City of Phoenix Transportation and Infrastructure Committee, Phoenix
February 17, 2017	African American Conference on Disabilities, Phoenix

5.3.2 Public Information Meetings

Four public information meetings were held throughout the study area during January 2017. Each meeting was held in an open house format. The meetings were held in three distinct communities along the Spine corridor to promote easy access for the public and to increase the potential for diverse participation. Table 5-6 shows the meeting locations and number of individuals who signed in at each meeting.

Table 5-6. Public Meeting Locations and Attendance

Date	Location	Attendance
January 24, 2017 11:30 a.m. to 1 p.m.	Maricopa Association of Governments Saguaro Room, 2nd Floor, 302 North 1st Avenue, Phoenix	83
January 24, 2017 6 to 7:30 p.m.	Maricopa Association of Governments Saguaro Room, 2nd Floor, 302 North 1st Avenue, Phoenix	19
January 25, 2017 6 to 7:30 p.m.	Town of Guadalupe El Tianguis Mercado Multipurpose Room, 9201 South Avenida del Yaqui, Guadalupe	65
January 31, 2017 6 to 7:30 p.m.	Washington Activity Center Multipurpose Room, 2240 West Citrus Way, Phoenix, 85015	66
Total		233

The four public information meetings were set up with similar formats, including the following five interactive areas:

- Technical data stations (NAR, alternatives screening documentation)
- Display banners
- Projected improvement image gallery
- Online comment form stations and interactive map viewer
- Comment tables

5.3.3 Meeting Sign-in

At the sign-in station, meeting attendees were greeted by members of the study team, asked to sign in and given a study fact sheet (produced in English and Spanish; see Appendix C) and a comment form (also available in English and Spanish; see Appendix C). Attendees were encouraged to visit each station and ask questions of study team members.

5.3.4 Display Banners

Eight banners (Appendix C) displaying study information were positioned around the meeting rooms for attendees to view (Figure 5-10).

Figure 5-10. Display Banners at Public Meeting



5.3.5 Online Comment Stations

An online comment form station (Figure 5-11) with laptops was available at each meeting to facilitate attendees' completion of the online form (previously described).

Figure 5-11. Online Comment Station at Public Meeting



5.4 Comments

Numerous comments were gathered through the agency and public outreach methods previously described. The following sections summarize agency and public comments received.

5.4.1 Agency Comments

Prior to the public comment period, the Corridor Master Plan project manager met with representatives from the following cities and departments to present the study's recommendations (Table 5-7).

Table 5-7. Agency Presentations

Date	Agency
November 14, 2016	Town of Guadalupe staff; attendees included Acting Town Manager and Town Councilmember
November 17, 2016	City of Chandler staff; attendees included representatives from City Manager's office and Transportation and Development Department (including Streets Maintenance and Transit)
November 17, 2016	City of Tempe staff; attendees included representatives from City Manager's office and Public Works Department (including Transportation and Transit Divisions)
November 18, 2016 and December 2, 2016	City of Phoenix staff; attendees included representatives from City Manager's office, Streets Transportation Department, Transit Department, Aviation Department, Planning and Development Department, Neighborhood Services Department and Community and Economic Development Department

During one of these meetings, City of Tempe representatives requested that the study team consider adding a bicycle/pedestrian (nonmotorized) crossing of I-10 near Knox Road in Tempe and Phoenix. The City of Tempe's Transportation Master Plan (November 2015) identifies Knox Road along its southern boundary with Chandler as its BIKEiT Seat Route bicycle boulevard east of Rural Road to I-10. Tempe staff noted the desire to make a connection across I-10 to give bicyclists the opportunity to access Mountain Vista Park in Ahwatukee.

Similarly, the City of Phoenix requested reconfiguring the I-17/Glendale Avenue traffic interchange into a high-capacity interchange. This request was made to better accommodate east-to-west arterial improvements along Glendale Avenue in recognition of its connections with Glendale on the west and Scottsdale on the east. City staff also requested that the study team consider other operational improvements to increase safety and capacity and to better incorporate bicycle and pedestrian movements.

Both requests were considered by the study team for feasibility. Following the public meeting period, the study's Management Partners recommended adding both requests to the Corridor Master Plan's overall recommendations.

After concluding this coordination effort with the four municipalities in the Spine corridor, the study team turned its attention to other regional agencies and utility companies to provide information regarding the study recommendations.

On January 4, 2017, 218 agency and utility representatives for 71 organizations were notified of the Corridor Master Plan recommendations. Appendix C contains a copy of the agency letter, which included a description of the need for the study, invitation to the public meetings and a request for written comments by February 17, 2017. In the January 4 email that accompanied the letter, a formatting error was discovered and a corrected email was sent to the agency representatives on January 5, 2017.

Immediate responses were received by the Corridor Master Plan project manager to change future agency contacts. These responses were received from the following:

- Arizona State Land Department
- National Park Service
- U.S. Army Corps of Engineers

On January 5, 2017, a representative from the AK-Chin Indian Community requested a presentation at the Four Southern Tribes Cultural Resources Working Group meeting on January 20, 2017. A project presentation was made by the Corridor Master Plan project manager and the MAG intergovernmental relations manager.

Attendees at this meeting included 19 representatives from the following tribes and agencies:

- AK-Chin Indian Community
- Gila River Indian Community
- Tohono O'odham Nation
- Salt River Pima-Maricopa Indian Community
- U.S. Department of the Interior Bureau of Land Management
- University of Arizona

Agency representatives attended the Corridor Master Plan's public meetings that were conducted on January 24, 25 and 31, 2017. Over the course of the four public meetings, 50 representatives from 21 agencies attended the meetings and spoke with study team members. Agencies represented included:

- ADOT
- Arizona State Land Department
- ASU
- City of Apache Junction
- City of Chandler
- City of Glendale
- City of Goodyear
- City of Phoenix Aviation Department
- City of Phoenix City Manager's Office
- City of Phoenix Community and Economic Development Department
- City of Phoenix Councilmember, District 4
- City of Phoenix Councilmember, District 8
- City of Phoenix Streets Transportation Department
- City of Scottsdale
- City of Tempe
- DPS
- FAA
- FHWA
- FCDMC
- Gila River Indian Community

- Maricopa County Department of Public Health
- Southwest Gas
- State of Arizona Attorney General's Office
- Superior Court for Maricopa County, Arizona
- Town of Guadalupe
- Valley Metro

Following the public meetings, the only requested follow-up was for mapping information near the Split, made by FAA representatives. The Corridor Master Plan project manager provided the requested information on February 10, 2017.

Only positive feedback was received from agencies during the comment period. Continuing coordination was maintained with MAG member agencies involved in the Corridor Master Plan after the period closed on February 17, 2017. Consultation letters were provided by the following City Managers:

- Andrew Ching, City of Tempe, on March 24, 2017
- Marsha Reed, City of Chandler, on March 29, 2017
- Ed Zuercher, City of Phoenix, on April 12, 2017

Copies of these letters are provided in Appendix C.

5.4.2 Public Comments

Public feedback was essential to the study team in considering strategies to improve mobility along the I-10 and I-17 corridors through 2040. Members of the public were encouraged to share their thoughts on the Spine corridor and transportation improvement strategies through comment forms, public meetings, emails and phone calls (Table 5-8). In total, 496 comments were received and analyzed. Demographic questions asked of the public were consistent with previous outreach efforts for purposes of comparison. The purpose of the comment forms was to collect public input on the recommended strategy and the elements proposed in the Corridor Master Plan.

Table 5-8. Comments, by Response Method

Source	Number of Comments
Online comment form (English and Spanish)	381
Hard-copy comment form	81
Other contacts (calls, emails, etc.)	34
Total	496

Based on the feedback received, the public generally supports the recommendation of expanding the use of managed lanes. However, respondents raised concerns related to traffic flow, enforcement, ROW and safety.

This section provides an overview of key themes that emerged through an analysis of the feedback received. As noted earlier (Section 5.2.7), public feedback centered on five key areas of questioning: managed lanes, designated entry to managed lanes, property acquisition, bicycle and pedestrian crossings and traffic interchanges, and overall program feedback.

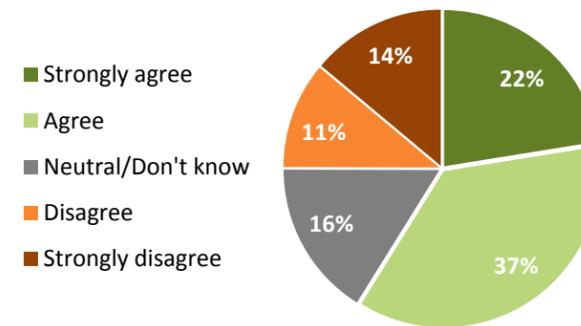
Feedback on Managed Lanes

The study team asked respondents to provide their feedback on the proposed recommendation—the addition of a managed lane through a large part of the Spine corridor (Appendix C). The initial strategy in the Corridor Master Plan envisions a second HOV lane where HOV lanes currently exist, and a new single HOV lane where HOV lanes do not currently exist. This strategy would support transit, reduce congestion and improve travel time reliability. For this question, 445 persons responded (Figure 5-12).

Question on Managed Lanes:

The Corridor Master Plan Recommendation includes the addition of a managed lane through a large part of the I-10/I-17 Spine Corridor. The initial strategy envisions a second high occupancy vehicle (HOV) lane where HOV lanes currently exist, and a new single HOV lane where HOV lanes do not currently exist. This strategy would support transit, reduce congestion, and improve travel time reliability. What are your thoughts on this strategy?

Figure 5-12. Responses to Question on Managed Lanes



The majority of participants agreed with the strategy to add new HOV lanes to the corridor, citing congestion problems throughout the Corridor Master Plan area and opportunities for public transportation and improved traffic flow. Considerable reservations were expressed by those who agreed with the strategy related to enforcement of regulations. A concern regarding noncompliance with the regulation of two or more people in a vehicle was often brought up. Those who disagreed with the strategy most often cited perceptions of underutilization of the current HOV lane on the corridor, concerns related to losing a general purpose lane (which is not part of the recommendation but was probably not clearly conveyed during the outreach effort based on the comments received) and safety concerns.

Key themes that emerged through the feedback received included the following:

- **Traffic Flow/Speed:** As the Phoenix population continues to grow, traffic flow and speed continue to be daily considerations of residents. Congestion, traffic flow and speed were commonly cited themes in the open-ended responses to question one. Feedback related to long commutes, rush hour and worsening congestion were often reflected in the comments. Respondents also expressed frustration related to congestion in key areas of the corridor, including the Split, the Stack, the Thomas Road and I-17 interchange, the "Broadway Curve" on I-10 and the I-10/US-60 interchange, the SR-202L/SR-51/I-10 interchange, and I-17 between the Split and the North Stack. However, respondents had differing opinions about how a new HOV lane would affect the highway system. Many suggested that HOV lanes worsen

congestion for single-occupant vehicles and raised questions about whether the current HOV lanes are used enough to warrant a second lane. However, a few noted that the new HOV lane would improve congestion by providing a lane for faster HOV traffic to pass slower HOV traffic without using the general purpose lanes for those passing movements. Several commenters noted that the traffic on I-10 is worse than on I-17.

One comment suggested that autonomous vehicles may eliminate congestion problems altogether, a concept the Spine study did explore. This issue is being discussed nationally with regard to how autonomous vehicles may influence roadway operations. While no consensus currently exists about what to expect, the study concluded with a solution that offers the maximum future flexibility to address these and other emerging technologies. The managed lane concept is an option that offers such flexibility.

- **Enforcement:** As the Spine study considers the addition of new HOV lanes on the corridor, respondents raised questions related to enforcement of HOV traffic regulations. One commonly raised concern was lane violations or use of HOV lanes by drivers without another passenger. Respondents suggested electronic enforcement and ticketing would be necessary to better enforce HOV traffic laws. Several respondents suggested a second HOV lane would increase the rate of noncompliance with the laws and that a new general purpose lane would be more effective in relieving congestion if HOV traffic laws are not more strictly enforced. Another issue raised was the idea of HOV law violators merging or “cross-weaving” in and out of the HOV lane to avoid detection. As one respondent noted, “adding more lanes in any capacity without addressing cross-weave and HOV access will only make things worse.”
- **Carpooling:** The idea of carpooling was commonly discussed in the feedback received. Respondents suggested a lack of incentive to carpool or van pool, even with the existing lanes. A few respondents noted that HOV lanes have been around long enough in the area that the new lane will not attract many new users. Issues related to incentivizing carpool included scheduling conflicts and the lack of a network of people with whom they could carpool. A small group of respondents felt the addition of a new HOV lane would encourage more carpooling and be more environmentally friendly.
- **Public Transportation and Freight:** Public transportation and freight traffic’s use of the HOV lanes was a theme throughout the comments. Several respondents suggested using the new HOV lane for public transportation as a way to improve travel time, noting that greater mass transit initiatives must be added in conjunction with the new HOV lanes to make the lanes more effective in reducing congestion. Respondents also suggested the idea of using HOV lanes for freight and commercial vehicle traffic to improve the mobility and speed of the general purpose lanes.

The Spine study team investigated using the managed lanes (currently managed as HOV) for other uses, including commercial and/or truck-only use during certain times of the day. With the information available, this concept did not advance as a recommendation; however, this option has not been dismissed. In the future, if this need exists, the managed lane could change to accommodate that need. This is another example of how the managed lane recommendation could adapt to future changes.

- **Highway Widening versus Existing Lane for HOV:** A consideration of many respondents was the idea of converting an existing general purpose lane for the new HOV lane or further widening the highway. Many respondents suggested they would support the addition of a new HOV lane only if the lane did not take away an existing general purpose lane. Respondents also considered the addition of new general purpose lanes to the highway system. Most were in favor of widening the highway to reduce congestion. As one commenter stated, “more lanes that ALL drivers can use are needed.” However, a few commenters suggested that the addition of new lanes would not solve congestion problems and investment should

instead be made in more innovative transportation frameworks, such as managed lanes, toll lanes and redirecting resources to safer, more reliable public transit.

As noted previously, the Spine recommendation is not proposing converting an existing general purpose lane into a managed lane. The new managed lane would be achieved through widening. In hindsight, this information was not clear in the materials shared with the public.

- **Right of way:** Properties adjacent to the highway were on the minds of several respondents. Commenters raised concerns about whether the government had the ability to acquire ROW adjacent to the highway for expansion. Commenters asked that homeowners located along the highway system have the opportunity to provide input on the plan. They also mentioned that “significant” property acquisition be avoided to build the recommended plan. Property identified to protect included homes on the corridor, such as the Bethany Crest housing cooperative.
- **Safety and Mobility:** Comments regarding safety and mobility on the highway system were often cited. Respondents expressed concerns related to HOV traffic entering and exiting the highway system, including emergency vehicles. Respondents often reported difficulties merging across general purpose lanes to and from the HOV lanes and predicted more driver confusion and accidents from reckless driving in and out of a second HOV lane. Improvements to relieve concerns related to HOV traffic access included a median or barrier to prevent unnecessary lane changes, left-hand exit and entrance ramps, using one of the lanes for through traffic only and U-turn bridges.

It should be noted that the recommendation does include many new HOV access ramps to the system to help create a safer and more efficient HOV lane system. The recommendation also explores the implementation of designated entry points in and out of the managed lanes. This is the topic of question two below.

- **Tolling:** Respondents also addressed the topic of using tolling on a new HOV lane. Several respondents supported the possibility of using tolling in a new HOV system to manage traffic. However, other respondents opposed the idea of tolling, saying it would reduce the system’s efficiency and segregate drivers based on ability to pay.

MAG studied the possibility of HOT lanes during the Managed Lanes Network Development Strategy project in 2012. This project examined the feasibility of introducing congestion pricing to the region. This recommendation continues to undergo additional study as part of a comprehensive approach for addressing congestion on the regional freeway system. Although HOT lanes did not clear the screening process for this Corridor Master Plan, the overall managed capacity recommendations do not preclude the opportunity to consider pricing in the future, if policy allows.

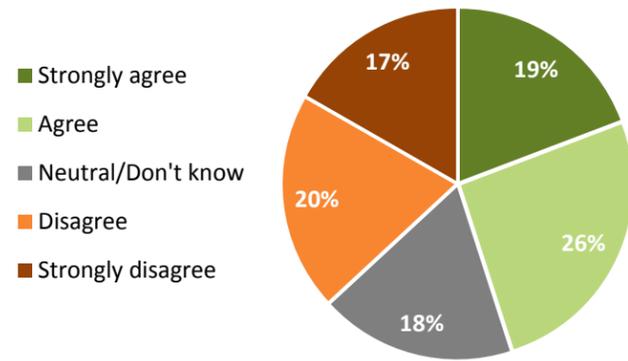
Feedback on Designated Entry Points to Managed Lanes

The study team asked respondents to provide their feedback on a designated entry and exit strategy for managed HOV lanes throughout the I-10/I-17 Spine corridor (Appendix C). If a second HOV lane is added to the corridor where HOV lanes currently exist, the corridor recommendations anticipate using a designated entry and exit strategy. This means HOV lane entrance and exits would be specified at designated points for safety. In total, 442 persons responded to the question (Figure 5-13).

Question on Designated Entry Points:

Currently, drivers can enter and exit the HOV lane at will. Having two managed lanes in each direction would result in limiting entrance and exit to those lanes at specific, designated points for safety. What are your thoughts on this strategy?

Figure 5-13. Responses to Question on Designated Entry Points



The idea of designated entry and exit points from the managed HOV lanes received mixed feedback. Those who agreed with the strategy felt the designated entry and exit points would reduce dangerous HOV merging and congestion. However, those who disagreed with the strategy raised concerns related to driver confusion, missed exits and congestion, and high accident rates at the designated access points.

Notable public feedback related to designated entry points included experiences of using a similar concept in other states. Those who commented on experiences in other states had mixed reviews. For example, one commenter stated, "I have driven these types of lanes in Los Angeles County," and another commenter stated, "the Express Lanes in Chicago seem to help traffic flow. If you know that you'll be taking highway for the next 12 miles, get in the far lane, get out of the way, and keep it moving!"

Key themes that emerged from the feedback include the following:

- Safety and Congestion:** Safety concerns were paramount to respondents when considering designated entry and exit points. Driver confusion was a heavily discussed topic as respondents raised concerns about mistakenly missed exits, mistaken entry into the HOV lane and rash decisionmaking as drivers attempt to merge back into general purpose lanes. Some respondents suggested the designated points of entry and exit would become congested and accident-prone because of driver confusion. Respondents also raised concerns about the difference in speed in the HOV and general purpose lanes and how that could cause accidents. Some respondents said the designated entry and exit points would make the HOV system safer because it would cut the amount of traffic weaving in and out of the HOV lanes illegally and reduce congestion related to merging. The use of directional signs was a common suggestion to improve safety if this strategy is implemented.
- Enforcement:** Another common concern of respondents was the idea of enforcing the HOV entry and exit points. As expressed previously, commenters suggested that concrete barriers or other physical separation elements might help enforce the designated entry and exit. Respondents were wary of double-line striping and believed violators would continue to weave in and out of the HOV lanes. Some respondents also commented that designated entry and exit points would make it easier for law enforcement officers to manage violators.
- Use of HOV Lanes:** Respondents raised concerns related to the spacing of the entry and exit points and the use of the lanes. Comments suggested that without enough entry and exit points to the HOV lanes, there is no incentive for local traffic to use the lanes. Several commenters suggested using one HOV lane to exit at will (for local traffic) and one HOV lane for restricted access (for long-distance travel).

- Emergency Response:** Several comments included questions about the strategy's ability to facilitate emergency response during accidents. Concerns included emergency vehicle access to restricted areas of the HOV system and traffic back-ups should an accident happen in an HOV lane with restricted exits.

During the analysis of question two comments, the study team discovered that many of the participants who agreed with the idea of adding a managed lane to the Spine Corridor disagreed or strongly disagreed with the designated entry strategy. This finding indicates the need for a robust public information and education campaign, should this strategy be implemented. It will be important that members of the public understand how to use managed lanes and why this strategy was recommended. Because of this discontinuity in feedback between question one and two, the Spine study team conducted additional research to further explore details of a designated entry HOV system. The result of that research is included in Appendix B, as a reference as the Spine study recommendations are implemented.

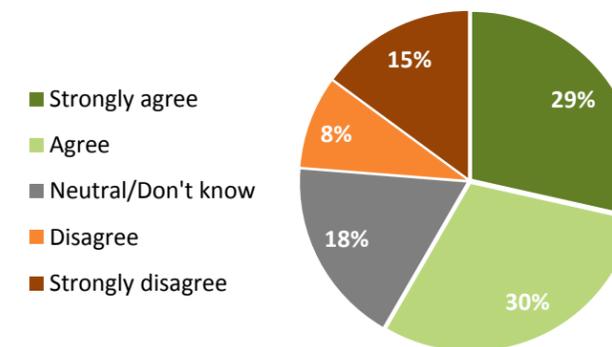
Feedback on Property Acquisition

Property acquisition is often a controversial issue among corridor stakeholders. The study team asked respondents for feedback on the issue of taking property along the corridor to implement the Spine study recommendation (Appendix C). In total, 442 persons responded to the question (Figure 5-14).

Question on Property Acquisition:

Do you support taking some properties along the corridor in order to improve traffic operations and safety? What are your thoughts on this strategy?

Figure 5-14. Responses to Question on Property Acquisition



The majority of commenters agreed with property acquisition, many noting that property owners receive fair compensation for their land. Those who disagreed with the idea of property acquisition cited concerns related to displacing homeowners and businesses.

Key themes that emerged through the feedback include the following:

- Compensation:** Many respondents agreed with the strategy of acquiring some properties along the corridor so long as property owners receive fair compensation. Respondents had differing opinions about fair compensation for properties. Some felt the government should offer more than the property is worth, whereas others felt the government should try to get properties for fair market value. Those who disagreed with the strategy often cited the cost of compensation and unfair compensation as reasons why they did not agree with property acquisition.

Because the original question used the word “taking” rather than “acquiring,” some respondents were concerned that the word “taking” implied acquisition without fair compensation, which may have created some confusion. In retrospect, the question should not have used the word “taking.”

- **Residential Displacement and Cultural Resources:** Respondents raised concerns related to historic properties on the corridor and low-income, minority populations. Many comments suggested that they would agree with this strategy so long as historic properties are protected and low-income residents are not disproportionately affected. Those who disagreed with property acquisition expressed reservations related to displacing residents and businesses.
- **Alternatives to Property Acquisition:** Several respondents who disagreed with property acquisition offered strategies to work around purchasing additional ROW. Strategies included differentiating office hour scheduling to minimize traffic during commutes, stacking or double-decking the highway, initiating BRT service and using existing lanes as HOV lanes.

The Spine study did explore these ideas, or variations of these ideas, as alternatives to property acquisition during the alternatives screening process. The results of this exploration are outlined below:

- Converting existing general purpose lanes to HOV lanes on the Interstate freeway system is generally prohibited, so that option was not carried forward.
- Employer-based alternative working hours is a TDM strategy that could be employed regionally, but would not be effective on a project-level basis. Such a strategy would likely have to be voluntary, and its effectiveness would be challenging to predict or quantify.
- The recommended alternative would encourage more transit use because the managed lane concept provides more predictability with HOV lane operations. Predictability is essential for BRT or express bus scheduling and its attractiveness to users.
- Stacking or double decking the highway is a common idea suggested to minimize ROW impacts. On I-17, where this would be the most likely option, impacts on adjacent properties along the freeway would switch from direct impacts to indirect impacts, which could actually be worse for property owners. Noise, air quality and visual impacts would negatively affect entire communities along the freeway, not just the first row of homes along the freeway ROW. In some instances, this strategy is limited in the acquisition of more property and ROW. As a result, the stacked freeway concept was not carried forward because it would disproportionately affect many of the low-income, minority residential areas along the I-17 corridor.
- **Aesthetics and Safety:** Many of those who supported property acquisition noted that properties along the corridor are blighted and in need of repair. They noted that acquisition would encourage businesses and residents to move into safer areas. Many commenters also noted that property acquisition would benefit the overall safety of the community through an improved highway system.

Feedback on Bicycle and Pedestrian Crossings and Traffic Interchanges

In the fourth question on the comment form, the study team asked for general feedback related to bicycle, pedestrian and traffic interchange improvements. In total, 370 persons responded to the question.

The vast majority of responses to this question focused on the proposed I-17 and Osborn Road bicycle and pedestrian crossing. These respondents, many who live in a community just east of I-17 around Osborn Road,

overwhelmingly oppose a new pedestrian and bicycle crossing over I-17 at Osborn Road. Respondents frequently cited concern for an increase in crime with greater access to their neighborhood.

Respondents also considered the addition of bicycle lanes to the area, new traffic interchange features and the ability of bicycle and pedestrian improvements to connect neighborhoods and improve safety.

Key themes that emerged through the feedback received include:

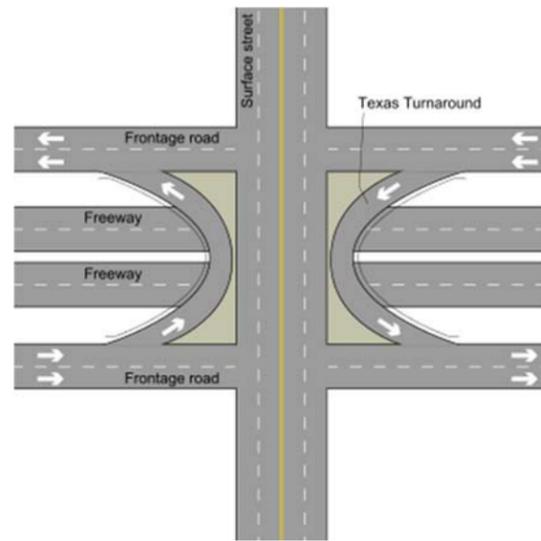
- **Cost:** Many respondents opposed the construction of pedestrian and bicycle crossings on the highway system because of cost. Commenters expressed concerns about underused crossings, given the city’s sprawling nature and the region’s hot weather. Respondents suggested resources would be better spent on transit and automobile transportation-related investments. Some respondents, however, supported additional investment in pedestrian and bicycle crossings, saying the improvements are “overdue.”
 - **Crime:** Crime was a often-cited theme in response to question four. Respondents opposed pedestrian and bicycle crossings because of fears of increased crime in their neighborhoods. Specific concerns related to transient activity and impacts of persons experiencing homelessness. Many commenters believed that if constructed, a pedestrian crossing at Osborn Road would increase neighborhood crime rates.
 - **Bicycle Lanes:** The idea of adding bicycle lanes to key areas of the corridor was frequently mentioned in responses. Respondents were in favor of adding bicycle lanes in densely populated urban areas and adding shading features to address the region’s hot climate. Those opposed to bicycle lanes raised concerns related to the danger of having a bicycle lane on the freeway, little use of the lanes and disruptions in traffic flow caused by narrow streets and bicycle crossings.
- Note that the Spine study is not recommending bicycle lanes on the freeway. Bicycle and pedestrian facilities are proposed only at crossings of the freeway or along certain arterials.
- **Traffic Interchanges:** Respondents supported interchange improvements including modifications around the “Broadway Curve,” Warner Road and I-17 from Bell to McDowell roads. Those who supported interchange improvements prioritized safety, east-to-west traffic flow and merging on and off the freeway as top considerations. Two suggestions were adding Texas-style U-turns (Figure 5-15) to the I-17 corridor and using designs that discourage wrong-way driving.

Texas-style U-turns have been used throughout the United States on freeways with frontage roads. In this corridor, I-17 has a continuous frontage road system for its entire 18 miles within the study limits, extending from 16th Street on the south to the North Stack on the north. The U-turns were studied as a concept during the development of the Corridor Master Plan’s recommendations. Although the concept was dropped as a corridor-wide recommendation, the project’s Management Partners believe that ADOT should consider their development on a project-specific basis along I-17 where travel demand warrants.

Question on Bicycle and Pedestrian Crossings and Traffic Interchanges:

The Corridor Master Plan Recommendations include a variety of other strategies, including bicycle and pedestrian crossings and traffic interchange modifications. What feedback do you have regarding these other improvements recommended as part of this strategy?

Figure 5-15. Example of Texas-style U-turn



- **General Support for Bicycle/Pedestrian Improvements:** Those who supported bicycle and pedestrian improvements cited reasons such as the ability of bicycle and pedestrian crossings to connect neighborhoods and bicycle path networks and to improve safety. Some commenters also suggested that these improvements would reduce traffic on the roadway.
- **Public Transportation:** Several commenters proposed improvements to public transportation. Bus pullouts, park-and-rides, express bus routes and the addition of light rail transit to the I-10 corridor were among the improvements discussed.

Many of these suggestions are either included in the recommendation, or will help encourage these elements. Support of public transportation is a major reason the recommendation was made. The recommendation was made because managed lanes/HOV lanes create an environment where public transportation will be a more attractive option because of travel time reliability improvements.

Summary of General Feedback

The study team invited general feedback in the final question of the comment form. A total of 289 persons responded to the question. The key themes were as follows:

- **Improvement Focus:** Some respondents asked that funding be used primarily for highway improvements, whereas others asked that public transportation and bicycle and pedestrian improvements be prioritized.
- **Flooding Infrastructure:** Several respondents noted a need for flood management infrastructure, citing rainwater drainage systems and the 2016 flood.

Several storm drain improvements are included in the Spine study recommendations.

Question Requesting General Feedback:

Do you have any other feedback regarding the Corridor Master Plan Recommendations?

- **Noise Walls:** Respondents also noted a need for trees and sound barriers along the highway system. New and replacement noise walls are included in the recommendations. It is important to note that trees do not mitigate noise.
- **Enforcement:** Respondents repeated concerns related to the lack of enforcement of traffic laws, speed limits and HOV regulations on the current highway system.
- **Highway Widening:** Respondents offered differing options on adding an additional lane to the highway system. Some respondents encouraged a highway expansion, citing a decrease in congestion if more general purpose lanes are added to the system. Others asked that the study team be wary of adding an additional lane because they believed it would not provide traffic relief. Other respondents also asked that the study team not add an additional HOV lane to the highway system.

The Spine study did evaluate adding additional general purpose lanes. However, the analysis concluded that additional lanes would not notably reduce congestion. Currently, so much demand exists in the corridor that additional general purpose lanes would fill up immediately. As a result, that option was carried forward in a only few select areas of the Spine corridor.
- **Light Rail:** Several respondents asked the study team to consider adding light rail transit to the corridor. The Spine study did evaluate this option, but found that ridership forecasts do not support such a route. Therefore, it was not carried forward to the recommendations.
- **Pedestrian Bridges:** Many respondents reiterated that they oppose the construction of bicycle and pedestrian crossings, specifically at I-17 at Osborn Road.
- **Project Timeline:** Respondents noted a need to implement improvements swiftly with future technology in mind. They also expressed some concerns about the timing and impacts of construction.
- **Public Involvement:** Respondents thanked the study team for the opportunity to attend public meetings and asked for continued public involvement in the Corridor Master Plan. Respondents specifically suggested corridor neighborhood meetings as a way to respond to resident concerns.

5.4.3 Demographic Information of Comment Form Respondents

Respondents were asked a series of questions to help the study team learn when, why and how they used the corridor. In addition, they were asked to provide a home ZIP Code. Figure 5-16 shows the ZIP Code areas in which residents reside. Roughly a third of the comments received were from the 85015 ZIP Code.

Figure 5-16. Comment Form Respondents, by ZIP Code Area

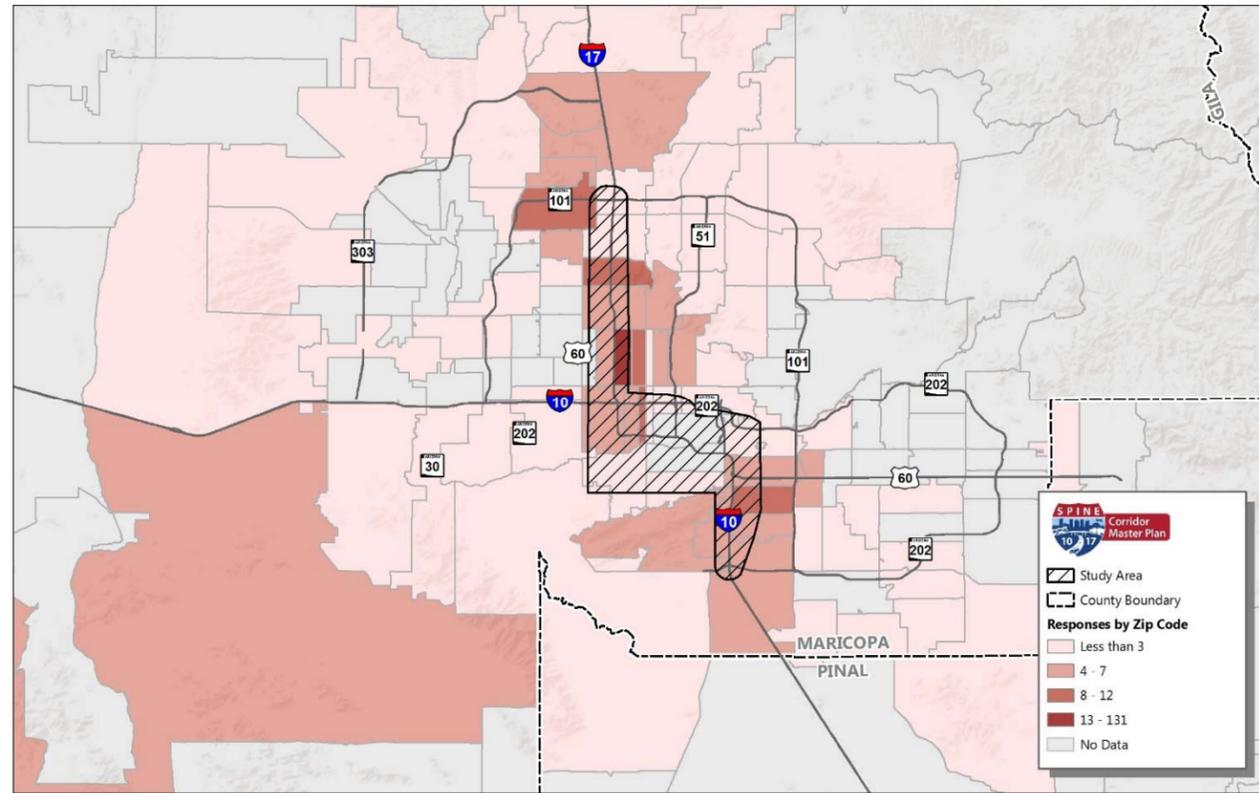
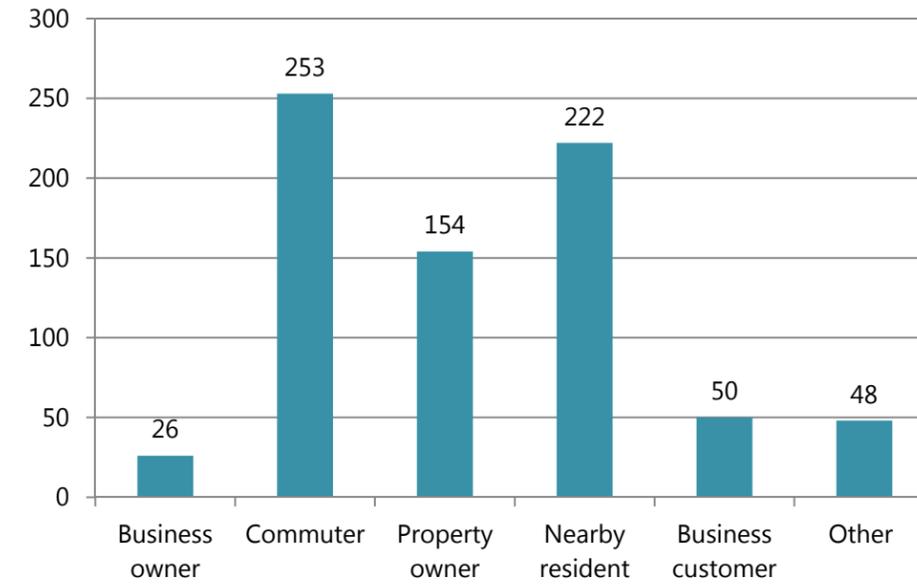


Figure 5-17 shows the participants' interest in the corridor. Participants were able to select all choices that applied to their interest area. Participants selected "commuter" most often, followed by "nearby resident." Examples of other interest areas specified included "community activist," "bicycle advocacy," "family in the area," and "truck driver."

Figure 5-17. Responses to Question: What is your interest in the Spine Corridor?



How often participants used the corridor is represented in Figure 5-18.

Figure 5-18. Responses to Question: How often do you use the Spine Corridor?

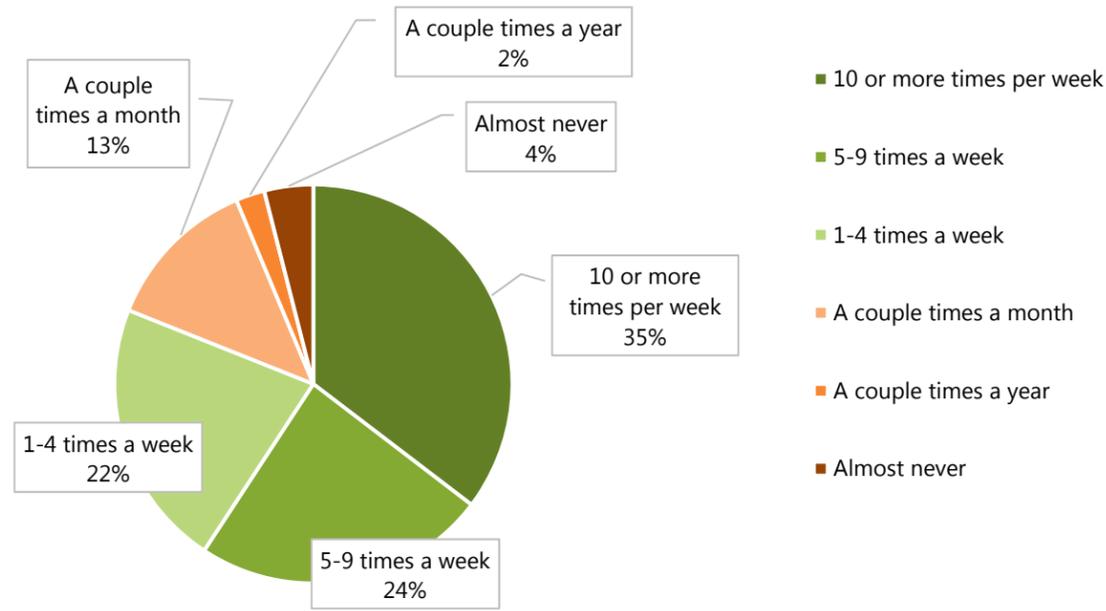
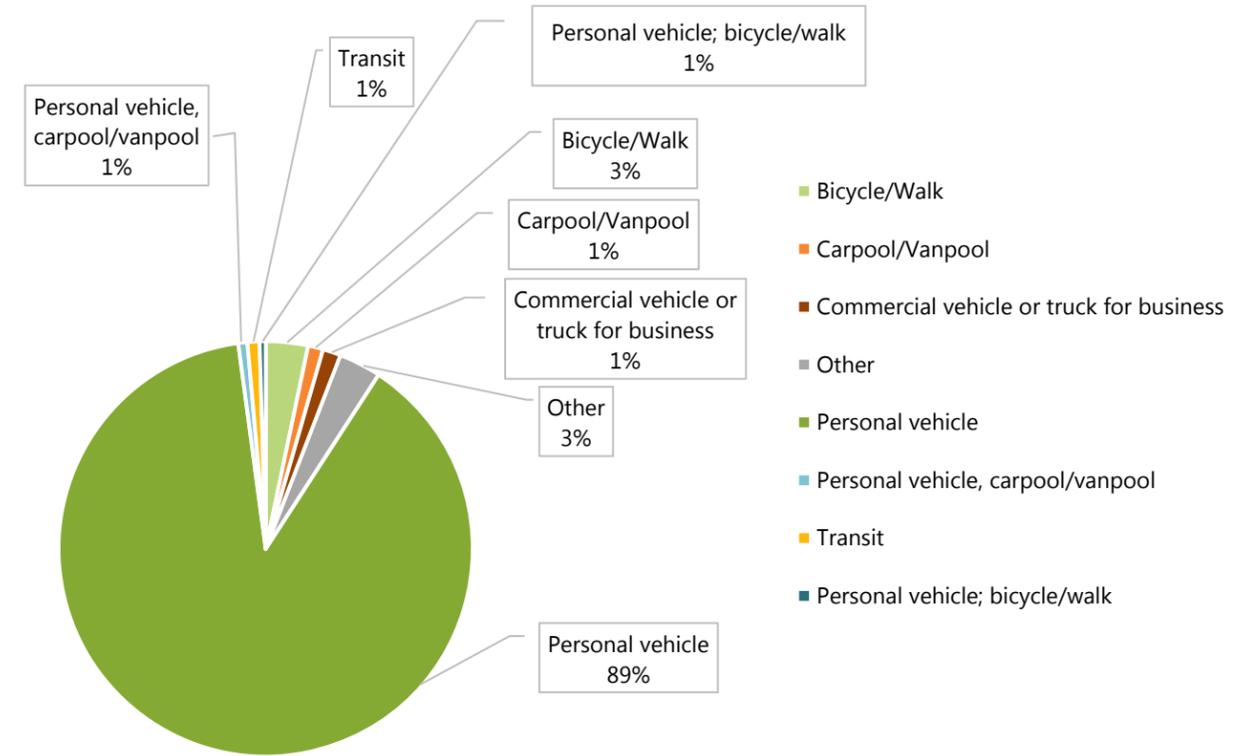


Figure 5-19 represents how participants travel in the corridor. Respondents most often used personal vehicles to travel in the Spine corridor.

Figure 5-19. Responses to Question: How do you typically travel in the Spine Corridor?



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6 Recommended Alternative

Disclaimer

Locations of improvements in this report are conceptual in nature and subject to additional study, review and approval by the Arizona Department of Transportation, Federal Highway Administration and appropriate municipal jurisdiction. Final project alignments and rights-of-way will be determined following completion of appropriate planning, environmental and design studies. While every effort has been made to ensure the accuracy of this information, the Maricopa Association of Governments makes no warranty, expressed or implied, as to its accuracy and expressly disclaims liability for the accuracy thereof.

The Spine study has concluded that an expanded managed lane system, combined with numerous localized improvements along the Spine corridor, is the recommended alternative. Generally, this means that the current managed lanes (HOV lanes) would be expanded with a second HOV lane in segments where HOV lanes currently exist, new HOV lanes would be added where none exist today, and DHOV ramps would be added to connect and terminate this expanded system. Operational flexibility regarding how these managed lanes could be used to address the uncertainty of future needs is a key advantage of this recommendation. Localized improvements target deficient interchanges, weaving sections, bicycle and pedestrian crossings, traffic interchange upgrades and sections with missing arterial redundancy. Recommended alternative features are discussed in Section 6.2. The final recommendation was presented to the MAG committees listed in Table 6-1 and was adopted into the MAG 2040 RTP, contingent on a new finding of conformity, on May 24, 2017.

As a reminder, Section 2.2 of this document discusses projects and elements of work included in the No-Build Alternative for this study. This included elements of work categorized as near-term improvements; however, as the Spine study progressed, the near-term improvement projects were cancelled and many of the work elements included in the near-term improvements on the Spine corridor, specifically on I-10, were added to the recommended alternative described in this chapter.

6.1 Purpose and Need Overview

The Spine study's purpose and need was defined in detail in Chapter 11 of the NAR, completed as part of this study in June 2015. To recap, the purpose of the study is to identify and budget for a project, or a series of projects, that would address the Spine corridor's transportation needs. The need for the project is as follows:

- I-10 and I-17 are at capacity during rush hour and are unable to handle future traffic levels.
- I-10 and I-17 experience lengthy periods of congestion. The lengths of congestion, both in time and distance, are projected to worsen over time.
- Travel times on the two freeways will worsen as the average travel speeds decrease.
- Projected growth will continue to put stress on the two freeways.
- Degradation of the two freeways will adversely affect the operations of HOV and transit modes such as freeway BRT, express buses and local bus routes.
- Aging infrastructure of the two freeways could limit economic growth opportunities in the region.
- Timely and efficient delivery of freight is vital to the region's economic health.
- Poor operations on I-10 and I-17 adversely affect local streets, especially at intersections.

Table 6-1. Spine Recommendation Presentations to MAG Committees

Date	MAG Meeting	Action
March 30, 2017	Transportation Review Committee	For information only
April 12, 2017	Management Committee	For information only
April 19, 2017	Transportation Policy Committee	For information only
April 26, 2017	Regional Council	For information only
April 27, 2017	Transportation Review Committee	Recommended accepting the final recommendation for the I-10/I-17 Corridor Master Plan for I-10 between the Pecos Stack and the Split and for I-17 between the Split and the North Stack for inclusion in the MAG 2040 RTP, contingent on a new finding of conformity.
May 10, 2017	Management Committee	Recommended accepting the final recommendation for the I-10/I-17 Corridor Master Plan for I-10 between the Pecos Stack and the Split and for I-17 between the Split and the North Stack for inclusion in the MAG 2040 RTP, contingent on a new finding of conformity.
May 17, 2017	Transportation Policy Committee	Recommended accepting the final recommendation for the I-10/I-17 Corridor Master Plan for I-10 between the Pecos Stack and the Split and for I-17 between the Split and the North Stack for inclusion in the MAG 2040 RTP, contingent on a new finding of conformity.
May 24, 2017	Regional Council	Accept the final recommendation for the I-10/I-17 Corridor Master Plan for I-10 between the Pecos Stack and the Split and for I-17 between the Split and the North Stack for inclusion in the MAG 2040 RTP, contingent on a new finding of conformity.

6.2 Features of the Recommended Alternative, by Segment

This section describes the minimum features of the recommended alternative and the justification for why they have been included. These features address the biggest problems, issues or shortcomings within the corridor and may not be comprehensive. Additional engineering and environmental study, combined with public and stakeholder input, may determine that other issues should or need to be addressed as well. However, the general scope and intent of the recommendation should be satisfied, avoiding major scope additions, especially related to the main line widening. All designs presented in this discussion are conceptual in nature, and are still subject to further engineering study through the project development process.

Common to all segments of the corridor, the recommended alternative includes using dual-lane exit ramps (one exit-only lane and one optional exit lane) wherever feasible to improve the operations and safety of all weaving sections. In addition, on I-17 where the frontage road system exists, the addition of Texas-style U-turns (described in Section 5.4.2 and Figure 5-15 of this document) should be considered during the next level of project development in areas where U-turn movements are particularly heavy and where the Texas-style U-turns can feasibly fit into the existing system.

6.2.1 Interstate 10: State Route 202L/Pecos Stack to U.S. Route 60

This segment of I-10 (SR-202L/Pecos Stack to US-60) can be generally described as having three general purpose lanes, one HOV lane and auxiliary lanes in each direction with a diamond interchange nearly every mile. This segment includes some of the newest construction elements throughout the Spine corridor. As a result, no major infrastructure deficiencies were identified, but some operational issues were identified and addressed with the recommendation. The layout for this segment of I-10 can be found in Figures 6-1 to 6-3 following this segment description.

- **I-10 Main Line Improvements**

One additional general purpose lane would be added to I-10 in each direction in this segment between Baseline and Ray roads. All lane and shoulder widths would be constructed to the current ADOT standards for urban freeway construction. Because of the existing DHOV connector at the I-10/US-60 traffic interchange, HOV demand and congestion noticeably drop on I-10 south of US-60. After the opening of the SR-202L South Mountain Freeway, traffic modeling indicates that the addition of one general purpose lane in each direction in this segment would best meet the travel demand with minimal or acceptable levels of congestion in 2040 in both the general purpose and HOV lanes. These improvements would enhance safety, reduce congestion and improve travel time reliability.

Between Elliot and Baseline roads, the recommendation is to extend the existing C-D roads north of Baseline Road south to the Elliot Road traffic interchange, eliminating the current auxiliary lane between Baseline and Elliot roads and using that width for the C-D road. This specific recommendation is included for two reasons. First, after studying the availability of parallel arterial routes for route redundancy and incident management detouring for the NAR, the study team realized that this 2-mile segment of the Spine corridor uniquely lacked adequate redundancy in the arterial system. East of I-10, Priest Drive/Avenida del Yaqui is the downtown main street of Guadalupe characterized by low speed limits, stop signs and numerous crosswalks. To the west, 48th Street/South Point Parkway is a private road that is a meandering, low-volume residential street with traffic calming elements to deter pass-through traffic. After consultations with the local agencies, it was apparent that neither of these two streets would ever be upgraded to convey large traffic volumes. Because the C-D road would be a barrier-separated facility from the I-10 main line, extending the C-D road south would provide that alternative route to the I-10 main line in the event of an incident, while at the same time providing added capacity to the main line to help minimize pass-through traffic on these two adjacent local roads. This concept was strongly supported by attendees at the public meetings, particularly those from Guadalupe.

The second reason to extend the C-D roads south is to help the traffic operations of the Baseline Road traffic interchange. By virtue of geography, the Baseline Road traffic interchange is a critical service interchange in the Spine corridor because it represents the first interchange users can use to detour off I-10 coming from the south to get to South Phoenix around the eastern point of South Mountain Park. Even after the SR-202L South Mountain Freeway opens in 2019, Baseline Road and its traffic interchange with I-10 will remain significant as a regional connection. As a result, the north-to-west and east-to-south movements at this interchange are very prominent because of the location of this interchange in the transportation system. The north-to-west movement creates backups on the I-10 westbound exit ramp to Baseline Road (sometimes extending back onto the main line). In addition, the ramp meter queuing on the I-10 eastbound entrance ramp will back up daily onto Baseline Road—one of the contributing root causes of the gridlock within that interchange. The C-D roads would help both situations. The off-ramp queuing would only back up onto the C-D road and would not affect the I-10 main line operations (which is exactly

what a C-D road should do). In addition, the Baseline Road eastbound entrance ramp meter could potentially be eliminated because it would only merge to a C-D road and not the I-10 main line, be timed to allow greater flow, or be designed to turn off when queuing approaches the crossroad to flush the backup.

It is recognized that the addition of the C-D road between Baseline and Elliot roads would create some drainage challenges along I-10. The C-D roads would cover the current roadside ditches/channels that convey the freeway stormwater to the south. While no specific drainage solution is proposed with this study, costs have been added to the cost opinion to address this issue, recognizing that costly underground storage/conveyance and/or ROW acquisition for conveyance/detention may be needed. Further study is required on this issue.

- **Interchange Modifications**

Comparing the 37 interchanges and grade separations in the Spine corridor limits, the crossings in this segment of I-10 generally scored very well, meaning traffic operations, safety and infrastructure condition performed well when compared with other crossings in the corridor. In fact, out of the 37 crossings, Chandler Boulevard, Ray Road, Warner Road, Elliot Road and Guadalupe Road ranked at 34, 29, 33, 22 and 37, respectively, in priority. Because of these rankings, no specific traffic capacity or safety improvements are proposed at Chandler Boulevard, Ray Road or Elliot Road. However, safety and capacity issues were identified at the Warner Road traffic interchange as part of the *Tempe Transportation Master Plan* (November 2015), so a project would be identified and studied to define the specific needs at this location.

It should be noted that although this Spine study does not propose improvements at the other traffic interchanges, it should not be implied that nothing should be done. Relatively low-cost interchange improvements or reconfigurations that largely stay within the existing ROW, such as additional turning/through lanes or new high-capacity geometrics, may still be warranted and could be further investigated if the need becomes apparent in the future.

The Baseline Road traffic interchange is the exception in this segment. The need to improve this location was prioritized second out of all the 37 corridor crossings. As previously noted in the I-10 main line improvement section, Baseline Road is a significant service interchange that serves regional traffic movements. It is also a regional destination because of the retail activity in the area, most notably the Arizona Mills shopping mall. The combination of these factors creates major congestion issues on Baseline Road every day of the week. There are various reasons why this interchange is congested. As previously noted, entrance ramp queuing backing up onto Baseline Road is one factor. Another major factor is that five signalized intersections are currently within 1,700 feet of either side of the current interchange. This equates to seven signals in 3,200 feet. Because of the current development, not much can be done to alleviate this issue, except possibly at Wendler Drive. Wendler Drive currently tees into Baseline Road from the north approximately 300 feet west of the eastbound ramp terminal. This intersection's proximity to the traffic interchange significantly disrupts the traffic interchange signal operations. Closing Wendler Drive is not possible because it is the sole access to several businesses north of Baseline Road.

The Spine study recommendation for the Baseline Road traffic interchange was developed with practicality in mind given the setting, and to also recognize the regional importance of the interchange. Some ROW and business impacts would occur with this improvement. Given the regional significance of this traffic interchange, the study team determined the impacts were appropriate trade-offs for the benefits gained. The Baseline Road traffic interchange recommendation is made up of four parts:

- Extend the C-D roads on I-10 to Elliot Road to address the south side ramp issues previously discussed.
- Realign Wendler Drive and consolidate its intersection with the Arizona Grand Parkway intersection. This eliminates one intersection and improves signal spacing and progression along Baseline Road. This realignment would affect a major retail operation at Wendler Drive and Baseline Road.
- Convert the Baseline Road traffic interchange into a DDI to improve capacity and safety of the significant left turning volumes in the interchange, while preserving the existing I-10 bridges crossing over Baseline Road. The study team considered other interchange geometrics at this location and found the DDI responded well to the travel patterns and provided the best fit for the available ROW.
- Extend the ADOT access control along Baseline Road at least 350 feet from the current ramp terminal intersections.

- **Arterial Improvements**

With the exception of the Baseline Road traffic interchange improvements previously noted, no other local arterial modifications are proposed in this segment.

- **Transit Improvements**

At I-10 and Galveston Street (the mid-mile location between Ray Road and Chandler Boulevard), the Spine study recommendation proposes to add a DHOV half interchange in the median of I-10, with ramps to and from the north. This DHOV interchange is envisioned to connect Galveston Road from 50th Street on the west to 54th Street on the east and would connect planned park-and-ride facilities on both sides of the freeway: one for Phoenix on the west side and one for Chandler on the east side. It is anticipated that this new DHOV traffic interchange would be heavily used by local buses and express buses for commuters.

- **Bicycle and Pedestrian Improvements**

Several bicycle and pedestrian improvements are proposed in this segment, all designed to improve or provide nonmotorized access across I-10. These locations are as follows:

- **Chandler Boulevard traffic interchange:** Upgrade this traffic interchange to extend the bicycle lanes on Chandler Boulevard from 54th Street west across the freeway. This could be done with either dedicated grade separations or improvements at grade through the interchange. More study is needed to coordinate with the stakeholders (i.e., ADOT, Phoenix and Chandler) to determine the appropriate solution.
- **Knox Road Alignment:** Add a new dedicated bicycle and pedestrian crossing over I-10 at this mid-mile location between Warner and Ray roads. This new crossing would connect Mountain Vista Park on the west with the Highline Canal trail system east of I-10. The City of Tempe's *Transportation Master Plan* (November 2015) indicated this recommendation as part of its system of bicycle trails and paths.

- **Warner Road traffic interchange:** Upgrade this traffic interchange to improve bicycle and pedestrian facilities to safely cross the freeway, consistent with the *Tempe Transportation Master Plan* (November 2015). More study is needed to determine the appropriate solution to accomplish this and should be integrated in the traffic improvement made to this interchange previously noted in the traffic interchange discussions.
- **Guadalupe Road grade separation:** Add a new dedicated bicycle and pedestrian crossing over I-10 at this grade separation to improve access from the town of Guadalupe to South Mountain Park. Because this is an existing roadway grade separation, more study is required to determine whether this new crossing should be north or south of the existing bridge. Should a crossing south of the existing bridge be chosen, an I-10 median pier is already in place to accommodate this crossing. Based on many comments from the public meeting held in Guadalupe, there is tremendous interest in getting this crossing built, but there are conflicting interests about which side of the road it should be placed. This crossing has been planned for several years and has been part of several previous studies. In addition to the bicycle and pedestrian crossing, a historical flooding issue exists in the southeastern corner of I-10 and Guadalupe Road. In partnership with the Town of Guadalupe, a lined drainage channel is planned to be built in this quadrant to address the flooding and will likely be built with the planned bicycle and pedestrian crossing improvements at this location.
- **Highline Canal trail crossing:** Add a new dedicated bicycle and pedestrian crossing over I-10 at the Highline Canal crossing, approximately 400 feet south of Baseline Road. This new bridge would connect existing and planned trails along the Highline Canal on both the Phoenix (west) side of the freeway and the Guadalupe (east) side of the freeway. This crossing, in conjunction with the Western Canal crossing, would ideally remove bicycle and pedestrian traffic from the Baseline Road interchange, further improving operations and safety. The City of Tempe's *Transportation Master Plan* (November 2015) indicated this recommendation as part of its system of bicycle trails and paths.
- **Western Canal trail crossing:** Add a new dedicated bicycle and pedestrian crossing over I-10 at the Western Canal crossing, located approximately 3,400 feet north of Baseline Road. This new bridge would connect existing trails along the Western Canal on both the Phoenix (west) side of the freeway and the Tempe (east) side of the freeway. This crossing, in conjunction with the crossing at the Highline Canal, would ideally remove bicycle and pedestrian traffic from the Baseline Road interchange, further improving operations and safety. Finally, this crossing would directly link residential neighborhoods with the Arizona Mills shopping mall. The City of Tempe's *Transportation Master Plan* (November 2015) indicated this recommendation as part of its system of bicycle trails and paths.

Figure 6-1. Recommended Alternative, Sheet 1 of 26 (I-10 Segment: SR-202L/Pecos Stack to US-60)

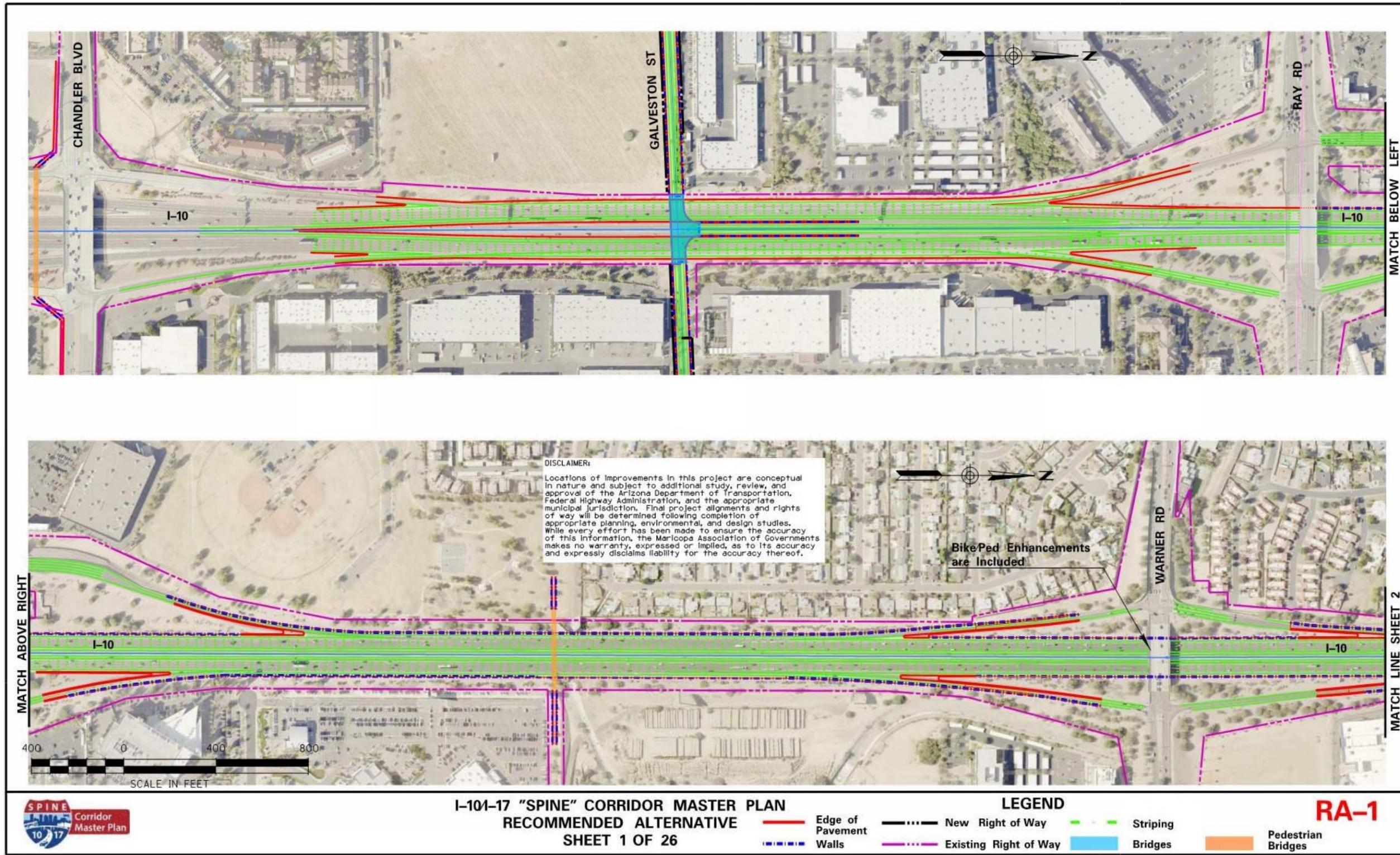


Figure 6-2. Recommended Alternative, Sheet 2 of 26 (I-10 Segment: SR-202L/Pecos Stack to US-60)

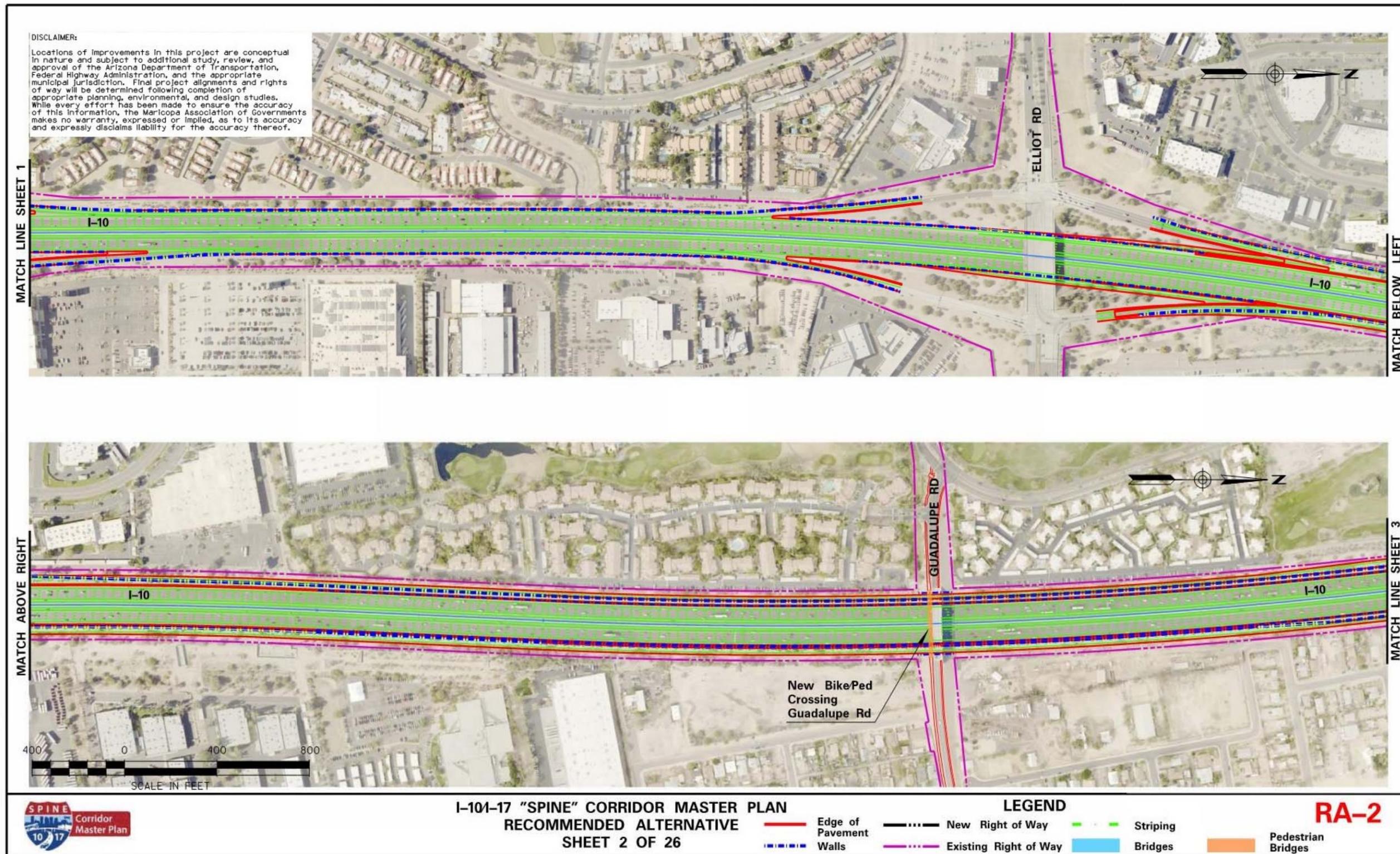
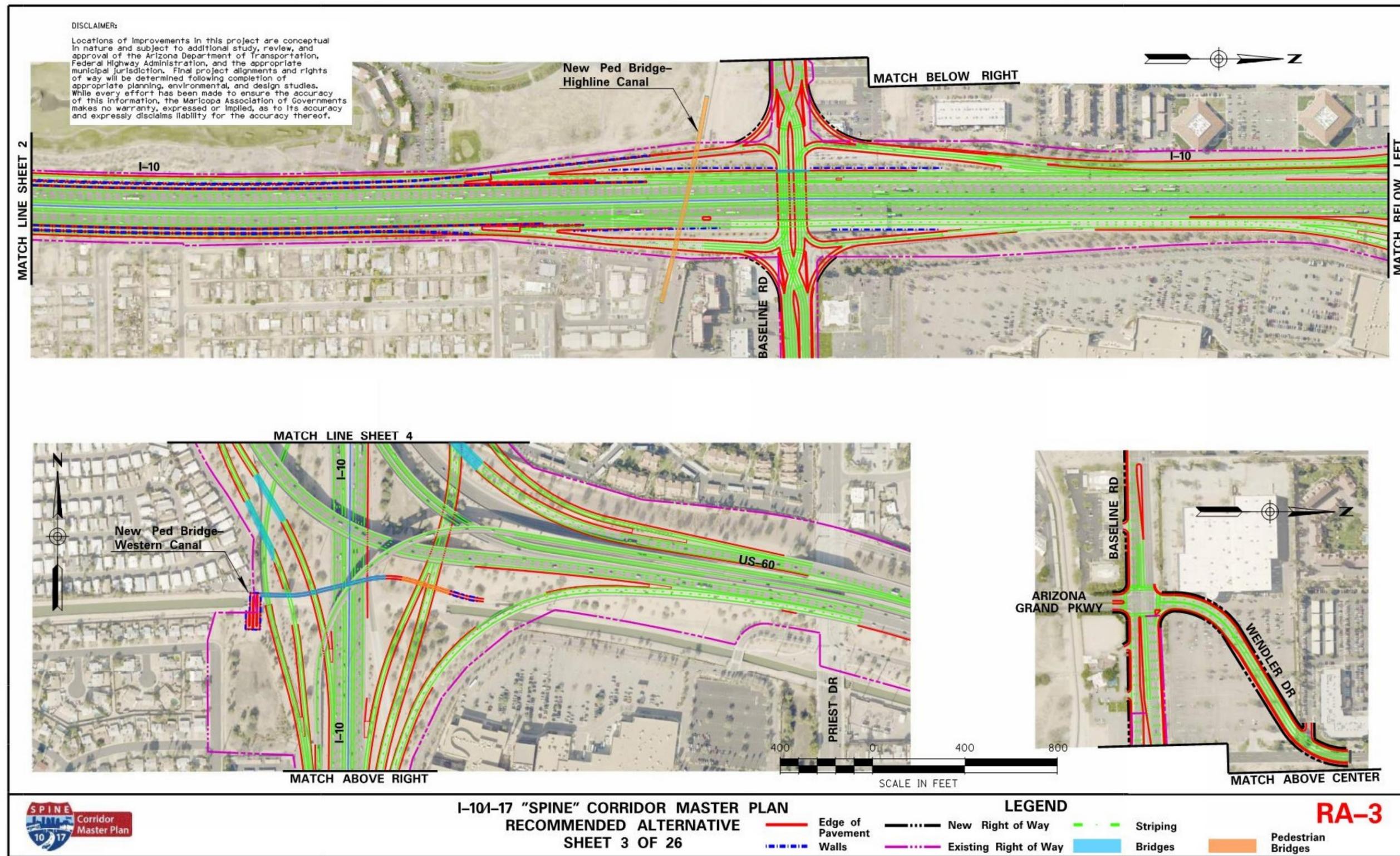


Figure 6-3. Recommended Alternative, Sheet 3 of 26 (I-10 Segment: SR-202L/Pecos Stack to US-60)



6.2.2 Interstate 10: U.S. Route 60 to State Route 143

This segment of I-10 (US-60 to SR-143) is bracketed on both ends by existing system traffic interchanges, one for US-60 and one for SR-143. In the westbound direction, the freeway includes six general purpose lanes and one HOV lane with reduced shoulders, while the eastbound direction includes five general purpose lanes and one HOV lane. The Broadway Road traffic interchange is integrated within the SR-143 traffic interchange.

This segment is recognized as a known capacity constraint in the Spine corridor because of the substantial weaving movements between US-60 and SR-143. Infrastructure condition is acceptable in this segment, although the 48th Street and Broadway Road bridges over I-10 are over 50 years old and limit the widening of I-10. The layout for this segment of I-10 can be found in Figures 6-4 to 6-5 following this segment description.

- **I-10 Main Line Improvements**

The main line improvements would add C-D roads in the westbound and eastbound directions to address the weave section between US-60 and SR-143, commonly known as the “Broadway Curve” segment of I-10 in the metro Phoenix area. Six general purpose lanes on the main line and between two and three general purpose lanes (depending on location) are required on the C-D roads to address capacity. In addition, one additional managed lane (HOV) would be added in each direction to create dual HOV lanes. The dual HOV lanes would extend farther west into the next segment, but the second dual HOV lane would begin/end at the US-60 traffic interchange DHOV ramp. All lane and shoulder widths would be constructed to the current ADOT standards for urban freeway construction to the extent practical. These improvements would enhance safety, reduce congestion and improve travel time reliability.

- **Interchange Modifications**

I-10/US-60 traffic interchange: No major improvements are proposed at the US-60 traffic interchange, except that the C-D roads would be integrated into the interchange so that connectivity to both I-10 and US-60 is maintained. The design would be consistent with the I-10 Near Term Improvements project underway during this Spine study and previous studies by ADOT for the Broadway Curve.

I-10/Broadway Road traffic interchange: The Broadway Road traffic interchange has several issues that are being addressed with this recommendation, as discussed in the following items. In addition, all improvements to the Broadway Road traffic interchange must be designed to be geometrically and operationally compatible with the SR-143 traffic interchange reconstruction, because of its proximity.

- The Broadway Road bridge over I-10 is among the oldest in the corridor. I-10 has been widened to its maximum width under this bridge, but is insufficient for the proposed widening of I-10 as part of the Spine study recommendation. As a result, the interchange reconstruction must replace this bridge.
- Broadway Road is the most continuous alternative parallel arterial route for I-10 and I-17 between 48th Street and 19th Avenue. For this route to be a suitable alternate route for these freeways during times of congestion or incidents, it is desirable to reconstruct the Broadway Road traffic interchange to give high priority to the east-to-south and north-to-west movements. Free flow movements are preferred.
- The eastbound entrance ramp is very short and, during the evening peak hour, queues back onto Broadway Road, mostly from the heavy traffic coming from the west. Because of this, the west-to-south traffic movement from Broadway Road to the freeway is frequently unable to turn left onto this ramp, creating additional congestion problems. To promote the east-to-south movement previously noted, it is desirable to discontinue merging the west-to-south movement with the east-to-south movement. A

loop ramp would accomplish this with low cost. To further enhance the Broadway Road operations, the eastbound exit ramp to Broadway Road (through the 48th Street intersection) would also be eliminated because it disrupts both the 48th Street flow and the Broadway Road operations. Because most of this traffic turns left (east onto Broadway), this movement would now occur at the 48th Street intersection with Broadway Road where left turns already exist, so as not to disrupt the Broadway Road traffic interchange itself. However, if this volume cannot be accommodated at the 48th Street/Broadway Road intersection without degrading operations to an unacceptable level, then a direct free-flow grade-separated ramp to connect eastbound I-10 with eastbound Broadway Road is recommended to avoid reintroducing signal systems on 48th Street and Broadway Road. Note that this design option is not shown in Figure 6-5.

- The northbound exit ramp frequently queues backs onto the I-10 main line. To address this, the recommendation makes the north-to-west movement a free flow movement. The north-to-east right turn movement and the through movement to 52nd Street would be the only two movements that use the ramp terminal signal, which should substantially reduce the queuing length for that exit ramp.

I-10/SR-143 traffic interchange: Like the Broadway Road traffic interchange, the SR-143 traffic interchange requires a complete reconstruction to address several factors:

- The 48th Street/SR-143 bridges over I-10 were built at the same time as the Broadway Road bridges over I-10 and have the same span constraints. As a result, as part of the traffic interchange reconstruction and main line expansion, these bridges must be replaced.
- The two major movements at this interchange are the south-to-east and west-to-north movements. The west-to-north movement is handled with a free flow two-lane ramp and rarely experiences congestion. Therefore, the proposed configuration should perpetuate this free flow two-lane ramp. In contrast, the south-to-east movement is handled with a single-lane, small-radius loop ramp that experiences heavy congestion daily, with queues extending north on SR-143 back to the Sky Harbor Boulevard interchange. The SR-143 traffic interchange reconstruction recommends developing a new free-flow two-lane ramp to handle this volume.
- Because this is an end-of-freeway interchange for SR-143, and because 48th Street extends south of the interchange, it is recommended to make the 48th Street southbound movement a right-hand exit off of SR-143 for driver expectancy.
- For driver expectancy, the DHOV ramp to I-10 coming from southbound SR-143 (discussed on the next page) should exit from the left-hand lane of SR-143.
- Weave sections exist in both directions between I-10 and University Drive along SR-143. The northbound weave rarely experiences congestion issues and may not require an upgrade, but further analysis is required to determine whether this is still true with future volumes. In contrast, the southbound weave is heavily congested on a daily basis. The south-to-east loop ramp queuing is partially to blame for this condition, but the heavy weaving movements approaching this end-of-freeway condition likely warrant a weave solution. Braiding the I-10 and University Drive ramps, coupled with slip ramps to perpetuate all existing movements, is the most likely solution, but other solutions may be equally acceptable if they accomplish the same desired outcome. Because of the tight ROW along SR-143, new ROW would likely be needed to improve these weave sections.
- The other two system ramp movements (south-to-west and east-to-north) are comparatively small compared with the heavy west-to-north and south-to-east movements. As a result, these two lower-

volume ramps should be given a lower capacity priority in the redesign. Because the east-to-north movement is a left turning ramp, a loop ramp is a proper design response for this movement, but a flyover style ramp could be used if it is determined to be a better solution.

- The I-10/SR-143 traffic interchange does not currently include a DHOV ramp. This is mostly because there are no HOV lanes on SR-143, nor are there plans to add them in the near future. As previously noted, the I-10 main line section between US-60 and SR-143 is a major weaving section between these two system connections. While the C-D roads would address the general purpose weaving, the weaving attributed to the HOV traffic on I-10 accessing SR-143 is an equally challenging problem that must be addressed. This is particularly true because a large volume of vehicles going between I-10 (and US-60) and Phoenix Sky Harbor International Airport via SR-143 is more than likely able to use the HOV lanes. Even though no HOV lanes exist on SR-143, the purpose of the DHOV ramp is to avoid HOV weaving on I-10 to realize the full system capacity of I-10. To accommodate this DHOV, the I-10 main line must be flared within the Broadway Curve to make this connection. The vertical geometry of this DHOV would be a challenge because it would need to pass under the Broadway Road bridges, and then rise to cross over the westbound I-10 lanes prior to 48th Street. To accomplish this geometric challenge, the Spine study recommendation proposes to depress the northbound 48th Street roadway under I-10 so that the DHOV connection would only have to rise one level over I-10. Additional study should be performed, however, to identify alternative solutions that may work better or be more cost effective. Elevating northbound 48th Street over I-10 may also be viable if the DHOV connection can still be accommodated geometrically.
- Because ample ROW exists within the interchange, the Spine study recommendation's traffic interchange configuration uses much of this ROW to keep the overall interchange height equal to what exists today. This should minimize visual and noise impacts, especially for residential areas in the southwestern quadrant. This has the added benefit of keeping the overall traffic interchange costs as low as possible. Note that some of the ROW within the interchange is not the current operational ROW for the freeway, but rather is used for ADOT-owned facilities. Costs would be associated with relocating ADOT's Construction and Maintenance offices and the Enforcement Compliance Division's Inspection offices.

- **Arterial Improvements**

No arterial improvements are proposed within this segment, except as noted as part of the Broadway Road traffic interchange and SR-143/48th Street traffic interchange reconstructions.

- **Transit Improvements**

No transit-specific improvements are proposed within this segment beyond adding the second HOV lane on I-10 and adding the DHOV at SR-143. The combination of these two elements should improve the HOV lane operations, safety and travel time reliability for those bus routes that currently use the I-10 corridor.

- **Bicycle and Pedestrian Improvements**

One new bicycle and pedestrian crossing is proposed in this segment at the Alameda Drive mid-mile crossing (between Southern Avenue and Broadway Road). This crossing would link to areas of Tempe, and would link Tempe Diablo stadium to land uses on the eastern side of I-10. This crossing is consistent with the *Tempe Transportation Master Plan* (November 2015).

Because the Spine study recommendation proposes to reconstruct the Broadway Road traffic interchange, it would also be upgraded with bicycle and pedestrian infrastructure presently pursued by ADOT in its construction projects.

Figure 6-4. Recommended Alternative, Sheet 4 of 26 (I-10 Segment: US-60 to SR-143)

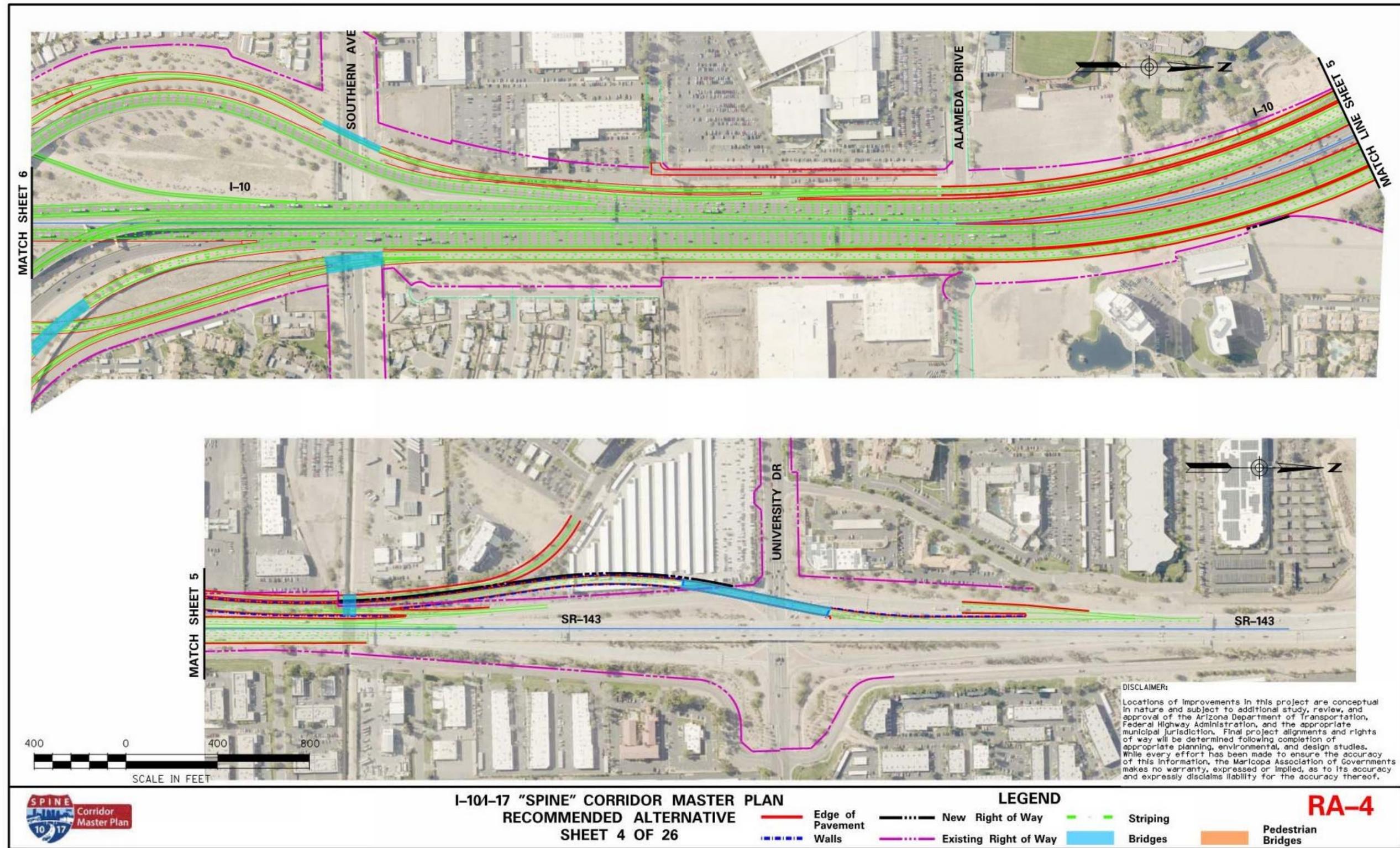
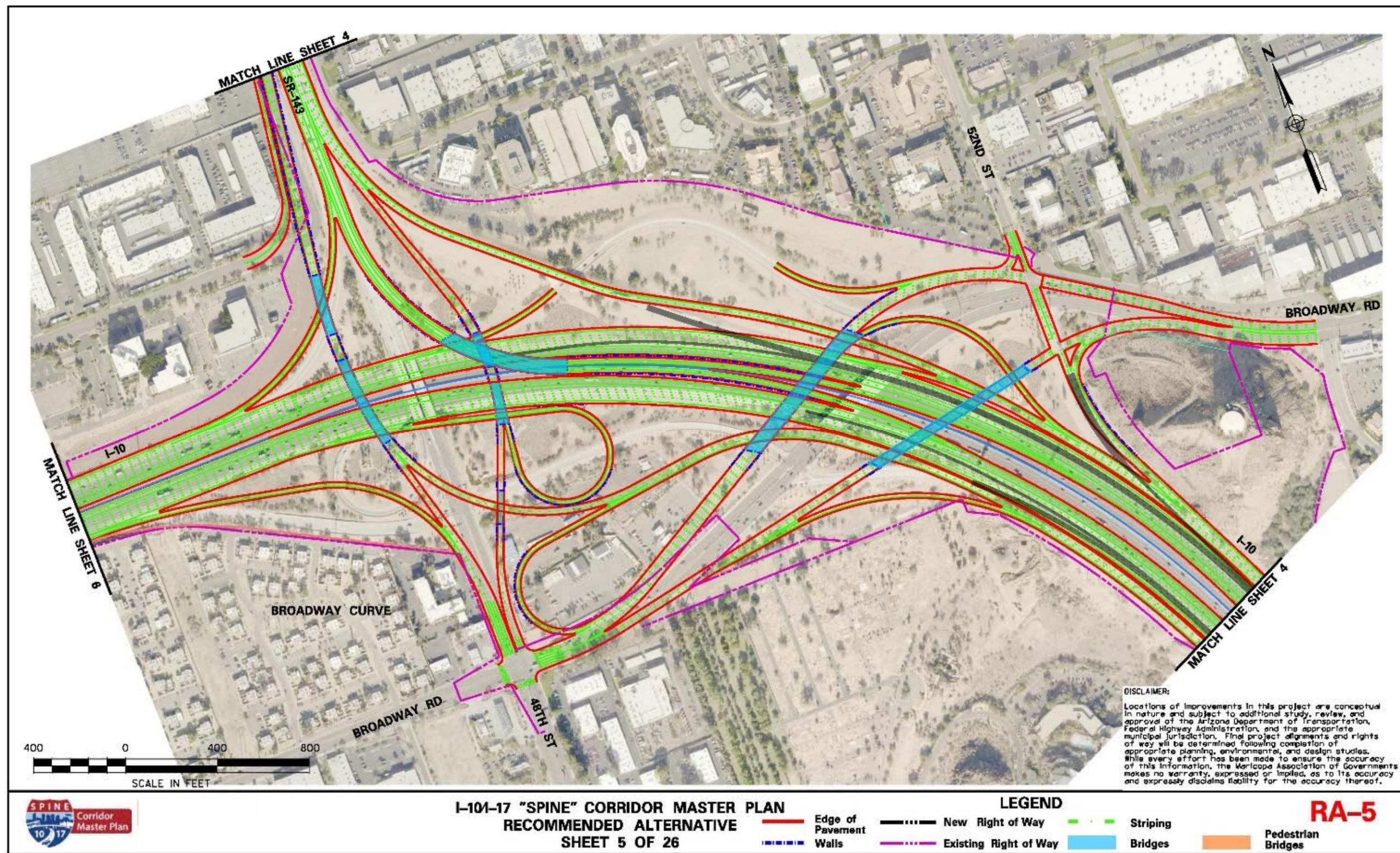


Figure 6-5. Recommended Alternative, Sheet 5 of 26 (I-10 Segment: US-60 to SR-143)



6.2.3 Interstate 10: State Route 143 to the I-17 Split

This segment of I-10 (SR-143 to the I-17 Split) is fundamentally the combination of two freeways: I-10 and I-17/US-60. As a result, all lane drops that exist in this segment create congestion. In the westbound direction, the auxiliary lane drop at the 40th Street exit ramp creates morning queuing through the SR-143 traffic interchange. In the eastbound direction, the three lane drops at 24th, 32nd and 48th streets all contribute to evening peak hour queuing that extends for several miles and can last for several hours. The single HOV lanes in each direction are frequently congested. Infrastructure condition is acceptable in this segment, including the Salt River bridge overcrossing, with no major replacements needed. The layout for this segment of I-10 can be found in Figures 6-6 to 6-7 following this segment description.

- **I-10 Main Line Improvements**

The main line improvements would widen I-10 to six general purpose lanes and two HOV lanes in each direction. All lane and shoulder widths would be constructed to the current ADOT standards for urban freeway construction. A new DHOV ramp is proposed at the Split to connect the second HOV lane on I-10 in this segment to new HOV lanes on I-17 (described for the next segment). The DHOV ramp is not technically part of this segment, but I-10 would need to be widened between the Salt River bridge and the 24th Street bridge to add the required median space for this future DHOV ramp. These improvements would enhance safety, reduce congestion and improve travel time reliability.

The Salt River bridge would need to be widened on both sides to accommodate the widening and the I-10 flaring for the future DHOV connector. The Tempe Drain wetland along the northern edge of I-10 between the Salt River and 32nd Street would require special attention, but impacts should be minimal.

With the introduction of a dual lane HOV system, the agencies may want to further explore the use of limited-access HOV lanes (as opposed to the continuous access practice in use today). Most dual HOV lane operations in other parts of the United States have introduced limited-access as a means to enhance safety and protect differing traffic flow speeds. Appendix B includes a technical study researching the limited access facilities. While inconclusive, it is apparent that further discussions are needed among the agencies to determine whether this is the correct approach for the MAG region.

- **Interchange Modifications**

I-10/40th Street traffic interchange: This location ranks 30th out of the 37 crossings in the Spine corridor. No major upgrades are proposed at this traffic interchange because the current bridge would adequately span the proposed improvements. The existing loop ramp in the southwestern quadrant may need to be removed to convert the traffic interchange to a standard diamond configuration. This removal is anticipated because the wider I-10 main line may result in a smaller and geometrically unacceptable loop ramp for the existing south-to-east movement because of ROW constraints. Other relatively low-cost interchange improvements such as additional turning/through lanes may be warranted. These issues would require further study to determine the appropriate course of action.

I-10/32nd Street traffic interchange: The 32nd Street location ranks 23rd out of 37 crossings in the Spine corridor. No major interchange upgrades are proposed except for the bicycle and pedestrian upgrades noted in the following. Relatively low-cost interchange improvements such as additional turning/through lanes may be warranted after further study, and should be coordinated with the City of Phoenix.

I-10/24th Street traffic interchange: The 24th Street location ranks 15th out of 37 crossings in the Spine corridor. Because the freeway crosses over 24th Street, the bridges are in acceptable condition, and the 24th Street bridge is close to Phoenix Sky Harbor International Airport, no major interchange upgrades are proposed except for the bicycle and pedestrian upgrades noted in the following.

- **Arterial Improvements**

No arterial improvements are proposed within this segment, except as noted as part of the traffic interchange modifications previously mentioned. However, in cooperation with the City of Phoenix, Broadway Road should be considered an alternative route in the event of Interstate closures or congestion.

- **Transit Improvements**

Transit-specific improvements are limited to adding a second HOV lane on I-10. The dual HOV lane would improve operations, safety and travel time reliability for existing and future bus routes that use the I-10 corridor.

- **Bicycle and Pedestrian Improvements**

Both the 32nd Street and 24th Street traffic interchanges warrant upgrades for bicycle and pedestrian movements, consistent with the *Phoenix Comprehensive Bicycle Master Plan* (November 2014). The nature of these improvements is not specifically defined, but is largely meant to target areas where bicycle and pedestrian movements are planned, where they exist with inadequate facilities, or where bicycle and pedestrian safety is a concern. Upgrading the 32nd Street traffic interchange would complement the University of Phoenix users in the southwestern corner. Finally, any improvements to the 40th Street traffic interchange would be done by incorporating the latest bicycle and pedestrian infrastructure for interchanges.

Figure 6-6. Recommended Alternative, Sheet 6 of 26 (I-10 Segment: SR-143 to I-17 Split)

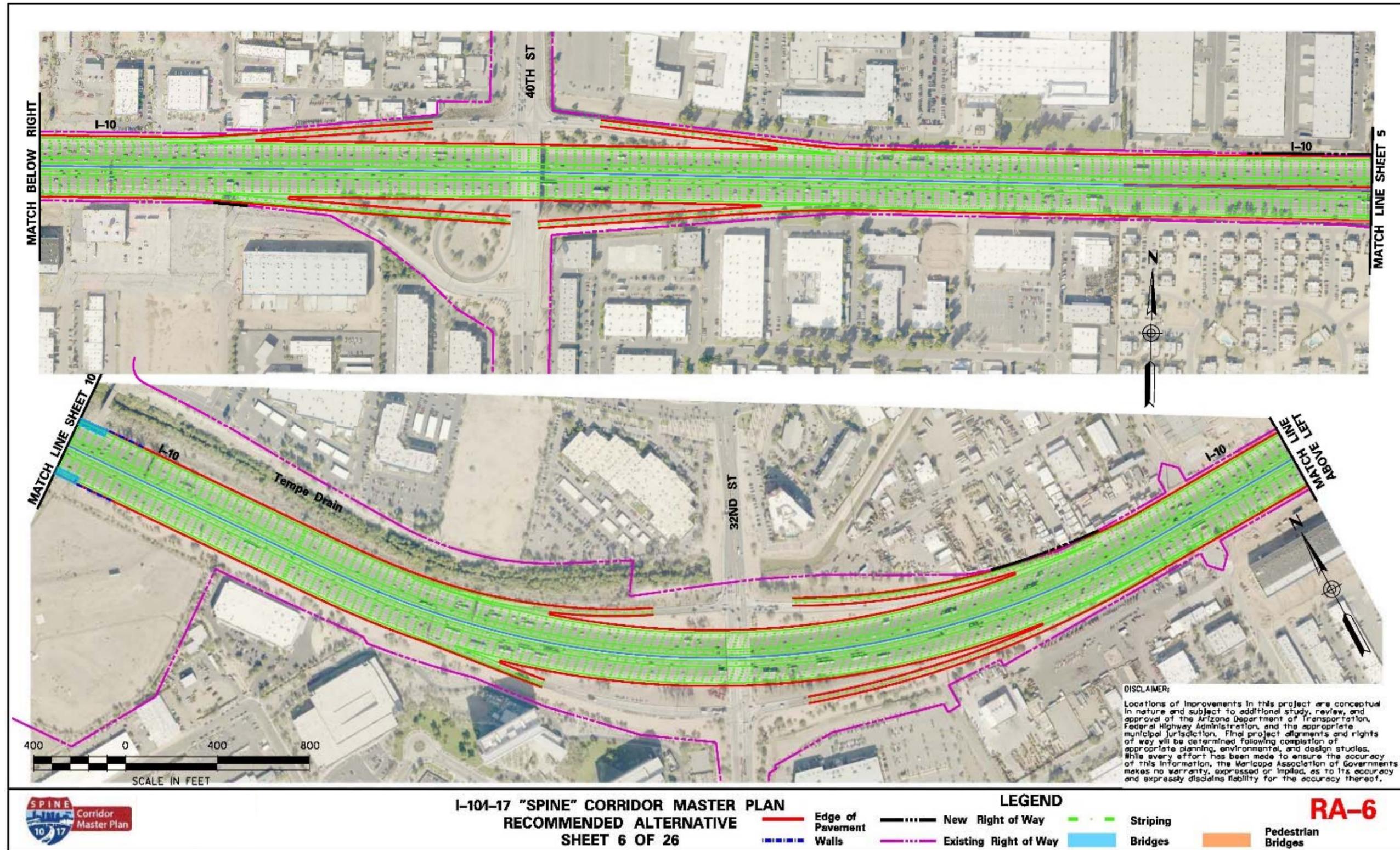
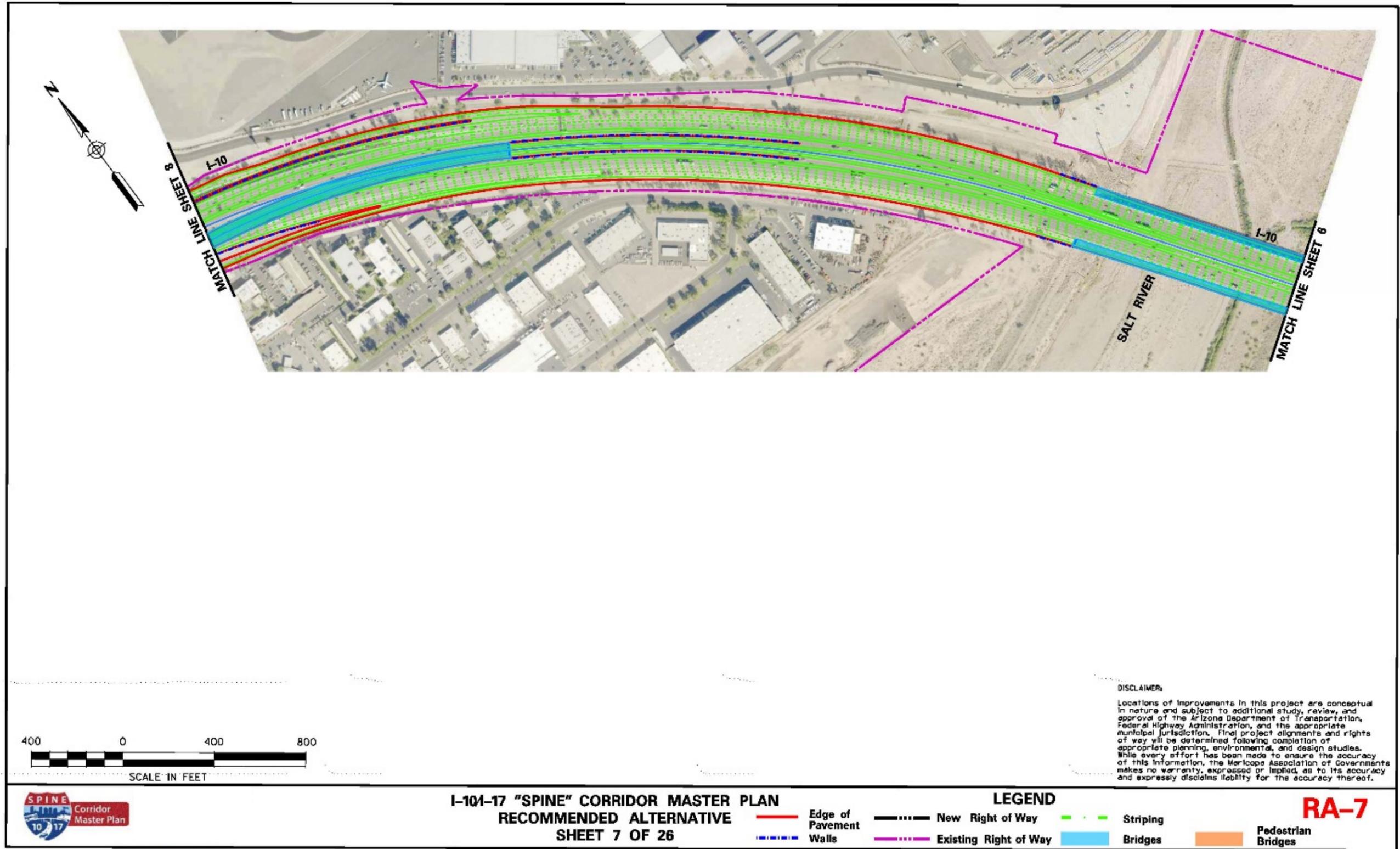


Figure 6-7. Recommended Alternative, Sheet 7 of 26 (I-10 Segment: SR-143 to I-17 Split)



6.2.4 Interstate 17: I-10 Split to the I-10 Stack

This segment of I-17 (I-10 Split to the I-10 Stack) is the oldest section of Interstate in the MAG region and includes three general purpose lanes and no HOV lanes in each direction. As noted in the NAR, bridges, pavements and drainage systems/outfalls are near the end of their service lives and need complete replacement. Expanding freight operations south of downtown Phoenix further point to the need for a complete replacement of this segment of I-17. Because portions of this segment predate the Interstate system, design elements are deficient when compared with current standards. These deficiencies are attributed to the age of construction and include substandard shoulder widths, inadequate ramp acceleration and deceleration lengths, inadequate vertical clearance at the bridge crossings and the lack of auxiliary lanes. Continuous one-way frontage roads exist along I-17, providing local access to adjacent properties and the freeway itself. From the Split to 19th Avenue, interchange designs are typical diamond-type configurations with intermixed grade separations for local roads and active and retired rail spur crossings. However, from 19th Avenue to the Stack, interchanges are fragmented into random ramps and lack any consistent access strategy. ADOT's TOC is located in the southwestern corner of the Durango Curve.

Three major transportation facilities are planned to interact with this segment of I-17. Two of these are planned Valley Metro light rail transit crossings: one at Central Avenue and one at Van Buren Street. At Central Avenue, the Valley Metro South Central Extension planning is underway. Because the Spine corridor recommendation proposes to replace this bridge and improve the vertical clearance, this bridge replacement work is being expedited early so that the new bridge can be in place prior to light rail transit passing under it. At Van Buren Street, the light rail would pass over I-17, using this crossing. Because the Spine corridor recommendation proposes replacing this bridge, its replacement should be coordinated with the Capitol/I-10 West Light Rail Transit Extension project.

Finally, MAG recently adopted a plan to extend SR-30 east from the SR-202L connection so that it ultimately connects to I-17 at or near the Durango Curve. SR-30 is a new freeway planned to extend from I-17 in downtown Phoenix to SR-85 in Buckeye, for a distance of 31 miles. This corridor is envisioned to provide relief to I-10 in the West Valley. Although a relatively new project in the freeway system, and presently unfunded at this time, all necessary care should be taken to ensure future compatibility with this connection.

The layout for this segment of I-17 can be found in Figures 6-8 to 6-13 following this segment description.

- **I-17 Main Line Improvements**

The main line improvements would reconstruct all I-17 pavements and bridges in their entirety and would provide three general purpose lanes and one HOV lane in each direction. Auxiliary lanes would be added where needed. All lane and shoulder widths would be constructed to the ADOT design standards for urban freeway construction to the extent practical. To extend HOV lanes through the Stack, no additional widening would be needed, because widening would be done through restriping and employing design exceptions where needed to avoid major reconstruction of the Stack.

3rd Street is an old railroad crossing of I-17. This track is no longer in existence and there is no need to perpetuate this crossing, so the 3rd Street bridges would be removed and not replaced. These improvements would modernize this aged section of I-17, standardize interchange configurations, enhance safety, reduce congestion and improve travel time reliability.

A new DHOV ramp is proposed at the Split interchange to connect the new I-17 HOV lanes to the dual HOV lanes on I-10 (described in the previous segment). The DHOV ramp is recommended to pass along the southern side of the Split, roughly following the south ROW line. This requires the DHOV to transition from

the median of I-17 to the south ROW just east of 16th Street and then transition back to the median of I-10 near 24th Street. This unusual (and costly) DHOV design is required to avoid adverse impacts on the Phoenix Sky Harbor International Airport airspace around the south runway.

A new DHOV interchange is also proposed at I-17 and 7th Street and is discussed in detail in the following. As it applies to the I-17 main line, the two directions of I-17 roadways need to be flared to account for the DHOV ramps that could exist from both sides of the interchange.

As previously noted, it should be expected that the Durango Curve may be the future site of the SR-30 connection. As such, design features should be included in the reconstruction to accommodate this future interchange. This could include realigning I-17 to account for a future DHOV connector to and from SR-30, altering the profile of I-17 for an easier connection, or modifying adjacent service interchange ramp locations to avoid future operational issues. More detailed study is required at this location to determine a suitable course of action.

Also, as previously noted, the future Valley Metro light rail transit crossings would need to be coordinated early to ensure these bridges are replaced with both ultimate facilities in mind.

Between the 16th Street and 7th Street traffic interchanges, and between the 7th Avenue and 19th Avenue interchanges, the study recommends reversing the ramps' order (sometimes referred to as "X-ramps") in these miles. These two 1-mile segments would be unique in the Spine corridor with this reverse ramp configuration. This configuration means that the weaving section would be removed from the main line and relocated to the frontage road.

The overarching reason for this ramp change is twofold. First, the weaving section on the main line is challenging for the heavy truck volumes to navigate, so by putting it on the frontage road and then making the ramps longer and flatter, trucks and other vehicles would be much safer. Second, the two west side 7th Street ramps are very steep because they must cross over the 11th Avenue railroad spur with 23.5 feet of vertical clearance. The reverse configuration means that these ramps would no longer cross over the railroad spur. Details about why this configuration is being recommended can be found in Appendix D in the Value Planning Report. While the reverse ramp configuration is part of the recommendation for the reasons noted, further study is warranted to test its effectiveness. Should the reverse ramps be implemented, a change of access report would be required by FHWA.

- **Interchange Modifications**

I-17/16th Street traffic interchange, I-17/7th Street traffic interchange, I-17/Central Avenue grade separation, I-17/7th Avenue traffic interchange, I-17/19th Avenue traffic interchange: These four locations ranked 18th, 21st, 20th, 9th and 5th out of the 37 crossings in the Spine corridor, respectively. Given condition and capacity issues, all of these crossings (including all other grade separations in this section) are proposed for reconstruction. These reconstructions would replace the main line bridges over the crossroads (and railroad tracks), increase vertical clearance to standard dimensions and lengthen bridges to upgrade crossroad cross sections.

At both 7th and 19th avenues, additional through and turn lanes are required to accommodate demand, resulting in their high priority scores. Furthermore, at 7th Street, this traffic interchange would be reconstructed to add a DHOV ramp to and from the east (I-17 South) in the median to provide a southern route into downtown for the express buses from the Southeast Valley.

It is assumed that the ultimate SR-30 connection would include a DHOV connection at the Durango Curve. Correspondingly, the 7th Street traffic interchange DHOV connection would be configured to accommodate future DHOV ramps to and from the west to accept those DHOV movements into the downtown core. The Central Avenue grade separation would be designed to accommodate the future light rail transit crossing under the bridge. Finally, the 15th Avenue and 11th Avenue grade separations would be replaced, the latter being an active railroad spur line crossing in the middle of 11th Avenue.

Grant Street traffic interchange, Jefferson/Adams Street traffic interchange, Van Buren Road grade separation: These three locations score 16th, 24th and 26th out of 37 crossings in the Spine corridor. This section of I-17 is a depressed freeway, so all of these crossings pass over the freeway. All bridges in this section, including those previously noted and the UPRR bridge and Buckeye Road bridge, would be replaced because of their condition and because their current configurations would not span the recommended I-17 widening. In addition, this is the section of I-17 with partial interchanges and random ramps. To standardize the access along this section of I-17, the Spine study recommendation proposes to eliminate the Grant Street traffic interchange ramps because these are very low-volume ramps and would be in conflict with the future SR-30 interchange system ramps. The I-17 frontage roads would remain, so access between I-17 and Grant Street would be altered, but maintained. All other ramps would be removed and replaced with a standard split diamond configuration at the Jefferson/Adams Street one-way couplets. This would be the only service interchange in this segment of I-17 between the Stack and the future SR-30 interchange. A change of access report would be required by FHWA. Finally, the Van Buren Road bridge over I-17 would be replaced with a longer span bridge to accommodate the I-17 widening. In addition, it is expected that the profile of Van Buren Road would be raised to the extent possible to provide additional length to the north side Jefferson/Adams traffic interchange ramps that have to cross under this grade separation. The Van Buren Road bridge would be replaced in a coordinated manner with the planned Valley Metro light rail transit Capitol/I-10 West crossing at this location. Further study is needed to determine the optimum manner in which this crossing is to be made.

I-10 Stack: The only improvement is to restripe the I-17 main line through the Stack for the addition of the new HOV lane in each direction. As previously noted, no major upgrades are envisioned for this traffic interchange because its age is not a significant factor and because modifications would be extremely expensive and would have dramatic impacts on the surrounding areas.

- **Arterial Improvements**

As previously noted, this section of I-17 has continuous one-way frontage roads along both sides of the freeway. The Spine study recommendation proposes to perpetuate and modernize these frontage roads and crossroad intersections to maintain local access, enhance safety and capacity, and provide I-17 main line redundancy during times of congestion or incidents.

Two-lane frontage roads are desirable, but single-lane frontage roads should be selectively used in areas where ROW is a substantial constraint. Because of the I-17 improvements, these frontage roads would likely be completely reconstructed, and in some cases would be relocated as well, requiring some new ROW. The exception would be the southbound frontage road between the Stack and Van Buren Road. This segment of roadway is planned to be the route for the Valley Metro light rail transit connecting downtown Phoenix with the I-10 West route. The frontage road needs to be closed for this alignment to be geometrically feasible and to avoid major impacts on the cemetery in the southwestern quadrant of the Stack. Initially, this route is being envisioned as a bus-only connection until the light rail transit is constructed.

In addition to the frontage roads, significant improvements are anticipated along 7th Street (to accommodate the DHOV connection) and 7th and 19th avenues to accommodate the additional through and turning lanes at their upgraded traffic interchanges.

- **Transit Improvements**

This segment of the Spine corridor recommendation has significant benefits for transit. The addition of HOV lanes to this segment, coupled with the DHOV at the Split, would be a welcome link that would connect the HOV systems in the North and Southeast Valley. In addition, the new DHOV traffic interchange at 7th Street would provide a long-overdue HOV connection into the downtown core from the south for both transit users and other HOV traffic. In the short term, this DHOV connection would benefit the many users of existing and future bus routes from the southeast part of the Valley. Presently, existing routes use the out-of-direction I-10/3rd Street DHOV ramp to access downtown.

Accommodations for the light rail transit crossings at both I-17/Central Avenue and I-17/Van Buren Road, including the southbound frontage road conversion to bus-only/light rail transit routes, would be important interface points of the two systems and should be coordinated early to ensure that optimum solutions are found for both the freeway and the transit.

- **Bicycle and Pedestrian Improvements**

All of the reconstructed traffic interchanges would be redesigned using current bicycle and pedestrian infrastructure design standards and features for interchanges. However, the Jefferson/Adams traffic interchange would require special attention because it is the one route in this segment identified in the *Phoenix Comprehensive Bicycle Master Plan* (November 2014) as a planned bicycle route.

Figure 6-8. Recommended Alternative, Sheet 8 of 26 (I-17 Segment: I-10 Split to I-10 Stack)

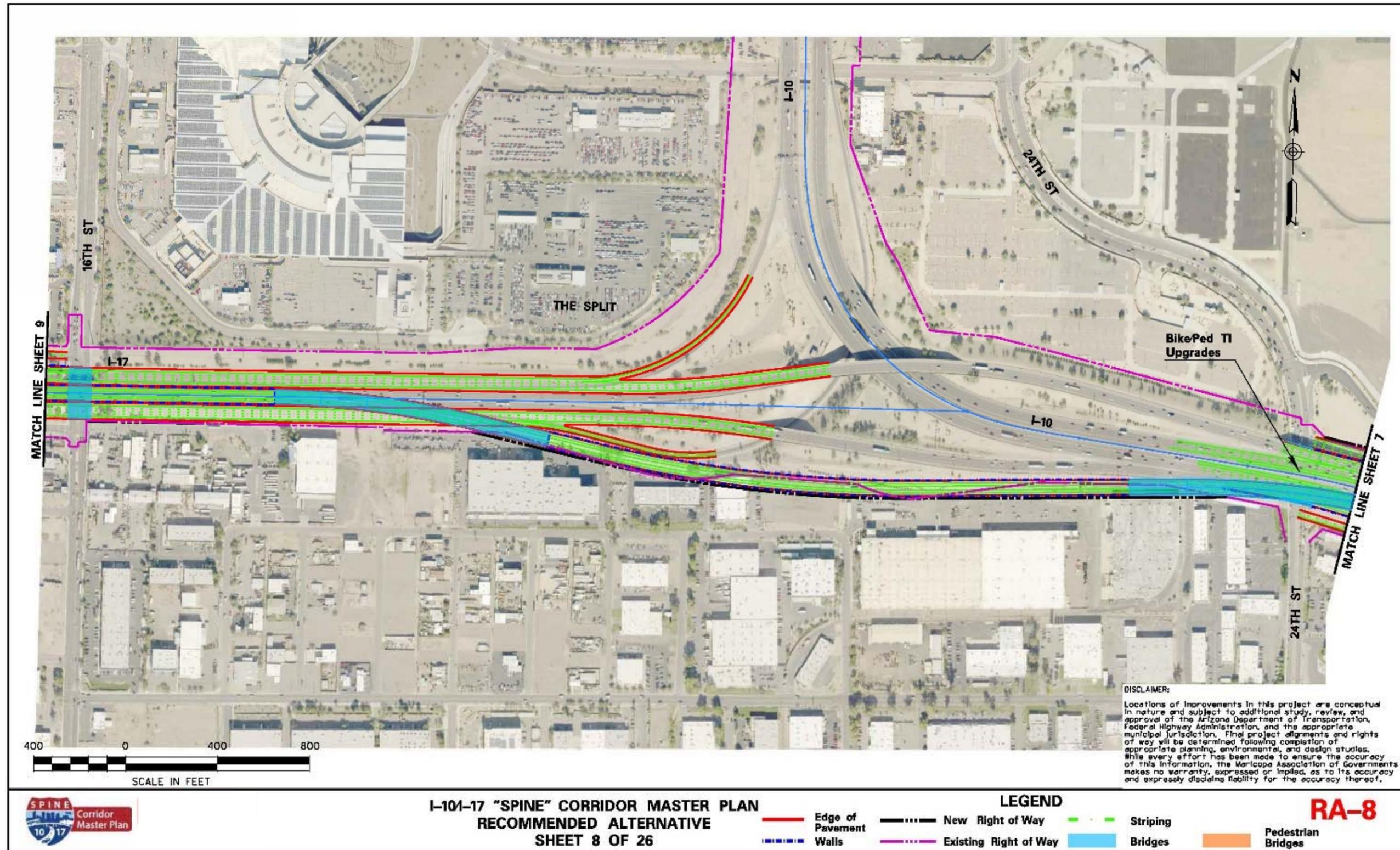


Figure 6-9. Recommended Alternative, Sheet 9 of 26 (I-17 Segment: I-10 Split to I-10 Stack)

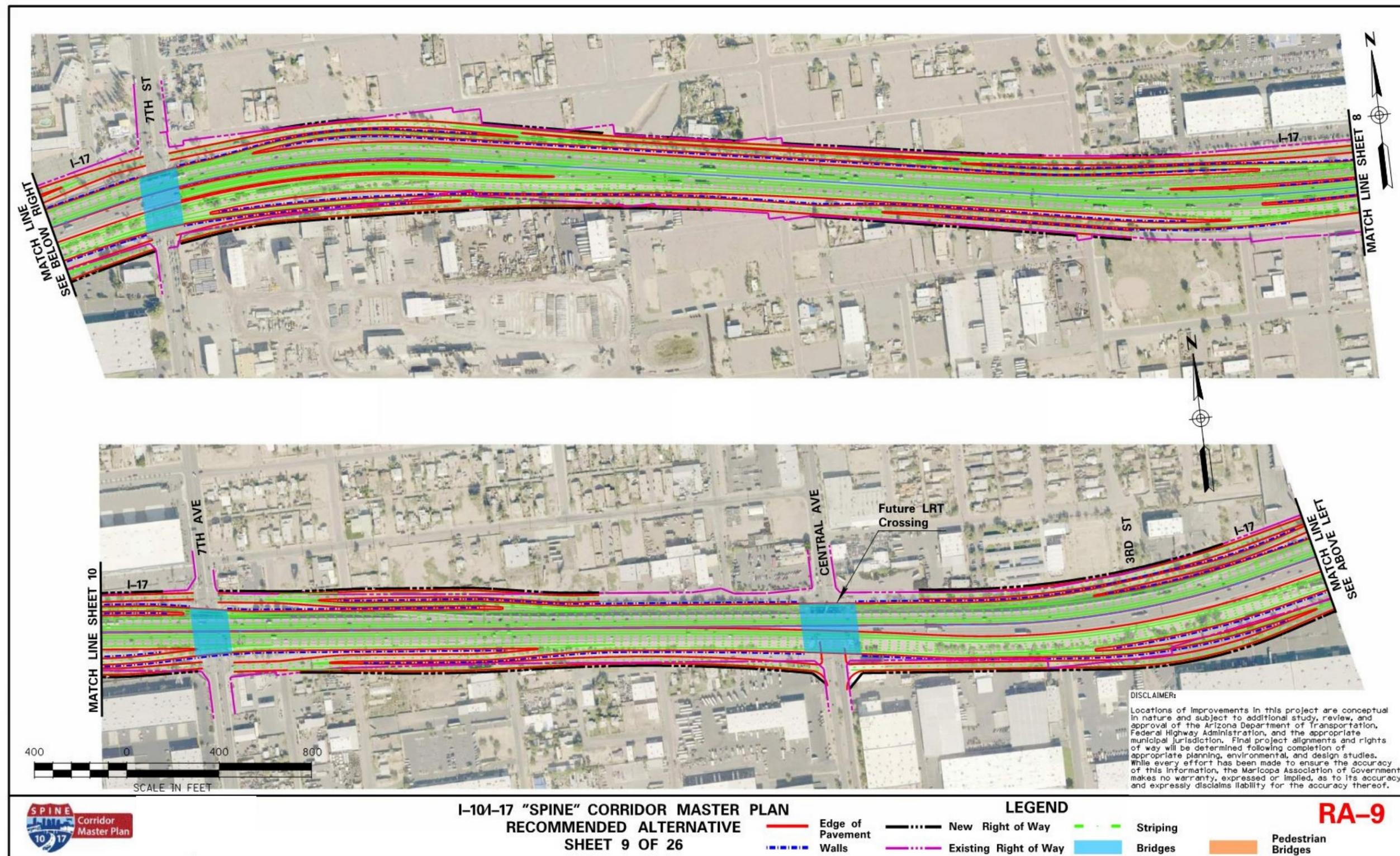


Figure 6-10. Recommended Alternative, Sheet 10 of 26 (I-17 Segment: I-10 Split to I-10 Stack)

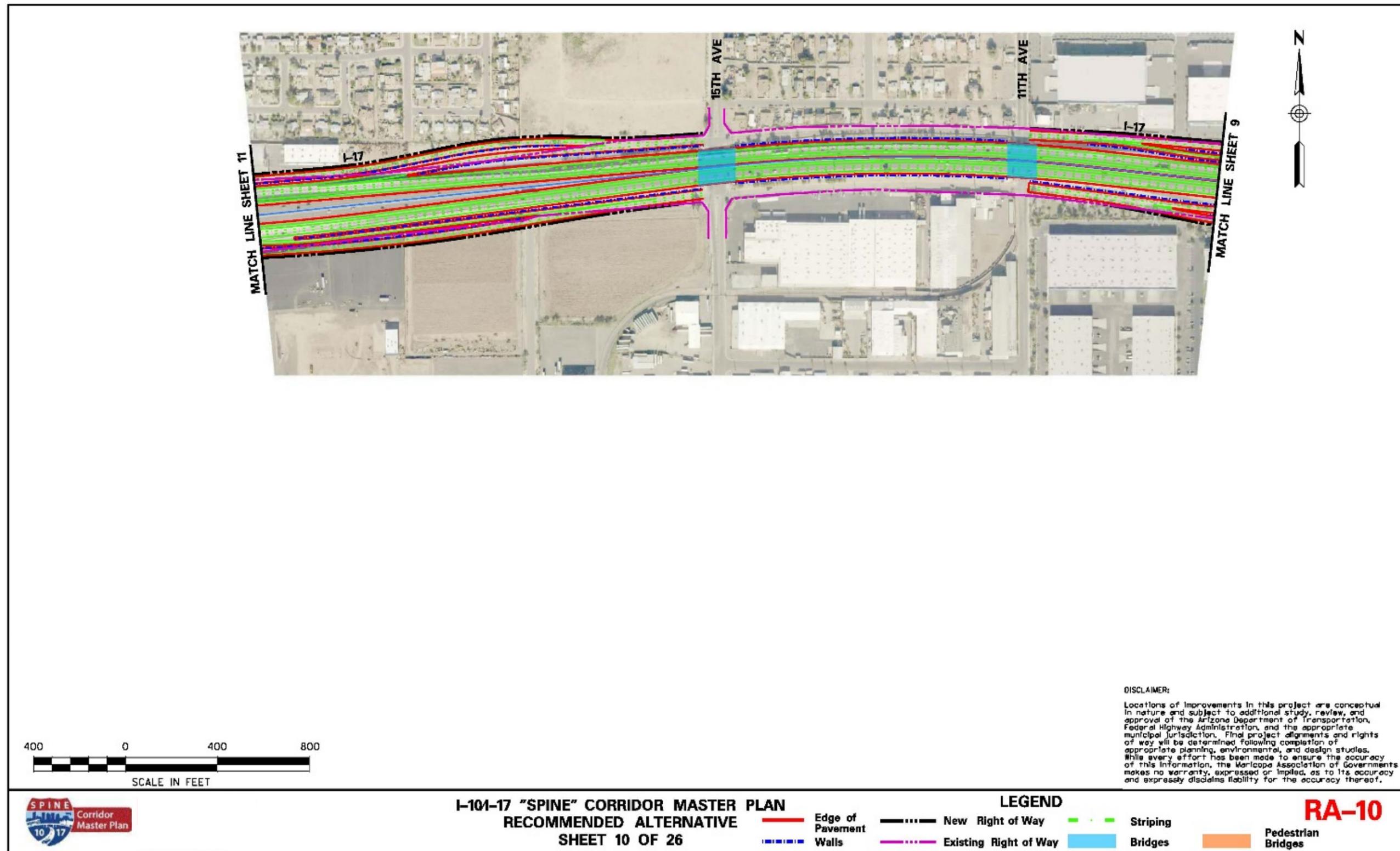


Figure 6-11. Recommended Alternative, Sheet 11 of 26 (I-17 Segment: I-10 Split to I-10 Stack)

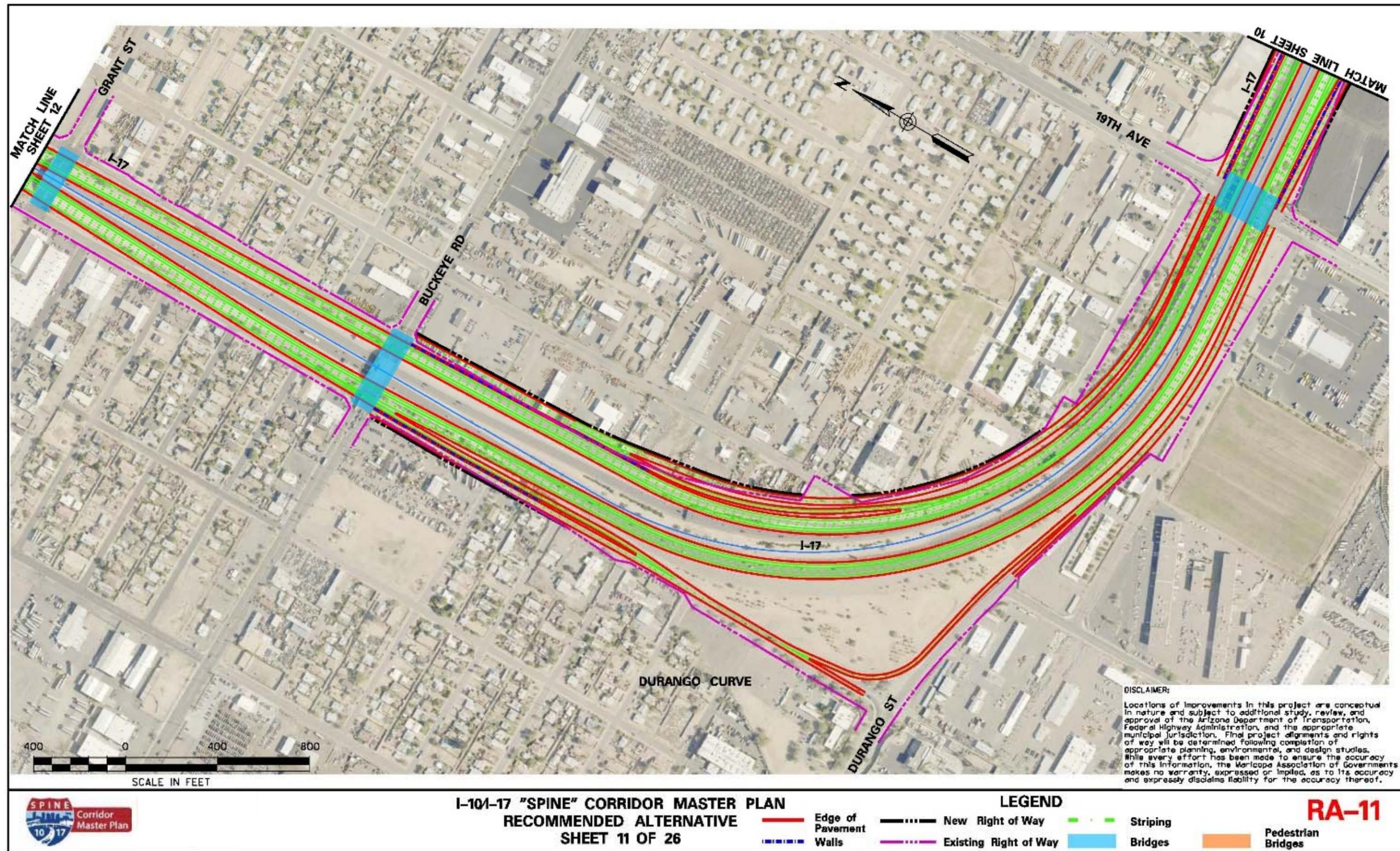


Figure 6-12. Recommended Alternative, Sheet 12 of 26 (I-17 Segment: I-10 Split to I-10 Stack)

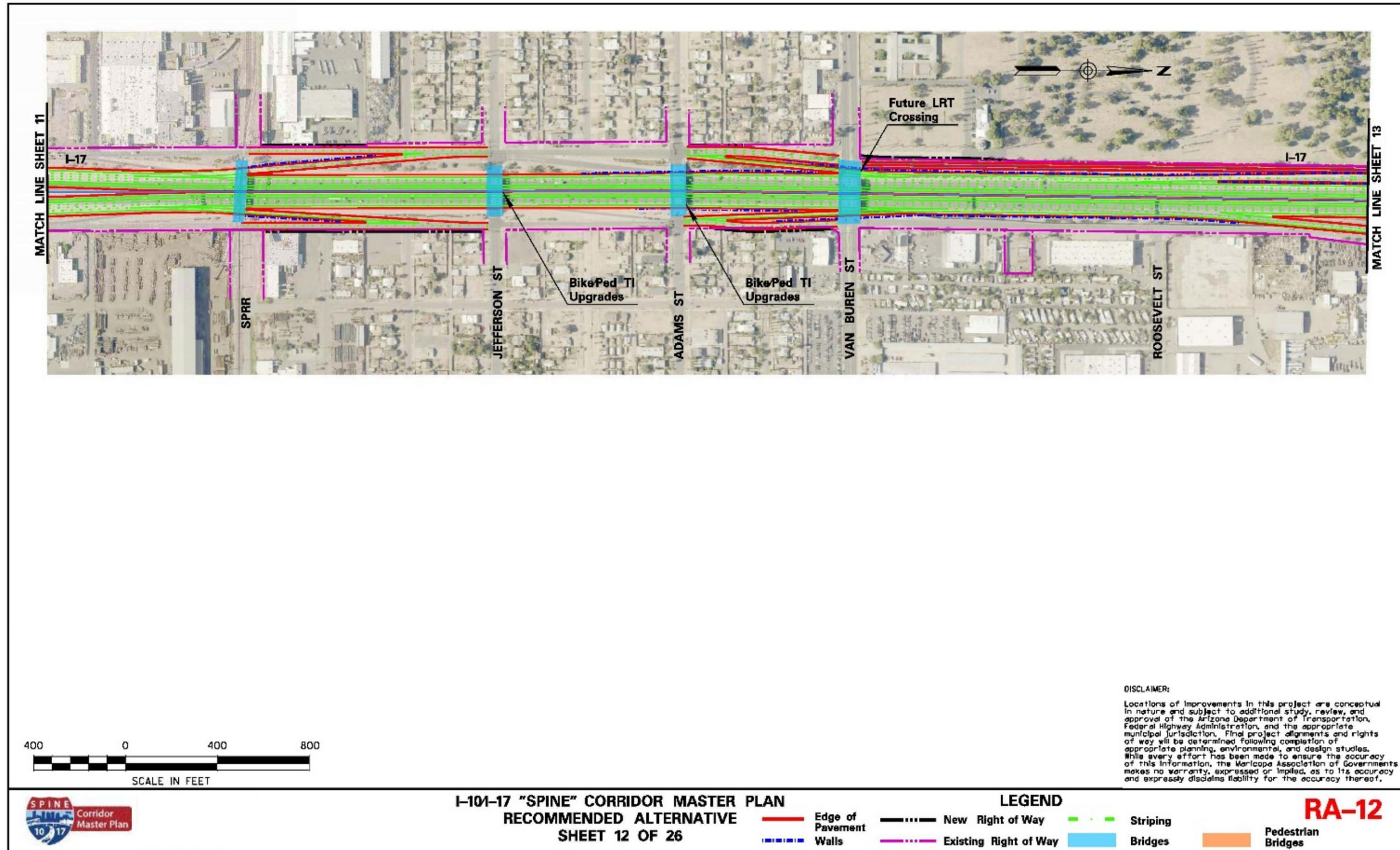
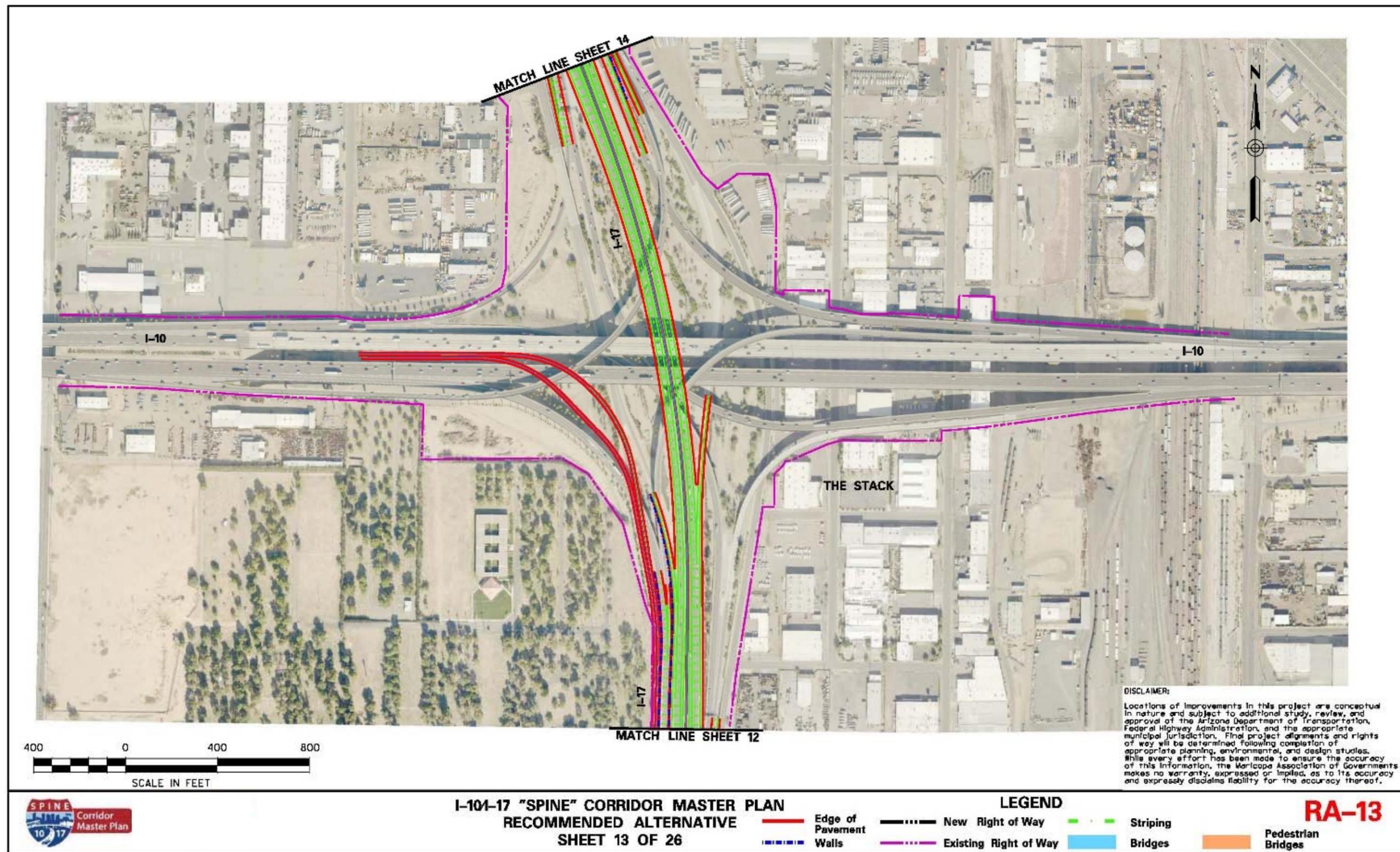


Figure 6-13. Recommended Alternative, Sheet 13 of 26 (I-17 Segment: I-10 Split to I-10 Stack)



6.2.5 Interstate 17: I-10 Stack to Dunlap Avenue

This segment of I-17 (I-10 Stack to Dunlap Avenue) is the second-oldest section of Interstate in Arizona and presently has three general purpose lanes, one HOV lane and one auxiliary lane in each direction. Some bridges and areas of pavement are old and in need of replacement, whereas other bridges are relatively new and do not require replacement. Continuous one-way frontage roads exist along I-17, providing local access to adjacent properties. In some cases, the sole access is from the frontage roads. All interchanges are either tight diamonds or SPUI configurations with frontage road movements. Currently, the northbound HOV lane begins just north of the Stack. In the southbound direction, the HOV lane abruptly turns into a general purpose lane just north of Indian School Road to allow HOV users adequate distance to transition to the Stack ramps. The profile of I-17 can be described as rolling, with the main line depressing under the arterials, but then rising up to grade through the mid-mile segments. As a result, no mid-mile crossings exist. Draining the main line sumps is handled by pump stations that outfall the flows into a large-diameter storm drain pipe under the southbound frontage road.

This segment of I-17 includes overcrossings for both US-60/Grand Avenue and BNSF at a 45-degree skewed crossing just south of Thomas Road. Until the construction of the I-10 Stack interchange, access was provided between I-17 and US-60. The Stack traffic interchange construction necessitated eliminating the US-60 access to I-17.

One Valley Metro light rail transit crossing is planned within this segment near Camelback Road. The West Phoenix-Central Glendale Extension is planned along this route and needs to cross I-17 on or near Camelback Road with the final route to be decided in early 2018.

When examining potential improvements for I-17 in this part of the Spine corridor, the study team considered how the freeway affects traffic flow in the surrounding area. A statistic that was uncovered during the Spine study is that more traffic crosses I-17 than traffic using the freeway interchange itself. Because no mid-mile crossings exist in this segment, all east-to-west traffic must cross I-17 at the traffic interchanges. This constraint breaks down the operations of the traffic interchanges and limits movement across the Interstate. A major emphasis as part of the Spine study recommendation was to provide east-to-west relief for all crossings of I-17.

The layout for this segment of I-17 can be found in Figures 6-15 to 6-21 following this segment description.

- **I-17 Main Line Improvements**

The Spine study recommendation proposes to widen I-17 throughout this length to provide three general purpose lanes, two HOV lanes and one auxiliary lane in each direction. All lane and shoulder widths would be constructed to the modern ADOT design standards for urban freeway construction to the extent practical. It is recognized that in this section of I-17, full-width standards may be cost-prohibitive or may create substantial impacts on the adjacent ROW, so more study is required to determine the appropriate solution. The *MAG Central Phoenix Framework Study* evaluated potential freeway sections and the reasonable widening limitations in this area and is a good reference for additional information. Toward the southern end of this segment, a single HOV lane would be added by widening and striping to connect to the new HOV lanes being added through and south of the Stack. The second HOV lane in each direction would terminate at Grand Avenue, where a new DHOV ramp connection to Grand Avenue would be constructed to and from the north. I-17 would need to flare to accommodate this DHOV ramp, anticipated to be located just north of Thomas Road.

Within this segment, all main line pavement would be replaced because it is far beyond its design life. However, many of the bridges over I-17 were replaced in the early 2000s and do not require replacement. The exceptions to this include the Grand Canal bridge (63 years old in 2017 and nearing the end of its useful life), the BNSF bridge, the Grand Avenue bridge and the McDowell Road bridge. These improvements would modernize this aged section of I-17, enhance safety, reduce congestion and improve travel time reliability.

As previously noted, the future Valley Metro light rail transit crossing at Camelback Road would need to be coordinated early to ensure this traffic interchange is modified with both ultimate facilities in mind, should the final alignment of the light rail transit be selected within the Camelback Road traffic interchange.

- **Interchange Modifications**

I-17/US-60 Grand Avenue and I-17/Thomas Road traffic interchange: These two locations ranked 32nd and 7th out of the 37 crossings in the Spine corridor, respectively. The bridges over I-17 for both Grand Avenue and the BNSF railroad are inadequate for the proposed I-17 widening and must both be replaced. It seems that the Thomas Road bridge span is adequate for the main line widening, and because limited improvements can be done at the Thomas Road traffic interchange, a replacement is not warranted. As part of the Grand Avenue crossing reconstruction, Grand Avenue would be developed to accept a DHOV ramp to and from the north. The Spine recommendation has conceptually developed a solution to accomplish this where the DHOV ramps would exit the I-17 median north of Thomas Road, cross to the west ROW and then stay on the structure until it crosses over Thomas Road where it would intersect with Grand Avenue. Coupled with this DHOV connection at Grand Avenue, improved connectivity between Thomas Road and Grand Avenue is proposed so that the DHOV traffic can access downtown Phoenix via Grand Avenue or the Central Avenue business district via Thomas Road and vice versa. As a result, improvements to the Thomas Road traffic interchange may be justified. This needs further study to determine the appropriate design details in this area but should consider the addition of a third eastbound lane on Thomas Road between the traffic interchange and 23rd Avenue.

I-17/Indian School traffic interchange, I-17/Camelback traffic interchange, I-17/Glendale traffic interchange, I-17/Northern traffic interchange: As previously noted in Chapter 4 of this report, several interchanges were identified where east-to-west travel demand was high, and where east-to-west regional connectivity was substantial. These four interchanges were all identified as being the best candidates for high-capacity interchanges that emphasized the east-to-west through movements. Three-level diamonds, or some equivalent high-capacity design, are proposed at these four locations. These locations rank as 17th, 8th, 11th and 13th out of 37 crossings in the Spine corridor, respectively. An example of a three-level diamond interchange is shown in Figure 6-14.

The need for upgrades is high. The primary reasons the three-level diamond configuration was recommended is because this high-capacity service traffic interchange design is compact and fits well within highly developed areas, is compatible with frontage roads, can maintain access to adjacent properties along the arterial corridor with U-turn movements, and improves bicycle and pedestrian safety within the interchange. At the Camelback Road traffic interchange, the three-level diamond has the added advantage of integrating the light rail transit into the median of the east-to-west flyover structure, significantly simplifying the light rail transit crossing of I-17 without negatively affecting the traffic interchange operations.

Figure 6-14. Example of a three-level diamond interchange in Redford Township, Michigan



Source: Bing Maps

I-17/Dunlap Avenue traffic interchange: This traffic interchange ranks 3rd out of the 37 crossings in the Spine corridor. This location scores high because of the high level of commercial activity in the area and because this traffic interchange has the second worst safety score relative to other traffic interchanges in the Spine corridor. Further study is needed to determine the appropriate design modifications that should be made at this traffic interchange to respond to these issues. One possible alternative may be to convert the traffic interchange to a tight diamond configuration and eliminate the SPUI configuration.

- **Arterial Improvements**

This section of I-17 has continuous one-way frontage roads along both sides of the freeway. The Spine study recommendation proposes to perpetuate these frontage roads to maintain local access and to provide I-17 main line redundancy during times of congestion or incidents. Two-lane frontage roads are desirable, but single-lane frontage roads may be all that is possible because of ROW constraints. Because of the I-17 improvements, these frontage roads would likely be completely reconstructed, and in some cases would be relocated, requiring some new ROW.

In addition to the frontage roads, substantial improvements are anticipated along the arterials where the interchange modifications are being proposed, noted in the previous section, especially at the three-level diamond locations.

Some east-to-west arterials in this segment were analyzed for capacity constraints between 19th and 35th avenues. Two arterial widenings are being proposed to eliminate arterial capacity constraints, but it should be noted that any arterial street improvements in Phoenix being proposed within this recommendation would be subject to City of Phoenix agreement.

- **Glendale Avenue:** Add a third eastbound lane between 24th and 19th avenues to maintain continuity. This proposed improvement would be necessary to make the three-level diamond traffic interchange

work properly. This widening would affect the frontage of Washington High School, but it is not expected that this widening would have a detrimental impact on the school.

- **Dunlap Avenue:** Add a third westbound lane between the traffic interchange and 19th Avenue. This proposed widening should be coordinated with the Valley Metro Light Rail Northwest Extension project and the improvements it proposes along this segment of Dunlap Avenue.

Finally, to help alleviate the east-to-west traffic vehicular traffic demand in the I-17 corridor, the introduction of new mid-mile crossings was evaluated. Ultimately, no suitable locations were identified because of geometric constraints, land use incompatibility or significant impacts. As a result, no new crossings are being recommended.

- **Transit Improvements**

Dual HOV lanes in each direction would improve public transportation operations, safety and travel time reliability for those bus routes that currently use the I-17 corridor. In addition, the new DHOV connection at US-60/Grand Avenue would be a convenient new way for transit to access the downtown core or the Central Avenue business district via Thomas Road, should existing routes be modified or future routes consider this new connection. This new DHOV connection would avoid the need of express buses to weave across the general purpose lanes to exit I-17.

The West Phoenix/Central Glendale light rail transit crossing of I-17 is an important interface point of the two systems and should be coordinated early to ensure that optimum solutions are found for both the freeway and the transit. At the time of this report, consideration is being given to Camelback Road as the crossing of I-17, in part due to its proximity to Grand Canyon University and its emerging student population. However, the City of Phoenix is considering multiple locations for this crossing and anticipates having a locally preferred alternative approved in early 2018.

RAPID buses and other buses using I-17 would access the park-and-ride and future light rail station at Metrocenter by using the Dunlap Avenue and Peoria Avenue traffic interchanges. While evaluated, the addition of a DHOV traffic interchange near the light rail transit station at Metrocenter is not feasible because of ROW and geometric constraints with the light rail transit crossing at Mountain View Road. As a result, it was not included in the Spine recommendation.

- **Bicycle and Pedestrian Improvements**

Chapter 6 of the NAR details the bicycle and pedestrian needs of the corridor. All reconstructed traffic interchanges would be redesigned using the current bicycle and pedestrian infrastructure design standards for interchanges. The Northern Avenue traffic interchange reconstruction would have a special emphasis on bicycle and pedestrian safety because that interchange has a high crash rate for bicycles and pedestrians.

A new dedicated grade-separated structure would cross over I-17 at Missouri Avenue, consistent with the *Phoenix Comprehensive Bicycle Master Plan* (November 2014). In addition, the existing bicycle and pedestrian bridge over I-17 at Maryland Avenue would likely have to be rebuilt because the spans are inadequate for the proposed I-17 cross section.

Finally, it should be acknowledged that the *Phoenix Comprehensive Bicycle Master Plan* (November 2014) does propose a new bicycle and pedestrian crossing over I-17 at or near Osborn Road. While that crossing was initially proposed in this plan, many public comments opposed such a crossing, and, as such, it has been removed from the Spine study recommendation pending further consideration by the City of Phoenix.

Figure 6-15. Recommended Alternative, Sheet 14 of 26 (I-17 Segment: I-10 Stack to Dunlap Avenue)

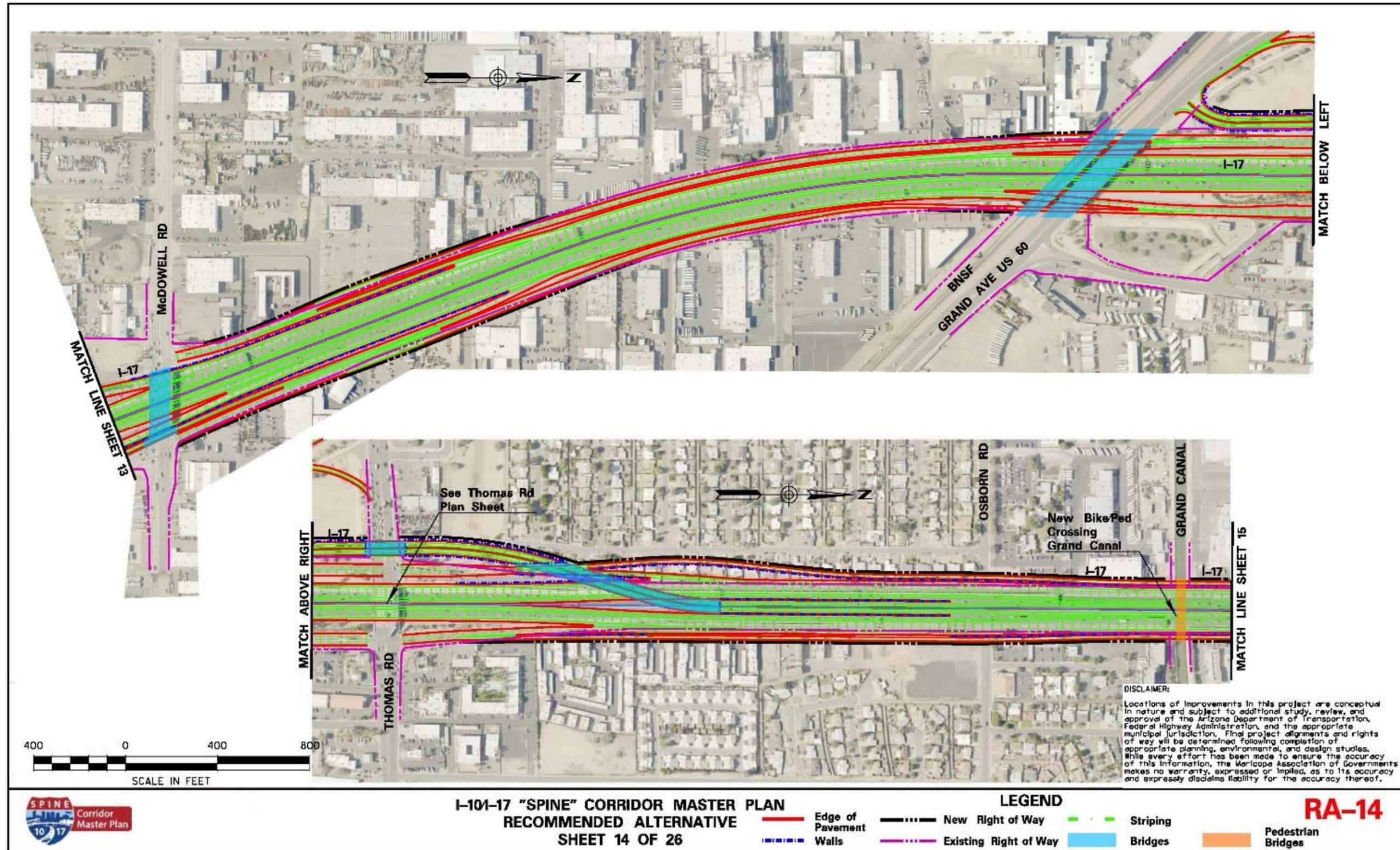


Figure 6-16. Recommended Alternative, Sheet 15 of 26 (I-17 Segment: I-10 Stack to Dunlap Avenue)

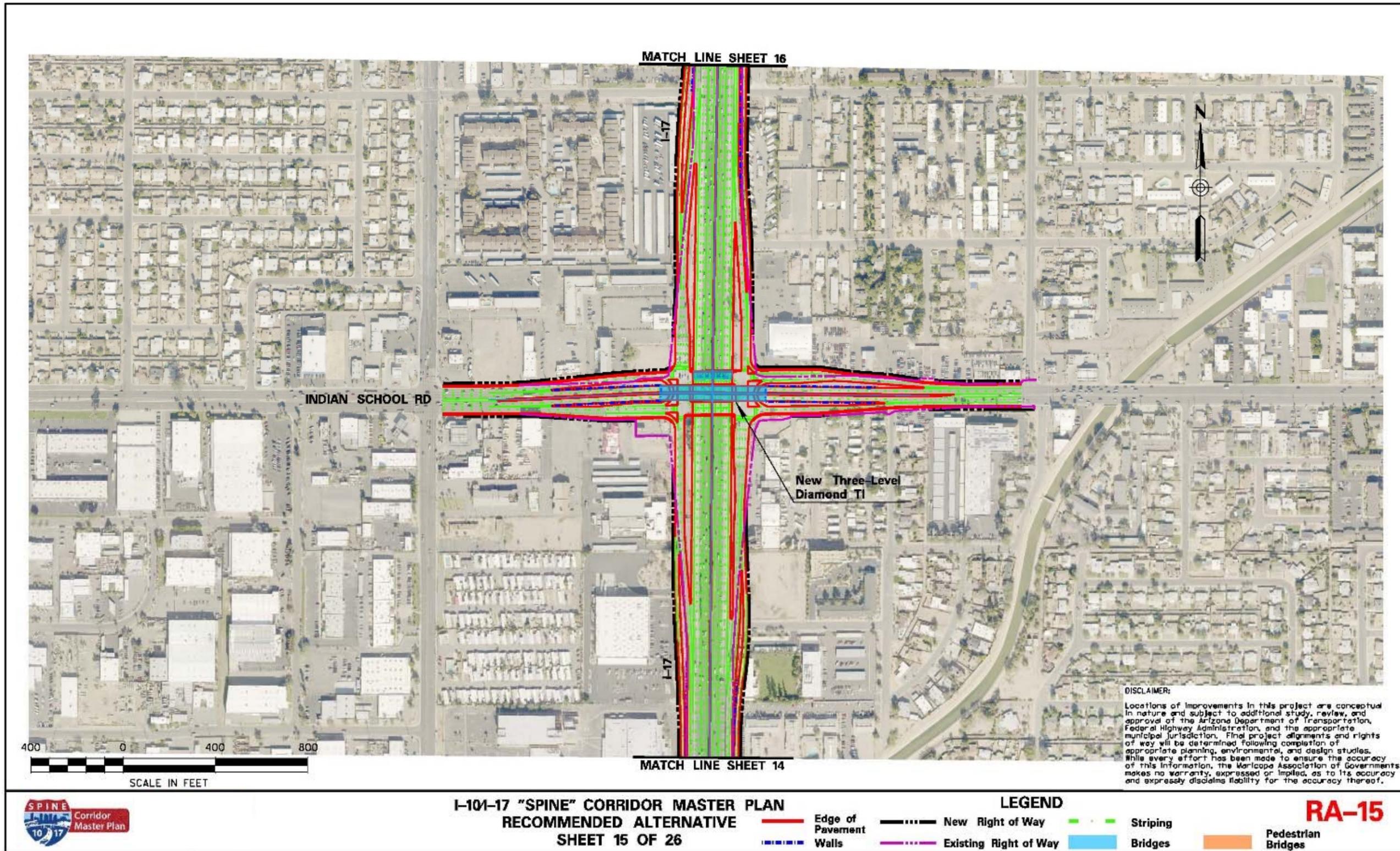


Figure 6-17. Recommended Alternative, Sheet 16 of 26 (I-17 Segment: I-10 Stack to Dunlap Avenue)

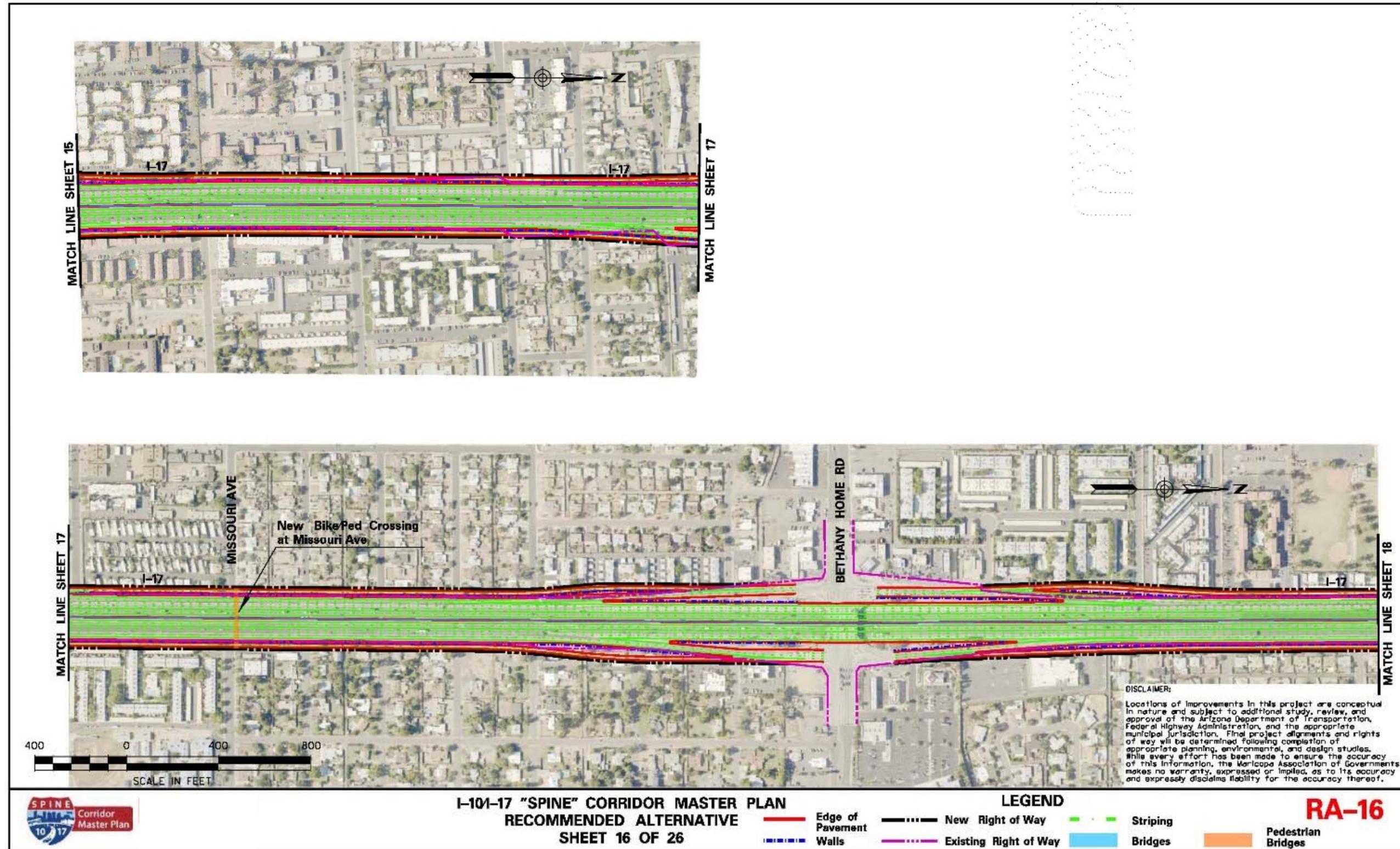


Figure 6-18. Recommended Alternative, Sheet 17 of 26 (I-17 Segment: I-10 Stack to Dunlap Avenue)

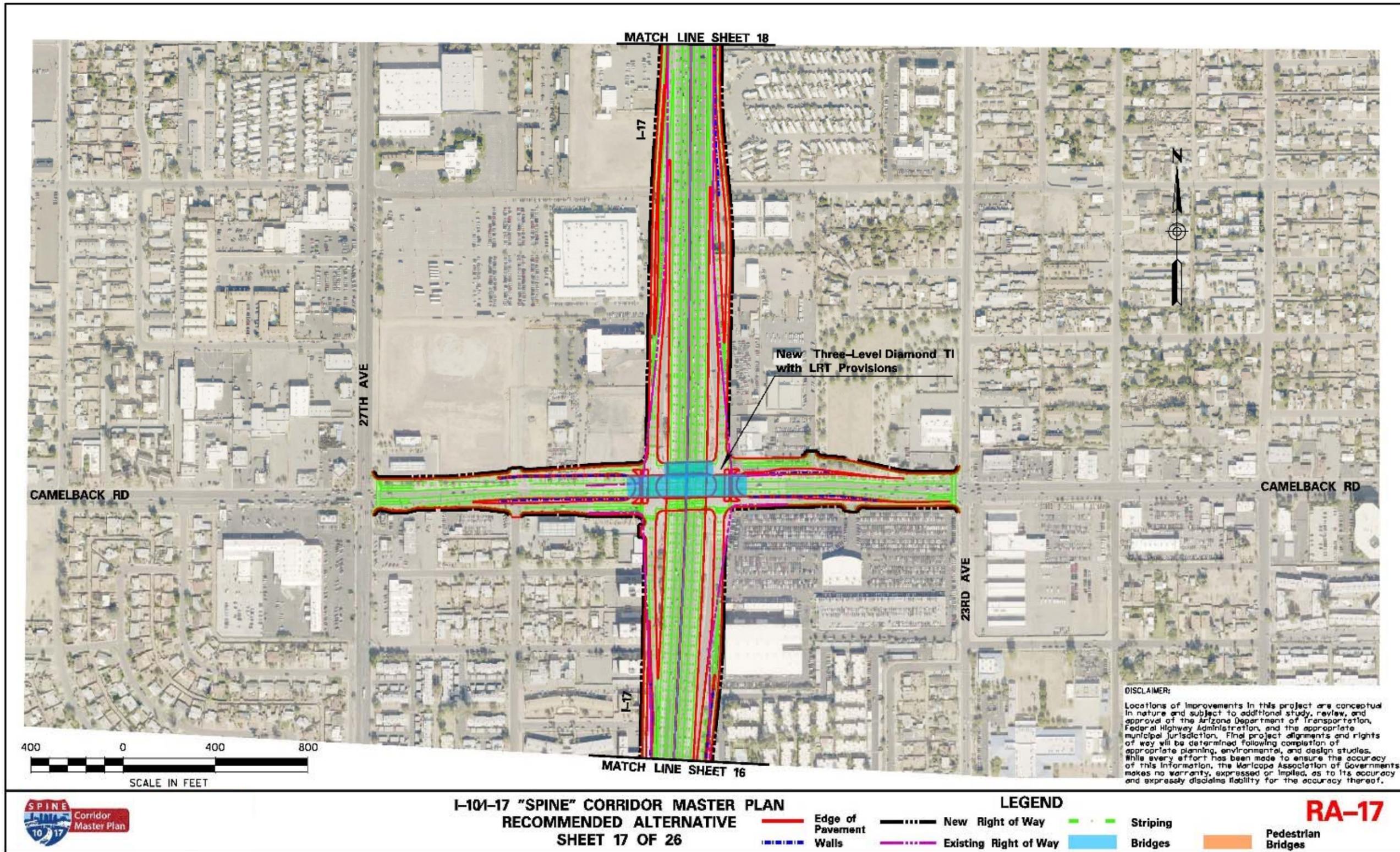


Figure 6-19. Recommended Alternative, Sheet 18 of 26 (I-17 Segment: I-10 Stack to Dunlap Avenue)

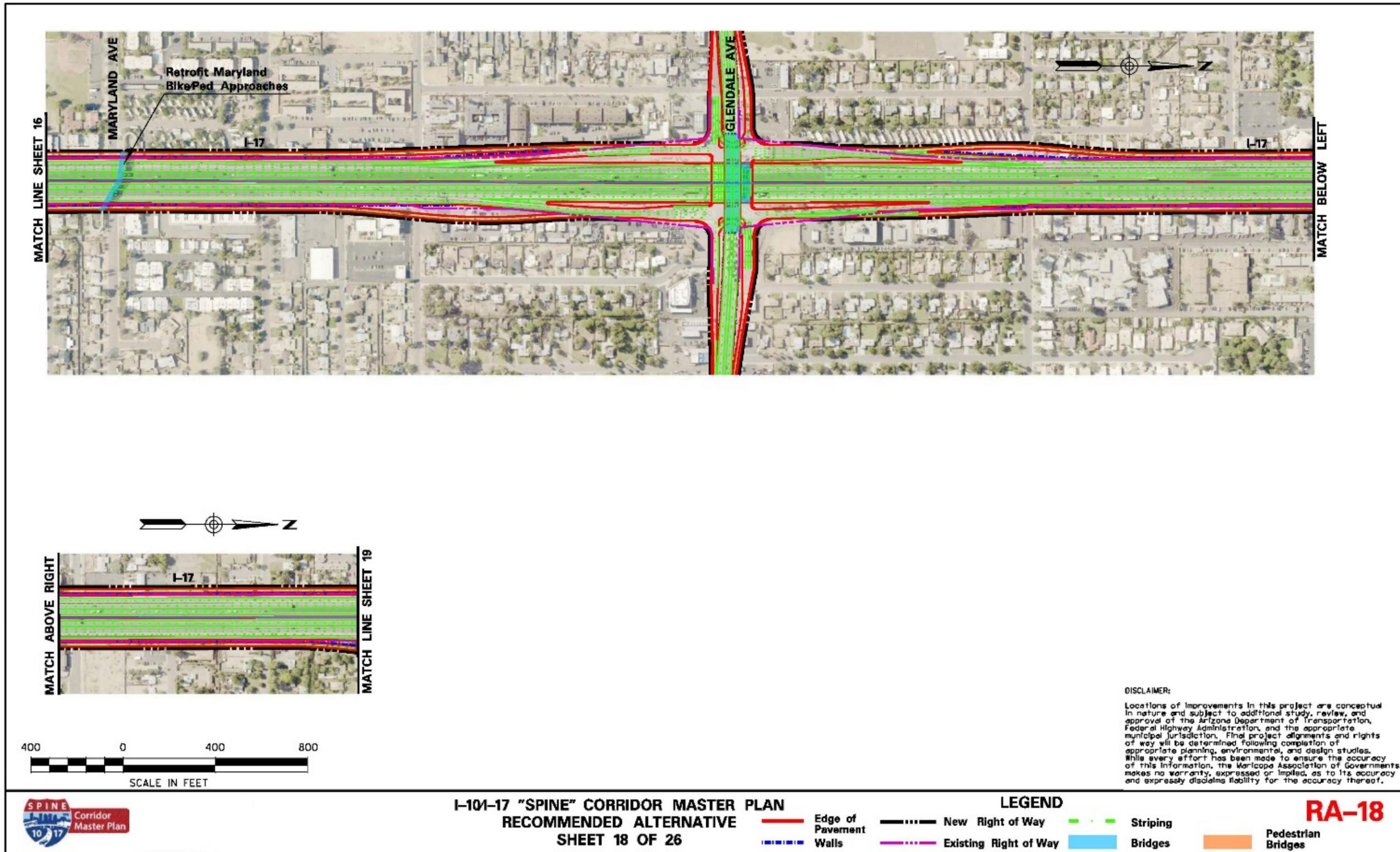


Figure 6-20. Recommended Alternative, Sheet 19 of 26 (I-17 Segment: I-10 Stack to Dunlap Avenue)

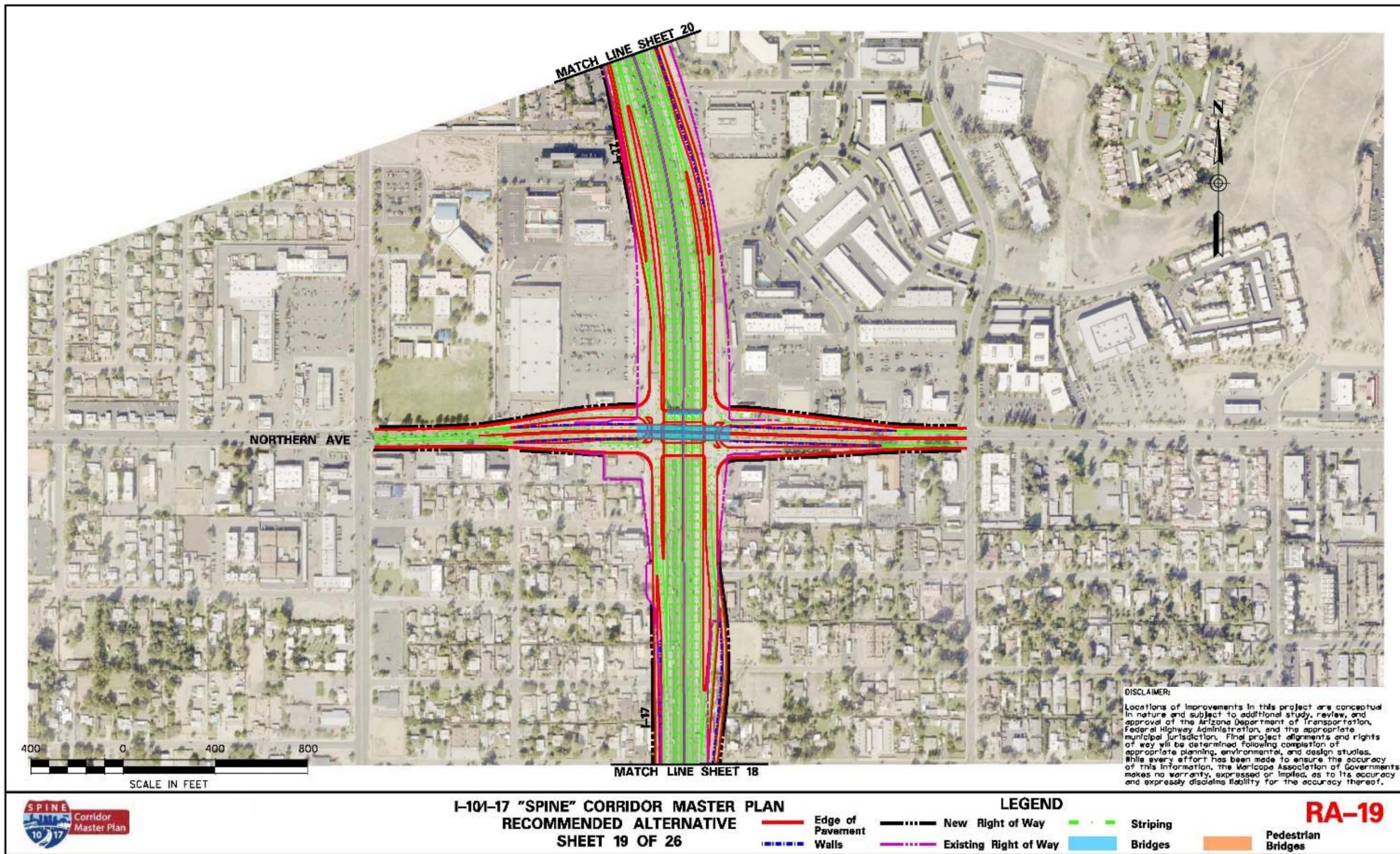
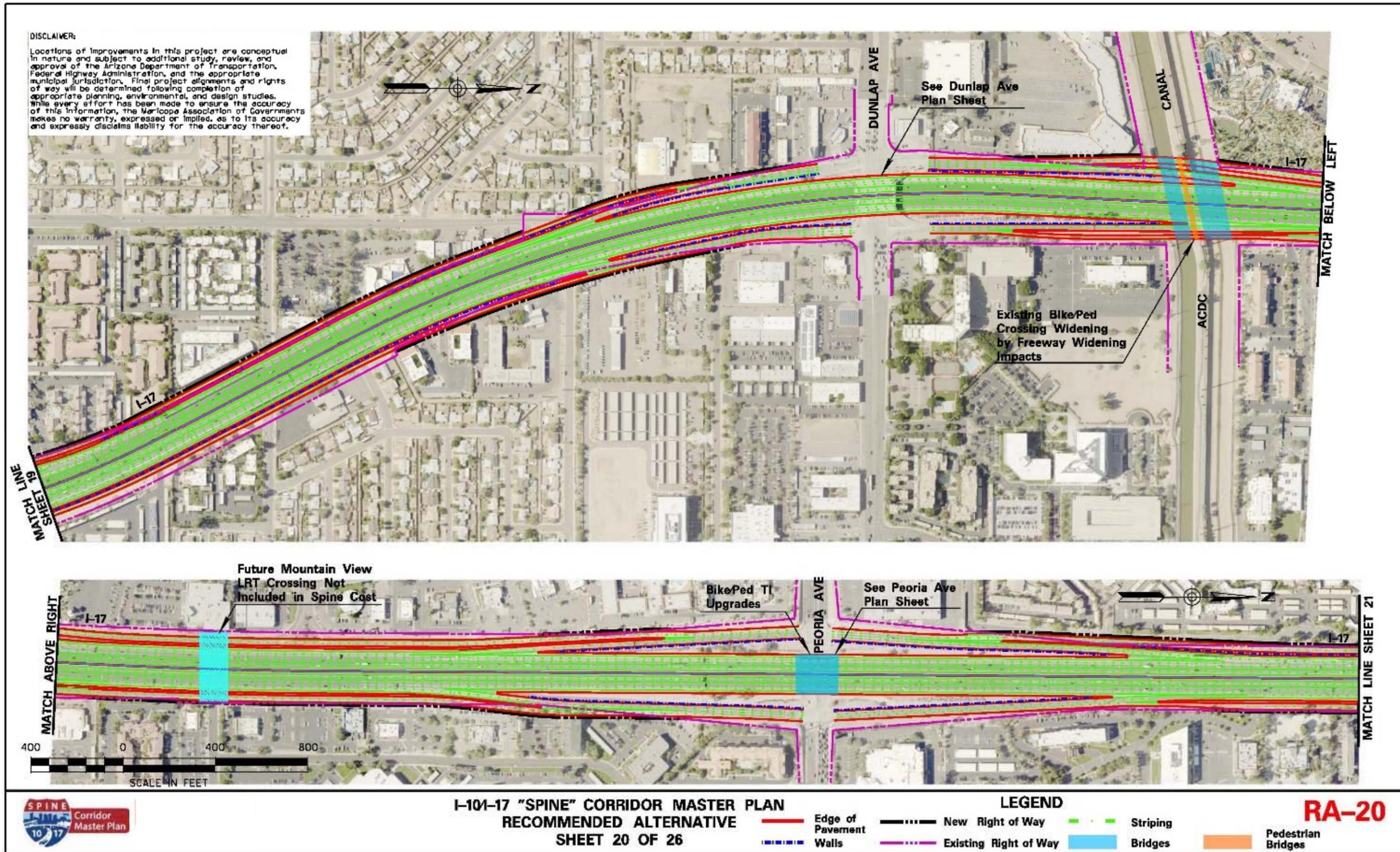


Figure 6-21. Recommended Alternative, Sheet 20 of 26 (I-17 Segment: I-10 Stack to Dunlap Avenue)



6.2.6 Interstate 17: Dunlap Avenue to SR-101L North Stack

This segment of I-17 (Dunlap Avenue to SR-101L North Stack) has a distinctly different character than the segment of I-17 to the south. After I-17 crosses over the ACDC just north of Dunlap Avenue, its profile remains at grade to the northern limits of the study area. With the exception of the Utopia Road traffic interchange, all interchange arterials undercross I-17, many drained with undersized and old pump stations that outfall into the City of Phoenix storm drain system in 35th Avenue.

The main line generally includes three general purpose lanes, one HOV lane and one auxiliary lane in each direction. The main line pavement between Dunlap and Peoria avenues is at the end of its service life, but north of Peoria, the main line pavement is less than 20 years old and can be widened. All of the bridges between the Arizona Canal/ACDC and Bell Road including these locations are at the end of their useful life and warrant replacement. North of Bell Road, the bridges do not need to be replaced.

Continuous one-way frontage roads exist along I-17, providing local access to adjacent properties. In some cases, the sole access is from the frontage roads. All interchanges are either tight/spread diamonds or SPU configurations with frontage road movements. No mid-mile crossings exist, however, to help alleviate the east-to-west traffic vehicular traffic demand in the I-17 corridor, and the introduction of new mid-mile crossings was evaluated. Ultimately, no suitable locations were identified because of geometric constraints, land use incompatibility or significant impacts. As a result, no new crossings are recommended.

One Valley Metro light rail transit crossing is planned within this segment crossing I-17 on a dedicated bridge at Mountain View Boulevard at Metrocenter. This is the Northwest Extension of the Valley Metro light rail transit system. Early coordination has already started to accommodate this crossing to ensure that light rail transit construction (which would occur before the I-17 improvements are made) is compatible with the Spine study recommendation on I-17 and the frontage roads.

In the southwestern quadrant of I-17 and Bell Road, a heavily used park-and-ride lot exists that is already at capacity Monday through Friday every week. This is the most-used park-and-ride in the Valley.

In this segment of I-17, more traffic is trying to cross I-17 as compared with the amount of traffic using and accessing I-17. Because no mid-mile crossings of I-17 exist in this segment, all this east-to-west volume must cross I-17 at the traffic interchanges, breaking down the traffic interchange operations. A major emphasis as part of the Spine study recommendation was to provide east-to-west relief at several of these interchanges.

The layout for this segment of I-17 can be found in Figures 6-22 to 6-27 following this segment description.

- **I-17 Main Line Improvements**

The Spine study recommendation proposes to widen I-17 throughout this length to keep the existing three general purpose lanes and add another HOV lane and one auxiliary lane in each direction. All lane and shoulder widths would be constructed to the ADOT design standards for urban freeway construction to the extent practical. The MAG *Central Phoenix Framework Study* evaluated potential freeway sections and the reasonable widening limitations in this area and is a good reference for additional information. At the North Stack, a new proposed DHOV connector ramp is proposed to connect the southern leg of I-17 with the western leg of SR-101L. This DHOV was part of the 2003 RTP, but was officially added to the Spine study recommendation as a way to logically drop and add the second HOV lane in each direction. I-17 would need to flare to accommodate this system DHOV ramp, anticipated to be located between Union Hills Drive and Utopia Road. Corresponding improvements and widening would be required along SR-101L between

27th and 35th avenues. These improvements would enhance safety, reduce congestion and improve travel time reliability.

Within this segment, the main line pavement would be replaced between Dunlap and Peoria avenues because it is far beyond its expected life span. In addition, all the bridges need to be replaced and many need to be elevated to restore adequate vertical clearance at the traffic interchange crossings and to improve signal head sight distance—a possible cause of many accidents in these interchanges. This means that most of the bridge replacements would raise the I-17 profile by 3 to 5 feet, causing up to 2,000 feet of main line pavement replacement centered on each bridge site. The Thunderbird Road and Bell Road traffic interchanges are both proposed to be upgraded to three-level diamonds. The most logical way to upgrade these is to reprofile the I-17 main line one level higher (or about 25 feet) over these current interchanges, causing up to 1 mile of main line reconstruction centered on each site. Ultimately, very little I-17 main line pavement could be retained.

Four drainage pump stations exist in this segment that are the four oldest in the Phoenix area. These four pump stations drain the arterial sumps under the Peoria Avenue, Cactus Road, Thunderbird Road and Greenway Road traffic interchanges. All four pump stations pump the outflow into a City of Phoenix storm drain system that ultimately dumps into the ACDC at 35th Avenue. This drainage outfall is undersized and cannot accommodate the traffic interchange flows adequately, which means frequent flooding is an issue at these interchanges. The Spine study recommendation adopts an ADOT solution developed in 2006 that removes all four pump stations by building a new gravity drain along I-17, mostly under the southbound frontage road, to the ACDC. The infields of the Thunderbird Road traffic interchange would be used for in-line detention to mitigate the peak flow events.

The future Valley Metro light rail transit crossing at Mountain View Road and its associated proposed elevated station straddling the southbound I-17 frontage road would need to be coordinated by multiple agencies to ensure this new light rail transit crossing is compatible with the Spine corridor recommendation. This includes accommodating both the ultimate I-17 and frontage road widths proposed in the Spine study recommendation, as well as the timing and location of the proposed storm drain pipe planned under the southbound frontage road and the elevated transit station.

- **Interchange Modifications**

I-17/Peoria Avenue traffic interchange, I-17/Cactus Road traffic interchange, I-17/Greenway Road traffic interchange: These three locations ranked 1st, 10th and 14th out of the 37 crossings in the Spine corridor, respectively. All three are similar in design and all three have similar issues. The current bridges limit the crossroad section that fits under them and, with low vertical clearances, the tight diamond configuration creates sight distance issues to both the signal heads and the ramp terminal intersections. As a result, all three traffic interchanges experience higher-than-average crashes.

Peoria Avenue has the worst traffic interchange crash score in the entire Spine corridor. When replacing the bridges, the Spine study recommendation is to raise them so that not only 16.5 feet of vertical clearance is achieved, but a few extra feet to improve signal head sight distance. In addition, the bridge spans should be lengthened so that the crossroad sections through the interchanges are not restricted through the bridges much like they are today. To avoid the tunnel-effect under these bridges, it may be desirable to spread the two directions of the I-17 main line apart by 10 to 20 feet to create an open space for natural light under the interchange. This would improve visibility and improve safety. At the Peoria Avenue traffic interchange, the crossroad section should be expanded to include a third eastbound through lane between 28th and 25th avenues as part of the traffic interchange modification.

At the Cactus Road traffic interchange, the crossroad section should be expanded to be three through lanes in each direction between 28th Drive and 25th Avenue with dual west-to-south left turns and a single east-to-north left-turn bay within the traffic interchange itself as part of the traffic interchange modifications. At the Greenway Road traffic interchange, three westbound through lanes and two eastbound through lanes should be accommodated between 29th and 19th avenues, with dual west-to-south left turns and a single east-to-north left turn bay within the traffic interchange as part of the traffic interchange modifications. Finally, all three of these interchanges would include the drainage improvements noted in the main line discussion and would be integrated into the new traffic interchange improvements.

I-17/Thunderbird Road traffic interchange and I-17/Bell Road traffic interchange: As previously noted in Chapter 4 of this report, several interchanges were identified where east-to-west travel demand was high, and where east-to-west regional connectivity was significant. These two interchanges were identified as being the best candidates for high-capacity interchanges that emphasized the east-to-west through movements. Three-level diamonds, or some equivalent high-capacity design, are proposed at these two locations. These locations rank as 6th and 12th out of 37 crossings in the Spine corridor, respectively, so the need for upgrades is high. The primary reason the three-level diamond configuration was recommended is because this high-capacity service traffic interchange design is compact and fits well within highly developed areas, is compatible with frontage roads, can maintain access to adjacent properties along the arterial corridor with U-turn movements, and improves bicycle and pedestrian safety within the interchange. Unlike the other four three-level diamond locations in the Spine corridor, these two would be unique in that the I-17 main line would be reprofiled to add the third level for the interchange. Given the current geometry of these interchanges, this appears to be the simplest method to construct these interchanges while maintaining all local access. Finally, the Thunderbird Road traffic interchange is one of the traffic interchanges that would include the drainage improvements noted in the main line discussions and would be integrated into the new traffic interchange improvements.

- **Arterial Improvements**

This section of I-17 has continuous one-way frontage roads along both sides of the freeway. The Spine study recommendation proposes to perpetuate these frontage roads to maintain local access and to provide I-17 main line redundancy during times of congestion or incidents. Two-lane frontage roads are desirable, but single-lane frontage roads may be all that is possible. Given the I-17 improvements, these frontage roads would likely be completely reconstructed, and in some cases would be relocated, requiring some new ROW.

In addition to the frontage roads, substantial improvements are anticipated along the arterials where the interchange modifications are being proposed, as noted in the previous section.

While improvements to both parallel arterials (19th and 35th avenues) was considered, no improvements were ultimately recommended because 19th Avenue is becoming a transit corridor that is not a good candidate for rerouting I-17 traffic during incidents. Similarly, 35th Avenue is also not a good candidate corridor to improve capacity because of the numerous school zones along that arterial.

- **Transit Improvements**

Dual HOV lanes in each direction would improve public transportation operations, safety and travel time reliability for those bus routes that currently use the I-17 corridor. In addition, the new DHOV connection at the North Stack traffic interchange would improve transit operations between I-17 and the Northwest Valley destinations.

The accommodations for the light rail transit crossings at the I-17/Mountain View Road crossing would be an important interface point of the two systems and should be coordinated early to ensure that optimum solutions are found for both the freeway and the transit, both in space and in time. This work has started and is progressing under the current assumption that the I-17 drainage improvements project is advancing early to precede the light rail transit construction.

The proposed three-level diamond at the I-17/Bell Road traffic interchange creates an opportunity to expand the park-and-ride facility in the southwestern quadrant. Today, expansion of that park-and-ride is not feasible, despite it being the most-used park-and-ride in the Valley. The three-level diamond would allow for that park-and-ride to be expanded into the current freeway ROW, allowing it to at least double in size. This park-and-ride expansion is included in the Spine study recommendation and would retain the express bus stop along the southbound entrance ramp and the dedicated HOV entrance ramp to I-17 at the Bell Road traffic interchange. This location can be seen in Figure 6-25.

- **Bicycle and Pedestrian Improvements**

All of the reconstructed traffic interchanges would be redesigned using the latest bicycle and pedestrian infrastructure design standards for interchanges. The Peoria Avenue traffic interchange reconstruction would have a special emphasis on bicycle and pedestrian safety because that interchange has a high crash rate for bicycles and pedestrians. Other interchanges are specifically noted in the *Phoenix Comprehensive Bicycle Master Plan* (November 2014) as having bicycle routes through them, including the Thunderbird Road, Greenway Road, Bell Road and Union Hills Road traffic interchanges. All but the Union Hills traffic interchange would be reconstructed, so integrating bicycle and pedestrian elements would occur with those efforts. The Union Hills traffic interchange, which ranks 35th out of 37 crossings in the Spine corridor, does not warrant a traffic interchange upgrade, but bicycle and pedestrian enhancements are proposed at this crossing to be consistent with the *Phoenix Comprehensive Bicycle Master Plan* (November 2014).

A new dedicated grade-separated structure would cross over I-17 at Paradise Lane, consistent with the *Phoenix Comprehensive Bicycle Master Plan*.

Figure 6-22. Recommended Alternative, Sheet 21 of 26 (I-17 Segment: Dunlap Avenue to SR-101L North Stack)

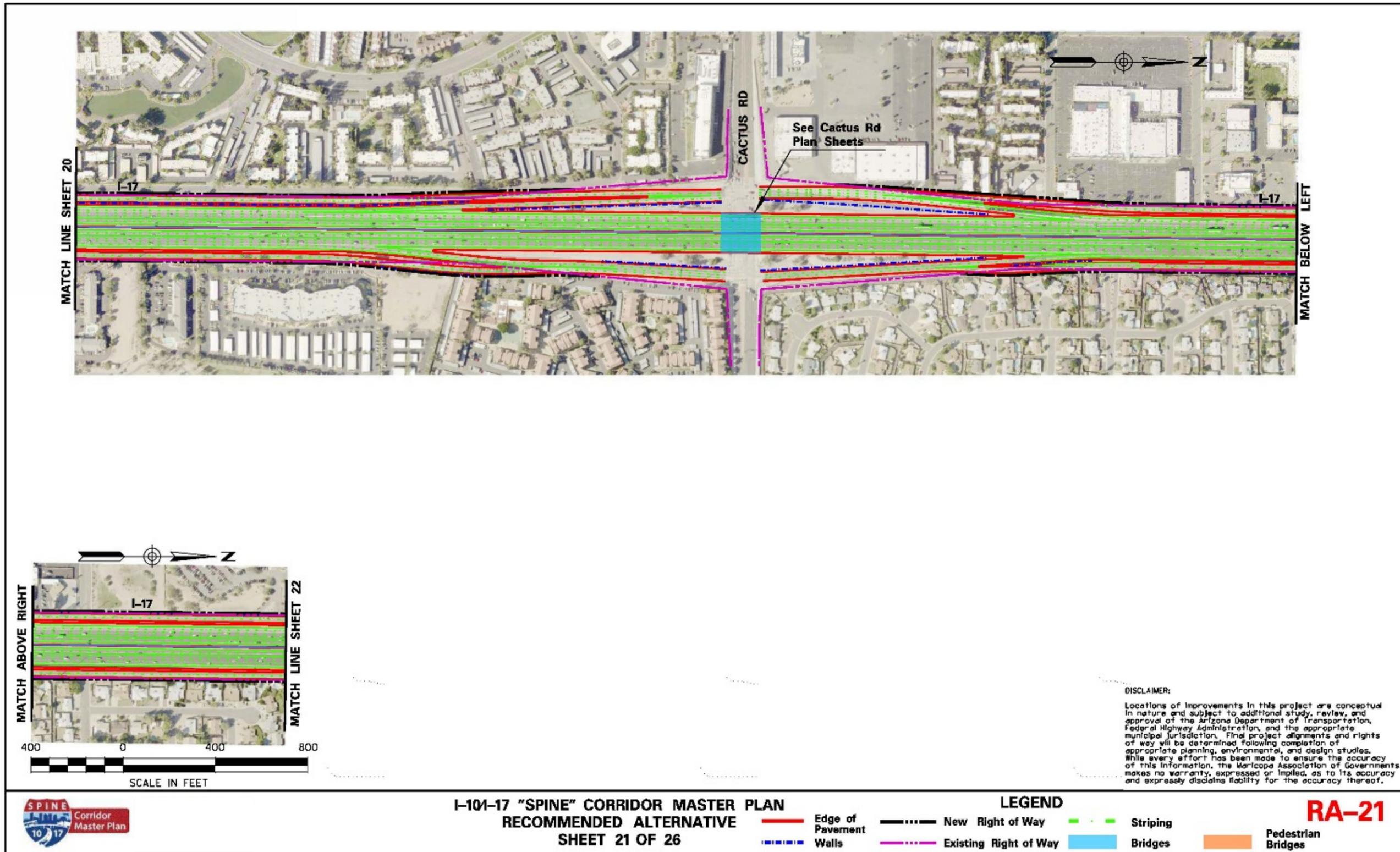


Figure 6-23. Recommended Alternative, Sheet 22 of 26 (I-17 Segment: Dunlap Avenue to SR-101L North Stack)

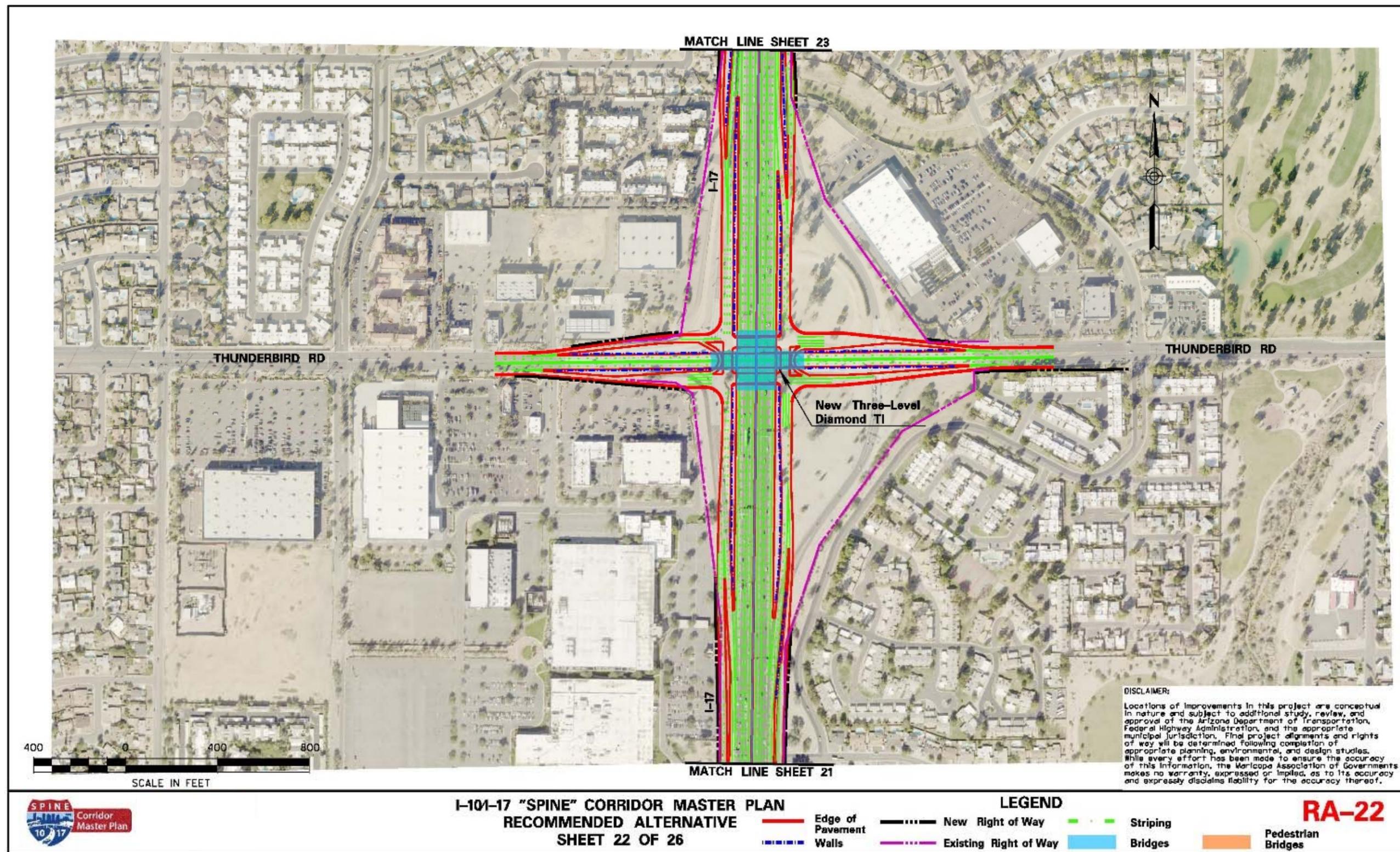


Figure 6-24. Recommended Alternative, Sheet 23 of 26 (I-17 Segment: Dunlap Avenue to SR-101L North Stack)

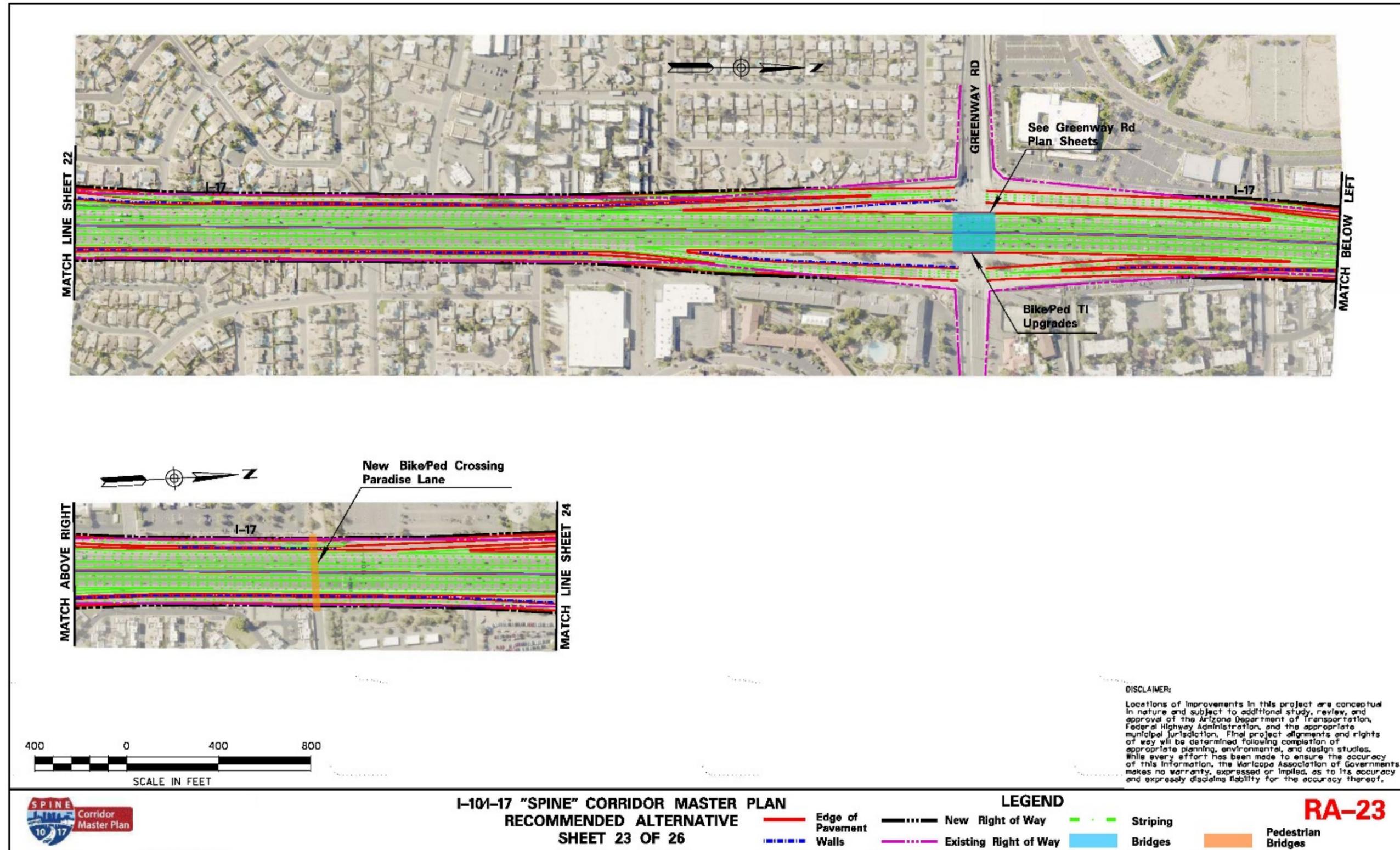


Figure 6-25. Recommended Alternative, Sheet 24 of 26 (I-17 Segment: Dunlap Avenue to SR-101L North Stack)

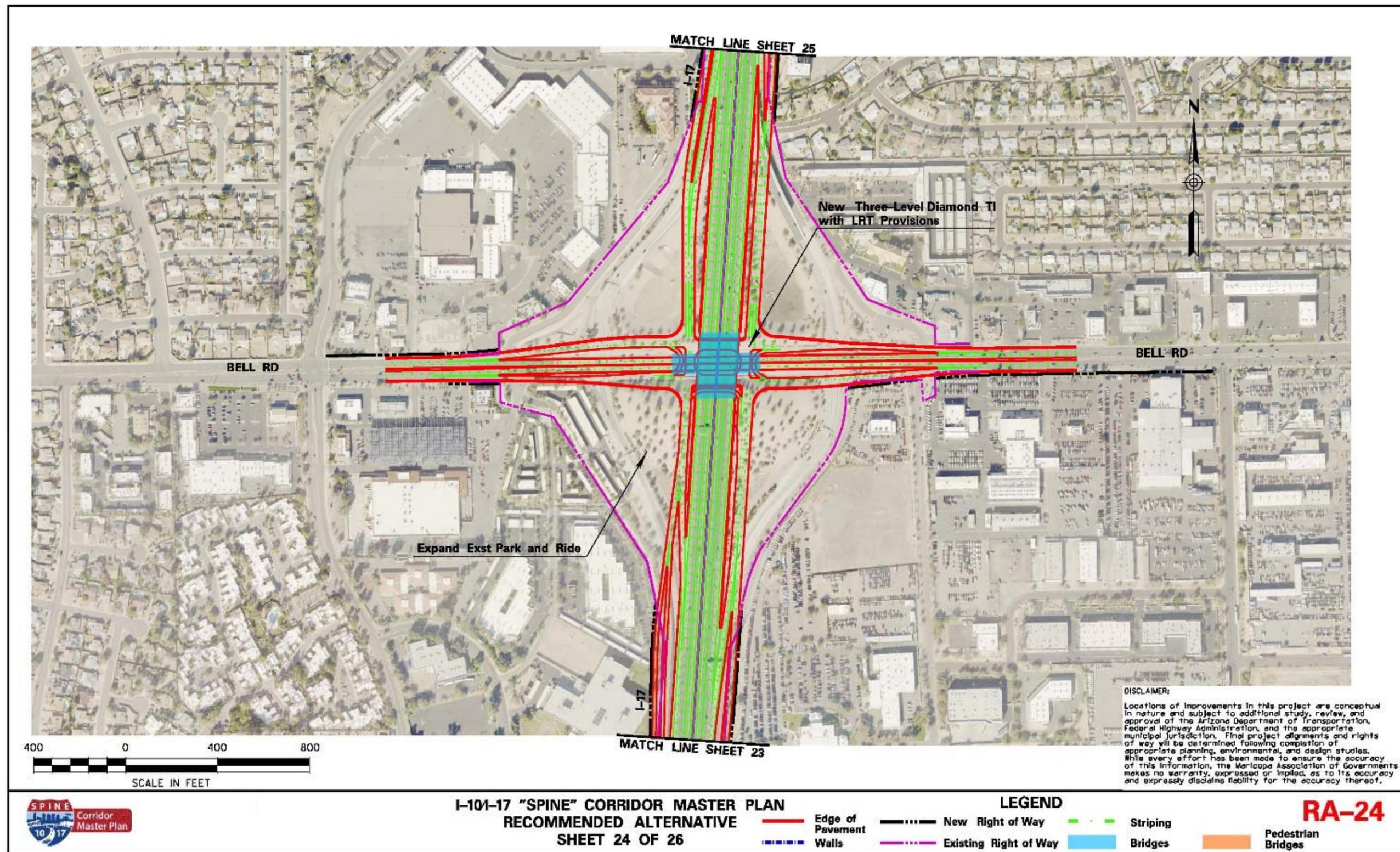


Figure 6-26. Recommended Alternative, Sheet 25 of 26 (I-17 Segment: Dunlap Avenue to SR-101L North Stack)

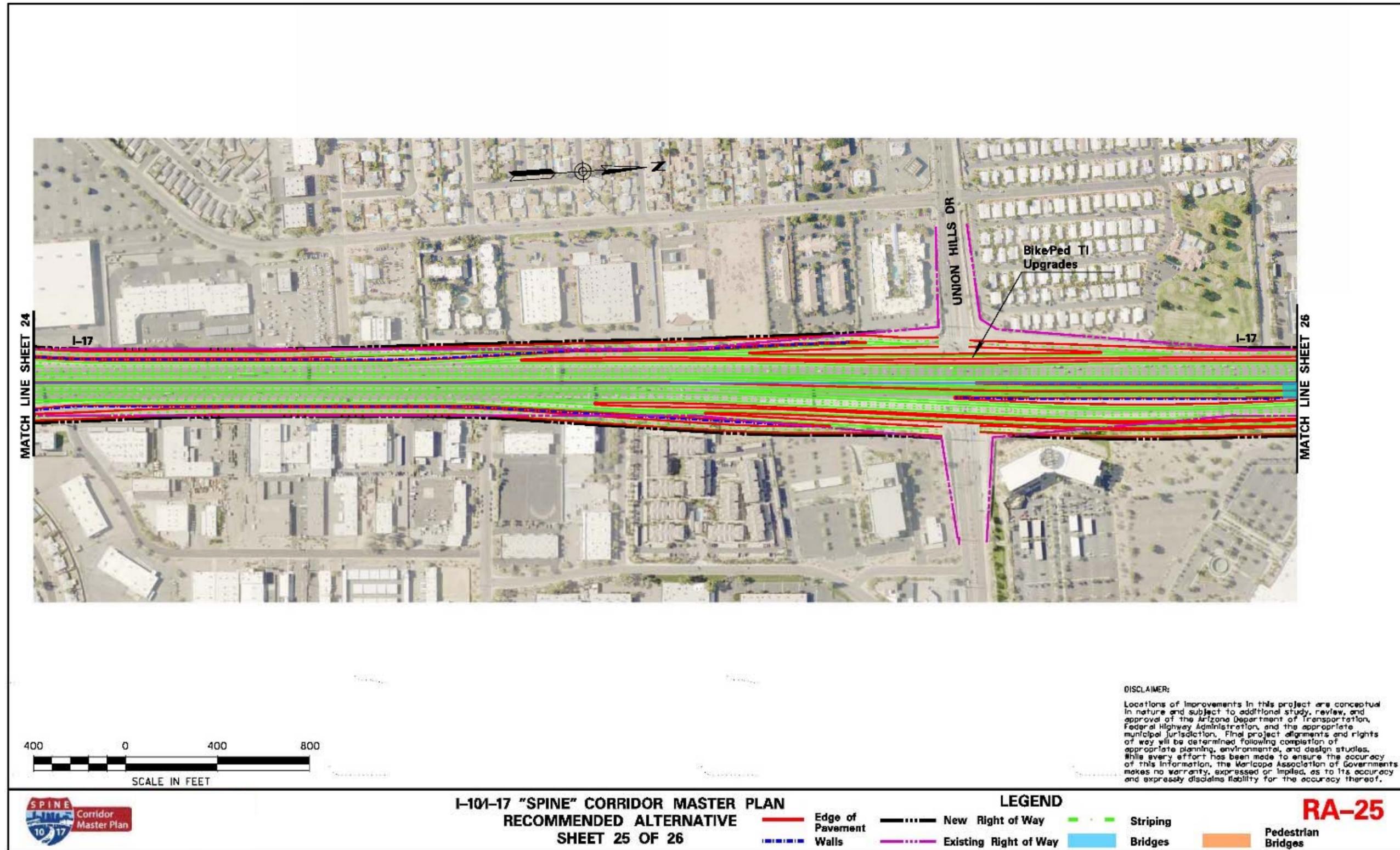
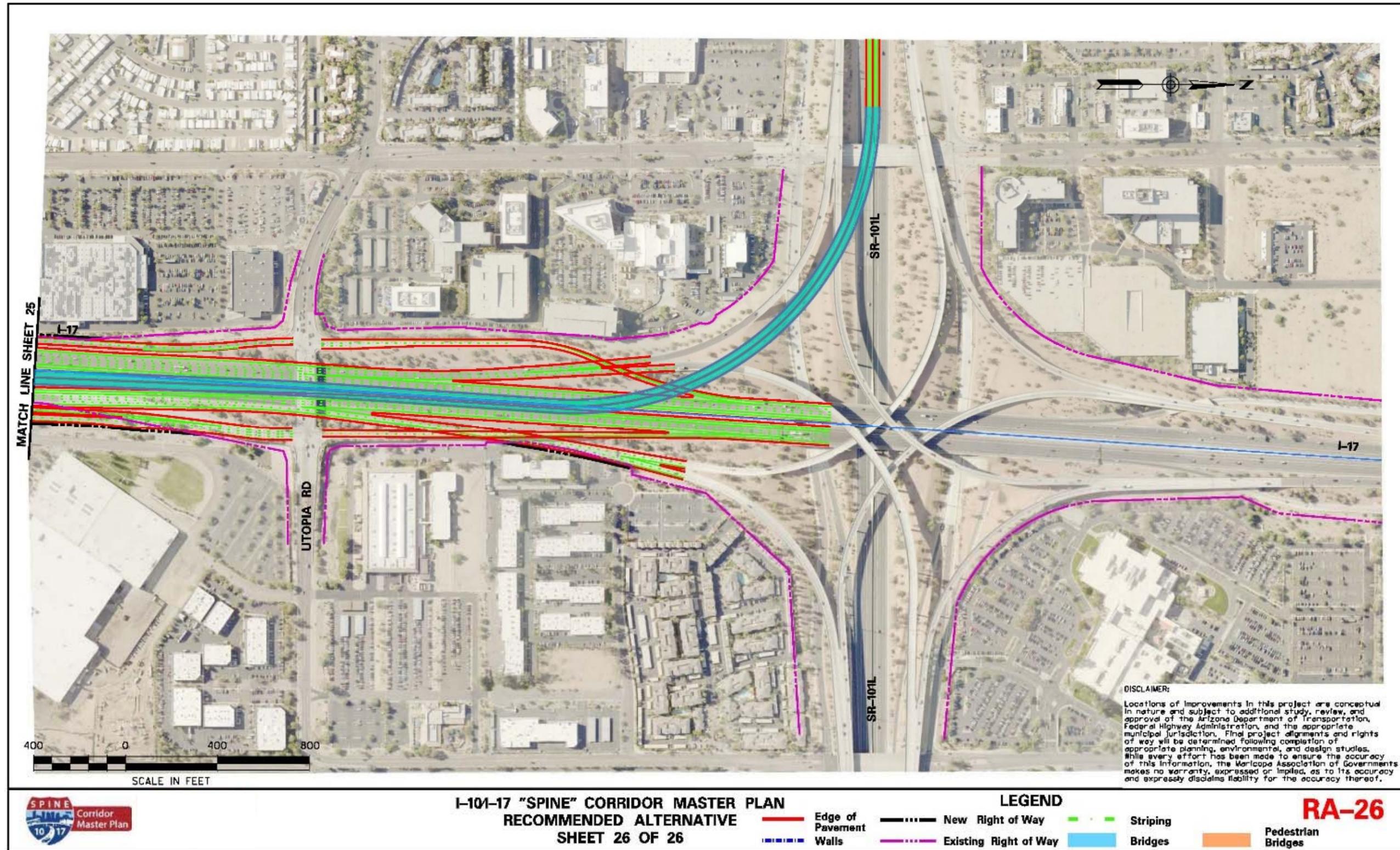


Figure 6-27. Recommended Alternative, Sheet 26 of 26 (I-17 Segment: Dunlap Avenue to SR-101L North Stack)



6.2.7 Technology Integration

The Spine study recommendation is not limited to roadway and transit expansion projects. From the beginning of this study, it has been recognized that integrating the latest technology into the Spine corridor to expand capacity would be mandatory. Because technology in this field is changing so rapidly, it is unclear exactly which technology would be used and where, but Chapter 7 of this report attempts to summarize what is known at this time. For the purpose of this recommendation, it should be assumed that information contained in that chapter is included in the Spine study recommendation.

6.3 Operational Characteristics of the Recommended Alternative

The recommended alternative was assessed with a variety of metrics to address the effectiveness of the proposed strategy in enhancing operations within the corridor. The analysis focused on the evening peak commute period for the forecast year (Table 6-2).

Each analyzed segment experienced a 2 to 4 percent increase in VMT, with an associated reduction in congested VMT. Corridor wide, the recommended alternative would facilitate nearly 200,000 more vehicle miles of travel during the evening commuting peak, and would accommodate an additional estimated 40,000 person-trips beyond that forecast under the base condition. The most notable increase in person trips would occur in the segment of I-17 between 24th Street and McDowell Road, where the recommended alternative would provide HOV opportunities not available under the base condition. In this segment, an estimated 16,700 additional persons would be accommodated in the future year peak period as compared with the base condition.

Travel speeds during the peak period are forecast to increase throughout the corridor, although only marginally (0.5 to 1.3 mph, depending on the segment). However, the duration of congestion along the corridor would decrease. The greatest decrease in the duration of congestion is anticipated to occur in the segments between Southern Avenue and McDowell Road. In this portion of the corridor, congestion is anticipated to last 9 hours per day in the northbound/westbound direction and over 11 hours per day in the southbound/eastbound direction. Essentially, this means that traveling through this segment of the corridor would be very slow (25 mph or less) and would be hard to avoid during daylight hours. With implementation of the recommended improvements, the duration of congestion is anticipated to decrease to 4 hours per day in the northbound/westbound direction and 6 hours per day in the southbound/eastbound direction—5 fewer hours of congestion each day per direction.

6.4 Design Exceptions Associated with the Recommended Alternative

Overall, the Spine study recommendation proposes to eliminate the most critical design exceptions in the corridor—lane and shoulder widths, short acceleration and deceleration lengths, substandard vertical clearances under structures and inadequate sight distance. However, the study team realizes that some of these design exceptions would still be necessary to execute the Spine study recommendation, especially as it relates to implementing context-sensitive or practical design solutions in areas where tight, sensitive or protected ROW exists.

The following is a list of areas where design exceptions would or may be necessary, depending on how the design process evolves. This list is not meant to be comprehensive, nor should it be construed that these design exceptions have been preapproved. Rather, it is meant to define expectations of all stakeholders going into the preliminary design phase of the project.

- **Inside shoulder widths:** Every bridge pier and foundation within the median barrier would restrict the inside shoulder to less than the desirable width for a short distance.
- **Weave lengths:** With regard to Chapter 10 of the American Association of State and Highway Transportation Officials 2011 *Green Book*, the desirable weave lengths will rarely be achievable throughout the corridor. Because the traffic interchanges in this corridor already exist, the available length for the weave area is a function of the current spacing. Ultimately, this means that the design will not be able to increase the weave length much beyond what exists today.
- **I-17 – Split to the Stack:** ROW is constrained in this segment, and in some cases contains EJ or Title VI communities. New ROW should be carefully considered to minimize impacts on businesses and communities. This may require some shoulder width design exceptions, ramp geometry exceptions or weaving length exceptions to balance impacts with the design. In addition, the Spine study recommendation does not attempt to address the large floodplain issue that exists along the eastern side of I-17 between the Durango Curve and I-10 because it is not within the scope of this Spine study. FCDMC has developed a preliminary design to solve the floodplain issue, but it does require large amounts of ROW in EJ and Title VI communities. As such, the Spine study recommendation relies on FCDMC to implement its solution or another solution to address the floodplain issue.
- **I-17 – Stack:** The restriping of I-17 through the Stack to extend the HOV lanes south through the Stack would require at least shoulder width but also possible lane width design exceptions.
- **I-17 – Stack to Dunlap Avenue:** This segment of I-17 is bordered on both sides by commercial and residential development that would have impacts with new ROW acquisition. Further study is required in this area to find the right balance between the needs of the Spine corridor and minimizing impacts on developed ROW. It is reasonable to conclude that some segments of I-17 in this area would use shoulder and/or lane width design exceptions to construct the required number of lanes.

6.5 Concept Plans Associated with the Recommended Alternative

Throughout this chapter, concept plans have been developed to illustrate the recommended alternative. This concept represents one possible interpretation of the features described in this chapter resulting from the Spine recommendation. This concept should not be interpreted as the only possible solution since further engineering, environmental and public outreach is needed to refine the project(s). The concept was developed so that a project, or list of projects, could be defined both in terms of costs, schedules and implementation for inclusion in the RTP. Details of how this has been done can be found in Chapter 8.

In addition to the concept plans, Figures 6-28 through 6-34 are included in the following pages to show the lane diagram for the recommended alternative.

Table 6-2. Operational Comparison of Recommended Alternative with No-Build

Alternative		VMT	% VMT Congested	VHT	% VHT Congested	VMT/VHT (mph)	General Purpose Travel Time (Minutes, 2-6 p.m. Peak)	HOV Travel Time (Minutes, 2-6 p.m. Peak)	Person-Trips ^a	Average General Purpose v/c	Average HOV v/c	Freeway Duration of Congestion (Hours)
I-10: SR-202L to Southern Avenue												
No-Build	Northbound/Westbound	1,103,239	38.6%	32,110	45.3%	34.4	5.25	4.28	32,194.90	0.76	0.40	0.5
No-Build	Southbound/Eastbound						7.71	5.87	43,077.96	1.11	0.53	0.0
Recommended Alternative	Northbound/Westbound	1,133,254	33.6%	32,471	41.2%	34.9	4.86	4.40	33,624.46	0.83	0.47	1.3
Recommended Alternative	Southbound/Eastbound						7.39	6.14	31,420.94	1.17	0.62	0.0
I-10: Southern Avenue to 24th Street												
No-Build	Northbound/Westbound	1,476,599	55.5%	54,810	58.1%	26.9	8.83	6.79	58,490.04	0.95	0.56	9.0
No-Build	Southbound/Eastbound						9.02	7.46	51,086.32	1.01	0.64	11.3
Recommended Alternative	Northbound/Westbound	1,533,154	53.2%	54,236	56.5%	28.3	5.45	3.64	65,915.24	0.96	0.51	4.3
Recommended Alternative	Southbound/Eastbound						5.57	4.01	55,570.04	0.94	0.48	0.5
I-17: I-10 24th Street to McDowell Road												
No-Build	Northbound/Westbound	1,585,619	53.4%	66,877	57.2%	23.7	17.89	13.99	26,548.77	1.09	N/A	6.8
No-Build	Southbound/Eastbound						10.40	10.40	19,004.80	0.74	N/A	6.0
Recommended Alternative	Northbound/Westbound	1,620,144	51.1%	66,640	55.5%	24.3	16.64	7.67	37,346.33	1.12	0.68	0.0
Recommended Alternative	Southbound/Eastbound						8.49	5.70	24,913.98	0.78	0.35	5.8
I-17: McDowell Road to Dunlap Avenue												
No-Build	Northbound	1,320,490	65.3%	56,416	69.4%	23.4	15.44	7.78	38,525.02	1.46	0.75	5.5
No-Build	Southbound						10.16	7.01	28,615.24	1.09	0.54	3.3
Recommended Alternative	Northbound/Westbound	1,368,625	61.1%	56,593	68.0%	24.2	16.13	6.76	45,633.44	1.25	0.58	4.8
Recommended Alternative	Southbound/Eastbound						10.22	5.99	35,387.72	0.97	0.37	5.3

Table 6-2. Operational Comparison of Recommended Alternative with No-Build

Alternative		VMT	% VMT Congested	VHT	% VHT Congested	VMT/VHT (mph)	General Purpose Travel Time (Minutes, 2-6 p.m. Peak)	HOV Travel Time (Minutes, 2-6 p.m. Peak)	Person-Trips ^a	Average General Purpose v/c	Average HOV v/c	Freeway Duration of Congestion (Hours)
<i>I-17: Dunlap Avenue to SR-101L</i>												
No-Build	Northbound	1,213,005	45.0%	40,251	49.0%	30.1	16.21	10.55	41,260.33	1.27	0.69	5.3
No-Build	Southbound						8.37	6.26	31,308.74	1.07	0.50	4.8
Recommended Alternative	Northbound/Westbound	1,242,816	46.4%	40,433	50.4%	30.7	16.05	7.93	46,325.66	1.21	0.61	4.5
Recommended Alternative	Southbound/Eastbound						8.37	5.47	34,139.88	1.07	0.40	4.0

^a Person-trips includes HOV, general purpose and transit trips.

Figure 6-28. Recommended Alternative Lane Line Diagram, Sheet 1 of 7

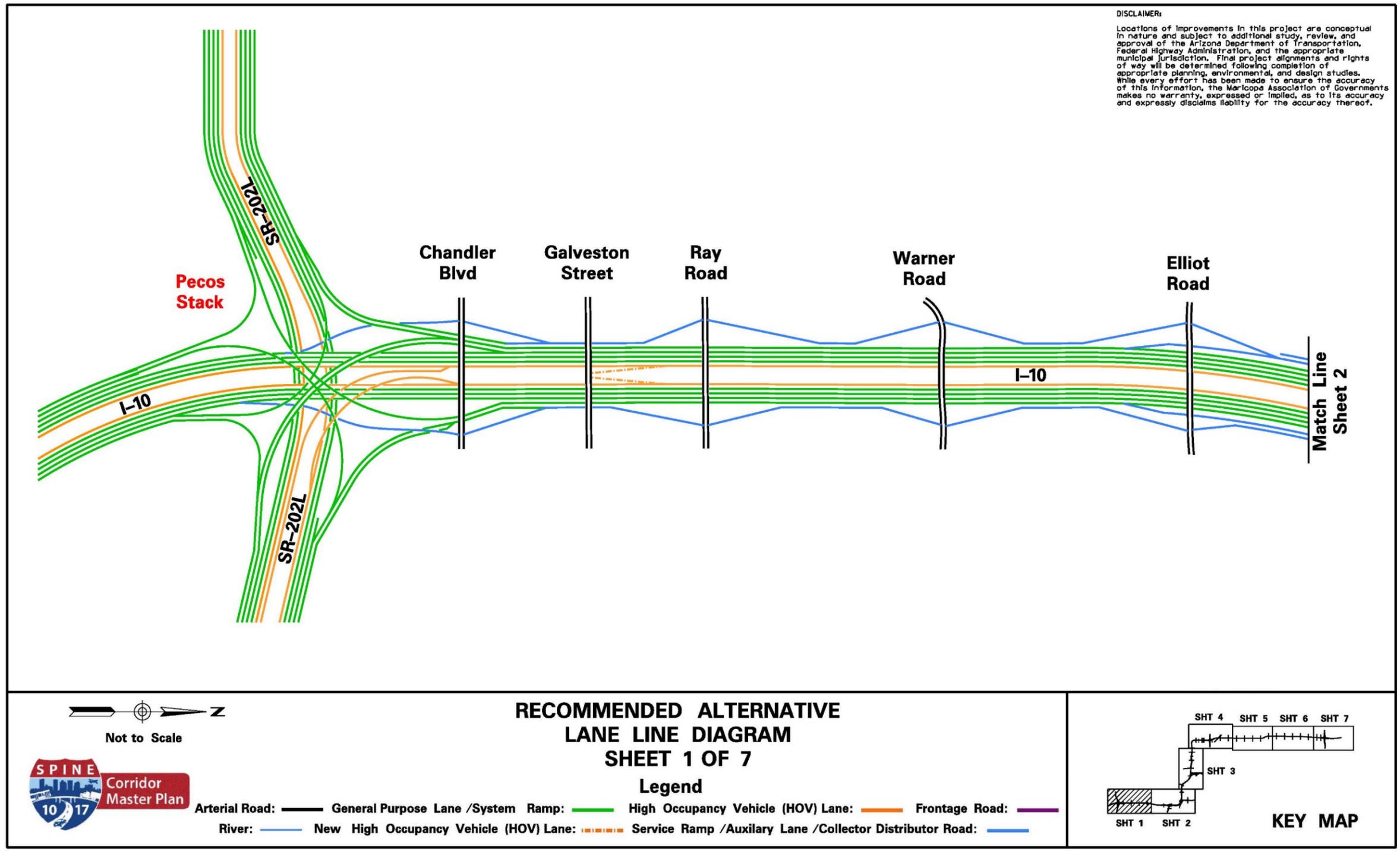


Figure 6-29. Recommended Alternative Lane Line Diagram, Sheet 2 of 7

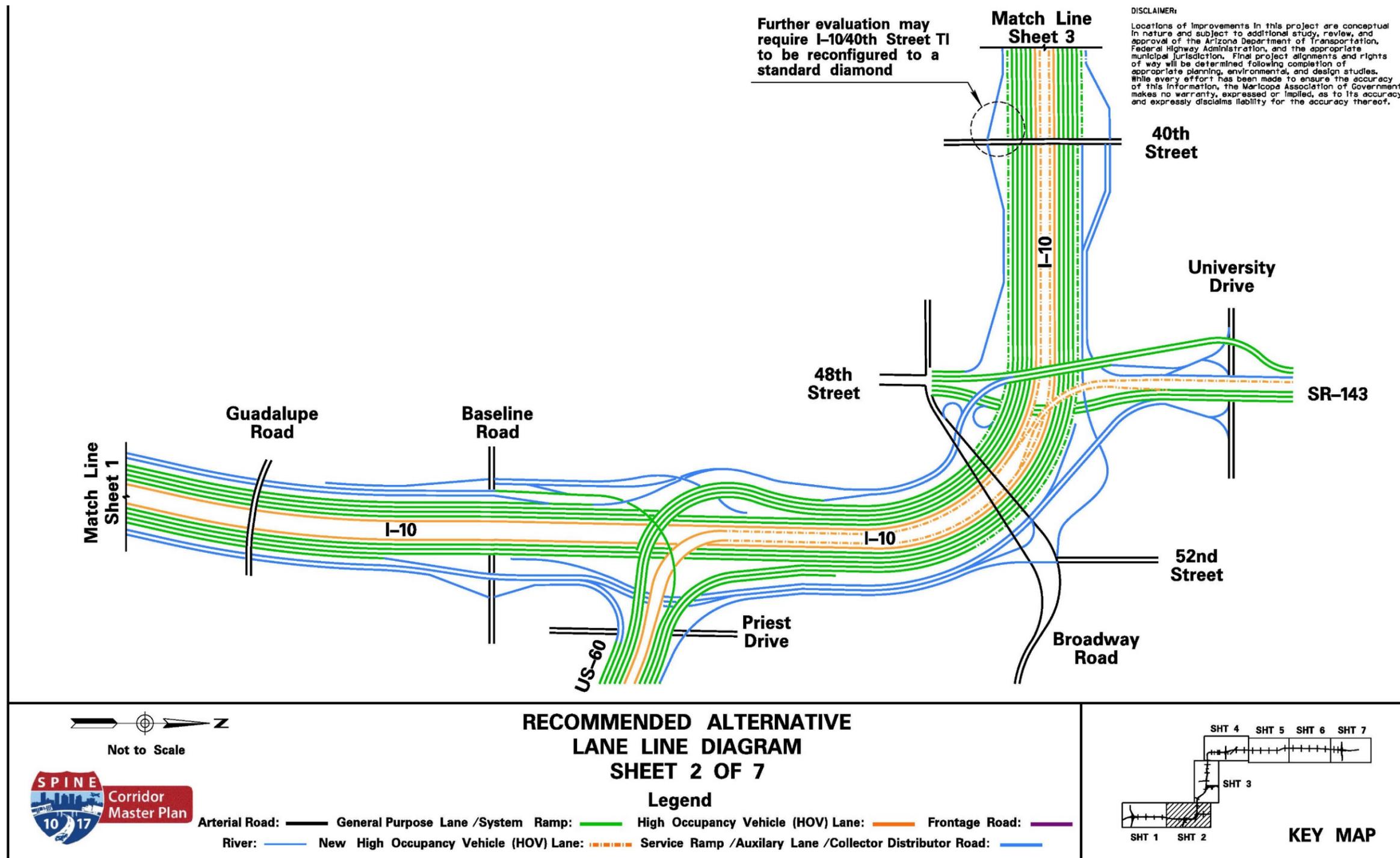


Figure 6-30. Recommended Alternative Lane Line Diagram, Sheet 3 of 7

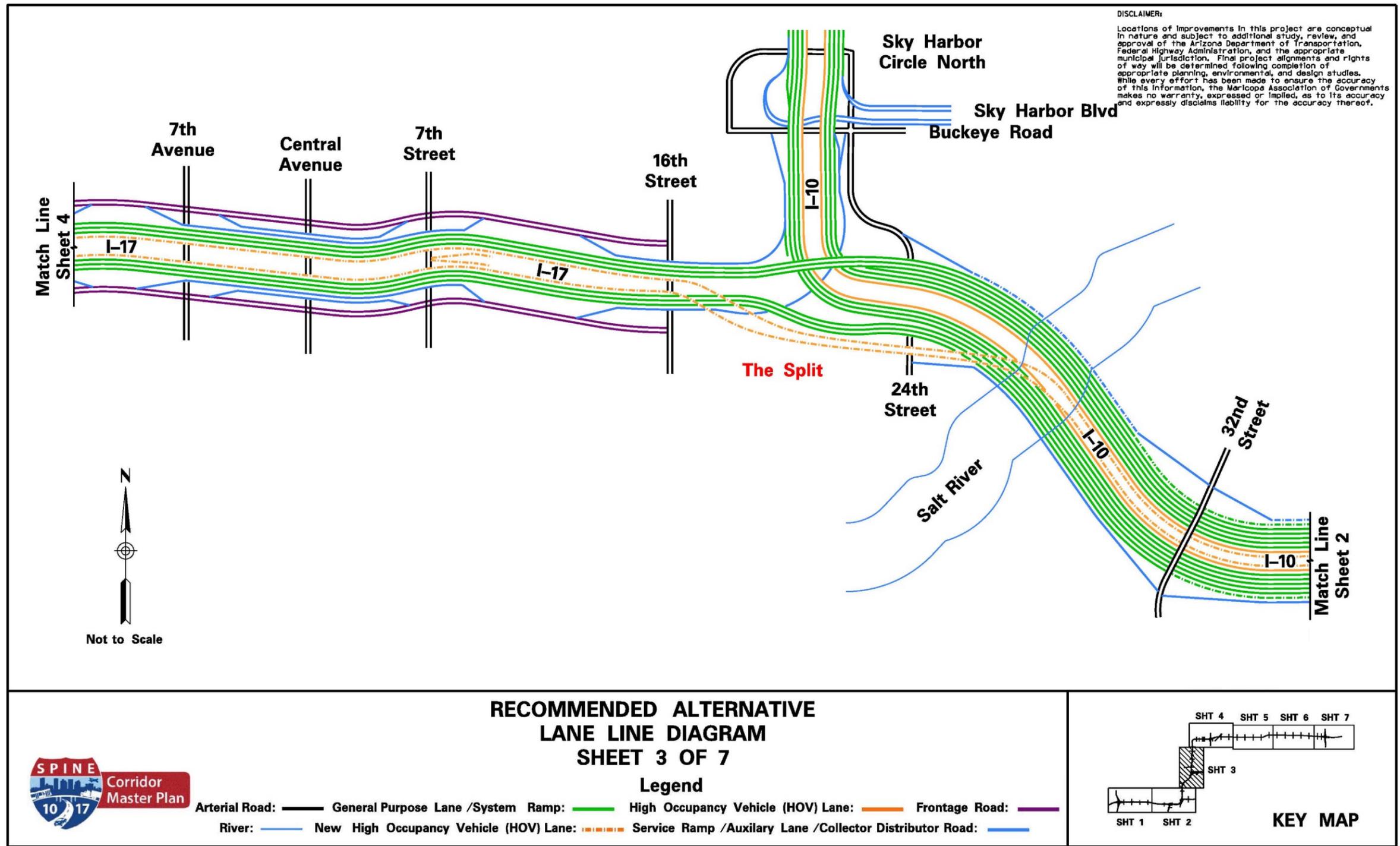


Figure 6-31. Recommended Alternative Lane Line Diagram, Sheet 4 of 7

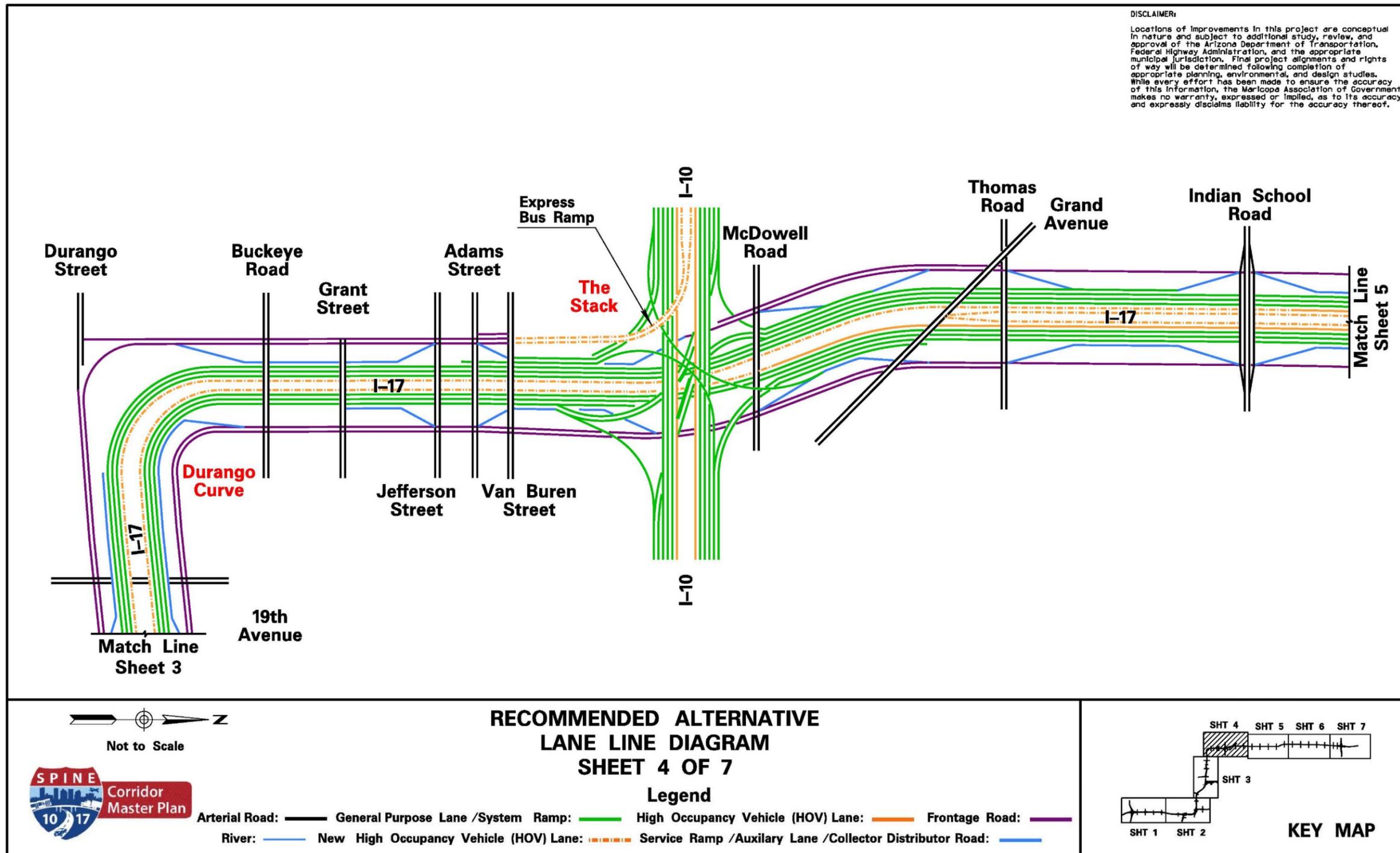


Figure 6-32. Recommended Alternative Lane Line Diagram, Sheet 5 of 7

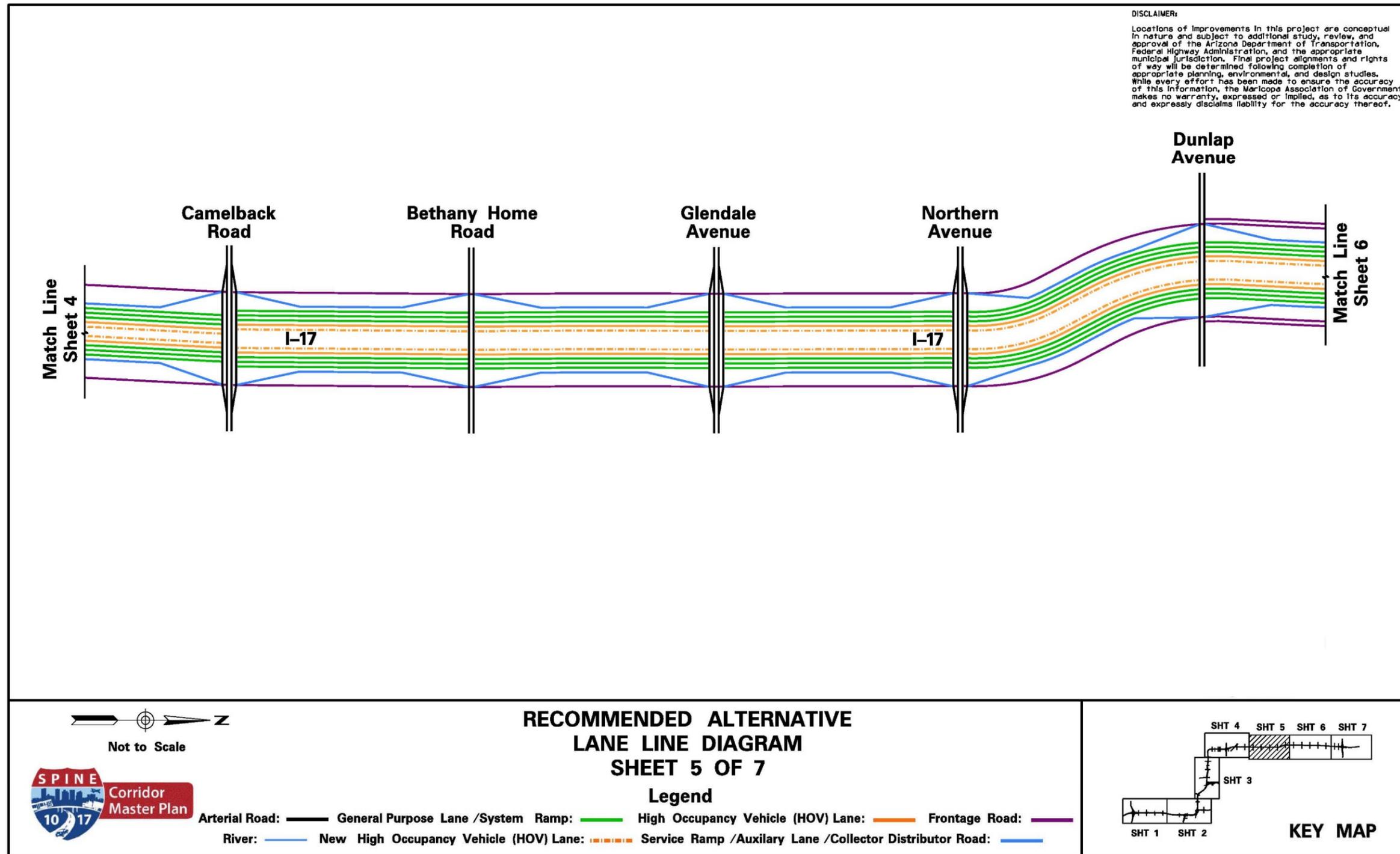


Figure 6-33. Recommended Alternative Lane Line Diagram, Sheet 6 of 7

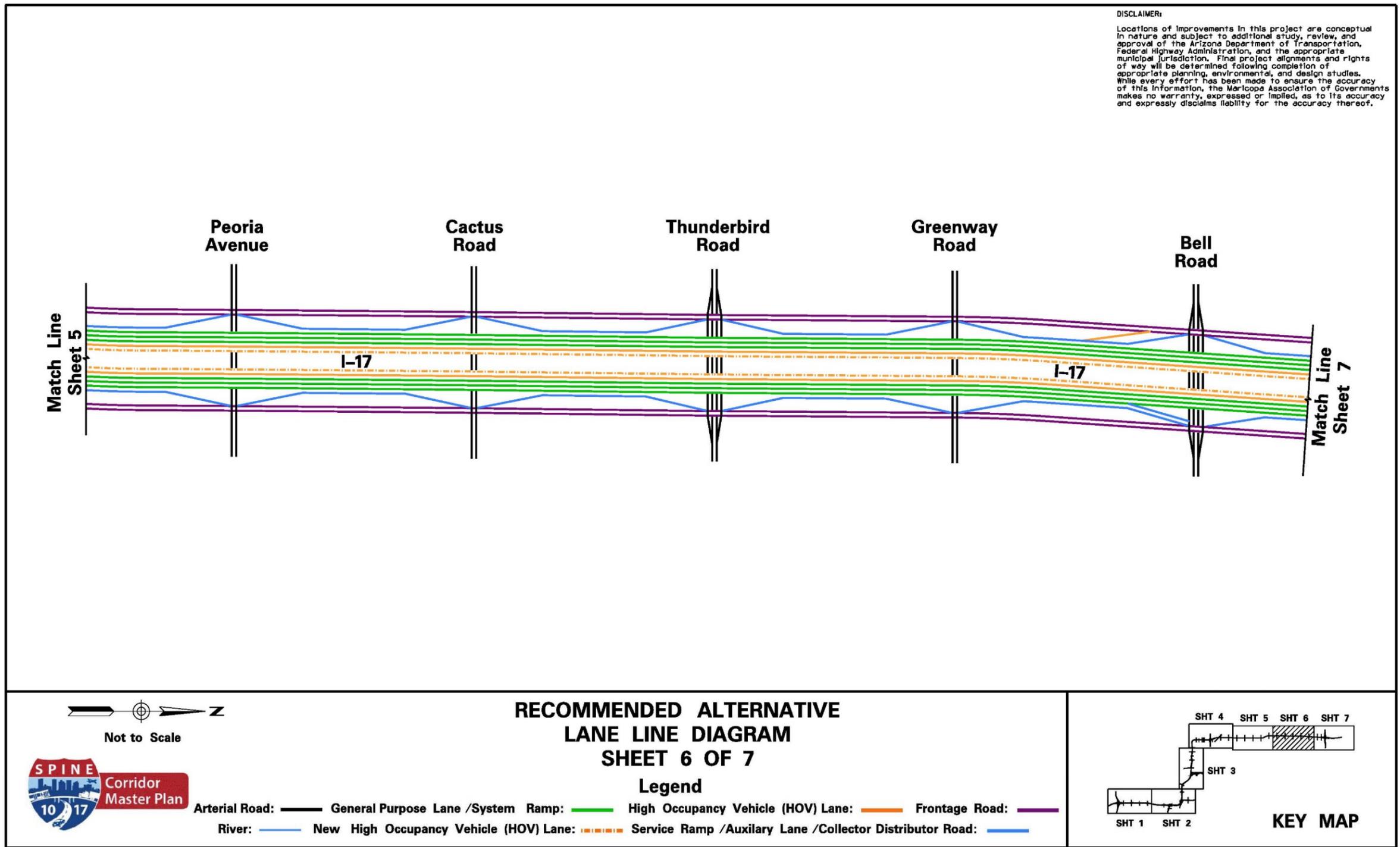
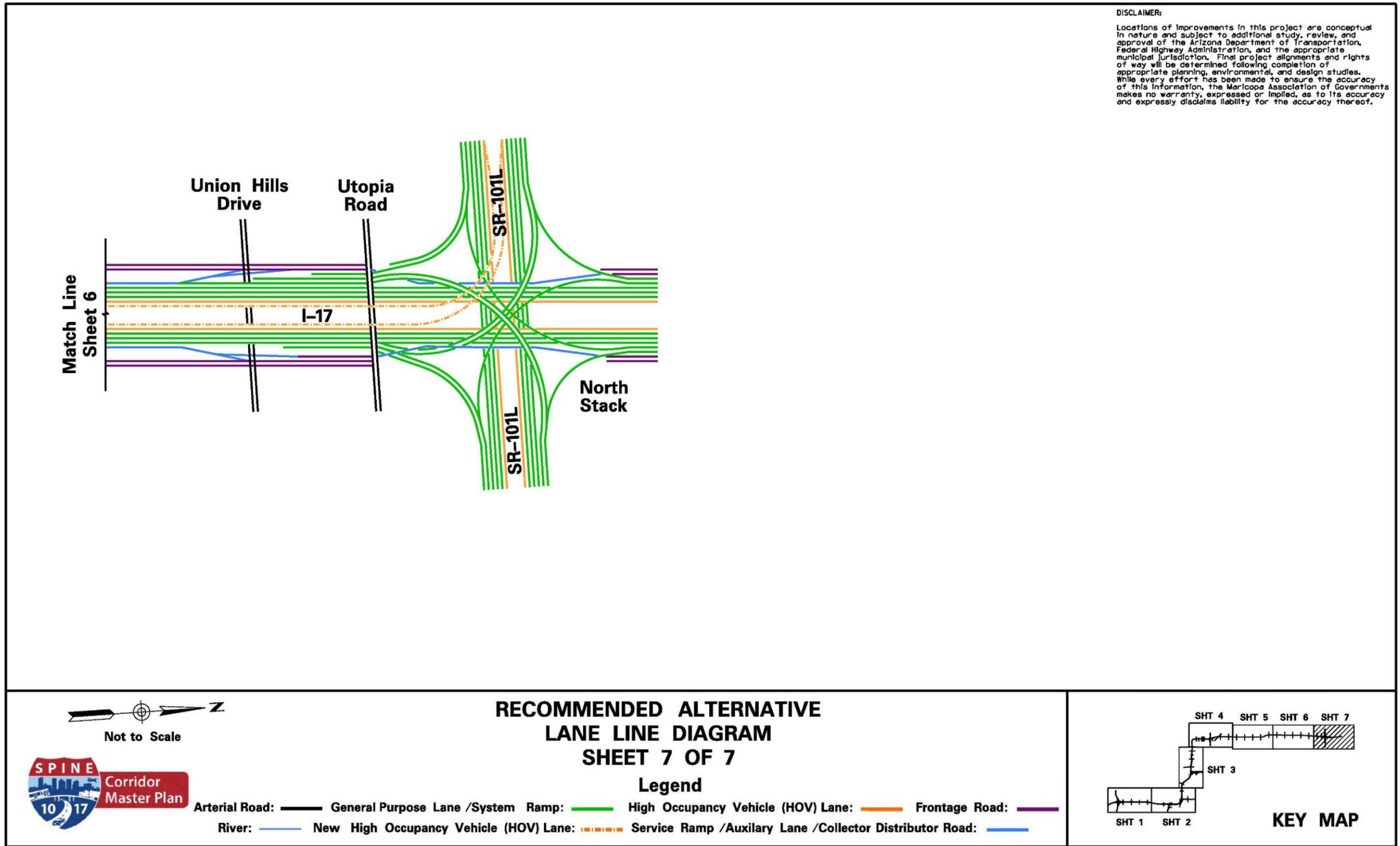


Figure 6-34. Recommended Alternative Lane Line Diagram, Sheet 7 of 7



7 Technology Considerations

This chapter describes the recommended ITS and operations environment for the Spine corridor network, including freeways and arterial streets. In an age defined by rapidly evolving technology and innovations, ITS technologies are critical components of transportation networks throughout the world, supporting safety and mobility. Technology and operations strategies can provide cost-effective solutions to mobility challenges, enable real-time data sharing among key system operations partners and connect travelers to decision-making information about current road and travel conditions.

MAG and its partner agencies continue to explore how technology can be used to support advanced operations strategies. The recommendations in this document were developed using the needs assessment and the corridor's identified operational gaps, but they were also largely informed by best practices and anticipated technology innovations for operations from around the world.

7.1 Background and Document Purpose

Agencies in the MAG region are advancing ICM concepts, which emphasize active corridor operations to coordinate between freeways and parallel arterials. New technologies are being piloted to test advanced ramp metering capabilities and detection systems that identify wrong-way drivers. Several local agencies are testing and operating adaptive traffic control systems, which allow traffic signals to respond to current traffic conditions rather than being set to fixed time-of-day signal plans. MAG and its member agencies are looking at successful implementations of active management strategies around the world to identify cutting-edge strategies that could be implemented on corridors such as the Spine to address specific safety and mobility issues.

This section discusses how technology will influence the transportation network through the 2040 horizon, identifies key opportunities to integrate new technologies into Spine corridor operations and recommends infrastructure enhancements. This section also provides planning-level cost opinions for technology improvements.

7.1.1 Technology Influences

The transportation system as users know it today will look very different in 2040. In the MAG region, numerous technology developers are already testing automated cars on the road network, and recently have begun recruiting real-world "civilian" drivers to see how these vehicles perform for typical day-to-day driving needs.

Transportation, like many things, is becoming more "on-demand"—and this will continue to drive innovation in personal mobility choices. Today's websites will continue to yield to more mobile applications that will either bring transportation to travelers or inform travelers of changes they should make to their travel plans. Vehicles will be able to make trip adjustments based on real-time information regarding current and predicted road conditions. Travelers will expect predictions of what travel conditions will be like and information about their trip and travel options.

Technology innovations will introduce new partners into the mobility supply chain. This is a fast-moving and competitive marketplace, with several layers of potential partners to collect, aggregate, share, analyze and archive information. Developers are needed to create technology platforms to process information and provide it in a usable format. Partnerships need to be in place to enable secure data exchanges. Information that agencies could not easily obtain will become ubiquitous and potentially sequestered in proprietary private-

sector systems. For key partnerships to be effective, an increased focus on acquiring and sharing data will be needed.

The Spine corridor contains some of the initial phases of ADOT's FMS, in operation since 1995 and expanded and upgraded over time to replace older technology with newer, more efficient systems. Along with these upgrades, ADOT also has advanced its operations capabilities, using the deployed systems to collect and disseminate travel time information, automate notifications to agencies about impacts on the network and share access to systems (such as camera images). Local agencies also have been steadily implementing and upgrading their traffic management capabilities, including traffic signal connectivity, communications infrastructure, real-time monitoring, freeway/arterial coordination planning and local TOCs. A strong foundation exists for expanding agencies' use of technology to improve safety and mobility throughout the Spine corridor.

7.1.2 Current Technologies and Initiatives in the Spine Corridor

The Spine NAR included details of current systems, technologies and initiatives in the Spine corridor, which are summarized in the following subsections. These existing capabilities provide an important foundation for future enhanced technology applications. This section concludes with recommendations for future technology infrastructure in the Spine corridor.

7.2 Freeway Operations and Assets in the Spine Corridor

7.2.1 ADOT Transportation System Management and Operations

ADOT was among the lead states to formalize TSMO at the agency. TSMO refers to a suite of systems, processes, collaboration and commitment to improving reliability and safety of the transportation network. It leverages available capacity by enhancing operations and coordination, particularly when nonrecurring events affect the transportation system, such as traffic incidents, work zones, hazardous weather or major planned special events. To better respond to these events and proactively address congestion and safety issues, ADOT's TSMO Division brought together key groups responsible for traffic operations, safety, system management and maintenance (traffic and systems). A benefit of ADOT's reorganization to establish the TSMO Division is the ability to coordinate important functions across these groups, such as traffic incident management, safety, system maintenance and system operations, performance management and system planning.

7.2.2 Freeway Management System

ADOT's FMS on I-10 and I-17 is centrally controlled from ADOT's TOC, which is staffed 24 hours per day, 7 days per week, 365 days per year. The FMS includes CCTV cameras, vehicle sensors, DMS and ramp meters for monitoring and mitigating traffic congestion on Phoenix-area freeways. Communication with the FMS field devices is provided through ADOT's extensive fiber-optic communication network that runs parallel to major freeways.

7.2.4 ADOT Traffic Operations Center

ADOT's TOC provides central management of the statewide transportation network. At the TOC, operators monitor and manage the Phoenix-area FMS. The ADOT TOC monitors and responds to both recurring and nonrecurring congestion on state road facilities. In addition to operators, a public information officer (PIO) and a DPS trooper are based at the ADOT TOC, providing liaison support for their respective departments during incidents.



Operators at the ADOT TOC monitor traffic conditions.

7.2.5 Traveler Information

Traveler information has been a core component of ADOT's FMS since it was constructed. Several activities and systems provide travelers, partner agencies and the media with current information about road and travel conditions:

- ADOT's PIO/Communications staff at the TOC actively disseminate information and notifications using tools such as Twitter (@ArizonaDOT), which currently has over 173,000 followers.
- ADOT has a long-standing relationship with local media channels to share camera images, alerts and travel times for traffic reports and updates.
- The ADOT 511 phone system provides corridor-based travel conditions information, including alerts for high-priority or emergency road closures or conditions. The www.az511.gov website includes an interactive map that can zoom in on urban areas to provide camera views, speed maps and current and planned closures and restrictions
- ADOT displays travel time estimates on freeways throughout Phoenix and Tucson using data gathered from FMS detectors.
- Two key data management systems support ADOT's traveler information capabilities. The Highway Condition Reporting System (HCRS) tracks incidents, closures, planned construction and planned event advisories. The HCRS is an important data source for 511 and www.az511.gov. The Regional Archived Data System (RADS) coordinates with HCRS and allows for data sharing and travel time calculation, and can support performance monitoring.

7.2.5.1 Active Traffic Management for Interstate 17

ATM strategies were evaluated for the I-17 corridor between I-10 and SR-101L and a concept of operations was developed for a host of ATM strategies. The concept included adaptive ramp metering, lane control signs on overhead gantries to support lane control and variable speed limits, queue warning through advance detection algorithms and arterial infrastructure to support freeway detours onto arterials during freeway lane closures. ADOT decided not to move forward with deploying this concept because of cost and maintenance concerns and because it wanted to explore other solutions that could address specific mobility and safety issues on the I-17 corridor. ADOT is now considering an "ATM lite" concept, where selected ATM strategies, such as smart ramp metering, are considered for different portions of the freeway based on their specific challenges.

7.2.5.2 Interstate 17 Wrong-Way Detection Deployment Pilot Project

Wrong-way driving has been a systemic issue in Arizona, causing incidents and fatalities that may be able to be avoided. DPS receives an average of 25 calls per month reporting a wrong-way driver. In response to the wrong-way driving problem in Arizona, ADOT is implementing a wrong-way driving detection pilot project along I-17 from I-10 to SR-101L. The project will provide thermal cameras at freeway exit ramps able to detect a wrong-way driver and to alert DPS and the ADOT TOC automatically. High-definition cameras will be mounted in the gore area of exit ramps to capture images of the vehicle as it enters the freeway. Thermal cameras along the I-17 main line will be able to track the wrong-way driving vehicle as it moves along the freeway. The project will be installed and tested in 2017, and is expected to be fully operational by early 2018. This pilot project will be closely monitored for effectiveness and potential deployment along other urban freeway corridors in Arizona.



A freeway message sign warns travelers of a wrong-way driver.

7.2.5.3 Integrated Corridor Management Planning for Interstate 10

The goal of ICM is to leverage available capacity across multiple modes (e.g., freeway, arterial, transit) to balance recurring congestion and to improve operations during freeway incidents or closures. The I-10 corridor has been a key focus for the region for initial ICM planning, and some level of expanded ICM implementation is envisioned to be a priority near-term strategy emerging from the Spine study. Early project concepts for the I-10 corridor have focused primarily on incident-based congestion—that is, when a major freeway incident closes or significantly restricts traffic mobility on I-10. It considers how state and local partners safely and effectively manage diverting traffic onto the adjacent arterial network. MAG received a grant from the U.S. Department of Transportation to develop an ICM plan and requirements for the I-10 corridor.

7.2.6 Connected Vehicle Pilot Program on Interstate 17

ADOT is working on a project to deploy dedicated short-range communication (DSRC) radios along the I-17 corridor near Anthem and New River. This pilot project expands, and will connect to, the SMARTDrive connected vehicle pilot in Anthem (led by MCDOT). The goal of connected vehicles is to provide real-time communication between equipped vehicles and roadside infrastructure, providing transportation agencies with an ubiquitous data source and with enhanced decision-making information for system operations strategies. The radios will be deployed on freeway DMS signs and CCTV camera poles. This deployment of DSRC radios along the corridor will connect to the testbed on Daisy Mountain Drive to create an extended testbed within a freeway corridor. Radios are expected to be installed later in 2017. Connected vehicle infrastructure should be considered for the entire Spine corridor to allow for extensive connected vehicle operations and testing and to keep the region at the forefront of connected vehicle readiness.

7.3 Arterial Operations and Assets in the Spine Corridor

Arterial street management agencies are also investing in arterial monitoring and management infrastructure. Phoenix, Tempe and Chandler are continuing to expand their arterial traffic monitoring and management capabilities to improve responsiveness to conditions on key arterials in real time.

7.3.1 City of Phoenix

The Phoenix Traffic Management Center (TMC) is located at Phoenix City Hall and oversees approximately 1,200 traffic signals, 24 miles of light rail transit intersections, more than 100 CCTV cameras, 5 arterial DMS, more than 72 miles of fiber-optic backbone, more than 900 wireless radios and several miles of twisted-pair copper cable. The City of Phoenix TMC operates during business hours, Monday through Friday.

An intergovernmental agreement (IGA) is being developed between the City of Phoenix and ADOT to allow ADOT to control the City of Phoenix signal system after business hours from the ADOT TOC. This after-hours support will allow ADOT to implement preset signal timing plans at intersections along I-10 if an incident or event on the freeway occurs that will affect Phoenix arterials. This agreement could be extended to the Spine corridor for after-hours support for arterial detours prompted by freeway closures.

Additional programmed projects in Phoenix through 2017 include:

- Creating predefined signal strategies and timing plans based on the developed concept of operations.
- Adding cameras and DMS throughout Phoenix and focusing investments on the Downtown Traffic Management System for special event management.
- Extending fiber-optic backbone to cover more signal and ITS infrastructure throughout Phoenix.

7.3.2 City of Tempe

Tempe's transportation system includes the arterial street system, bus network, bicycle trails and Valley Metro light rail transit. Tempe is an event "hotspot" in the region, hosting more than 150 special events each year. These events require road closures and support from police officers, fire department personnel and others to manage transportation to and around the event.

The Tempe TMC operates Monday through Friday during business hours. There are 222 traffic signals on arterial and collector routes, and Tempe has an IGA with ADOT to own, operate and maintain traffic signals at freeway traffic interchanges. CCTV cameras are located at arterial crossings and along the Valley Metro light rail transit in Tempe.

Programmed projects through 2017 include fiber communications along Elliot and Rural roads and DMS at key locations throughout. CCTV infrastructure is programmed for implementation in the next 4 years as part of projects programmed in the MAG TIP.

7.3.3 City of Chandler

The City of Chandler's current infrastructure includes a TMC, a fiber communication network on nearly all arterial streets throughout the city that connects 216 traffic signals, three DMS and more than 800 video devices (consisting of pan-tilt-zoom CCTV and video image detectors) to the TMC. Chandler's TMC operates weekdays during business hours.

Chandler was the first local agency in the region to deploy Bluetooth readers to estimate arterial travel times and post them on arterial DMS alongside freeway travel times. These real-time travel times are posted on DMS on three major arterial roads in Chandler from 6 a.m. to 7 p.m. Monday through Saturday. These signs also provide traveler information in response to major incidents or road closures.

Programmed projects in Chandler through 2017 include additional CCTV and fiber communications.

7.3.4 Maricopa County

The MCDOT TMC is open Monday through Friday, and will extend operations hours if a large-scale incident after business hours requires support from MCDOT's Regional Emergency Action Coordination Team (REACT). The MCDOT TMC serves in an important coordinating role for arterial incidents and issues social media alerts and notifications about incidents or events affecting the network.

MCDOT owns and operates RADS, which collects all ADOT FMS data, many local agency data sets and Phoenix Fire Department filtered computer-aided dispatch (CAD) data. The RADS stores and processes the data for a variety of purposes, such as calculating freeway travel times to be posted on freeway DMS. The system is linked with HCRS to provide real-time traffic data to support speed maps on the ADOT 511 website. It also provides supplemental road condition information collected from public safety agencies and local agencies that is not already collected through the HCRS system.

Future enhancements to RADS processes include:

- TMC center-to-center interfaces with other cities.
- Transit information integration into RADS system.
- Support of "connected vehicle" development activities.
- Retrieval of DMS display data for archiving.

7.3.4.4 Bell Road Adaptive Signal Timing Project

Agencies in the region are beginning to test adaptive signal capabilities, and Bell Road is the first regionally significant corridor where adaptive traffic signal control is being implemented. Multiple segments of Bell Road are testing different adaptive traffic signal control strategies, and the City of Phoenix's segment crosses I-17. Adaptive signal operations are being implemented along this corridor to adaptively respond to changing traffic conditions, particularly at freeway intersection locations, and to demonstrate multijurisdictional coordination of adaptive systems. This project is being led by MCDOT and includes the Cities of Surprise, Phoenix, Peoria, Glendale and Scottsdale.

7.4 Coordinated Traffic Incident Management

According to the U.S. Department of Transportation, an estimated 50 percent of congestion is caused by traffic incidents. Arizona agencies are actively coordinating to improve response, clearance and management of incidents affecting freeways and arterials in the following ways:



Operators at the MCDOT TMC monitor traffic conditions.

- DPS operates a 24-hour-per-day, 7-day-per-week, 365-day-per-year dispatch center for statewide incident and emergency response. Incident information is logged and subsequently disseminated to DPS vehicles through a CAD system, and a CAD data feed is provided to the ADOT TOC and MCDOT TMC via a dedicated workstation. This data feed improves real-time notifications to these agencies.
- In 2015, through a partnership with DPS, ADOT and MAG, DPS stationed a uniformed officer at the ADOT TOC with a goal of improving incident response and communications. In the first year of the program, this co-location helped reduce the average time to clear freeway incidents by almost an hour.
- The regional Freeway Service Patrol (FSP) assists stranded motorists on Phoenix metropolitan area freeways and helps to eliminate road hazards and distractions. FSP helps with non-emergency responses, such as flat tires, fuel or calling a tow truck. DPS and MAG co-fund this program for the Phoenix metropolitan area at \$1 million per year in the MAG TIP. AAA Arizona also provides some sponsorship and support for the program.
- The Arizona Local Emergency Response Team (ALERT) is operated by ADOT and is a 24-hour-per-day, 7-day-per-week response team for major crashes, emergencies or weather-related events along freeways in the Phoenix metropolitan area. In the event of an incident, law enforcement will determine whether assistance from the ALERT team is needed to support traffic control.
- The AZTech Traffic Incident Management Coalition, led by DPS, brings together state and local responders, law enforcement, fire, emergency medical services and tow operators for monthly strategic meetings regarding how to improve coordination and communication, provide training and track incident response performance.
- Each city within the Spine study area has its own police and fire department. The Phoenix Fire Department dispatches local fire and emergency medical dispatching services for approximately 23 jurisdictions in the Phoenix metropolitan area.

7.5 Other Technology and Operations Initiatives in the MAG Region

Although not directly part of the Spine corridor, technologies and initiatives discussed in this section highlight activities on other corridors in the region, or on a regional level, that can be evaluated for potential Spine implementation.

7.5.1 Adaptive Ramp Metering Pilot on State Route 51

Ramp meters are deployed on all freeway entrance ramps within the Spine corridor. Most are currently activated by time-of-day scheduling and have adjustable activation thresholds based on main line detection near the ramp. In the fall of 2016, ADOT began testing an algorithm for adaptive and responsive ramp metering on SR-51 where the ramp meter program automatically selects the best metering rate for the series of ramp meters along the corridor based on freeway congestion and queuing at the ramp meter.

Detectors along the entrance ramps assess whether ramp traffic is backing up and accordingly adjust the ramp metering timing based on a custom algorithm. At locations where ramp meter queues become extended, the metering rate is sped up, while another ramp meter with less queue is slowed down. ADOT is conducting a before-and-after evaluation of the ramp metering pilot to provide insights into the benefits and lessons learned.

7.5.2 SR-101L Integrated Corridor Management

ADOT, Scottsdale, MCDOT, the Salt River Pima-Maricopa Indian Community and MAG jointly developed an ICM program for the SR-101L corridor in Scottsdale. The SR-101L ICM plan includes protocols for improved coordination and communication between operating and responding agencies involved when an arterial detour is needed through the city of Scottsdale to accommodate traffic from SR-101L. The plan includes notification processes and traffic management protocols that use a strategic combination of Scottsdale arterial signal and infrastructure control, ADOT freeway DMS messaging and traffic control to most efficiently detour traffic off and back on to the freeway. Key partners included transportation, law enforcement and emergency responders.

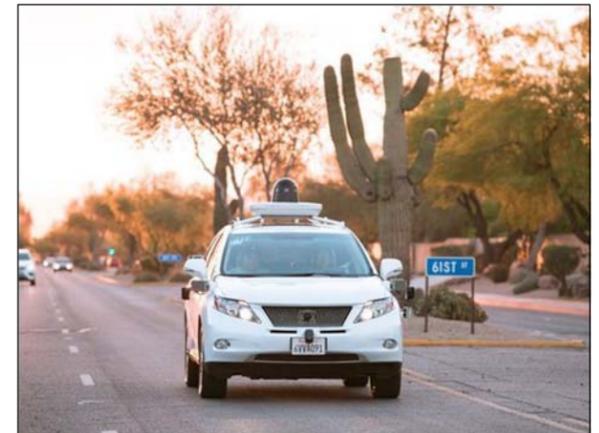
The plan has been implemented and has helped partner agencies better manage freeway incidents on SR-101L and implement construction detours related to the SR-101L widening/HOV lane project.

With the success of this first implementation along SR-101L in Scottsdale, plans are being developed to extend the ICM along SR-101L through Phoenix and the West Valley cities.

7.5.3 Autonomous Vehicle Testing

In 2015, the Arizona Governor signed an executive order to support autonomous vehicle testing and attract new technology business to the state. Companies are attracted to Arizona because of the unique experiences that the cars can be tested with, including extreme heat, watering trucks, dust storms and a variety of transit, bicycle and pedestrian facilities.

Since 2015, Google (Waymo), Uber, General Motors, Ford and others are now testing autonomous vehicles throughout the Phoenix metropolitan area. These tests include human drivers who sit in the front seats to ensure the vehicles are operating properly. Google has reached out to the City of Chandler Transportation Department to learn about the information behind the traffic signal and ITS systems in the city and to identify ways that the autonomous vehicles could better interface with city traffic signals.



An autonomous vehicle is tested in Arizona.

7.6 Key Needs and Gaps to be Addressed in the Spine Corridor

Considering the existing capabilities related to operations and management along the Spine corridor, this section identifies some of the key gaps that can be addressed using strategically deployed technology and systems.

7.6.1 Real-time Data

The FMS on freeways in the Spine corridor provide ADOT with condition data that can be used to monitor and make real-time decisions related to freeway operations. However, this level of data is not equally available for locally owned adjacent arterials in the corridor to support real-time monitoring of arterial operations.

To date, private-sector data have not been widely used to supplement arterial data, thus leaving a gap in the data available for real-time systems management and operations in the region. Crowdsourcing options use a combination of anonymous crowd-sourced data and historical data to identify speeds or provide travel times. Several acknowledge that their models are still being refined and that arterials pose some different challenges than freeway corridors. Connected vehicles, when deployed, can also serve as a valuable source of real-time information on the transportation network.

Recently, ADOT issued a request for proposals to obtain statewide data from a third-party provider(s). The advancement of this project would provide ADOT with probe data for the entire state, including arterials and freeways, which would create the opportunity for the region to pursue strategies that require or benefit from real-time data. These might include real-time traffic signal optimization strategies or supporting the implementation of freeway-arterial detours throughout the region.

7.6.2 Integrated Operations Between Freeways, Arterials and Transit

While freeways, arterials and transit are each operated by different agencies, operations along the corridor should be coordinated and complementary to provide the greatest efficiency for travelers along the corridor. Integrating the operations of these facilities should mean that operators from the different agencies are in frequent communication and that data and real-time condition information from each facility/agency are shared. This will facilitate better use of existing corridor capacity and provide better and more consistent information to the traveling public.

7.6.3 Decision Support Systems

Going one step beyond integrated operations, regional agencies have discussed developing a Decision Support System (DSS) to manage the regional transportation network, including the Spine corridor. A DSS leverages real-time data and the operational capabilities of agencies' existing central management systems, concurrently with a set of preset response plans, to make operations recommendations for managing the transportation network in response to existing conditions. A DSS uses a software algorithm to examine the transportation network as a whole, including freeways, arterials and transit, and to identify the best operational responses for current network conditions.

7.6.4 Improved Intersection Safety for All Modes

Many of the freeway interchanges along the corridor need enhancements to improve the safety of bicyclists and pedestrians. Freeway interchanges can have specific safety challenges for bicycles and pedestrians because cars approach the intersections at high speeds and because a multi-intersection configuration is needed to support on- and off-ramps for both directions. Intersection geometry improvements are being addressed as part of the Spine corridor recommendations, but the role of technology in improving intersection safety for bicycles and pedestrians should be considered—at freeway interchanges and at regular arterial intersections within the Spine corridor. Technologies will likely include both intersection-based technologies that can be influenced by public agencies, such as detection and connected vehicle infrastructure, and vehicle-based technologies that will be private-sector driven, such as collision avoidance systems built into vehicles.

7.6.5 Enhanced Local Operational Capabilities

Gaps in infrastructure, staff and systems can hinder a local agency's ability to most effectively monitor, operate and manage its network. For example, many infrastructure gaps, such as lack of detection or CCTV cameras,

occur along arterials within the Spine corridor in Phoenix that limit Phoenix's ability to manage traffic on the arterials because it cannot gather real-time data about the intersection or traffic flow. All local agencies within the Spine corridor have challenges related to staffing at local TMCs or operations facilities to actively monitor and manage traffic conditions.

7.7 Operational and Technology Approaches for Spine Corridor

This section describes near- and long-term concepts for operational enhancements to freeways and arterials in the Spine corridor. The concepts include technologies and processes that support advanced operations and management of the corridor.

7.7.1 Enhanced Freeway and Arterial Management Concept

The Enhanced Management approach involves technology and operational strategies to support advanced traffic management on freeways and arterials and improved freeway-arterial coordination. Technologies have specifically been chosen as part of this concept to support multiple uses; for example, freeway and arterial signs could provide traveler information for commuters, queue or travel time information for freight destinations or mode shift travel times for transit users.

MAG has explored Managed Motorways concepts, which are actively used to manage freeways and adjacent corridors in urban areas of the United Kingdom and Australia. These concepts are similar to ICM and ATM implementations in the United States, in that they integrate technology and operational processes to coordinate traffic operations and manage travel demand at the corridor level, and when peak demand is at its highest. Some examples of technologies that are typically part of a Managed Motorway include variable speed limits, adaptive ramp metering, lane control systems and monitoring systems (including cameras and detectors). In addition to technology and operations strategies, managed lane policies are also part of several Managed Motorways programs. MAG initially started exploring Managed Motorways concepts as part of the MAG Managed Lanes Network Development Strategy. Phase 1 of the strategy was completed in 2013 and has since moved on to pilot implementation of advanced ramp metering strategies on SR-51 in 2017.

On the freeway, technologies could support collection of real-time condition data including speed, travel times, congestion and queues. These data would help identify congested freeway conditions and would be used as an input in determining whether an arterial detour is needed. The data would support calculation and posting of comparative travel times to allow travelers to make informed decision about their routes and mode of travel. Additional DMS infrastructure would allow more frequent dissemination of traveler information along the freeway. One key audience for traveler information is freight operators, who could be alerted of network conditions ahead of them and the anticipated impacts on their routes based on real-time information. CCTVs would be placed where necessary to provide complete surveillance coverage of the freeway throughout the corridor, including all entrance and exit ramps. The necessary communications infrastructure would be in place to support seamless communications between freeway devices and the ADOT TOC.

To provide enhanced traffic management on the freeways, adaptive ramp metering technologies would be deployed on all freeway entrance ramps, where implementation of ramp metering rates would be informed by real-time conditions data collected on the freeway main line, ramp and interchange associated with the ramp. Connectivity between the ramp and the interchange traffic signal would be established so they could work in concert to improve traffic flow onto the freeway without negatively affecting traffic on adjacent arterial streets.

Arterials designated as detour routes, and those that cross the freeway, would be outfitted to support the rerouting of freeway traffic onto the arterial network in the case of a freeway closure or severe restrictions to freeway operations. The arterials identified as potential detour routes would be equipped to collect and provide real-time condition data, such as speeds, travel times and queues. These data would support the selection of the detour route and allow for calculation of arterial travel times. The arterials would have complete surveillance coverage at all major intersections to monitor the detour routes at all times. Route guidance infrastructure would be in place at major decision points along the arterial detour options to support wayfinding by travelers when detours are implemented. All the infrastructure deployed on these designated arterials would have communications that connect them either to the ADOT TOC or a local TMC to allow for remote operation and management.

To provide enhanced traffic management on arterials within the corridor, all traffic signals including freeway interchanges would have the technology and communications to support coordinated traffic signal operations. Interoperability between signals would be available and operated by different agencies, using a central DSS so that corridor-based timing plans could be generated to reduce delay and improve traffic flow along the Spine corridor. Arterial traffic signals along the corridor would support adaptive signal control, which would support more dynamic, coordinated and condition-driven signal timing along corridors. These advanced operations would facilitate improved arterial traffic flow based on real-time traffic condition data collected by arterial devices. These systems would also support improved signal operations where higher volumes of truck traffic enter or exit freeway ramps. Key locations include I-17/7th Avenue, I-17/19th Avenue and I-10/Broadway Road.

Enhanced monitoring and traveler information along the freeway and arterial networks would support the improved movement of all users through the system, including personal vehicles, freight, transit and bicycles/pedestrians that will use or cross the network.

7.7.2 Enhanced Multimodal Intersection Safety Concept

In coordination with traffic interchange improvements and construction of bicycle and pedestrian bridges across the freeway, this concept would deploy technologies to improve safety of bicyclists and pedestrians in the intersection and to improve the intersection's efficiency as it balances multimodal demands.

Intersections in the corridor, including freeway interchange intersections, would be equipped with technology to support the automatic adjustment of traffic signal timing based on pedestrian demand; this would occur in conjunction with adaptive signal timing. This would involve detection within the sidewalk and crosswalk that provides data on the approximate number of pedestrians waiting to cross the intersection at a certain leg. The software would trigger an extension of the pedestrian cross phase when large numbers of people are waiting, allowing more people to cross the road during that phase. Additionally, the detection can cancel the pedestrian crossing phase if it detects that a pedestrian who has activated the crossing button is no longer present (that is, if he or she



This traffic signal has a bicycle signal head showing bicyclists when it is safe to cross the intersection.

crossed the road in a different direction, crossed outside of the pedestrian crossing phase or decided not to cross the road at all). This application would increase the efficiency of the crosswalk by not activating the complete pedestrian crossing phase if it is not needed.

Intersections would also be equipped with advanced sensors combined with radar-type detection to specifically detect bicyclists in a travel lane. When a bicyclist is detected, the signal timing would be triggered (if the signal is in the red phase) or the green time would be extended (if the signal is in the green phase) to allow the bicyclist enough time to pass through the intersection. This would eliminate the challenges of bicyclists not being able to trigger detection at intersections and the need for bicyclists to cross traffic to push the pedestrian push button.

To improve bicyclist safety at intersections, bicycle signal heads would be installed that provide specific phasing information to bicyclists about when they can enter the intersections. The bicycle signals would be incorporated into existing intersections and the timing and phasing would be coordinated with the regular signal, but with timing and phasing that best accommodates bicycle movement. These signal heads would exist at locations where newly constructed bicycle/pedestrian bridges meet an arterial and at all reconstructed intersections along the Spine corridor.

This concept could be piloted at specific locations with higher crash rates involving bicycles and pedestrians prior to full implementation. Potential locations include: 19th Avenue, 27th Avenue, 35th Avenue, Priest Drive/University Drive, 7th Street/McDowell Road and Kyrene Road/Baseline Road. An outreach and education program would be needed to alert pedestrians and bicyclists about the new technology. These technology enhancements would be in addition to design and operations countermeasures (crosswalk striping and marking, signs or bicycle lane striping).

7.7.3 Connected and Autonomous Vehicle Concept

This concept would include deploying technology and systems that support connected and autonomous vehicle operations as they become more prevalent in the future. Much of the research and pilot testing to date has focused on systems for connected vehicles. It is not yet known whether any systems will be needed to enable autonomous vehicles, since many companies are already testing such vehicles with limited coordination with agencies and no new equipment deployed by agencies.

Connected vehicle applications have the potential to improve detection of incidents and the impact of incidents, identify and provide advanced warning of road hazards, improve real-time control and coordination of traffic signals and ramp meters, support lane control strategies and provide robust data about real-time conditions. Several of these applications are applicable to the Spine corridor and will require a vehicle-to-infrastructure interface. To enable data transmission between roadside equipment and vehicles, DSRC radios would need to be installed on both the freeway and adjacent arterials. DSRC enables reliable, high transmission rate, low latency and secure communications, and is a more likely choice for safety-driven applications (intersection collision warning) than using a different communications method, such as Wi-Fi or cellular. Both Wi-Fi and cellular are less secure and could be affected by the density of



Technology systems that support connected and autonomous vehicles would communicate with various types of vehicles.

equipped vehicles, increased latency of data transmission and network vulnerabilities. Lower-risk applications, such as wide area broadcast announcements, emissions monitoring and even ramp metering could potentially leverage cellular or Wi-Fi communications.

ADOT plans to install DSRC radios on I-17 as part of an expansion of the SMARTDrive Connected Vehicle Test Bed in Anthem. These will be installed on existing structures, sign gantries and posts, light posts and other similar structures. DSRC radios have a range of approximately 1,000 feet. Existing data servers will be configured to take in the data and process it for use by traffic control and management systems. It has not yet been determined whether the freeway DSRC will interface locally at equipment (such as ramp meters or DMS).

Expanding the DSRC capabilities to adjacent arterials would require additional radios and system upgrades at local agencies. Connected vehicles have the potential to address a major gap in today's operations—the lack of real-time congestion and travel information on arterials.

7.7.4 Wrong-Way Driving Detection and Warning Concept

This concept would extend the limits of the I-17 Wrong-Way Detection Deployment Pilot Project, which is scheduled to be constructed on I-17 between SR-101L and I-10 in 2017. It will allow the ADOT TOC and DPS to detect a wrong-way driver who is entering or already driving on the freeway in the wrong direction and allow them to activate responses to warn other drivers on the corridor.

On freeway exit ramps, including freeway-to-freeway transition ramps, detection technology would detect a wrong-way driver at the top of the ramp (near the interchange) and at the bottom (gore point). Also at the gore point, equipment would provide high-quality, visual confirmation of a wrong-way vehicle that also provides identifying characteristics of the vehicle and driver to help the TOC and DPS find the vehicle on the roadway. Dynamic signs placed on the exit at the gore point that are triggered by the detection of a wrong-way driver would provide a visual warning to the driver that he or she is driving the wrong way.

On the freeway main line, detection technology would be deployed that could detect a wrong-way driver and provide an alert to the ADOT TOC. Additional dynamic message boards would provide information and warnings to right-way drivers of wrong-way drivers on the corridor at a greater frequency than the current 3-mile intervals at which DMS are spaced. Complete surveillance along the freeway would allow remote monitoring of the main line and exit ramps within the corridor by the ADOT TOC.

Communications equipment would be in place to allow all equipment on the main line, the ramps (entrance ramps, exit ramps and freeway-to-freeway transition ramps) and at the freeway interchange to communicate with the ADOT TOC so that they can be remotely monitored and operated.

7.7.5 Nontechnology Operational Approaches

The operational approaches described below are recommended to support implementation of the technology approaches. The strategies fall into two categories: staffing resources and coordination and collaboration.

7.7.5.5 Staffing Resources

- **Regional ITS maintenance support:** Create dedicated staff positions to support proactive maintenance and operational reliability of ITS and technology investments on the Spine corridor. Anticipated to be a 10-year contract for staff and should include provision of continuous training and education as technologies change and evolve.

- **Emergency response services:** Expand the FSP, ALERT and REACT to provide greater availability and frequency of service along the Spine corridor. This would involve increasing staff numbers and the availability of emergency response equipment used to respond to events by each team.
- **Regional corridor manager:** Identify a dedicated staff member to focus on operations and management of the Spine corridor. This includes freeway and local traffic management, incident response and support resources (ALERT, FSP, law enforcement), project prioritization and programming and maintenance.

7.7.5.6 Coordination and Collaboration

- **Regional DSS:** Develop and integrate a centralized DSS for the region, which would use real-time data from freeways, arterials and transit along the corridor and recommend a set of strategies to optimize operations in the corridor. This would include a combination of agency and third-party data. The strategies would include freeway, arterial and transit strategies that work coherently and collectively to move traffic efficiently and safely through the corridor. Strategies for each facility would be predetermined and agreed upon by all agencies involved, and partner agencies would also decide whether the recommended set of strategies would be automatically deployed throughout the corridor or whether they would be manually accepted and deployed by each agency.
- **Shared operations agreements:** Formal agreements to support 24-hour-per-day, 7-day-per-week operations of all freeway and arterial roadways within the Spine corridor would provide full coverage for critical corridors. This includes agreements and standard procedures that allow local agencies to operate their respective operations and manage equipment and systems within the corridor during business hours while allowing the ADOT TOC to implement agreed-upon strategies for arterials after business hours.
- **Message library:** Create an agreed-upon message library for DMS, social media postings, and 511 alerts to standardize messaging along the corridor between freeway, arterial and transit agencies. This would support consistent messaging to travelers about corridor conditions, including advanced notification of lane restrictions or alternate routing options, across jurisdictional boundaries, between the modal network (e.g., freeways, arterials and transit) and through multiple media outlets (e.g., DMS, social media and 511).

7.8 Implementation Recommendations and Cost Opinions

Implementation recommendations have been developed that factor in planned enhancements, as well as considering strategies that could be phased in over time. Several stakeholders, including MAG, ADOT, MCDOT, cities and public safety agencies, had input to different strategies and needs as part of structured focus group discussion during the I-10/I-17 Corridor Master Plan study. In parallel with that project, MAG is also preparing a Systems Management and Operations Plan for the region, and that plan identified ICM as a regional priority. There is a strong correlation between the Spine technology recommendations and those that are emerging from the MAG Systems Management and Operations Plan.

Corridor segments are shown in Figure 7-1, and these segments are consistent with other recommendations in the I-10/I-17 Corridor Master Plan.

Table 7-1 summarizes the infrastructure and systems included in the recommended concepts.

Figure 7-1. Spine Corridor Segments

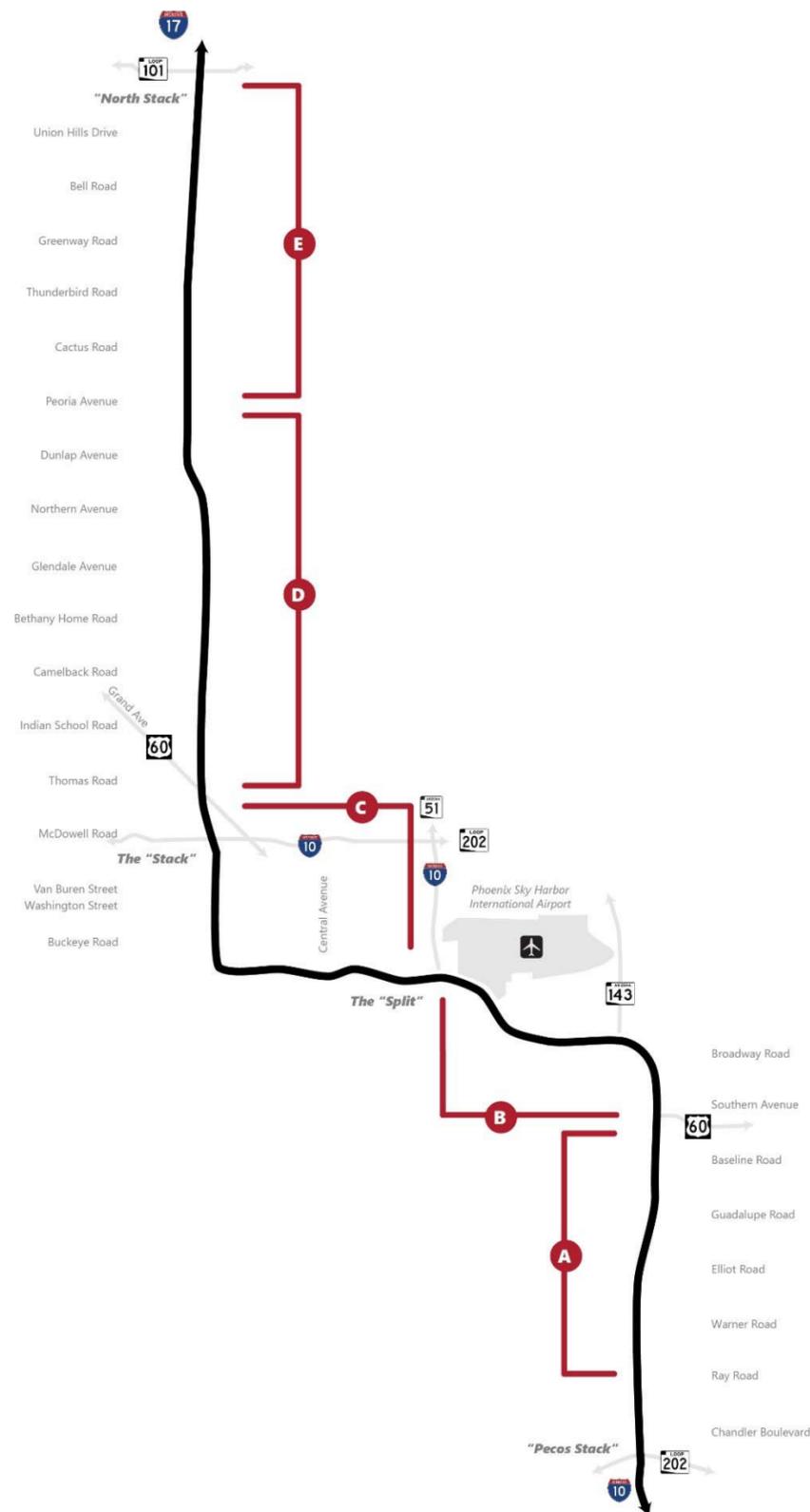


Table 7-1. Summary of Technology Recommendations and Uses

Technology	Description and Use
Enhanced Freeway and Arterial Management Concept	
Arterial communications infrastructure	Fiber and wireless network that provides for stable communications connections between all ITS infrastructure and a central management system on key arterials.
Arterial detection	Detection infrastructure—including existing detection (loops, video identification detection and Bluetooth) and ARID to fill gaps—that supports the collection of travel time and speed data. Data would be used to provide more comprehensive and real-time traveler information for arterials. Recommended deployment at all major-major intersections along potential detour routes and at all freeway traffic interchanges for contiguous coverage.
Arterial detour wayfinding infrastructure	Signs to support detour wayfinding to safely route traffic from freeways to arterials and back to the freeways. Would include static signs at all major decision points along an arterial detour route.
Arterial detour surveillance infrastructure	CCTV cameras to support surveillance of corridor routes, especially during freeway-arterial detouring to make sure that the routes remain safe and free of hazards. Surveillance would also support faster identification and response to incidents and infrastructure malfunctions on these routes.
Arterial detour messaging infrastructure	DMS that can be changed remotely in real time to support traveler information, including posting comparative travel times for freeways and arterials, providing information to support detour routing and providing general traveler information for the Spine corridor.
Adaptive signal control	Central system that would collect and analyze data from arterial detection to determine and implement the optimal signal timing and phasing for traffic signals along a corridor. The system would undergo this analysis and optimization process every few minutes to keep traffic flowing smoothly and to reduce unnecessary delay at intersections. Would help address signal operations needs for vehicles and for trucks.
Freeway ATM side-mounted DMS	Side-mounted DMS along the freeway located every mile in between the existing overhead DMS, which are spaced roughly every 3 miles in each direction. Signs would be mounted in the median or on the shoulder to provide traveler information on corridor travel times, mode shift messaging, incident notifications, detour routing or other messaging opportunities, such as wrong-way driver warnings.
Adaptive ramp metering	Adaptive ramp metering software that is informed by detection along ramps and the main line to implement conditions-responsive and coordinated ramp metering rates throughout the corridor. This would improve traffic flow and throughput on the freeway.
Enhanced Multimodal Intersection Safety Concept	
Bicycle signal head	Install a new signal head at existing traffic signals to provide bicycle-specific timing and phasing. Modifying signal phasing to accommodate bicycles and providing specific instructions to bicyclists for navigating the intersection would facilitate safer crossing for bicyclists and less conflict with vehicles.
Bicycle intersection detection	Microwave detection and presence sensors that, together, allow for bicycle-specific detection at intersections. When a bicycle is detected, the signal system would be triggered to provide time for bicyclists to use the intersection (shown via the bicycle signal head described above) safely.
Pedestrian adaptive traffic signal timing	Enhanced pedestrian crossing buttons, pedestrian detection and signal software modifications that allow for detection of the number of people waiting to cross an intersection so that more crossing time would be allocated if a large number of people are detected waiting to cross. The application would also allow for limiting or canceling the pedestrian phase, even after it is activated with the push button, if it confirms that a pedestrian is no longer waiting to cross.

Technology	Description and Use
Connected and Autonomous Vehicle Concept	
Connected vehicle equipment	Would incorporate technology, including DSRC radios, infrastructure and systems required for future connected and autonomous vehicle operations. This would have broader impacts on other freeway and arterial networks in the region.
Wrong-Way Detection Deployment	
Wrong way driving detection and warning components	This would extend the wrong-way driving application along I-17 north of I-10 to the south along the Spine corridor and would include thermal video detection at the top of and at the gore of all exit ramps, along with fixed high-definition cameras for views of exit ramps.
Nontechnology Operational Approaches	
Regional DSS	Software package that could collect and assimilate real-time corridor data from freeways, arterials and transit to identify appropriate traffic management strategies that collectively allow the corridor to operate most efficiently and safely based on current conditions. Supporting a DSS would require establishing predefined operational strategies for multiagency operations during full freeway closures, including traffic signal operations and timing, coordination with law enforcement in the field, preferred routes for detours and transit operations. Through the system, real-time freeway and arterial information could be made available to TOC/TMC staff and be integrated into publicly available traveler information. A DSS would also support performance management by making real-time information available to support strategy implementation by freeway, arterial and transit operations agencies.

7.8.1 Estimated Implementation Cost Opinion

The total cost opinion for implementing all recommendations in the table would be \$47 million (Table 7-2). Baseline equipment costs for each technology deployment recommendation are provided in Table 7-3. The cost opinions were broken down by corridor segments, corresponding to the segments established in the NAR.

Table 7-2. Summary of Total Costs

Freeway Corridor Segment: Segment Length:	A 5.5 miles	B 5.5 miles	C 7 miles	D 6.75 miles	E 6.75 miles
Total per corridor segment	\$6,478,905	\$5,197,468	\$10,105,328	\$10,620,635	\$10,629,785
Total per mile per segment	\$1,177,983	\$944,994	\$1,443,618	\$1,573,427	\$1,574,783
Total for Spine corridor	\$47,282,121				

The cost opinions do not include engineering or installation; each recommendation, either deployed individually or gathered into packages, would need to incorporate below-the-line costs including engineering, contingencies, administrative fees and other items such as traffic control, which would add 55 percent to the baseline cost of equipment. Some cost savings could be realized by coordinating implementation with other improvements in the corridor. Ongoing maintenance and operations also are not part of the cost opinions.

Table 7-3. Spine Corridor Technology Recommendation Cost Opinions

Freeway Corridor Segment: Segment Length:		A 5.5 miles	B 5.5 miles	C 7 miles	D 6.75 miles	E 6.75 miles	\$ per mile	
Regional								
Regional ITS maintenance contract	Each	\$150,000	Included	Included	Included	Included		
Regional corridor manager (dedicated staff)	Each	\$100,000	Included	Included	Included	Included		
Parallel corridor signal timing detour plans	Each	\$150,000	Included	Included	Included	Included		
DSS software package	Each	\$4,000,000	Included	Included	Included	Included		
Total Regional Initiatives			\$4,400,000				\$139,682	
Freeway								
Freeway ATM side-mounted DMS	Each	\$160,000	5	5	5	8	7	
		Total	\$800,000	\$800,000	\$800,000	\$1,280,000	\$1,120,000	\$152,381
Freeway detector for lane	Each	\$2,145	22	16	24	23	13	
		Total	\$47,190	\$34,320	\$51,480	\$49,335	\$27,885	\$6,673
Freeway CCTV	Each	\$41,050	5	1	1	6	6	
		Total	\$205,250	\$41,050	\$41,050	\$246,300	\$246,300	\$24,760
Freeway wrong-way driving detection	Each TI	\$194,333	5	6	6	0	0	
		Total	\$971,665	\$1,165,998	\$1,165,998	\$0	\$0	\$104,878
Freeway connected vehicle infrastructure (DSRC radio)	½ mile	\$7,000	12	12	17	16	14	
		Total	\$84,000	\$84,000	\$119,000	\$112,000	\$98,000	\$15,778
Freeway adaptive ramp metering	Each TI	\$2,500	6	4	7	7	6	
		Total	\$15,000	\$10,000	\$17,500	\$17,500	\$15,000	\$2,381
Total Freeway Initiatives			\$9,665,821				\$306,851	
Arterial								
Parallel corridor signal timing re-optimization	Each TI	\$150,000	29	23	53	64	55	
		Total	\$145,000	\$115,000	\$265,000	\$320,000	\$275,000	\$35,556
Arterial surveillance (CCTV)	Each	\$7,000	10	7	27	25	31	
		Total	\$70,000	\$49,000	\$189,000	\$175,000	\$217,000	\$22,222
Arterial detection (ARID)	Each	\$3,400	12	9	17	15	24	
		Total	\$40,800	\$30,600	\$57,800	\$51,000	\$81,600	\$8,311
Intersection bicycle detection	Each	\$4,500	12	9	17	15	24	
		Total	\$54,000	\$40,500	\$76,500	\$67,500	\$108,000	\$11,000

Freeway Corridor Segment: Segment Length:			A 5.5 miles	B 5.5 miles	C 7 miles	D 6.75 miles	E 6.75 miles	\$ per mile
Arterial messaging (DMS)	Each	\$114,000	12	9	24	31	34	
	Total	\$1,368,000	\$1,026,000	\$2,736,000	\$3,534,000	\$3,876,000	\$398,095	
Arterial wayfinding sign assembly	Each	\$40,000	38	29	59	73	74	
	Total	\$1,520,000	\$1,160,000	\$2,360,000	\$2,920,000	\$2,960,000	\$346,667	
Arterial connected vehicle infrastructure (DSRC radio)	Each	\$7,000	29	23	53	64	55	
	Total	\$203,000	\$161,000	\$371,000	\$448,000	\$385,000	\$49,778	
Bicycle signal head at intersection	Each	\$10,000	10	3	1	5	5	
	Total	\$100,000	\$30,000	\$10,000	\$50,000	\$50,000	\$7,619	
Adaptive signal control (+ pedestrian crossing application)	Each	\$40,000	19	10	41	30	26	
	Total	\$855,000	\$450,000	\$1,845,000	\$1,350,000	\$1,170,000	\$180,000	
Total Arterial Initiatives			\$33,366,300			\$1,059,248		

Table 7-4. Programmed Projects in Relation to Technology Recommendations

Fiscal Year	Project Description	Corridor Segment	Relevant Technology Recommendations
2019	Adding general purpose lanes and reconstructing traffic interchanges on I-10 between the I-17 Split and SR-202L	A, B	All freeway recommendations and inclusion of fiber (as needed), arterial detection, CCTV, wayfinding and DMS at interchanges, arterial improvements
2019	Reconstructing the I-17/Central Avenue traffic interchange	C	Fiber (as needed), arterial detection, CCTV, wayfinding and DMS, arterial improvements
2020	Reconstructing the I-17/Camelback Road traffic interchange	D	Fiber (as needed), arterial detection, CCTV, wayfinding and DMS
2024	Adding an HOV lane and reconstructing traffic interchanges on I-17 between the Split and Thomas Road	C	All freeway recommendations and inclusion of fiber (as needed) arterial detection, CCTV, wayfinding and DMS at interchanges
2024	Reconstructing the I-17/Indian School Road traffic interchange	D	Fiber (as needed), arterial detection, CCTV, wayfinding and DMS

During the planning and engineering of each of these projects, the relevant technology recommendations in this document should be considered for inclusion in the project.

A similar approach should be considered for all projects that result from this Spine study, including the freeway reconstruction projects, the traffic interchange reconstruction projects, the transit projects and the bicycle and pedestrian projects. Freeway and interchange projects should follow the considerations discussed above. The transit and bicycle/pedestrian projects that can be relevant for inclusion of technology largely consist of intersection improvements on existing arterials and freeway interchanges. Similar to the recommendations for including technology in interchange reconstructions, these intersection enhancements are a good opportunity to deploy technology that is recommended for intersections, including fiber (if needed), detection, CCTV, wayfinding signs and DMS. There is also the opportunity to deploy DSRC radios at intersections, but this should be considered only if a deployment will occur along a series of intersections along a corridor, rather than a single, isolated radio deployment.

7.8.4 Operational Recommendations

Multiple operational recommendations included in this chapter would not involve infrastructure deployment or construction, but would require time and money to develop and implement. For example, all of the regional operations recommendations, such as establishing a corridor manager staff position or establishing a regional maintenance contract for ITS devices, could be started immediately and would not have the constraints related to the project development process. However, they need to be budgeted at a regional level, either through an entity such as MAG or through a type of pooled fund with all agencies in the region. This is especially true for the staff position and maintenance contract because they would have an ongoing cost, as opposed to a one-time cost.

The other operational recommendations—including developing a DSS, re-optimizing corridor signal timing and developing detour routing plans for the corridor—would involve coordination and partnership and would provide regional benefits that extend outside of the Spine corridor. As such, MAG, ADOT or MCDOT should lead these efforts as agencies with regional influence and a regional focus. They should be considered for inclusion in the MAG Unified Planning Work Program, the TIP and the future RTP.

7.8.2 Implementation Timeframes and Phasing

All of the technology and operations recommendations could be implemented in the near-term, since they do not require major retrofit of the roadway and are generally low-cost improvements compared with large reconstruction projects. Most of these projects will fall into the categorical exclusion category; any equipment will be in addition to what is already in the ADOT or local agency ROW, or will be part of a system enhancement that does not require environmental clearances or approvals.

7.8.3 Infrastructure Recommendations

The recommendations could be implemented individually or in packages, but they could also be implemented as part of larger construction projects, such as those programmed for the Spine corridor in the near-term or any of the near-term recommendation projects that have resulted from the I-10/I-17 Corridor Master Plan. For example, for projects that involve widening the freeway, installing in-pavement detection as part of that project would help avoid having to cut into the pavement later, thus resulting in time and cost efficiencies. The same concept is true for installing fiber communications along corridor arterials; any time that there is trenching or disruption of pavement, conduit and fiber should be installed to avoid having to re-trench and repave the roadway at a later time. During interchange reconstruction projects, opportunities to deploy many of the recommended technology components have been identified, including ARID, CCTV cameras and DMS or wayfinding signs.

There are also efficiencies to including technology in larger projects, rather than keeping them as separate projects, by avoiding the duplication of below-the-line costs, such as administrative fees, contingencies and traffic control. With this consideration, Table 7-4 provides information about projects that are programmed and included in the MAG RTP for construction by 2025 and should be leveraged to include implementation of relevant technology recommendations.

8 Implementation Strategy, Cost Opinions, and Planning and Environmental Linkages

At the beginning of the Spine study in 2014, \$1.47 billion was specified in the RTP for improving both the I-10 and I-17 corridors. Throughout 2016 and into 2017, the RTP has undergone a rebalancing effort because more revenue is available. MAG, in consultation with ADOT and FHWA, has identified several elements of the Spine study recommendation that have been prioritized as the early projects to be funded. Because the Spine study recommendation total cost is approximately \$2.8 billion, nearly half of the recommendation will soon be programmed and under construction. The other half of the recommended improvements are not currently funded, but are expected to be funded when future funding becomes available.

Section 8.1 summarizes the projects that have been funded during the RTP rebalancing effort, their approximate costs and approximate project schedules. Section 8.2 summarizes one possible list of projects that can be implemented when funding becomes available, their approximate cost and justification for the projects' limits and definitions. Section 8.3 summarizes all the projects and their respective detailed cost opinions. Finally, Section 8.4 describes the PEL Questionnaire and Checklist that has been completed in conjunction with the Spine study and how this documentation should be used to inform the NEPA process for all of the projects described in Tables 8-1 and 8-2.

8.1 Implementation Strategy – Funded Projects

Table 8-1 lists projects in the Spine study recommendation that are programmed and funded in the RTP, sorted by construction start dates, as of June 28, 2017—when the MAG Regional Council took action (agenda item 5F) to approve these projects. Note that programmed costs do not necessarily match the projects costs defined in Table 8-3. This occurred because the costs used for programming were the best available information when the programming effort occurred in early 2017—prior to the finalization of this document.

Table 8-1. Funded and Programmed RTP Projects from the Spine Study Recommendation

RTP Map ID ^a	Project	Lead Agency	Supporting Agencies	Figures 1-3 and 1-4 Key Map ID Elements ^b	Programmed Cost	Construction Start Date
15	I-17: ACDC to Greenway drainage improvements	ADOT	—	Drainage portions of 12, 13, 14, 15	\$30,000,000	January 2019
9	I-17/Central Avenue bridge replacement	ADOT	Valley Metro	21	\$23,500,000	May 2019
11	I-17/Indian School Road traffic interchange	ADOT	City of Phoenix	8	\$59,450,000	January 2020
4, 5, 6	I-10: Split to SR-202L (includes all of the I-10 Spine recommendation <i>except</i> for those noted in Table 8-2) ^c	ADOT	Cities of Phoenix and Tempe	A, B, 2, 3, 32, 33, 34, 35, 48, 49	\$525,500,000	May 2021
12	I-17/Camelback Road traffic interchange	ADOT	City of Phoenix, Valley Metro	9, 24	\$68,600,000	July 2021
14	I-17/Northern Avenue traffic interchange	ADOT	City of Phoenix	10	\$66,850,000	January 2024
10	I-17: Split to 19th Avenue ^c	ADOT	—	4, 5, and portions of C	\$217,350,000	January 2024
13	I-17/Glendale Avenue traffic interchange	ADOT	City of Phoenix	18	\$75,000,000	January 2025
16	I-17/Thunderbird Road traffic interchange	ADOT	City of Phoenix	Interchange portion of 14, 43	\$113,650,000	July 2026
17	I-17/Bell Road traffic interchange	ADOT	City of Phoenix, Valley Metro	16, 26, 46	\$96,350,000	July 2026
Total					\$1,276,250,000	

^a "RTP Map ID" refers to this funded project's identifier in the MAG RFHP.

^b If only a portion of the Spine key map project ID is part of the project list, it is noted as a "portion of" the project.

^c Indicates those projects that construct major portions or key elements of the expanded managed lane infrastructure.

8.2 Implementation Strategy – Unfunded Projects

Table 8-2 lists those projects in the Spine study recommendation that are unfunded in the current RTP RFHP, but are expected to be funded when future funding becomes available. These project descriptions and limits are subject to change to match funding constraints, timing priorities or alternative delivery packaging. For programming, project schedule dependencies are noted in the last column.

Table 8-2. Unfunded Projects from the Spine Study Recommendation

Project	Lead Agency	Supporting Agencies	Figures 1-3 and 1-4 Key Map ID Elements ^a	Project Cost Opinion	Schedule Dependencies
I-10/Chandler Boulevard traffic interchange bicycle and pedestrian upgrades	ADOT	Cities of Phoenix and Chandler	30	\$6,091,000	None
I-10: Galveston Road DHOV traffic interchange	ADOT	Cities of Phoenix and Chandler	65	\$46,539,000	None, except may not want to construct until local park-and-rides are open.
I-10: Knox Road bicycle and pedestrian bridge	ADOT	Cities of Phoenix and Tempe	50	\$7,219,000	None
I-10/Warner Road traffic interchange	ADOT	Cities of Phoenix and Tempe	31	\$11,536,000	None
I-10: Baseline to Elliot C-D roads	ADOT	—	70	\$98,989,000	None
I-10/Baseline Road traffic interchange	ADOT	City of Tempe	1	\$25,940,000	Ideally, traffic interchange would be done after the I-10: Baseline to Elliot C-D roads are open.
Split traffic interchange DHOV connector ^b	ADOT	City of Phoenix	60	\$102,159,000	Project should be completed just before or along with the I-17 inner loop HOV lanes opening.
I-17: 19th Avenue to Indian School Road (includes I-17/7th Street east side DHOV ramps) ^b	ADOT	City of Phoenix, Valley Metro	Portions of C and D, 6, 7, 17, 22, 23, 36, 61	\$376,338,000	None – project connects to the existing HOV lanes on I-17. Ideally, it would be completed prior to the FCDMC project to address floodplain issue in the area.

Table 8-2. Unfunded Projects from the Spine Study Recommendation

Project	Lead Agency	Supporting Agencies	Figures 1-3 and 1-4 Key Map ID Elements ^a	Project Cost Opinion	Schedule Dependencies
I-17: Indian School Road to Dunlap Road traffic interchange (includes the I-17/Grand Avenue DHOV connector) ^b	ADOT	City of Phoenix	Portion of D, 11, 38, 39, 41, 62	\$421,132,000	None
I-17: Dunlap Road traffic interchange to SR-101L traffic interchange (excluding the I-17/SR-101L DHOV connector) ^b	ADOT	City of Phoenix, Valley Metro	E and portions of D; interchange portions of 12, 13; and 15, 25, 40, 42, 44, 45, 47	\$310,234,000	Completed during or after the completion of the I-17: Stack to Dunlap Road traffic interchange segment.
I-17/SR-101L traffic interchange North Stack DHOV connector ^b	ADOT	City of Phoenix	63	\$139,187,000	Completed during or after the completion of the I-17: Dunlap Road traffic interchange to SR-101L traffic interchange segment.
Total				\$1,545,364,000	

^a If only a portion of the Spine key map project ID is part of the project list, it is noted as a “portion of” the project.

^b Indicates those projects that construct major portions or key elements of the expanded managed lane infrastructure.

8.3 Project Cost Opinions

A detailed summary of the cost opinions for these projects is included in Table 8-3. Note that some differences exist between the detailed cost opinions for the funded projects and the programmed costs shown in Table 8-1. This occurred because the costs used for programming were the best available information when the programming effort occurred in early 2017—prior to the finalization of this document.

Table 8-3. Detailed Cost Opinions for the Spine Study Recommendation Projects

Project	Removals and Earthwork	Pavement and Surfacing	Drainage	Bridges	Traffic	Landscaping and Utilities	Roadway and Walls	Mob., CE, Contingency, Environmental Mitigation, Design, ROW, ICAP	Project Total
I-17: ACDC to Greenway drainage improvements	\$2,067,000	\$1,932,000	\$12,480,000	\$0	\$1,508,000	\$1,050,000	\$600,000	\$9,796,000	\$29,433,000
I-17/Central Avenue bridge replacement	\$1,601,000	\$1,845,000	\$1,170,000	\$7,636,000	\$2,990,000	\$1,750,000	\$3,380,000	\$13,290,000	\$33,662,000
I-17/Indian School traffic interchange	\$1,717,000	\$1,689,000	\$520,000	\$5,520,000	\$4,355,000	\$3,500,000	\$4,440,000	\$13,789,000	\$35,530,000
I-10: Split to SR-202L	\$43,611,000	\$34,362,000	\$17,940,000	\$45,950,000	\$109,902,000	\$15,050,000	\$47,375,000	\$172,914,000	\$487,104,000
I-17/Camelback Road traffic interchange	\$1,490,000	\$1,958,000	\$520,000	\$9,298,000	\$4,355,000	\$3,500,000	\$4,533,000	\$21,303,000	\$46,957,000
I-17/Northern Avenue traffic interchange	\$1,713,000	\$1,702,000	\$520,000	\$5,548,000	\$4,355,000	\$3,500,000	\$4,827,000	\$15,647,000	\$37,812,000
I-17: Split to 19th Avenue	\$27,103,000	\$20,230,000	\$13,325,000	\$24,739,000	\$68,770,000	\$7,350,000	\$49,119,000	\$123,484,000	\$334,120,000
I-17/Glendale Avenue traffic interchange	\$1,444,000	\$1,517,000	\$520,000	\$5,935,000	\$4,355,000	\$3,500,000	\$5,115,000	\$15,754,000	\$38,140,000
I-17/Thunderbird Road traffic interchange	\$5,074,000	\$5,601,000	\$2,470,000	\$8,880,000	\$17,420,000	\$4,200,000	\$9,601,000	\$29,393,000	\$82,639,000
I-17/Bell Road traffic interchange	\$5,420,000	\$7,143,000	\$2,470,000	\$9,667,000	\$17,420,000	\$12,200,000	\$9,840,000	\$35,675,000	\$99,835,000
Funded Total	\$91,240,000	\$77,979,000	\$51,935,000	\$123,173,000	\$235,430,000	\$55,600,000	\$138,830,000	\$451,045,000	\$1,225,232,000
I-10/Chandler Boulevard traffic interchange bicycle and pedestrian upgrades	\$0	\$0	\$0	\$0	\$553,000	\$0	\$3,549,000	\$1,989,000	\$6,091,000
I-10: Galveston Road DHOV traffic interchange	\$2,480,000	\$5,566,000	\$3,250,000	\$3,461,000	\$4,680,000	\$2,100,000	\$4,948,000	\$20,054,000	\$46,539,000
I-10: Knox Road bicycle and pedestrian bridge	\$0	\$0	\$0	\$0	\$553,000	\$0	\$3,752,000	\$2,914,000	\$7,219,000
I-10/Warner Road traffic interchange	\$98,000	\$1,495,000	\$260,000	\$930,000	\$1,365,000	\$1,050,000	\$1,830,000	\$4,508,000	\$11,536,000
I-10: Baseline to Elliot C-D roads	\$8,190,000	\$3,542,000	\$27,040,000	\$490,000	\$5,980,000	\$4,200,000	\$16,485,000	\$33,062,000	\$98,989,000
I-10/Baseline Road traffic interchange	\$1,181,000	\$2,376,000	\$520,000	\$490,000	\$2,730,000	\$2,100,000	\$2,992,000	\$13,551,000	\$25,940,000
I-10/I-17 Split traffic interchange DHOV connector	\$3,840,000	\$1,739,000	\$2,600,000	\$36,940,000	\$6,695,000	\$2,100,000	\$11,366,000	\$36,879,000	\$102,159,000
I-17: 19th Avenue to Indian School Road	\$28,243,000	\$29,309,000	\$13,000,000	\$35,692,000	\$64,025,000	\$8,400,000	\$54,690,000	\$142,979,000	\$376,338,000

Table 8-3. Detailed Cost Opinions for the Spine Study Recommendation Projects

Project	Removals and Earthwork	Pavement and Surfacing	Drainage	Bridges	Traffic	Landscaping and Utilities	Roadway and Walls	Mob., CE, Contingency, Environmental Mitigation, Design, ROW, ICAP	Project Total
I-17: Indian School to Dunlap Road traffic interchange (includes the I-17/Grand Avenue DHOV connector)	\$18,256,000	\$32,473,000	\$12,350,000	\$13,218,000	\$97,500,000	\$10,500,000	\$54,121,000	\$182,714,000	\$421,132,000
I-17: Dunlap Road traffic interchange to SR-101L traffic interchange (excluding the I-17/SR-101L DHOV connector)	\$16,711,000	\$27,281,000	\$6,370,000	\$24,066,000	\$56,810,000	\$12,600,000	\$44,740,000	\$121,656,000	\$310,234,000
I-17/SR-101L traffic interchange North Stack DHOV connector	\$10,920,000	\$4,700,000	\$4,225,000	\$44,945,000	\$11,830,000	\$2,100,000	\$14,280,000	\$46,187,000	\$139,187,000
Unfunded Total	\$89,919,000	\$108,481,000	\$69,615,000	\$160,232,000	\$252,721,000	\$45,150,000	\$212,753,000	\$606,493,000	\$1,545,364,000

8.4 Planning and Environmental Linkages Questionnaire and Checklist

The Spine study team has completed a PEL Questionnaire and Checklist using the ADOT-defined template. The PEL process was created in response to the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, which sought to develop corridor studies that could be used more directly to inform the NEPA process on projects identified by the corridor study. Effective, conceptual-level transportation planning studies, such as the Spine study, that follow the PEL process provide opportunities to identify important issues of concern early and to achieve agency, stakeholder and public awareness so that these issues can be successfully addressed. This early planning is not driven solely by regulatory requirements or the quest for more efficient and effective processes, although those are desirable results; transportation and environmental professionals—as well as those in metropolitan planning organizations, state and federal resources agencies, and nongovernmental organizations—are finding that early collaboration helps achieve broader transportation and environmental stewardship goals through better decisions regarding programs, planning and projects.

The ADOT PEL Questionnaire and Checklist were developed to provide guidance, particularly for transportation and environmental planners, regarding how to most effectively link the transportation planning and NEPA processes. By considering the questions and issues raised in the questionnaire, transportation planners are more aware of the potential gaps in their corridor studies, better understand the needs of future users of the study and are reminded of the benefits of wider and/or deeper collaboration with agencies, the public and other stakeholders. Environmental planners who fill out the checklist assume a new role in the transportation planning process by becoming an advocate for early awareness of environmental issues before the NEPA process begins.

The PEL Questionnaire and Checklist was used to effectively influence the scope, content and process employed during the Spine study. Completion of this questionnaire and checklist supported the PEL process and served dual objectives:

- Provided guidance to the Spine study Management Partners regarding the level of detail needed to ensure that information collected and decisions made during the Spine study could be used during the subsequent NEPA processes for the proposed projects described in this chapter.
- Provides the future NEPA study team(s) with documentation regarding the outcomes of the transportation planning process, including the history of decisions made and the level of detailed analyses undertaken.

When conducting a transportation planning study that links to the future NEPA process, major issues include:

- Identifying the appropriate level of environmental analysis for the study.
- Identifying the appropriate level of agency, stakeholder and public involvement.

- Defining unique study concurrence points for seeking agreement from relevant resource agencies, stakeholders and members of the public.
- Developing a process to ensure that the study will be recognized as valid in the NEPA process.
- Identifying when to involve resource agencies in the study, and to what extent they influence decision making.
- Identifying how to persuade U.S. Department of Transportation reviewers to accept the use of these studies in the NEPA process.

These issues were considered extensively throughout the Spine study process as documented in both the Spine NAR and this *Alternatives Screening Technical Report*. The Spine study team members reviewed the ADOT PEL Questionnaire and Checklist at the beginning of the study to familiarize themselves with relevant local and general issues. The questionnaire and checklist was completed in three parts:

- **Questionnaire for Transportation Planners – Part 1:** This was completed by the Spine study team at the beginning of the study and is included in the Spine study NAR in Appendix D.
- **Questionnaire for Transportation Planners – Part 2:** This was completed at the conclusion of the Spine study.
- **Checklist for Environmental Planners – Part 3:** This was updated throughout the Spine study by the environmental planners and was completed at the conclusion of the Spine study.

8.4.1 Application of Planning and Environmental Linkages to the Future Spine Recommended Projects

The approved and signed PEL Questionnaire and Checklist for the Spine study will be included as an appendix to the Spine study Corridor Master Plan document, scheduled for completion by the end of 2017. The signed PEL Questionnaire and Checklist will document how the study met the requirements of 23 Code of Federal Regulations § 450.318 (Subpart C: Metropolitan Transportation Planning and Programming). The PEL will provide the basis and justification for the alternatives evaluation phase of the future NEPA documents associated with the Spine study recommended alternative projects, regardless of which agency undertakes the NEPA documentation. Ultimately, this will simplify and accelerate all NEPA documents for every Spine study recommended project.

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