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

Alternatives Screening Technical Report

September 12, 2017

MARICOPA ASSOCIATION of GOVERNMENTS

ADOT

U.S. Department of Transportation Federal Highway Administration

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.

SPINE 10 17 Corridor Master Plan

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

Alternatives Screening Technical Report

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Abbreviations and Acronyms

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

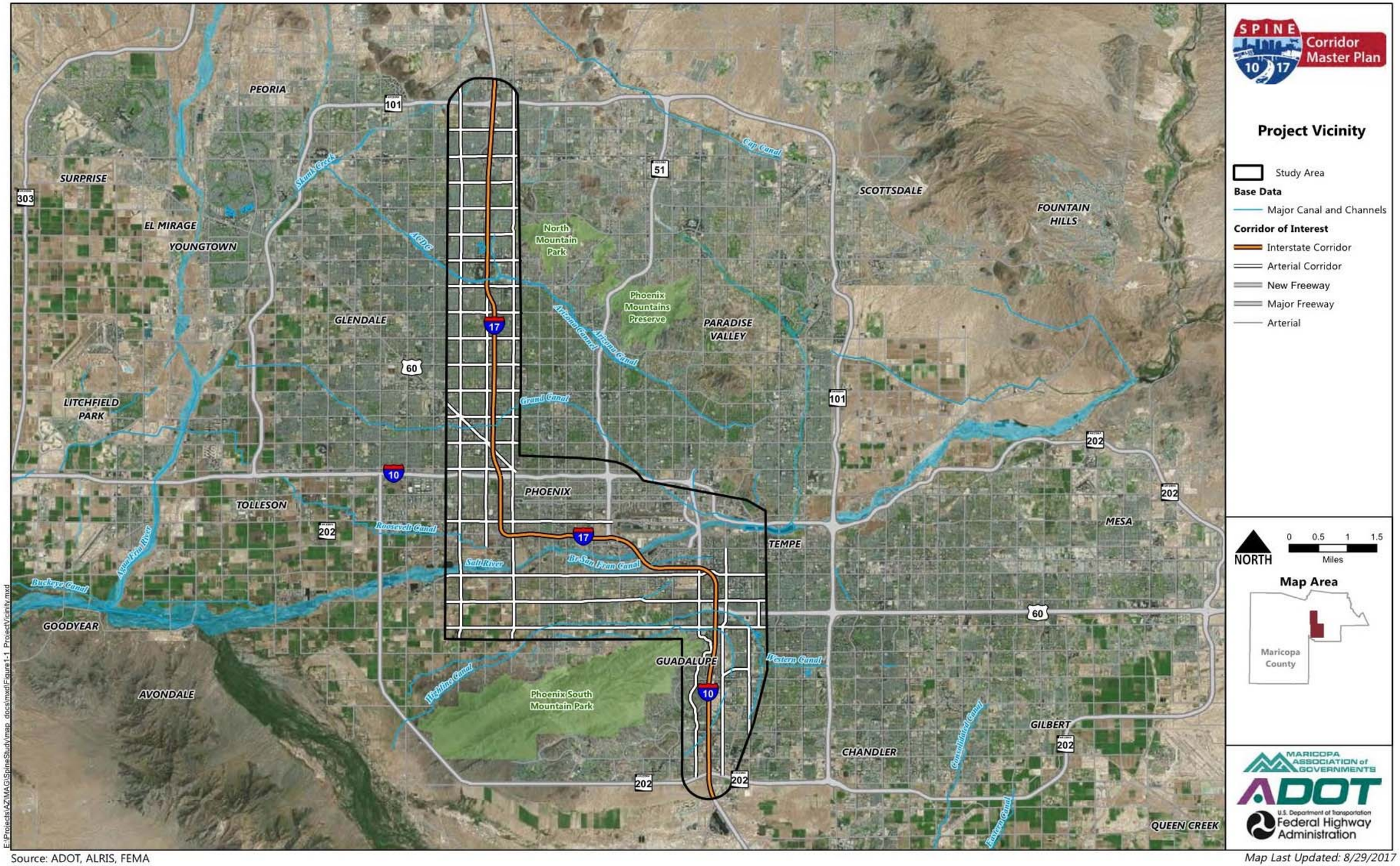
The primary purpose of the I-10/I-17 Corridor Master Plan is to develop an improvement and implementation strategy to appropriately manage travel demand and movements in the I-10 and I-17 corridors. The strategy has identified a group of projects to incorporate into the RTP and TIP. Phases of the projects 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



E:\Projects\AZ\MAG\SpineStudy\map_docs\mxd\Figure1-1_ProjectVicinity.mxd

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:

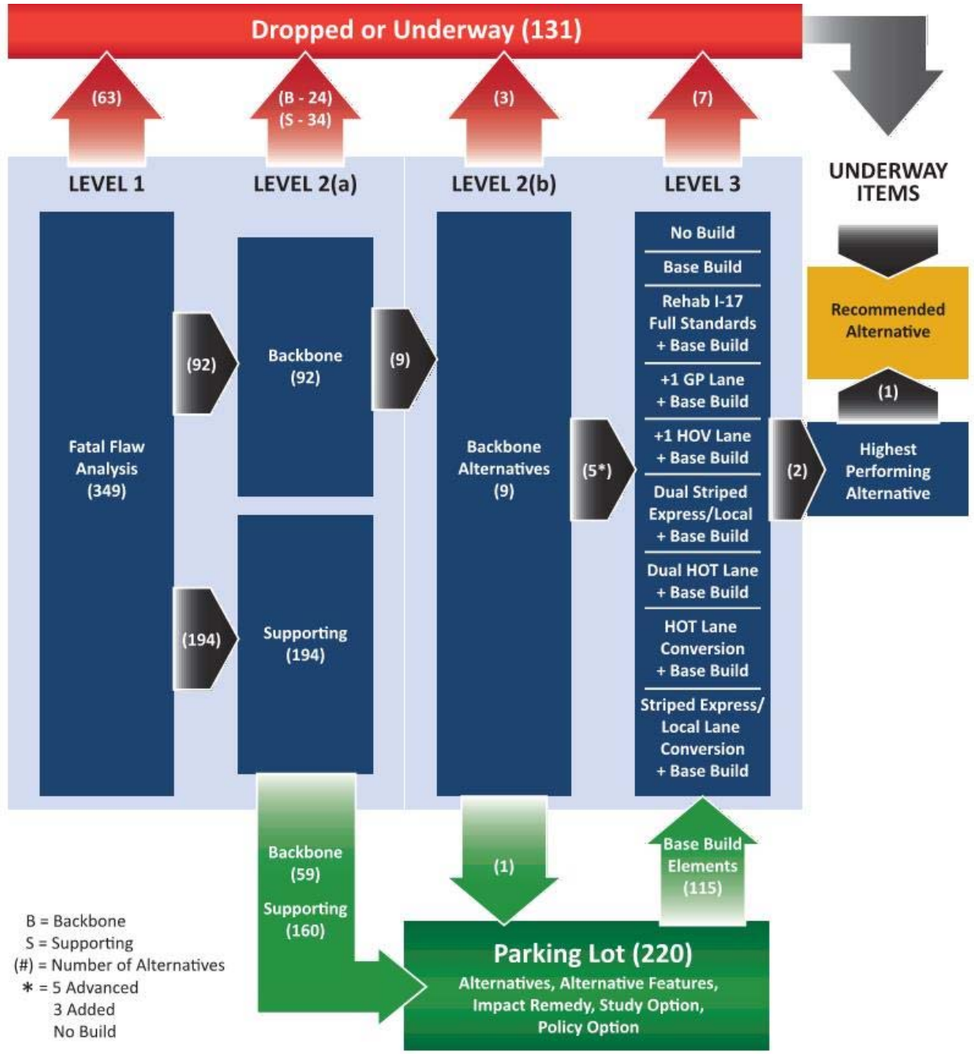
- I-25 Valley Highway EIS (Colorado Department of Transportation)[1]
- I-70 East Mountain Corridor EIS (Colorado Department of Transportation)[2]
- I-405 Corridor Program (Washington State Department of Transportation)[3]

[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



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: 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

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.

RECOMMENDATIONS KEY MAP

SPINE Corridor Master Plan

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?

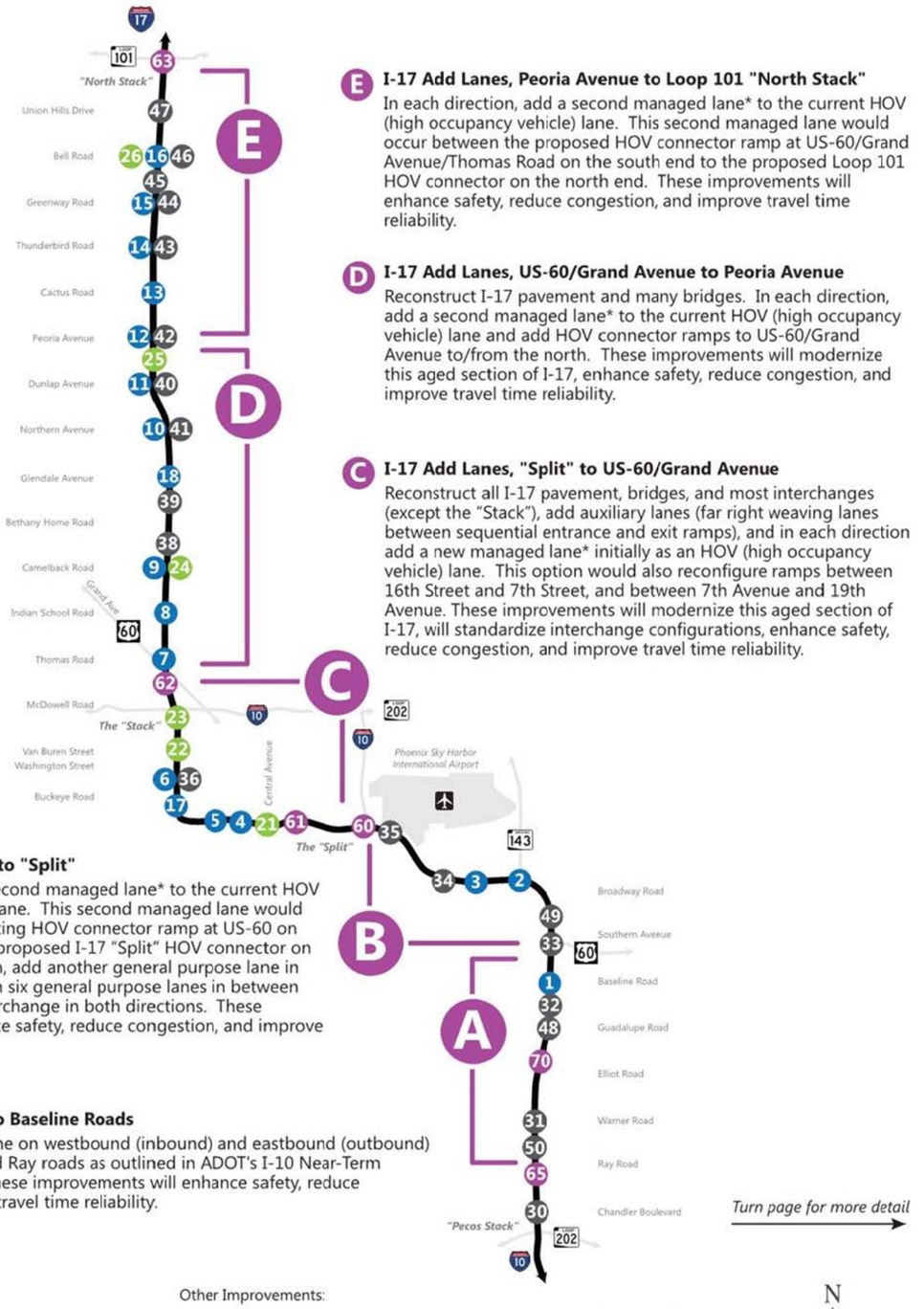
A managed lane is one where strategies are proactively implemented in response to conditions.

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 Addd 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.

Turn page for more detail

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.

N

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.

spine.azmag.gov

March 28, 2017

Figure 1-3. Recommended Alternative Map

CORRIDOR MASTER PLAN RECOMMENDATIONS

Traffic Interchange Modifications

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, capcity, and incorporate bicycle and pedestrian movements. A three-level platform diamond interchange is one possible solution for this location.

Transit Improvements

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.

Bicycle/Pedestrian Improvements

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 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/Pesestrian Bridge crossing I-10 at Knox Rd** Construct bicycle pedestrain crossing as recommended by City of Tempe to support the BikeIt Seats Route identified in the City's Transportation Master Plan.

Lane/Ramp Improvements

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.

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

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	• 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	• **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	• None, except as related to the interchange modifications.
	Transit Improvements	• 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	• 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	• 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	• **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	• 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	• 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	• 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	• 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	• **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	• None, except as related to the interchange modifications. • Broadway Road improvements may be implemented within this segment to incorporate ICM.
	Transit Improvements	• 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	• 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	• Complete reconstruction of all roadways, bridges and drainage elements due to age and condition. Reconstruction would add one HOV lane and auxiliary lane in each direction for a section of three general purpose, one HOV and auxiliary lanes as needed in each direction. One-way frontage roads along both sides of I-17 would be perpetuated (except the southbound frontage road between McDowell and Van Buren roads—see *Transit Improvements* row below). • The I-17 profile would be redefined to achieve adequate vertical clearance with all the cross streets, railroads and light rail crossings. • Modify entrance and exit ramps between 16th and 7th streets and between 7th and 19th avenues to enhance efficiency and minimize steep grades for commercial vehicles. • Stack – Restripe northbound and southbound I-17 to add the HOV lane through the Stack using design exceptions as required. • Add a DHOV ramp connecting I-17 to I-10 east at the Split. DHOV ramp would skirt the south ROW line around the Split to avoid runway airspace concerns. • Provide for the reconstruction of I-17 for a future SR-30 connection to I-17 at or near the Durango Curve, including a DHOV at this location between SR-30 and I-17 on the east.

Table 1-2. Spine Recommended Alternative Features

Spine Corridor Segment	Improvement Category	Summary of Improvements
I-17, Split to the Stack (cont.)	Interchange Modifications	• **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 *Transit Improvements* 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	• 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	• 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	• 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	• 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	• **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	• 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	• 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	• 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	• 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	• **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	• 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	• 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	• 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	• 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	• 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 *except* 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
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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