FINAL REPORT

Southeast Corridor Major Investment Study

MARICOPA ASSOCIATION of GOVERNMENTS

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SOUTHEAST CORRIDOR MAJOR INVESTMENT STUDY
Final Report

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Maricopa Association of Governments

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1.0 Introduction

The Maricopa Association of Governments (MAG) has completed a comprehensive transportation study of southeast Maricopa County. The Southeast Corridor Major Investment Study (SE Corridor MIS) identifies compatible transportation elements designed to improve overall mobility within a portion of southeast Maricopa County. The Southeast Corridor (study area) is bounded by I-10 (Papago Freeway) and SR-202L (Red Mountain Freeway) on the north, SR-101L (Price Freeway) on the east, the Gila River Indian Community border on the south, and I-17 (Black Canyon Freeway) and the 23rd Avenue alignment on the west (Figure 1). The study area includes the Town of Guadalupe and parts of Phoenix, Tempe, and Chandler.

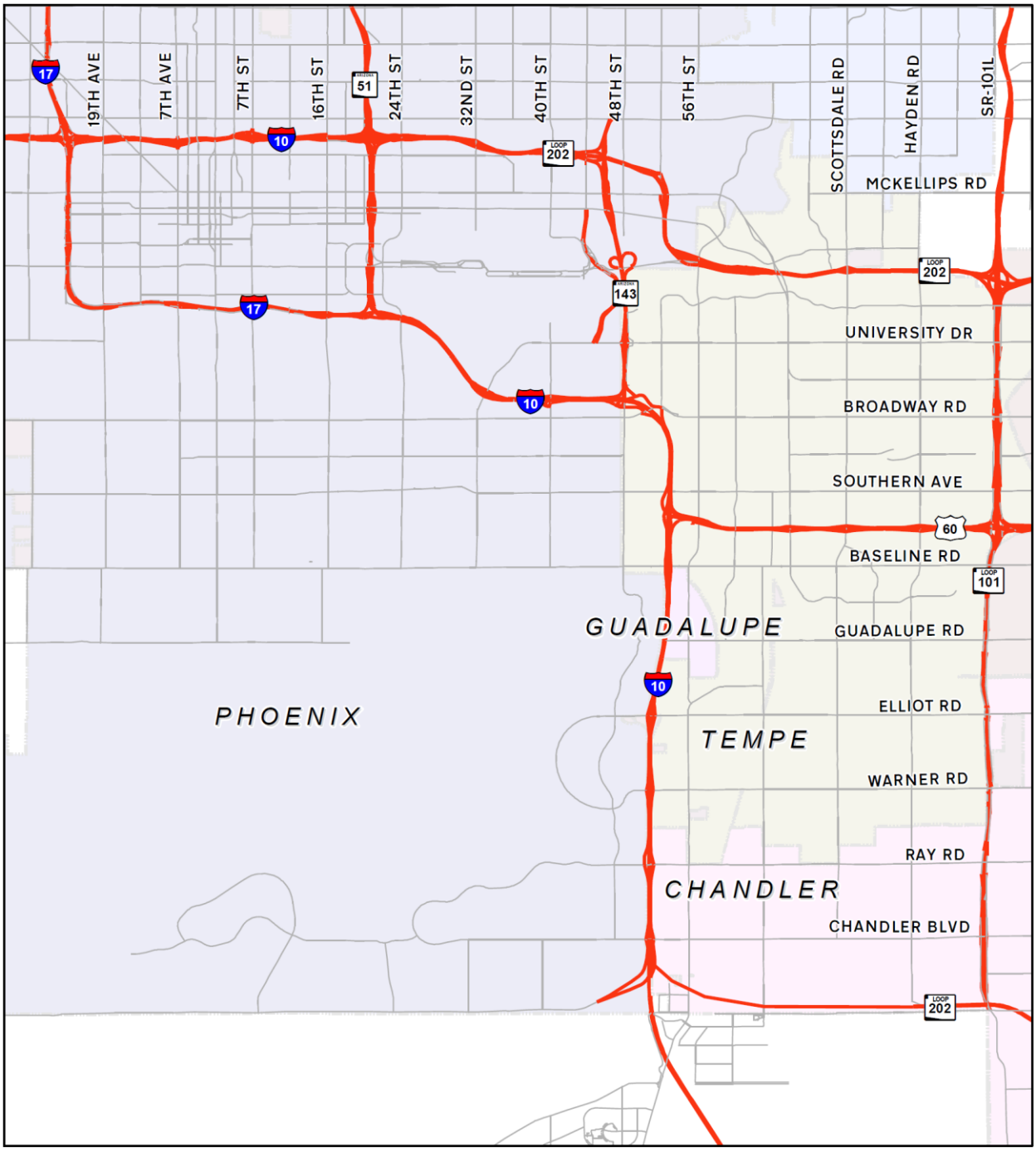
The transportation system within the study area provides connections between many of Maricopa County's major activity centers as well as access to regional, national and international destinations. At present, freeways and roadways in the study area experience recurring weekday congestion. The area's population is expected to double between 2010 and 2030, placing increased demand on transportation infrastructure.

The SE Corridor MIS identifies multi-modal transportation investment options to the currently planned expansion of I-10 between the I-10/I-17 traffic interchange (TI) (referred to as "The Stack") and the I-10/SR-202L (Pecos Stack) TI, including the Broadway Curve. Transportation improvement options were explored to address the projected increases in area employment and population and the resulting increase in roadway congestion levels as demonstrated by the following findings from previous studies:

- The *2006 MAG Freeway Level of Service Study* indicates that every freeway within the study area currently experiences recurring congestion.
- A major increase in the number of congested intersections (level of service (LOS) E and F) will occur between 2012 and 2030, despite the construction of the arterial improvements indentified in the current *Regional Transportation Plan* (RTP).[1]

[1] Source: MAG TDM simulations of the traffic performance of the regional roadway network based on 2008 travel demand and 2030 travel demand forecasts prepared for the RTP.

Figure 1. Study Area



2.0 Previous Studies and Plans

The Maricopa Association of Governments has recently completed or updated three significant regional transportation related plans or studies that are relevant to the SE Corridor MIS. These planning efforts include the *MAG Regional Transportation Plan*, *MAG Regional Transit Framework Study* (RTF), and *MAG Commuter Rail System Study* (CRSS). Each of these plans and studies, which were developed in coordination with other local and regional planning efforts, include the most complete documentation of the planned regional transportation investments within the study area.

In addition to a review of existing transportation related studies and plans, relevant community general plans or master plans were reviewed to identify any potential significant changes in community land-use or circulation plans. The most recently adopted plans from the cities of Chandler, Guadalupe, Phoenix, and Tempe were reviewed. The *Existing Conditions and Planned Transportation Improvements Report* (Appendix A) provides reviews of the following plans and studies:

- *The MAG Draft RTP – 2010 Update* is a regional plan that outlines transportation improvements in Maricopa County through Fiscal Year 2031
- MAG RTF
- MAG CRSS
- *Chandler General Plan 2008*
- *Guadalupe Master Plan 1992-2010*
- *Phoenix General Plan 2002*
- *City of Tempe General Plan 2030*

3.0 Existing and Planned Roadway Facilities

3.1 Existing Roadway Facilities

3.1.1 Freeways and Highways

The existing freeway/highway system in the study area consists of facilities constructed, maintained, and operated by the Arizona Department of Transportation (ADOT). These facilities include:

I-10 Maricopa Freeway	**I-17** Black Canyon Freeway	**US-60** Superstition Freeway	**SR-51** Piestawa Freeway
SR-101L Price Freeway	**SR-202L** Red Mountain Freeway	**SR-202L** Santan Freeway	**SR-143** Hohokam Expressway

Two interstate freeways and one US highway are located within the study area. I-10 is the predominant freeway/highway facility that spans the country and bisects the study area. I-17 is located in the northern portion of the study area, and is a north-south connection between I-10 and I-40. US-60 extends beyond the region and varies in functional classification. In the study area, US-60 is a multiple lane freeway. The remaining freeways/highways within the study area are regional routes. Figure 2 illustrates the existing freeway/highway system.

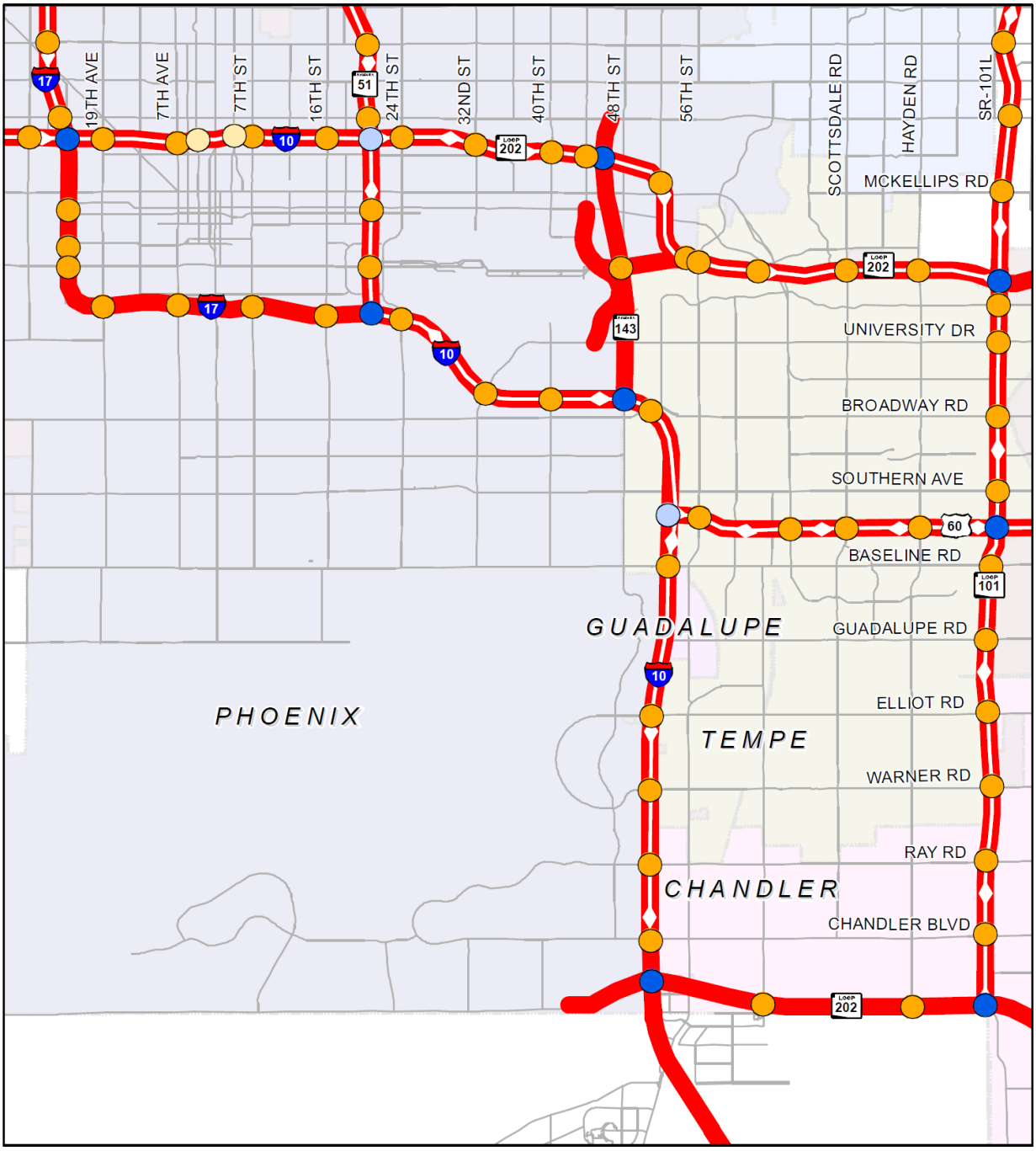
High Occupancy Vehicle Lanes
The study area has a developed High Occupancy Vehicle (HOV) lane system. HOV facilities are located on several of the freeway/highways within the study area. Current HOV facilities consist of one-lane for each direction of travel. The location of existing HOV facilities are illustrated in Figure 2.

Traffic Interchanges
Traffic interchanges provide access between freeways/highways (system TI) and between freeways/highways and the arterial street system (service TI). Service TI spacing within the study area varies; however, it is typically one mile corresponding with the one-mile arterial street grid. Figure 2 illustrates the location of existing system and service TIs, including TIs that provide direct HOV (DHOV) connectivity.

3.1.2 Arterial Streets

The existing arterial street system extends throughout the study area, except for the southwest portion which contains Phoenix South Mountain Park. The arterial street system consists of the one-mile grid that is typical for the metro area, and is oriented north-south/east-west. The typical number of through lanes for arterial streets within the study area ranges from four to six lanes. Figure 2 illustrates the existing arterial street system.

Figure 2. Existing Freeway/Highway and Arterial Street Systems in the Study Area



Maricopa Association of Governments
Southeast Corridor MIS

Existing Freeway/Highway and Arterial Street Systems

Legend

- Freeways
- HOV Lanes
- Service Direct HOV
- Service Interchange
- System Interchange/Direct HOV
- System Interchange

0 1 2 Miles

3.2 Planned Roadway Facilities

3.2.1 Freeways and Highways

The RTP identifies substantial freeway/highway improvements in the study area to be constructed over a 20-year period between 2010 and 2030; which include varying levels of improvement on nearly every freeway/highway. This includes corridor capacity improvements along I-10 and a new South Mountain Freeway along the southern border of the study area. New HOV ramp connections are planned for the I-10/SR-202L and SR-101L/SR-202L system TIs. Additional general purpose (GP) and HOV lanes are planned along existing facilities.

Improvements to I-10 include reconfiguring the current facility to a local/express lane arrangement. The current RTP funds these improvements from 32nd Street to the Pecos Stack. This improvement provides additional GP and HOV lanes for through traffic. HOV lanes throughout the study area are typically one lane in each direction; however, two will be provided in the same direction from the I-10/I-17 TI (The Split) on the southeast corner of downtown Phoenix to the I-10/US-60 TI. New multiple local lanes will be provided to address local access to the arterial streets over the same approximate length. The South Mountain Freeway is a planned facility that will extend SR-202L (Santan Freeway) west from the Pecos Stack. The South Mountain Freeway will span along the southern border of the study area, and then turn north outside of the study area and connect to I-10, near 59th Avenue.

Also programmed in the RTP within the study area are additional GP and HOV lanes along I-17, from the I-10/I-17 TI on the northwest corner of downtown Phoenix, to The Split. Further, additional GP and HOV facilities, including direct ramp connections and additional lanes, are programmed for the SR-202L (Santan Freeway), from I-10 to east of the study area.

3.2.2 Arterial Streets

Five regionally funded arterial street projects identified in the RTP are located within the study area. Four projects are intersection improvements, all of which are located within the City of Chandler. These include the intersection of Chandler Boulevard and Kyrene Road, and the intersections of Ray Road with Kyrene Road, McClintock Drive, and Rural Road. The fifth project, Avenida Rio Salado between 51st Avenue and 7th Street, is a new and improved arterial roadway within the City of Phoenix.

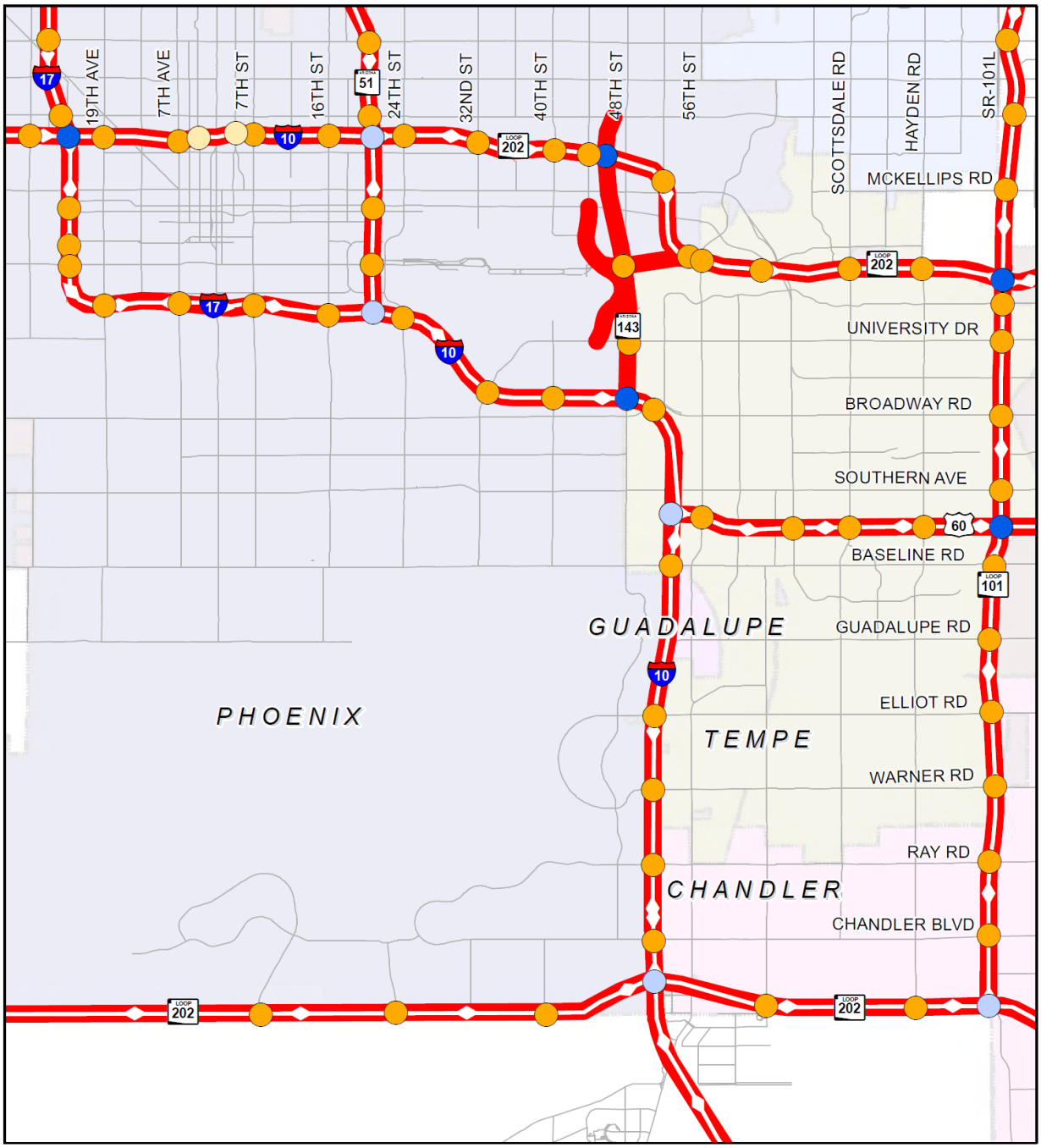
3.3 Summary of Planned Roadway Facility Investments

Planned freeways and capacity improvements in the study area include:

- GP and HOV lanes on sections of I-10, I-17, and SR-202L (Santan Freeway)
- Multiple local lanes along I-10
- South Mountain Freeway
- Five regionally funded arterial street projects (four intersection improvement projects and one new/improved arterial roadway)
- One illustrative roadway project which includes improving I-10 to a local/express lane configuration between the I-10/SR-51/SR-202L TI and 32nd Street

Figure 3 illustrates the study area RTP planned 2031 freeway/highway system, while Figure 4 identifies the number of freeway/highway lanes defined in the 2031 MAG Travel Demand Model (TDM).

Figure 3. 2031 Freeway/Highway System



Maricopa Association of Governments
Southeast Corridor MIS

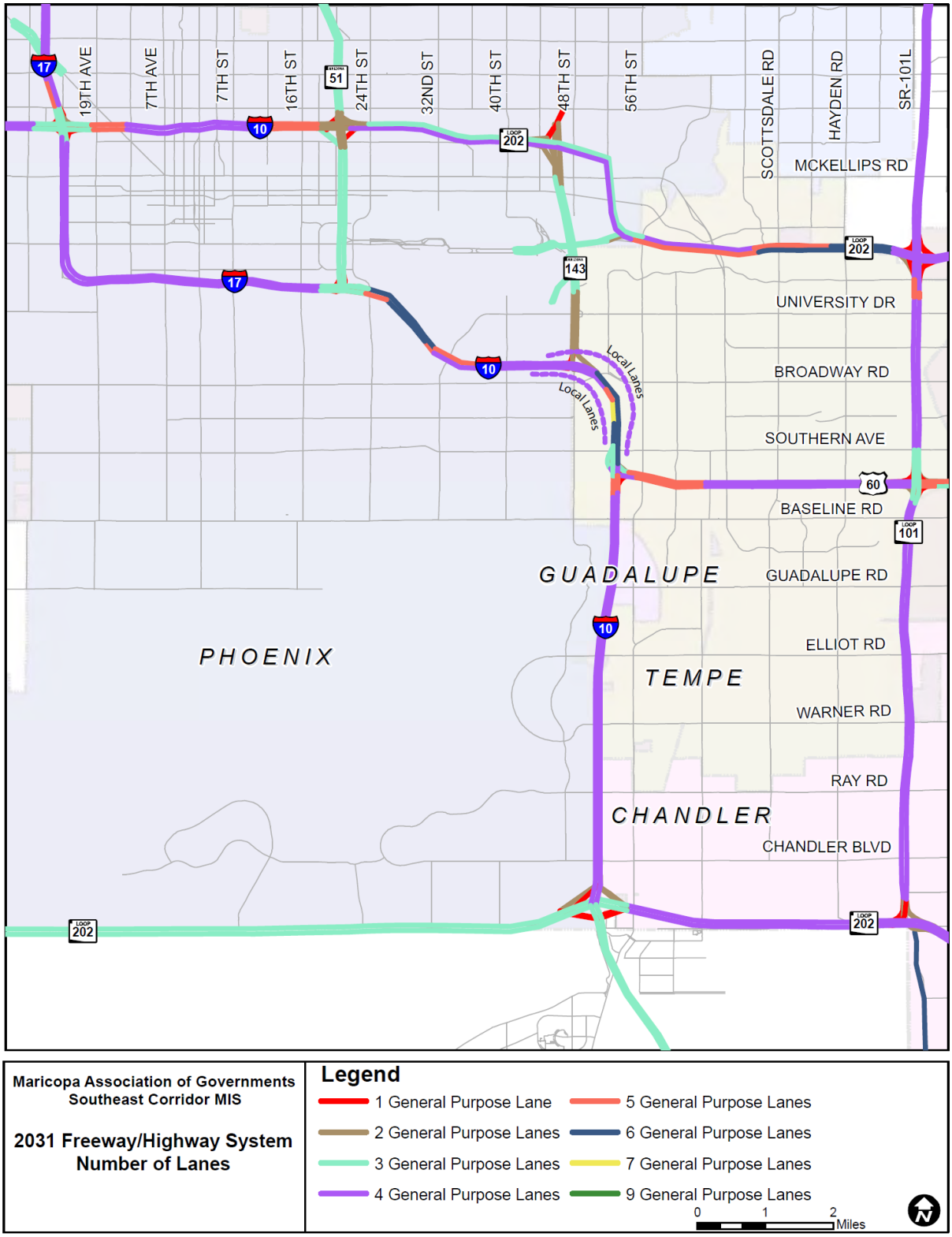
2031 Freeway/Highway System

Legend

- Freeways
- HOV Lanes
- Service Direct HOV
- Service Interchange
- System Interchange/Direct HOV
- System Interchange

0 1 2 Miles

Figure 4. 2031 Freeway/Highway System Number of Lanes



Source: MAG, 2010

4.0 Existing and Planned Transit Services and Facilities

4.1 Existing Transit Services

The existing transit services in the study area consist of local bus, circulators, express bus, and light rail. For the purpose of this review, only the routes that directly impact the study area were included in this section. Service frequencies presented in this report were obtained from Valley Metro's *Transit Book* for July 2010 to January 2011.

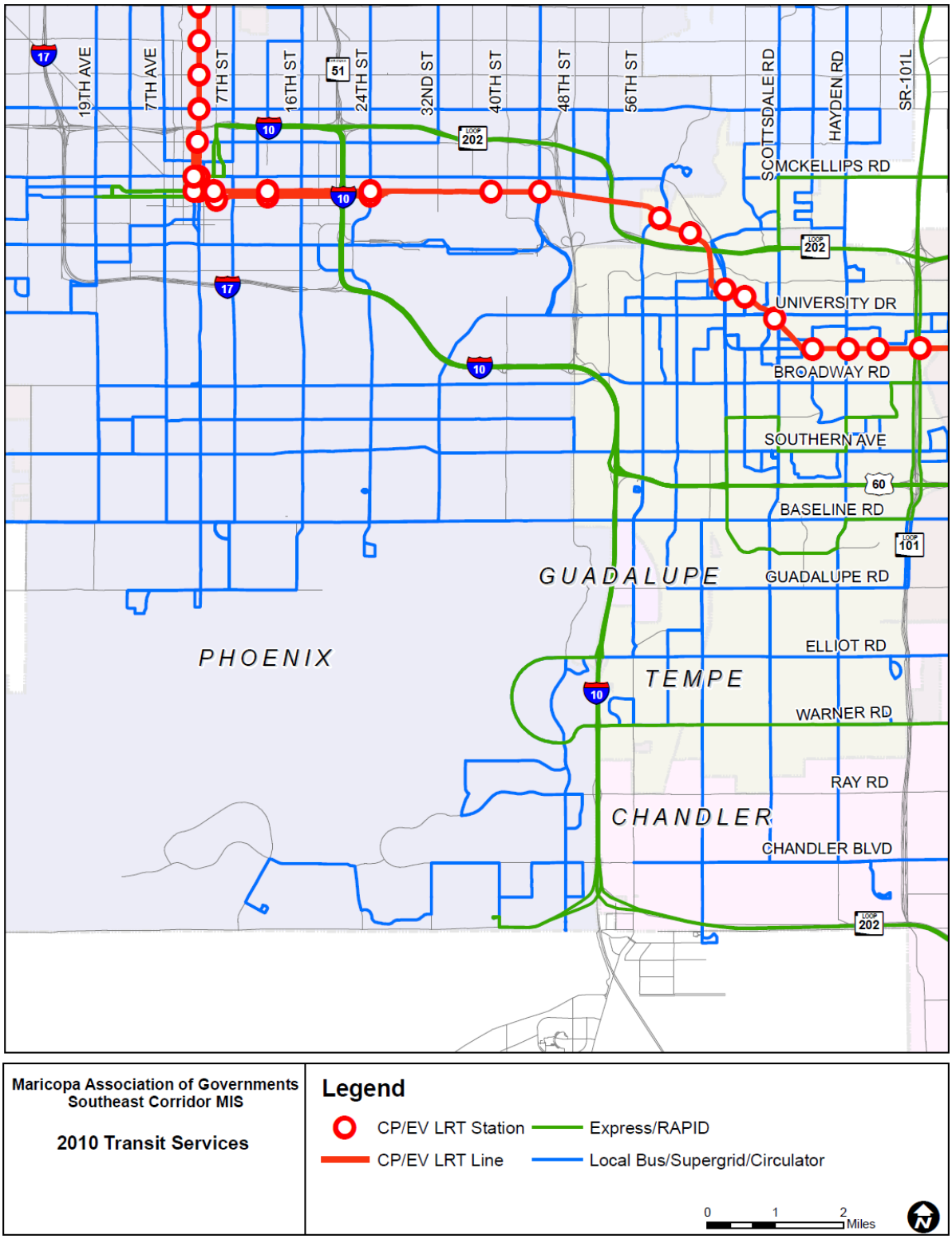
Local Bus/Supergrid
A total of 29 local bus routes provide service seven days a week in the study area. On the weekdays, 5 local bus routes operate at a 20-minute or greater frequency all day, 8 local bus routes operate at a 20-minute or greater frequency during peak periods and provide 30-minute off-peak service, while the remaining routes operate at a 30-minute or less frequency service all day. On the weekends, 14 routes operate 30-minute, all day service, and 15 routes operate all day service less frequent than 30 minutes. Figure 5 illustrates the existing local bus service.

Circulators
Eleven circulator routes operate in the study area with two routes operated by the City of Phoenix and eight routes operated by the City of Tempe. The City of Phoenix operates the Downtown Area Shuttle (DASH), providing service between Central Station (downtown Phoenix) and the State Capitol area. DASH operates Monday through Friday with service every 10 minutes. The City of Phoenix also operates the Ahwatukee Local Explorer (ALEX) route which provides service in Ahwatukee. This route provides service every 60 minutes, seven days a week. The City of Tempe operates three routes around downtown Tempe/Arizona State University (ASU) known as FLASH. Service is provided every 10 to 30 minutes, Monday through Friday. In addition, the City of Tempe also operates five other circulator routes branded as Orbit. Service is provided every 15 minutes, Monday through Saturday, and every 30 minutes on Sunday. The existing circulator routes are shown in Figure 5.

Express Bus
Eleven express bus routes provide service within the study area. Ten of the express routes provide peak period, peak direction service to downtown Phoenix. One route (511) provides two-way, peak period, suburb to suburb service. Figure 5 illustrates the existing express bus network.

Light Rail
The Central Phoenix/East Valley Light Rail Line (CP/EV LRT Line) is a 20-mile route that operates within the study area. This route has 28 stations and 8 park-and-ride facilities. The CP/EV LRT Line connects the cities of Phoenix, Tempe, and Mesa with stations in downtown Phoenix, downtown Tempe/ASU, and Sky Harbor International Airport. The existing light rail service corridor is shown in Figure 5.

Figure 5. Existing Transit Service in the Study Area



4.2 Planned Transit Services

A variety of transit service improvements are planned for the study area and include local bus/supergrid, express bus, Arterial Bus Rapid Transit (Arterial BRT), and high capacity transit (HCT).

Local Bus/Supergrid

According to the RTP 2007 Update, 10 Supergrid routes are planned to be operated with regional sales tax revenues. Supergrid service is local bus service which provides consistent levels of service through multiple jurisdictions. Nine of the routes currently operate today, while one of the routes (Ray Road) is a new route. Two routes (Buckeye Road and Tatum Boulevard/44th Street) are identified for implementation beyond 2026. Routes postponed beyond 2026 were originally included in the RTP; however, current economic conditions have delayed their implementation or transition to regional funding beyond 2026. Depending upon future economic conditions, regional funding for these routes could be restored. Planned Supergrid routes are illustrated in Figure 6.

Express Bus

Eight new express bus routes are planned for study area. One route is planned to operate by 2015 with a total of 48 daily trips. The remaining routes are planned to be implemented beyond 2026. Figure 6 depicts the planned express bus routes.

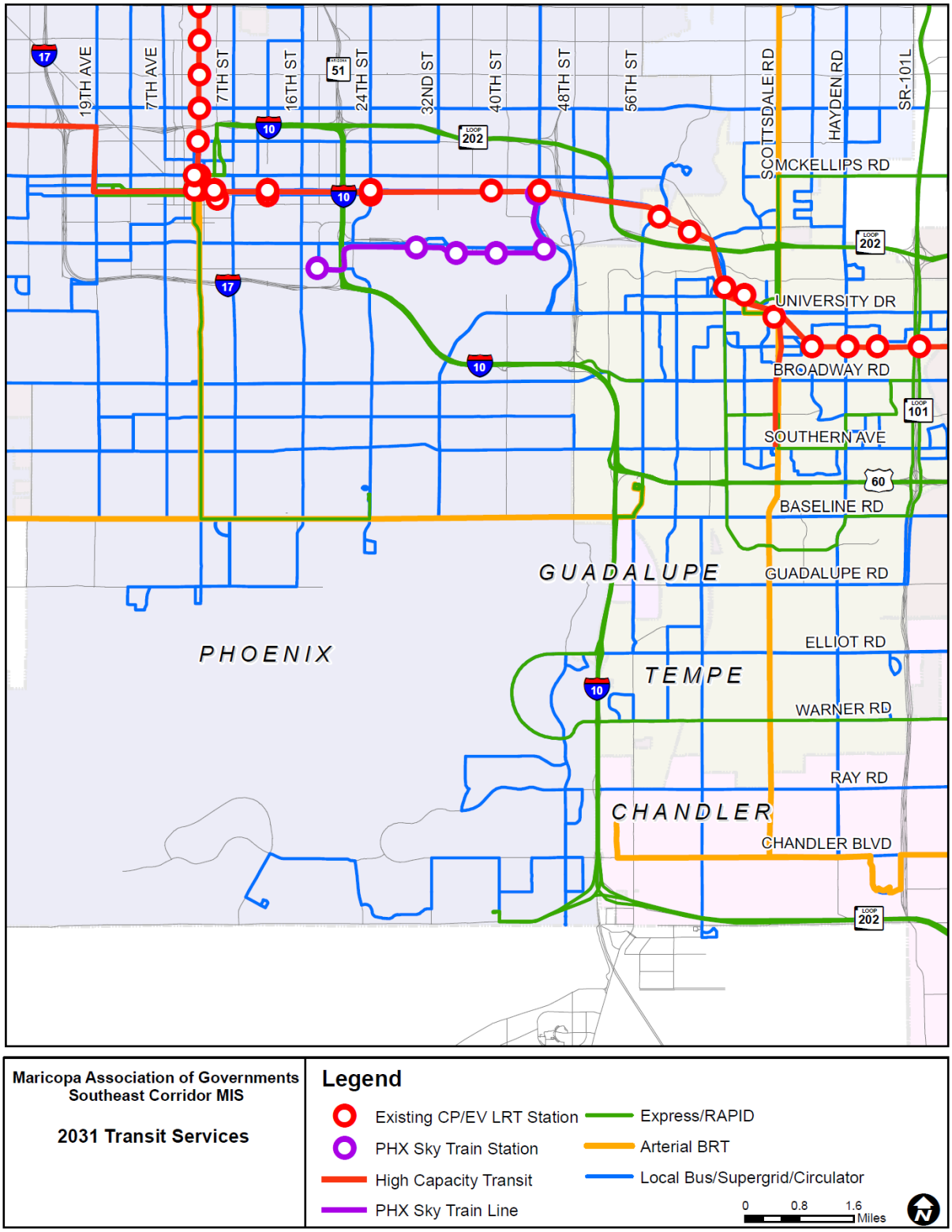
Arterial BRT

Three new Arterial BRT routes are identified in the study area. Arterial BRT is a branded, limited stop bus route that has enhanced stations and takes advantage of queue jumper lanes, signal priority, or other travel time saving methods. The planned Arterial BRT routes are designed to feed into existing or planned high capacity transit. Figure 6 shows the planned Arterial BRT service. Two of the routes have been postponed to a year beyond 2026.

High Capacity Transit

Three HCT corridors are identified within the study area. The Tempe South corridor would provide service from downtown Tempe/ASU to the south. The Phoenix West corridor would provide service between downtown Phoenix and west Phoenix. PHX Sky Train is an automated people mover that is planned to provide a transit connection between the 44th/Washington Street LRT Station and Phoenix Sky Harbor International Airport. PHX Sky Train will be implemented in two phases, with the first phase connecting the 44th/Washington Street LRT Station to Phoenix Sky Harbor Terminal 4. By 2020, PHX Sky Train will have stations at the airport's Terminal 3, a future terminal, and the rental car center. Figure 6 identifies the planned HCT services within the study area. Planning work is concurrently ongoing for the Tempe South and Phoenix West corridors and final HCT station locations have not been defined yet; therefore, the stations for these corridors are not depicted in Figure 6.

Figure 6. 2031 Planned Transit Service Network in the Study Area



4.3 Summary of Planned Transit Investments

Implementation of many planned transit services in the study area have been delayed to after year 2026 due to recent economic conditions. The planned transit services include:

- New local and express bus routes are planned within the study area; however, planned service levels are very modest
  - One new Supergrid route
  - One additional Express bus route by 2015
  - Seven additional Express bus routes after 2026
- Three new Arterial BRT routes, two after 2026
- Three planned HCT corridors: Tempe South corridor, Phoenix West corridor, and PHX Sky Train
- Three illustrative HCT corridors identified
  - Two potential HCT all day service corridors along Scottsdale Road/Rural Road and Central Avenue (south of Jefferson Street)
  - One HCT peak period service corridor near the Tempe Kyrene Branch freight rail line

5.0 Transportation System Performance

Understanding how existing transportation infrastructure and services are performing today along with projected travel demand is invaluable for identifying overall transportation system deficiencies and needs. Existing performance of the study area's highway, arterial roadway, and transit networks is documented in this chapter. All reported data is sourced from previously completed studies or from agency provided performance reports.

5.1 Existing Roadway Performance

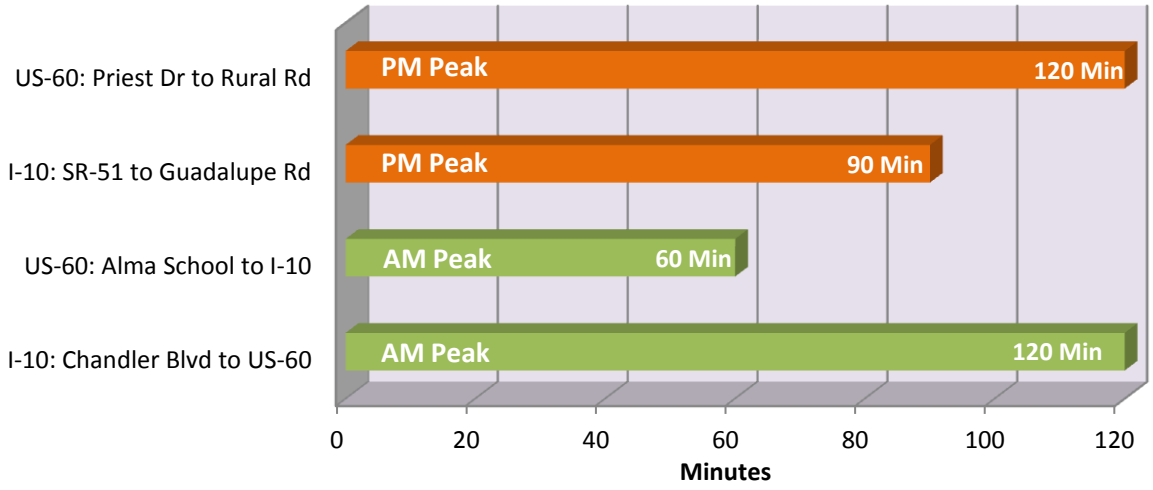
Recurring weekday congestion in the study area has been well documented by MAG. Three particular documents that have recently quantified congestion in the corridor are the: 1) *2006 MAG Freeway Level of Service Study*; 2) *2007 MAG Regional Travel Time and Speed Study*; and 3) MAG 2010 Update RTP. The first two studies involved the collection and analysis of field data related to traffic operations and the third included simulation analysis using the regional MAG TDM. From these sources four separate performance measures are available to quantify existing roadway performance. These measures include freeway LOS, freeway travel times and speed, freeway bottle necks, and intersection LOS.

The *2006 MAG Freeway Level of Service Study* provides information on traffic congestion in the corridor. This study involved the analysis of aerial photography shot during morning and afternoon periods to record traffic densities on freeways in the region. The densities were then correlated to speed and LOS. The report contains detailed LOS results for each photographed freeway, including levels of service in 30-minute time intervals during the morning and afternoon periods, 5:30 to 9:30 AM and 3:00 to 7:00 PM, respectively. The study results indicate that every freeway within the study area experiences recurring congestion.

The *2007 MAG Regional Travel Time and Speed Study* provides a detailed view of average daily traffic operations in the corridor. Freeway results are fairly consistent with the findings of the *2006 MAG Freeway Level of Service Study* and further illustrate the existing congestion within the corridor. The study verified that somewhat, but not drastically, higher average speeds are experienced on the HOV facilities than the general freeway during peak hours. For arterials, through traffic at numerous intersections within the study area experiences significant delay in the morning peak hours, although it is moving in a coordinated traffic signal system. In the afternoon peak hours, through traffic at even more intersections begins to experience delay including some severe delays, especially on arterials that feed the freeway system. Such delays are not experienced in the mid-day hours indicating that the congestion is primarily a peak-hour problem.

The *2007 MAG Regional Travel Time and Speed Study* and ADOT Freeway Management System (FMS) data were used by MAG to highlight recurring bottleneck locations on the regional freeway network. Segments of the I-10 and US-60 corridors located within the study area are experiencing traffic delays between 30 and 120 minutes in duration with person hour delays as high has 600 to 900 person hours per mile. The most significant delays are found on I-10 northbound between Chandler Boulevard and US-60 and on US-60 westbound between Mill Avenue and Priest Drive during the AM peak period. During the PM peak period, the most significant bottle necks in the study area are on I-10 eastbound between I-17 and Guadalupe Road and on eastbound US-60 between I-10 and Rural Road. Figure 7 identifies the duration of peak period bottlenecks and the estimated delay per mile in the I-10 and US-60 corridors within the study area.

Figure 7. Peak Period Freeway Bottleneck Duration



Source: 2007 MAG Regional Travel Time and Speed Study; ADOT FMS

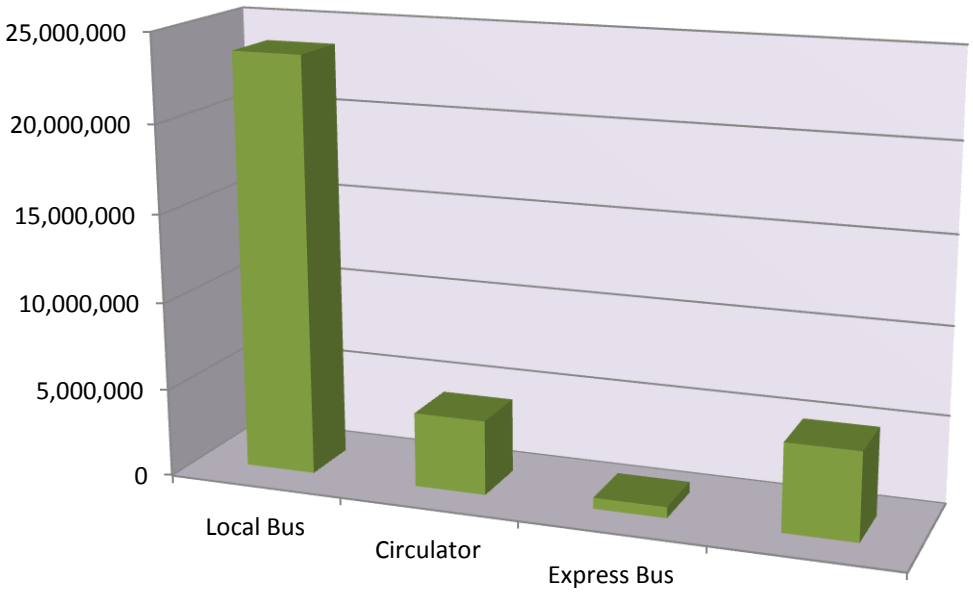
For the development of the RTP, MAG created TDM simulations of the traffic performance of the regional roadway network based on 2008 travel demand and 2030 travel demand forecasts. This is the only document of the three discussed herein that addresses future conditions. For the freeways in the study area, significant congestion (LOS E & F) exists in 2008 for all freeways within the corridor, which is consistent with the other two studies discussed. By 2030, freeway congestion levels are predicted by the model to worsen significantly, which is not surprising given that population forecasts in the region indicate that population will double between 2000 and 2030. The RTP arterial intersection LOS results are similar to the freeway findings. Several intersections currently experience LOS E & F during the PM peak period. A major increase in the number of congested intersections will occur between now and 2030 even with the arterial improvements included in the current RTP.

5.2 Existing Transit Performance

Transit service performance is tracked by the Regional Public Transportation Authority/Valley Metro on a regular basis through monthly and annual performance reports. Information from these reports is aggregated by service productivity (ridership) at the route, jurisdiction, and modal level.

Based on Valley Metro's reported ridership data, local fixed route bus service carried more passengers than any other transit mode, followed by light rail, circulator bus and express bus. The data reported for light rail transit is incomplete as it only represents ridership for half a year (January 2009 – June 2010). Extrapolated to a full year, ridership for light rail transit in Phoenix and Tempe would still be less than fixed route local bus. If compared on a route level basis, light rail carries more passengers than any other single route. A comparison of annual transit ridership by mode is presented in Figure 8.

Figure 8. Study Area Annual Transit Ridership (Boardings) by Mode[1]



Source: Valley Metro Annual Ridership Report for Fiscal Year 2008-2009
[1]Annual ridership for light rail is for January 2009 through June 2009

Overall, the local bus routes with the highest ridership in the study area operate within or through the central Phoenix area. These services include Route 19 (19th Avenue), Route 17 (McDowell Road), Route 0 (Central Avenue), Route 16 (16th Street), and Route 7 (7th Avenue). However, several other local bus routes have relatively high ridership, including Route 61 (Southern Avenue), Route 45 (Broadway Road) and Route 77 (Baseline Road). These three routes show a strong existing demand for east-west local transit service. A summary of ridership by route is provided in Table 1.

While express bus service has the lowest total ridership of any mode in the study area, it also has the lowest service levels (weekday peak period only) and serves a specific market: downtown Phoenix commuters. The I-10 East RAPID route accounts for more than one-third (37 percent) of the express route ridership in the service area, despite that the study area has a total of 11 express bus routes. The I-10 East RAPID route provides direct express bus service primarily using the I-10 HOV lanes between the Pecos Park-and-Ride and downtown Phoenix. Following the I-10 East RAPID route, the three Chandler Express routes (540, 541, and 542) combined account for approximately 24 percent of the express bus ridership in the study area. These routes provide service between the historic Chandler Central Business District (CBD) area and downtown Phoenix utilizing a combination of arterial roadways and freeway HOV lanes.

Table 1. Existing Transit Service Performance by Route and Ridership Performance

Route	Description	Mode	Annual Ridership[1]
LRT	Central Phoenix – East Valley	LRT	5,000,043
19	19th Avenue	Local	2,830,894
17	McDowell Road	Local	2,203,158
70	Glendale/24th Street	Local	1,896,896
0	Central Avenue	Local	1,796,330
3	Van Buren Street	Local	1,792,510
7	7th Street	Local	1,650,458
16	16th Street	Local	1,603,805
61	Southern Avenue	Local	1,140,243
8	7th Avenue	Local	986,658
72	Scottsdale Road/Rural Road	Local	974,601
10	Roosevelt Street/Grant	Local	947,783
45	Broadway Road	Local	928,630
44	44th Street/Tatum Boulevard	Local	867,870
15	15th Avenue	Local	861,290
Orbit - Jupiter	Tempe Circulator	Circulator	802,687
77	Baseline Road	Local	755,644
FLASH[2]	Tempe Circulator	Circulator	687,456
Orbit - Mercury	Tempe Circulator	Circulator	687,009
56	Priest Drive	Local	665,063
81	Hayden/McClintock Road	Local	594,061
Orbit - Earth	Tempe Circulator	Circulator	556,456
DASH[3]	Phoenix Circulator	Circulator	531,250
12	12th Street	Local	530,673
30	University Avenue	Local	472,674
62	Hardy/Guadalupe Road	Local	435,564
ALEX	Phoenix Circulator	Circulator	391,735
Orbit - Venus	Tempe Circulator	Circulator	374,245
156	Chandler Boulevard/Williams Field Road	Local	355,721
13	Buckeye Road	Local	332,901
1	Washington Street/Jefferson Street	Local	281,015
52	Roeser	Local	279,086
65	Mill Avenue/Kyrene	Local	261,810
66	Mill Avenue/68th Street/Kyrene	Local	247,025
I-10E	RAPID - I-10 East	Express	233,318
Orbit - Mars	Tempe Circulator	Circulator	199,370
76	Miller	Local	185,020
108	Elliot Road	Local	175,841
40	Apache/Main Street	Local	132,985
541	Chandler Express	Express	78,847
521	Tempe Express	Express	58,482
540	Chandler Express	Express	52,890
533	Mesa Express	Express	48,724
531	Mesa/Gilbert Express	Express	41,540
520	Tempe Express	Express	34,274
535	Northeast Mesa/Downtown Express	Express	28,815
532	Mesa Express	Express	22,332
542	Chandler/Downtown Express	Express	21,159
511	Tempe/Scottsdale Airpark Express	Express	6,195
Total			**36,043,036**

Source: Valley Metro Annual Ridership Report for Fiscal Year 2008-2009

[1]Includes segment of route in study area jurisdiction only for local and circulator services.

[2]Includes the Downtown and Government Loops. DASH Downtown was discontinued in July 2010.

[3]Includes FLASH Forward, FLASH Back, and FLASH University. FLASH University was replaced with FLASH McAllister in July 2010.

5.3 Existing and Projected Travel Demand

An initial review of travel demand was completed to identify general travel patterns between the study area and other parts of the region. In addition, other travel patterns were reviewed to identify where trips to two of the study area's highest demand activity centers, downtown Phoenix and downtown Tempe/ASU, are projected to originate from.

5.3.1 Study Area Travel Demand

Trip Destinations

General travel demand in the study area was measured using outputs from the MAG TDM. Based on the results of the model, presented in Table 2, the top general destinations for trips originating in the south Tempe, Chandler and Northern Pinal County area include:

- Southeast and east valley areas (Mesa, Gilbert and Pinal County)
- North Tempe (north of Baseline Road)
- Central Phoenix north area (including Sky Harbor International Airport, Uptown Phoenix, and the Camelback/Biltmore area)

Table 2. 2010 and 2030 Total Study Area Person Trips – Trips from Study Area

Sub-Area	2010 – Percent of Trips	2030 – Percent of Trips
Southeast and East Valley Areas	43%	44%
North Tempe	25%	20%
Central Phoenix North Area	18%	17%
All Other Areas Combined	13%	19%
Total	**100%**	**100%**

Source: MAG TDM, 2010

When comparing between 2010 and 2030, there appears to be limited change in the projected travel demand patterns. The highest destinations in 2010 are projected to remain strong destinations in 2030.

Trip Origins

From a trip origin perspective, the travel demand pattern is nearly a reverse of the destination patterns. The areas of the region that generate the most trips destined to the south Tempe, Chandler and Northern Pinal County area include:

- Southeast and east valley area (Mesa, Gilbert and Pinal County)
- North Tempe (north of Baseline Road)

Trips from the central Phoenix north area, which is considered a leading destination, represent only 6 percent of the total daily person trip origins. However, it should be noted that a significant number of trips, approximately two-thirds in 2010 and three-quarters in 2030 originate from the southeast and east valley areas. Table 3 identifies the general location of the trip origins (total daily person trips) destined to the south Tempe, Chandler and Northern Pinal County area.

Table 3. 2010 and 2030 Total Study Area Person Trips – Trips to Study Area

Sub-Area	2010 – Percent of Trips	2030 – Percent of Trips
Southeast and East Valley Areas	69%	75%
North Tempe	13%	10%
All Other Areas Combined	18%	16%
Total	**100%**	**100%**

Source: MAG TDM, 2010

5.3.2 Activity Center Demand

Activity center demand was reviewed for the two most desired activity centers in the study area: downtown Phoenix and downtown Tempe/ASU. However, the study area has multiple potential activity centers as illustrated in Figure 9 and Figure 10. These maps identify the projected concentrations of employment and population in year 2030 respectively and call out potential activity centers based on three different tiers of potential activity level. Tier 1 activity centers are projected to have a higher level of activity than Tier 2 and Tier 3 activity centers, or are designated as a community core area.

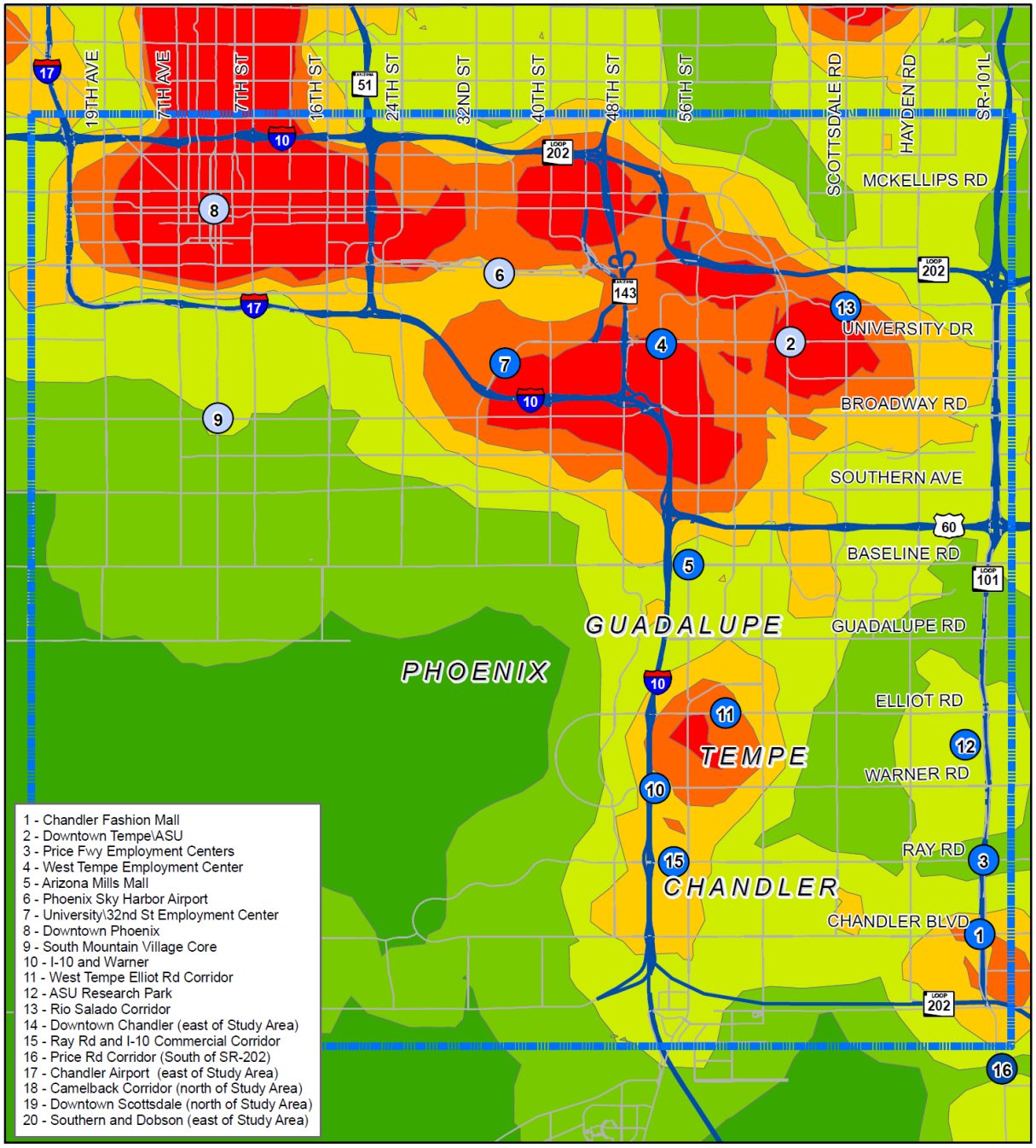
Two of the densest activity centers (employment density and population density) in the region are located in downtown Phoenix and downtown Tempe/ASU. Existing and projected travel demand to these activity centers shows a high level of demand from communities in the east valley and Pinal County. Figure 11 and Figure 12 illustrate the projected origins of peak period trips destined to the Downtown Tempe/ASU and downtown Phoenix areas.

For the downtown Tempe/ASU area, approximately one-fifth (20.4 percent in 2010 and 19.5 percent in 2030) of the peak period trips destined for this area originate from the south Tempe, Chandler and Northern Pinal County area. Other areas that have a high level of trips that area destined for downtown Tempe/ASU include:

- Southeast valley area (Mesa and Apache Junction)
- Central Phoenix north area (including Phoenix Sky Harbor International Airport, Uptown Phoenix, and the Camelback/Biltmore area)

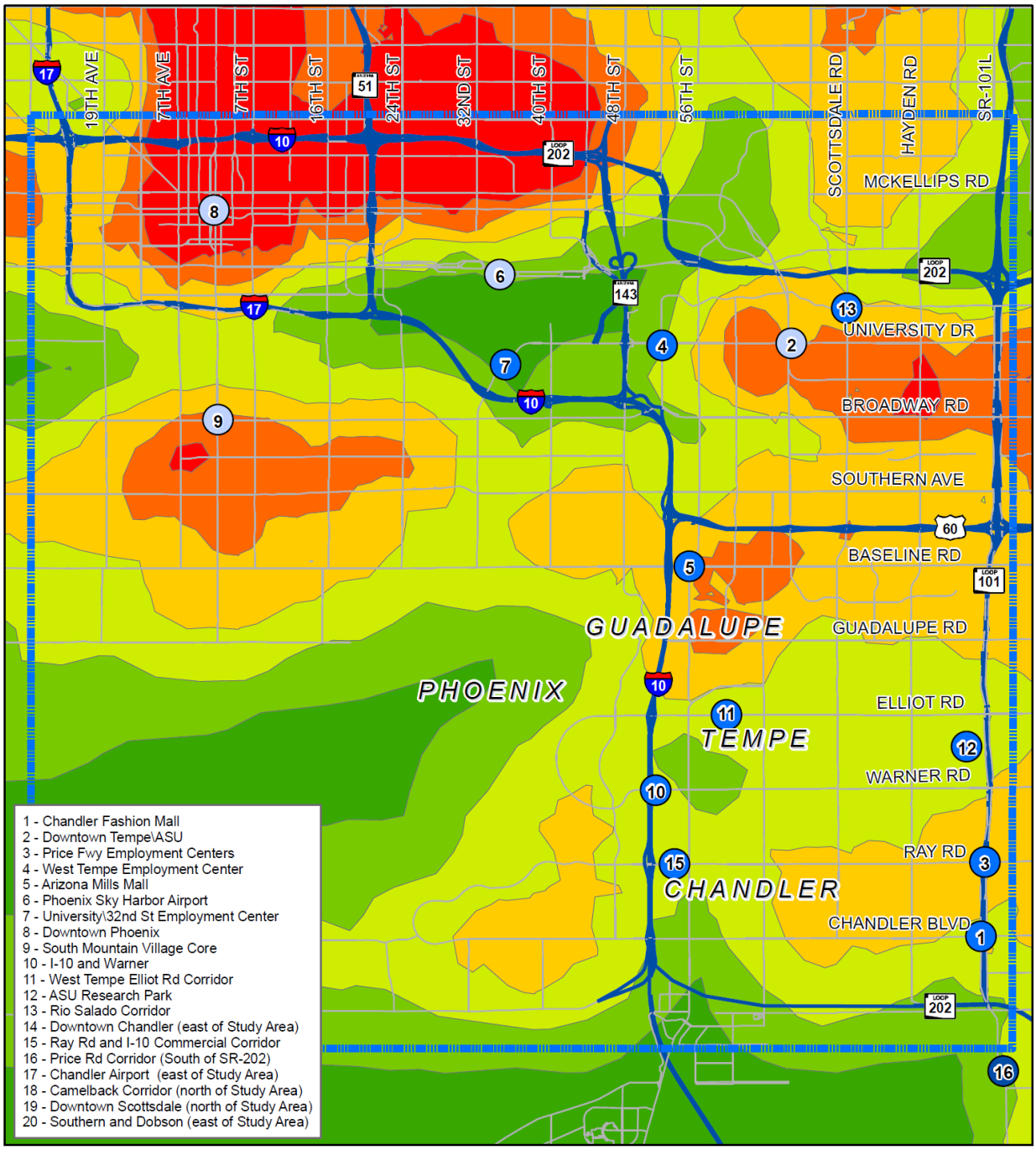
Nearly 40 percent of the trips destined for downtown Phoenix originate from the Central Phoenix north area in both 2010 and 2030. Trips from the south Tempe, Chandler and Northern Pinal County areas only comprise approximately 8 percent of the trips destined for downtown Phoenix. However, 20 percent of all trips to downtown Phoenix are from all east valley areas combined (excluding Scottsdale).

Figure 9. 2030 Employment Concentrations & Potential Activity Centers



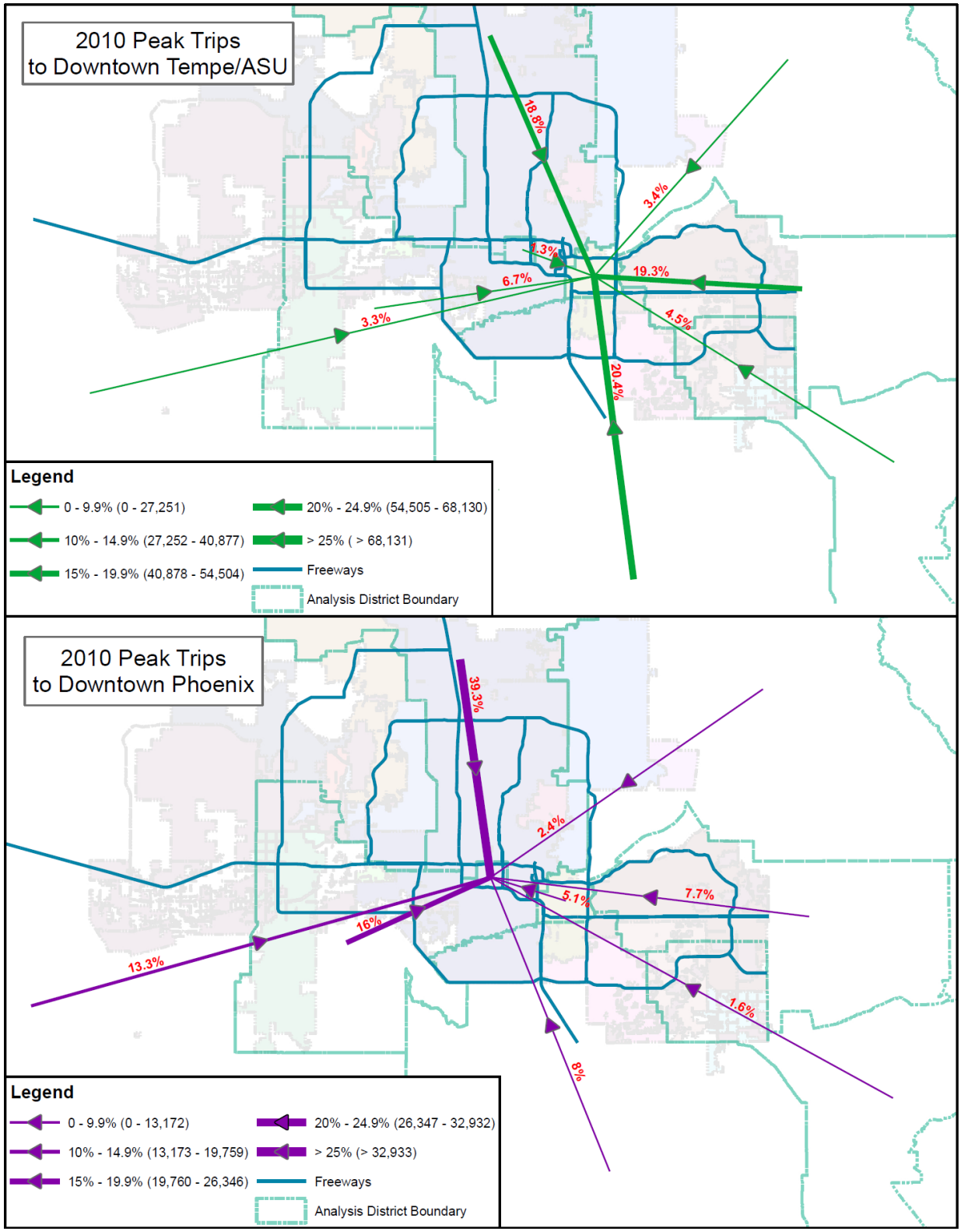
Data Source: MAG, 2011

Figure 10. 2030 Population Concentrations & Potential Activity Centers



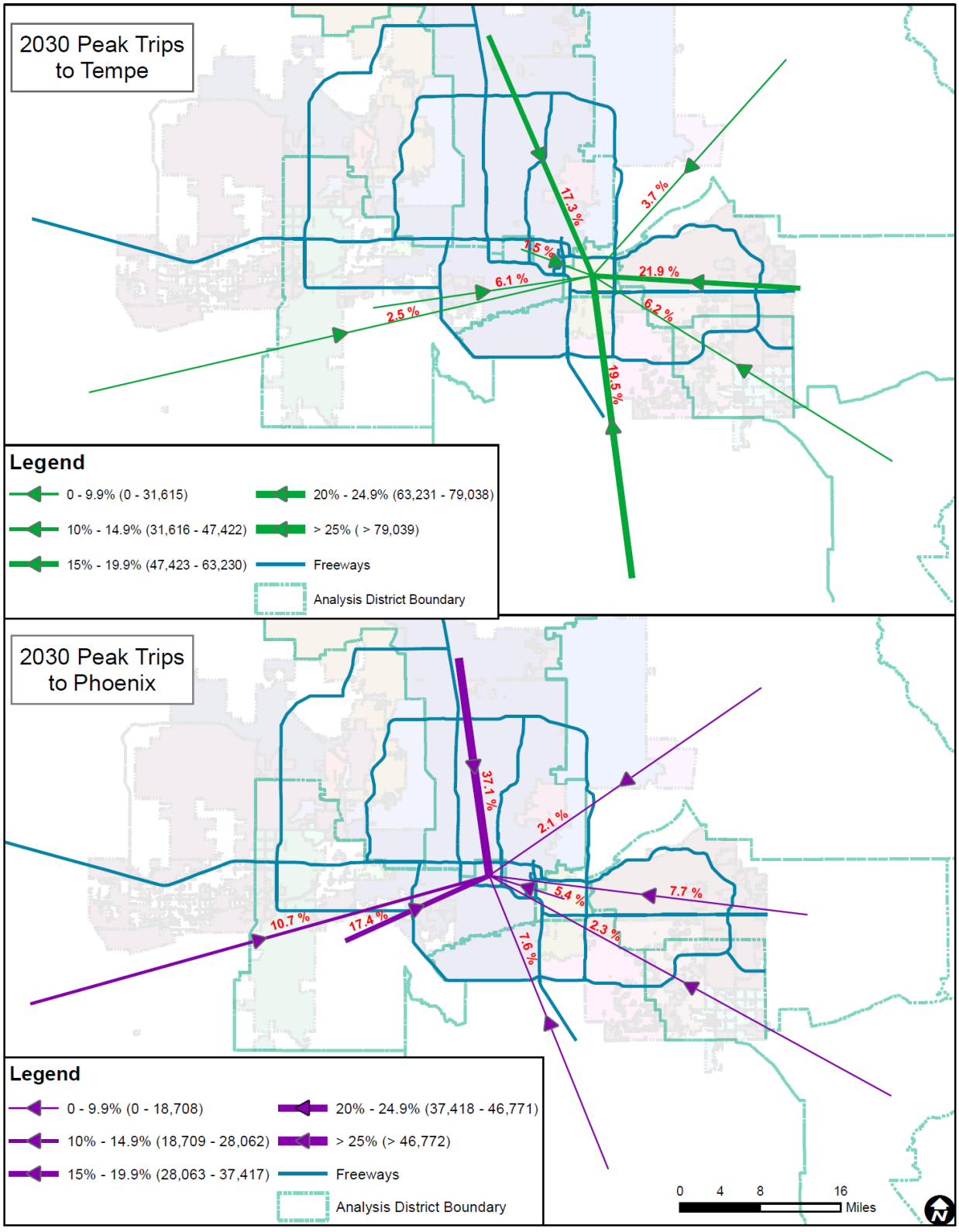
Data Source: MAG, 2011

Figure 11. 2010 Trip Origins Destined to Downtown Phoenix and Downtown Tempe/ASU



Data Source: MAG TDM, 2010

Figure 12. 2030 Trip Origins Destined to Downtown Phoenix and Downtown Tempe/ASU



Data Source: MAG TDM, 2010

5.4 Transportation Performance and Forecasted Demand Key Findings

The information documented in this report was summarized from the *MAG SE Corridor MIS Existing Conditions and Planned Transportation Improvements Report*. The report, which is provided in Appendix A, documents information essential for understanding existing and planned transportation investments, current performance of the study area's highway, roadway and transit networks and general travel demand patterns. The key transportation performance and travel demand findings documented in the *MAG SE Corridor Existing Conditions and Planned Transportation Improvements Report* and in this study include:

Transportation Performance

- Previous studies indicate that every freeway within the study area experiences some recurring congestion
- The most significant freeway delays are found on I-10 northbound between Chandler Boulevard and US-60 and on US-60 westbound between Mill Avenue and Priest Drive during the AM peak period. During the PM peak period, the most significant bottle necks in the study area are on I-10 eastbound between I-17 and Guadalupe Road and on eastbound US-60 between I-10 and Rural Road
- Slightly higher average speeds are experienced on the HOV facilities than the general freeway lanes during peak hours
- Arterial congestion is primarily a peak-hour problem, where through traffic experiences significant delays at numerous intersections during the morning peak hours, and even more intersections during the afternoon peak hours
- Within the study area, local fixed route bus service carried more passengers than any other transit mode, followed by light rail, circulator bus and express bus in Fiscal Year (FY) 2009
- The local bus routes with the highest ridership in the study area operate within or through the central Phoenix area; however the south Phoenix and Tempe east-west crosstown routes (Broadway Road, Southern Avenue, and Baseline Road) have strong existing ridership
- The I-10 East RAPID (Ahwatukee to downtown Phoenix Express) accounts for more than one-third (37 percent) of the express route ridership in the service area while the three Chandler Express routes (540, 541, and 542) account for approximately 24 percent of the express bus ridership

Travel Demand

- The top general destinations for trips from the south Tempe, Chandler and Northern Pinal County area include:
  - Southeast and east valley areas (Mesa, Gilbert and Pinal County)
  - North Tempe (north of Baseline Road)
  - Central Phoenix north area (including Sky Harbor International Airport, Uptown Phoenix, and Camelback/Biltmore area)
- The areas of the region that generate the most trips destined to the south Tempe, Chandler and Northern Pinal County area include:
  - Southeast and east valley area (Mesa, Gilbert and Pinal County)
  - North Tempe (north of Baseline Road)
- Trips from the central Phoenix north area, which is considered a leading destination, represents only 6 percent of the total daily person trips; however, it should be noted that a

significant number of trips, approximately two-thirds in 2010 and three-quarters in 2030, are from the southeast and east valley areas

- Approximately one-fifth (20.4 percent in 2010 and 19.5 percent in 2030) of the peak period trips destined for the downtown Tempe/ASU area are from the south Tempe, Chandler and Northern Pinal County area. Other areas that have a high level of trips destined for the downtown Tempe/ASU area include:
  - Southeast valley area (Mesa and Apache Junction)
  - Central Phoenix north area (including Sky Harbor Airport, Uptown Phoenix, and Camelback/Biltmore area)
- Nearly 40 percent of the trips destined for the downtown Phoenix area are from the Central Phoenix north area in both 2010 and 2030. Trips from the south Tempe, Chandler and Northern Pinal County area only comprise approximately 8 percent of the trips to downtown Phoenix; however, all east valley areas combined (excluding Scottsdale) comprise approximately 20 percent of the trips

6.0 Identification of Transportation Investment Options and Bundles

The study area currently experiences some of the highest levels of overall travel demand in the region. To help meet growing demand in the corridor, freeway capacity improvements are planned. This study was initiated to identify and evaluate additional alternative capacity and mobility enhancements, including transit and roadway options, within and near the study area. Initial alternative transportation improvement concepts have been identified for the corridor and incorporated into three unique bundles. Six additional alternative bundles were developed and analyzed during the study process.

The three initial draft bundle concepts (multi-modal alternatives) were developed through a participatory planning process that included representatives of stakeholder communities and public agencies. This chapter provides a brief summary of the bundle planning process, documentation of investment options included in each of the initial and subsequent bundles, and a summary comparison of all bundles considered. A detailed evaluation of the bundles based on quantifiable evaluation measures is provided in Chapter 7.0 of this report.

6.1 Bundle Planning Process

The bundle planning process was completed in two phases which included the collection and review of study area data and an interactive planning charrette. Data related to study area demographics, existing and future transportation investments (roadway and transit), system performance, and travel demand were collected for an existing and future conditions report completed earlier in the study process. Additional research regarding potential alternative transportation investment options (roadways and transit) to be considered during the planning process was also conducted. The research identified appropriate applications for alternative transportation investment options and their typical unit costs. Examples of alternative transportation investment options include but are not limited to BRT, LRT, heavy rail, and transit oriented parkways (TOPS).

A planning charrette was conducted between January 12, 2011 and January 13, 2011 to interactively develop the three initial alternative transportation bundle concepts. The charrette included participation from the study area stakeholder groups identified below:

- ADOT
- MAG
- METRO
- City of Phoenix
- City of Tempe
- Regional Public Transportation Authority/Valley Metro

Federal Highway Administration, City of Chandler and Town of Guadalupe staff were invited to participate, but were not able to attend.

Charrette participants were divided into two planning “teams” to independently consider potential solutions for increasing transportation capacity within the study through alternative investment options. During the first day of the charrette, each team generated three bundles each (total of six bundles). The three bundles represented an alternative transportation approach within the general limits defined in Table 4.

Table 4. Bundle Concepts

Bundle	Objective	Desired Funding Target* (billions)
Bundle 1 – "Basic Mobility Alternatives"	Demonstrate the alternative regional transportation investments, constrained to a minimal increase in funding that can be implemented within the study area to improve corridor mobility.	$0.50 – $1.25
Bundle 2 – "Peer Competitive"	Identify the potential transportation improvements that could be implemented if regional public transportation funding was more consistent with funding levels in peer regions.	$2.00 - $3.00
Bundle 3 – "Transit Focus"	Develop a comprehensive transit solution that meets regional and local transportation needs within the study area	$3.75 - $4.75

**Assumes funding will be generated through year 2031.*
Source: HDR Engineering, 2011

The funding limits defined for each scenario are based on the following defined criteria:

- Bundle 1 - Extension of the regional sales tax to 2031 would generate an additional $0.50 to $1.25 billion in revenue for this concept.
- Bundle 2 - Additional regional transportation revenues are estimated at approximately two times the current regional transportation sales tax starting in 2015 and ending in 2031. This is consistent with the average annual per capita transit operations expenditures of six peer regions (Atlanta, Denver, Dallas, Salt Lake City, San Diego and Seattle).
- Bundle 3 - The maximum funding level assumed for this bundle is equivalent to a value similar to the annual per capita transit operations expenditures of the Seattle region.

The second day of the charrette focused on refining the six bundle concepts developed by the planning teams into three distinct bundle concepts. To complete this task, the planning teams rejoined and interactively reviewed similarities and differences between the individual bundle concepts and reviewed performance/financial indicators to identify preferred transportation investments for each bundle tier.

6.2 Transportation Investment Options

Multiple transportation investment options were considered as part of the charrette and the overall major investment study planning process. Transit options considered ranged from local fixed route bus and modern streetcar to heavy rail. Table 5 provides a comparison of transit options considered.

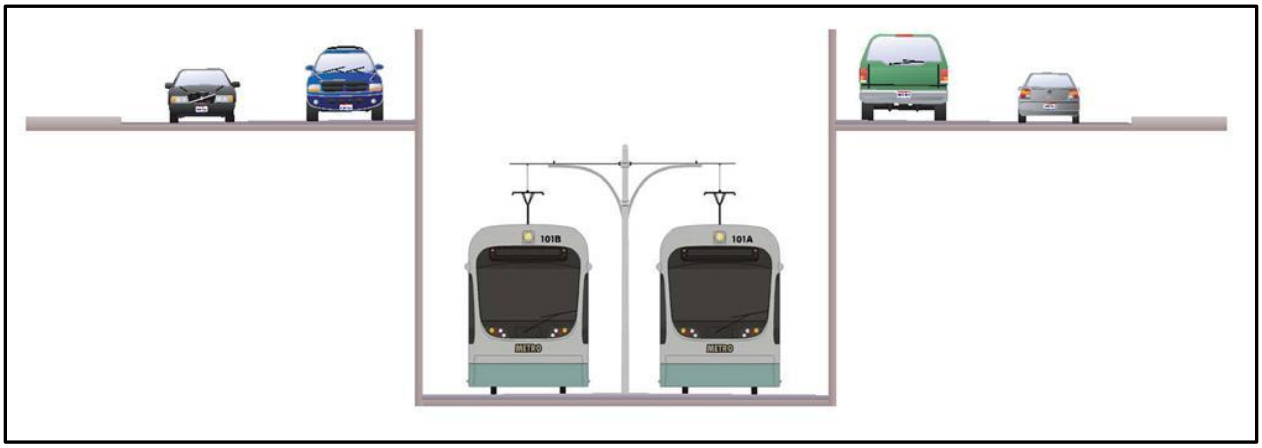
Non-transit options considered included managed lanes within I-10 and the application of the TOPS concept in arterial roadway corridors. The TOPS concept integrates a transit guideway in the center median of a parkway. This roadway design concept helps accommodate higher volumes of vehicular traffic while providing a dedicated grade-separated guideway for transit operations including BRT, LRT, heavy rail, or other transit technology. Figure 13 provides an illustration of a potential TOPS cross section.

Table 5. Comparison of Primary Transit Options Considered

Technology	Purpose / Market Type	Corridor Characteristics	Passenger Access	Capital Cost per Corridor Mile[1]	Operating Cost per Mile[1]	Typical Passenger Capacity per Vehicle
HOV Express 	Enhanced-speed, moderate-volume commuter or regional connections	Mostly Freeways	Park-and-ride facilities and a minimal number of non-parking facilities	N/A	$7.50-$9.50	40
Arterial BRT 	Enhanced-speed, high-demand local or regional connections	Arterial Streets and HOV Lanes	Approximately every mile	$560,000	$7.50-$9.50	55
Automated Guideway Transit 	Low-speed, high-demand internal activity center connections	Exclusive guideway. Generally operates above grade	Nodes within activity centers as close as one to two city blocks	$40,300,000	$23.50-$25.50	55 per car
Modern Streetcar 	Moderate-speed, moderate-demand local or regional connections	Semi-exclusive or integrated guideway	Nodes within activity centers as close as one to two city blocks	$50,000,000	$16.00-$18.00	30 seated; 170 standing
Light Rail 	Higher-speed, high-demand regional connections	Exclusive or semi-exclusive guideway	Approximately every half- to one-mile or longer	$87,500,000	$19.50-$21.50	180-200 per car
Heavy Rail 	Higher-speed, high-demand local or regional connections	Exclusive guideway	Approximately every half- to one-mile or longer	$75,550,000 to $314,810,000	$12.50-$14.50	100-150 per car
Commuter Rail 	Higher speed, high-demand commuter or regional connections	Exclusive or semi-exclusive guideway	Park-and-ride facilities and a minimal number of non-park facilities	$9,300,000	$13.50-$15.50	130-160 per car seated; 270 standing

[1]*Capital and operating cost per mile gathered from the MAG Regional Transit Framework Study. Cost estimates were increased by 3% to account for 1 year of inflation. Capital Costs for People Mover and Heavy Rail were collected from USDOT, FHWA, and FTA (2001). The capital costs were adjusted for inflation based on the Consumer Price Index from the U.S. Department of Labor, August 2010. Operating Costs per Mile were calculated for People Mover and Heavy Rail based on the National Transit Database: 2008 Transit Profiles, FTA.*

Figure 13. Typical TOPS Cross Section



Source: MAG, 2011

6.3 Bundle Components

Each bundle, including alternate bundles defined after the initial evaluation, includes a combination of roadway and transit investments designed to increase overall transportation capacity and mobility within the study area. Three common elements have been identified in each bundle including:

- I-10/I-17 managed lanes – I-10/SR-202L to I-10/I-17 TI
- New DHOV ramps – Five new DHOV ramps along I-10 and I-17
- Southern Avenue /Central Avenue Transit Investment – Southern Avenue and Rural Road to downtown Phoenix


I-90 at 142nd Place SE in Bellevue, WA

The new DHOV ramps were identified in locations that provide or enhance access to major transportation generators. The proposed I-17 DHOV ramp at Washington Street/Jefferson Street is near the State Capitol. The proposed I-10 DHOV ramp at Central Avenue provides access to Central Phoenix, while the proposed SR-143 DHOV ramp offers access to Sky Harbor International Airport. Finally, the proposed I-10 DHOV ramps at Carver Road and Galveston Street provide access to South Tempe, Guadalupe, Ahwatukee, and West Chandler. Additionally, the proposed Carver Road and Galveston Street DHOV ramps would require minimal street construction to provide access to I-10 and offer locations where park-and-ride facilities may be constructed with direct connections to the freeway. The photograph above (provided by the Washington State Department of Transportation [WSDOT]) provides an example of a DHOV ramp with direct park-and-ride access, bus interface facility, and direct access into a managed lanes facility. An excerpt from WSDOT's website pertaining to DHOV lanes is provided in Appendix B.

For purposes of this study, all corridors are defined as approximately one-mile on either side of the roadway or corridor named. For example, the final alignment for a Southern Avenue corridor investment could occur in the area between and including Baseline Road and Broadway Road.

6.3.1 Bundle 1

Bundle 1 emphasizes capacity improvements in the Southern Avenue corridor to help improve the reliability of travel times between the communities in the eastern side of the study area (Ahwatukee [Phoenix Village], Chandler, Guadalupe, Mesa, and Tempe) and the Central Phoenix/Phoenix South Mountain Village areas. Southern Avenue investments include the development of a parkway between US-60 and SR-202L (South Mountain) and the implementation of a new BRT service to provide a higher speed travel option (compared to existing fixed route service). While the proposed Southern Avenue Parkway is envisioned to extend beyond the western limit of the study area (23rd Avenue), the costs identified in this report are limited to the capital and operating investments within the study area only. The conceptual Southern Avenue parkway would include three (3) GP lanes plus one (1) bus/right-turn only (BAT) lane in each direction.

Managed lanes and DHOV freeway ramps provide an alternative option with potentially improved travel time reliability for local and regional travel within the existing freeway corridors. The managed lanes would be separated from the GP lanes and only accessed at the termini and through the new and existing DHOV connections. A diagram of a typical lane configuration with managed and GP lanes is provided in Figure 14 and Figure 15. Finally, capacity improvements along the 7th St and 7th Avenue corridors between Southern Avenue and downtown Phoenix are recommended to improve sub-area circulation and connections to downtown Phoenix. A list and general description of the Bundle 1 concepts are provided in Table 6, while Figure 16 illustrates the proposed elements.

Figure 14. Typical Lane Configuration of Managed and General Purpose Lanes on I-17/I-10

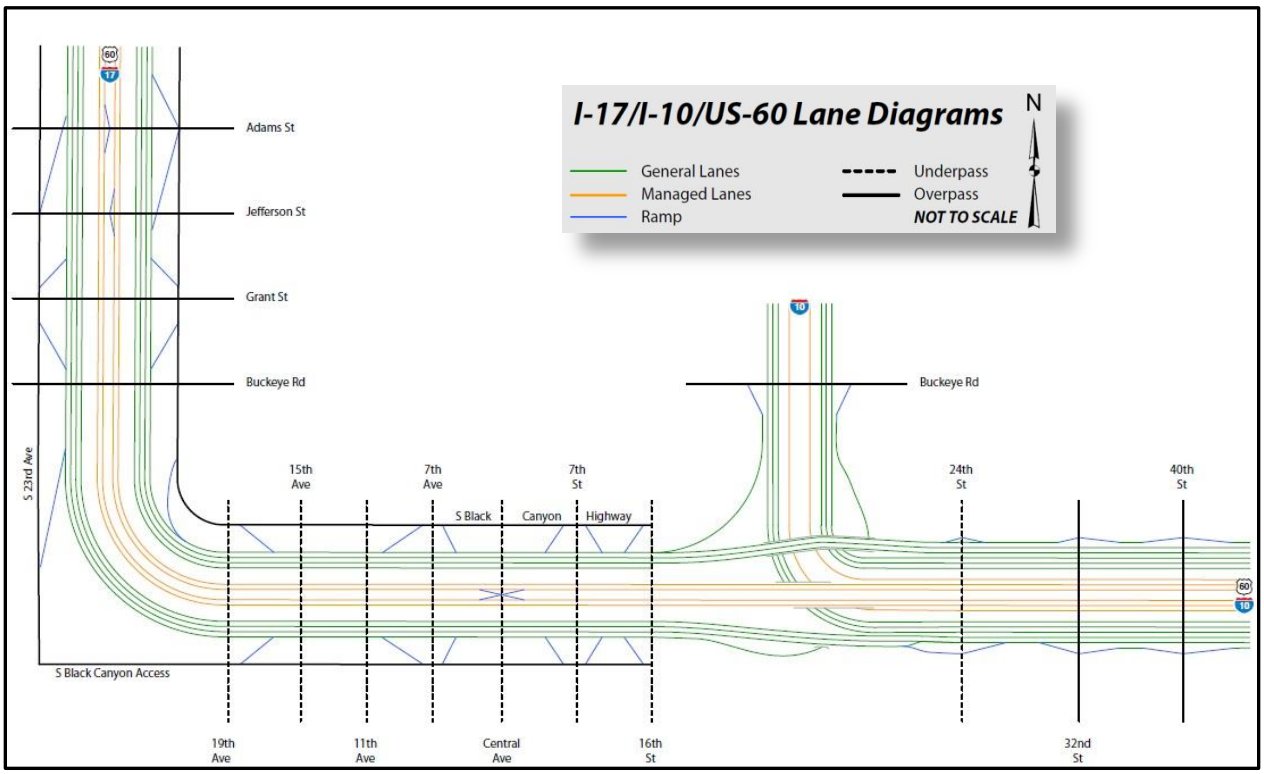


Figure 15. Typical Lane Configuration of Managed and General Purpose Lanes on I-10

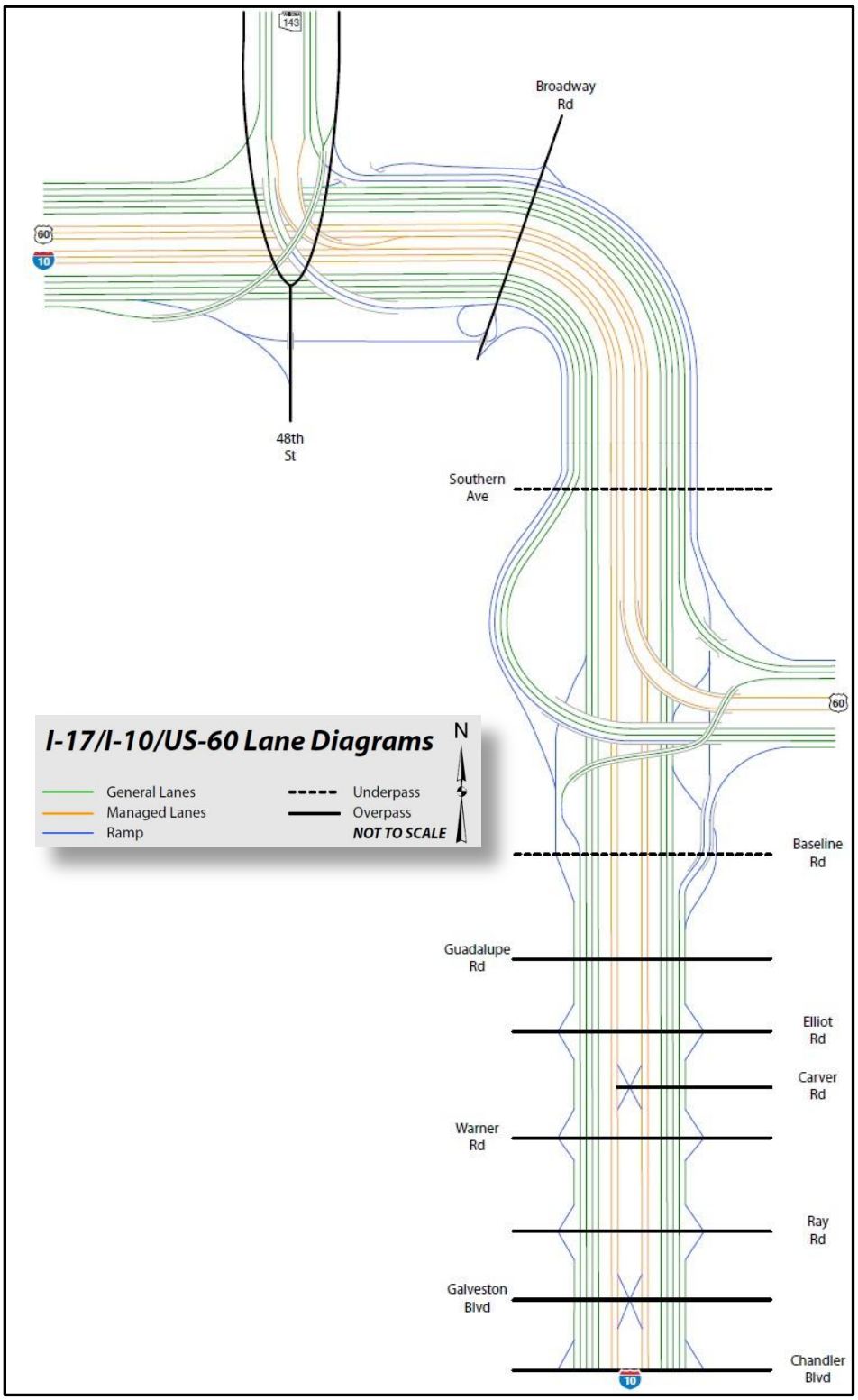


Table 6. Bundle 1 Elements

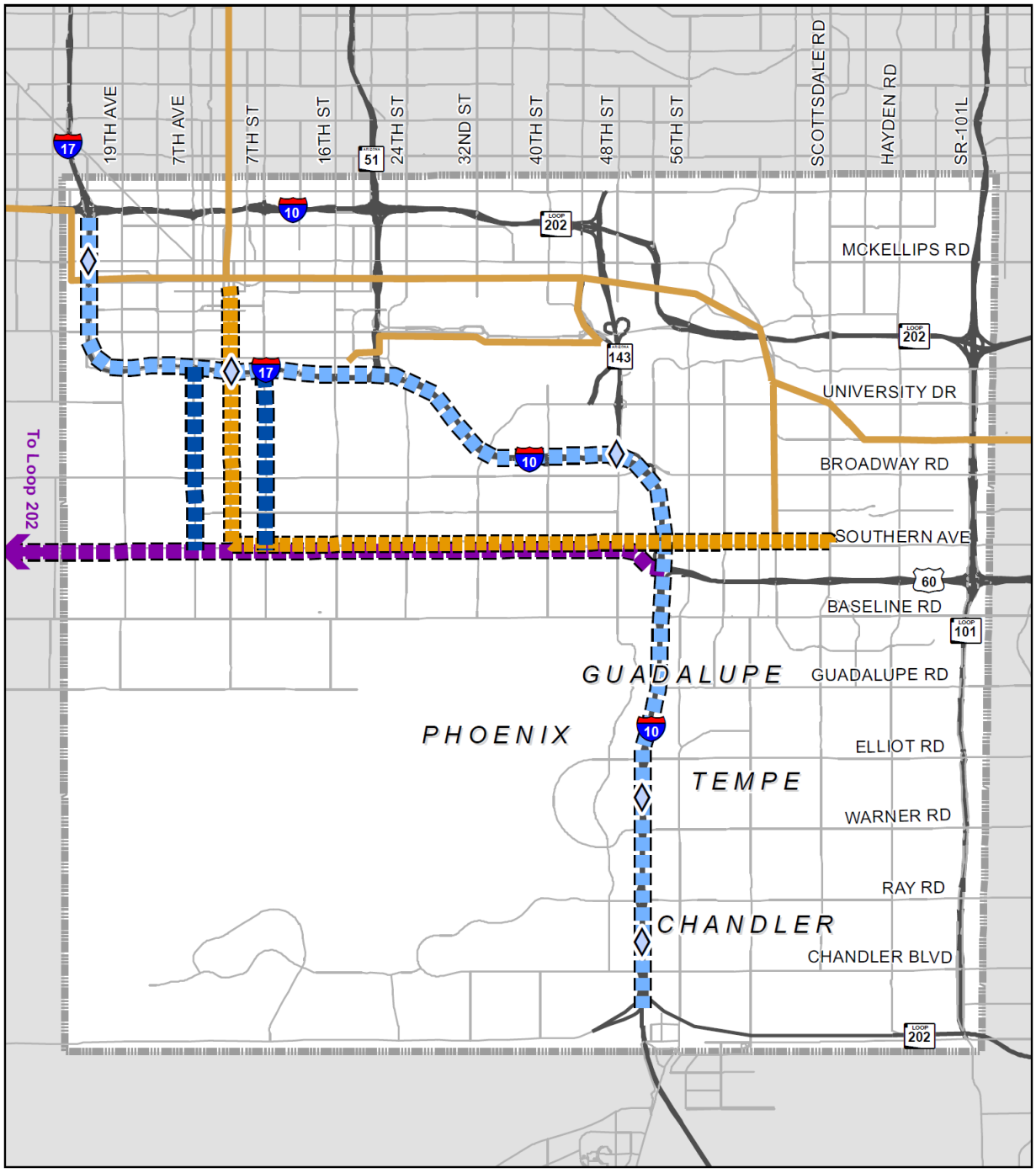
Concept	Description	Length in Study Area (miles)
Managed Lanes	I-10 and I-17 - Pecos Stack to Stack	20.0
New DHOV Ramps	I-17/Washington Street[1] I-17/Central Avenue I-10/SR-143 I-10/Carver Road I-10/Galveston Road	---
BRT	Southern Avenue/Central Avenue – Phoenix CBD to Rural Road	13.5
Parkway	Southern Avenue - US-60 to 23rd Avenue[2] (6GP+2BAT)	8.4
Arterial Street Capacity Enhancement	7th Street – Southern Avenue to I-17 (re-stripe to increase vehicle capacity)	2.3
Arterial Street Capacity Enhancement	7th Avenue – Southern Avenue to I-17 (re-stripe to increase vehicle capacity)	2.3

Source: HDR Engineering, 2011

[1] Assumed to be a half diamond design with northbound access to Jefferson Street and southbound access to Adams Street

[2] Envisioned to extend beyond the study area to SR-202L (West Phoenix)

Figure 16. Bundle 1 Concept



Maricopa Association of Governments
Southeast Corridor MIS

Bundle 1

Legend

- Southeast Corridor Study Area
- Highways
- Major Roads
- Planned High Capacity Transit
- New Direct HOV Ramp
- Bus Rapid Transit
- Managed Lanes
- Parkway (3 GP and 1 BRT lane each direction)
- Add one lane each direction (restripe)

0 1 2 Miles

6.3.2 Bundle 2

Bundle 2 retains the I-10 and I-17 managed lanes/DHOV ramps and Southern Avenue Arterial BRT service. However, in lieu of the Southern Avenue Parkway, east-west capacity enhancements are accomplished through Arterial BRT service on Southern Avenue/Central Avenue (no bus/right-turn only lane) and a commuter rail transit (CRT) service between Pinal County and downtown Phoenix. The commuter rail service would include several passenger stops within the study area.

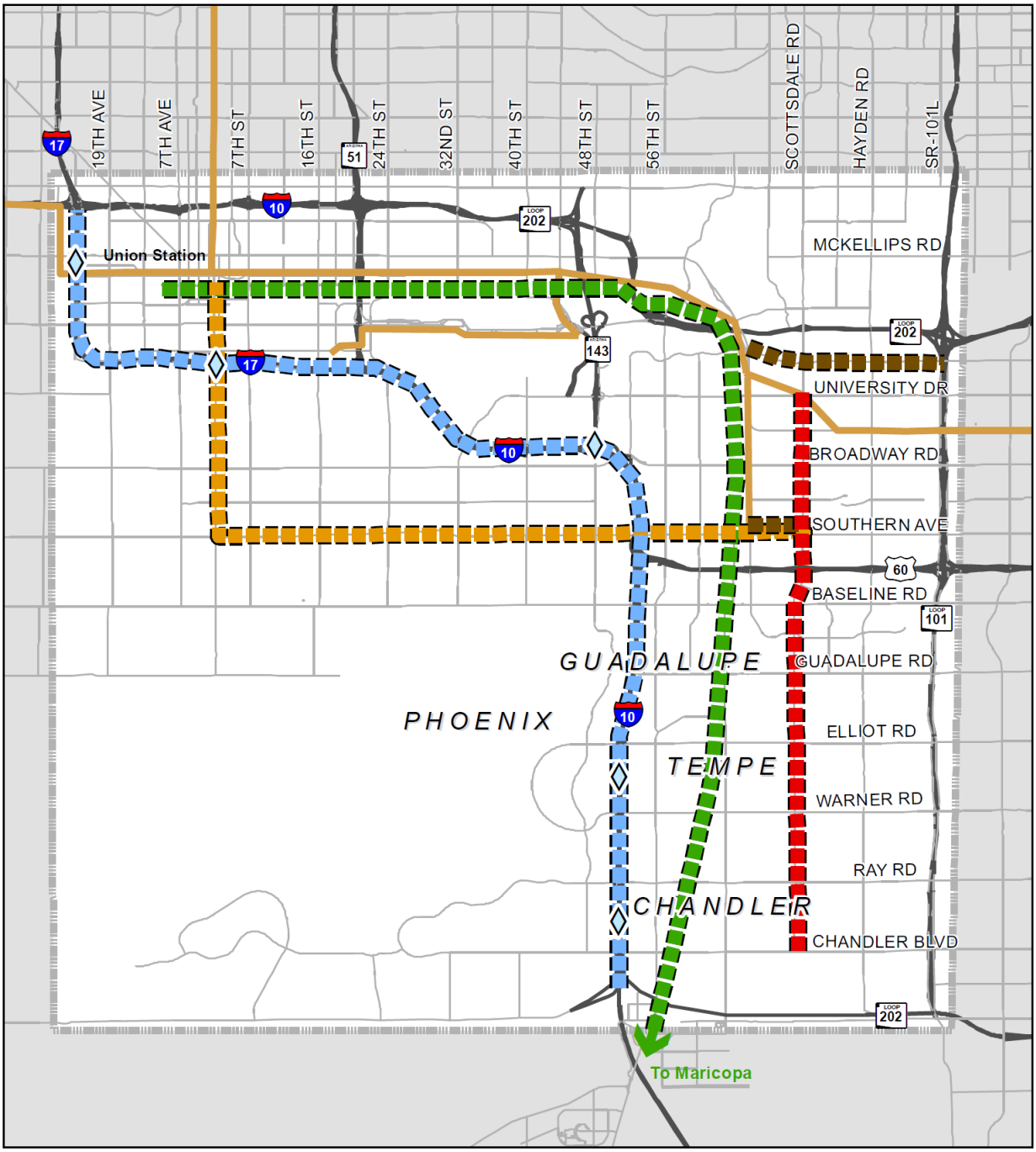
North-south capacity improvements would be achieved through the development of an exclusive guideway transit service (potentially LRT) within the Rural Road corridor between Chandler Boulevard and University Drive. This service will connect with the existing LRT starter line. Additionally, local circulation will be enhanced by extending the proposed Tempe Modern Streetcar on Southern Avenue between Mill Avenue and Rural Road and on Rio Salado Parkway between Mill Avenue and SR-101L. Figure 17 provides an illustration of the proposed Bundle 2 investments. A list and general description of the Bundle 2 elements are provided in Table 7.

Table 7. Bundle 2 Elements

Concept	Description	Length in Study Area (miles)
Managed Lanes	I-10 and I-17 - Pecos Stack to Stack	20.0
New DHOV Ramps	I-17/Washington Street I-17/Central Avenue I-10/SR-143 I-10/Carver Road I-10/Galveston Road	---
Arterial BRT	Southern Avenue/Central Avenue – Phoenix CBD to Rural Road	13.5
Exclusive Guideway Transit	Rural Road – Chandler Boulevard to University Drive	8.0
Modern Streetcar	Rio Salado Parkway - Extension from Mill Avenue to SR-101L	3.5
Modern Streetcar	Southern Avenue - Extension from Mill Avenue to Rural Road	1.0
Commuter Rail	Pinal County to Phoenix	19.0

Source: HDR Engineering, 2011

Figure 17. Bundle 2 Concept



6.3.3 Bundle 3

Bundle 3 is the most aggressive investment option of the three proposed bundle options. Similar to the first two bundles, Bundle 3 includes the I-10 and I-17 managed lanes/DHOV ramps; however, it provides a significantly greater number of HCT options. A new fixed guideway transit network connected to the planned regional HCT network is envisioned for the study area. The fixed guideway service would operate on Central and Southern avenues (downtown Phoenix to Rural Road) as well within the Rural Road and Chandler Boulevard corridors between ASU and downtown Chandler.

Two CRT corridors are considered in Bundle 3. These include CRT service between Pinal County and downtown Phoenix (same as Bundle 2) and CRT service between Queen Creek and downtown Phoenix. Both of these corridors would serve several top activity centers within the study area.

Local circulation will be enhanced by extending the proposed Tempe Modern Streetcar on Southern Avenue between Mill Avenue and Rural Road and on Rio Salado Parkway between Mill Avenue and SR-101L. In addition, a new automated guideway transit service (People Mover) in the 48th Street corridor is proposed to connect with the future PHX Sky Train service near the east side of Sky Harbor International Airport. This service would provide convenient access to the airport for employees and air travelers. Figure 18 provides an illustration of the proposed investments for Bundle 3. A list and general description of the Bundle 3 elements are provided in Table 8.

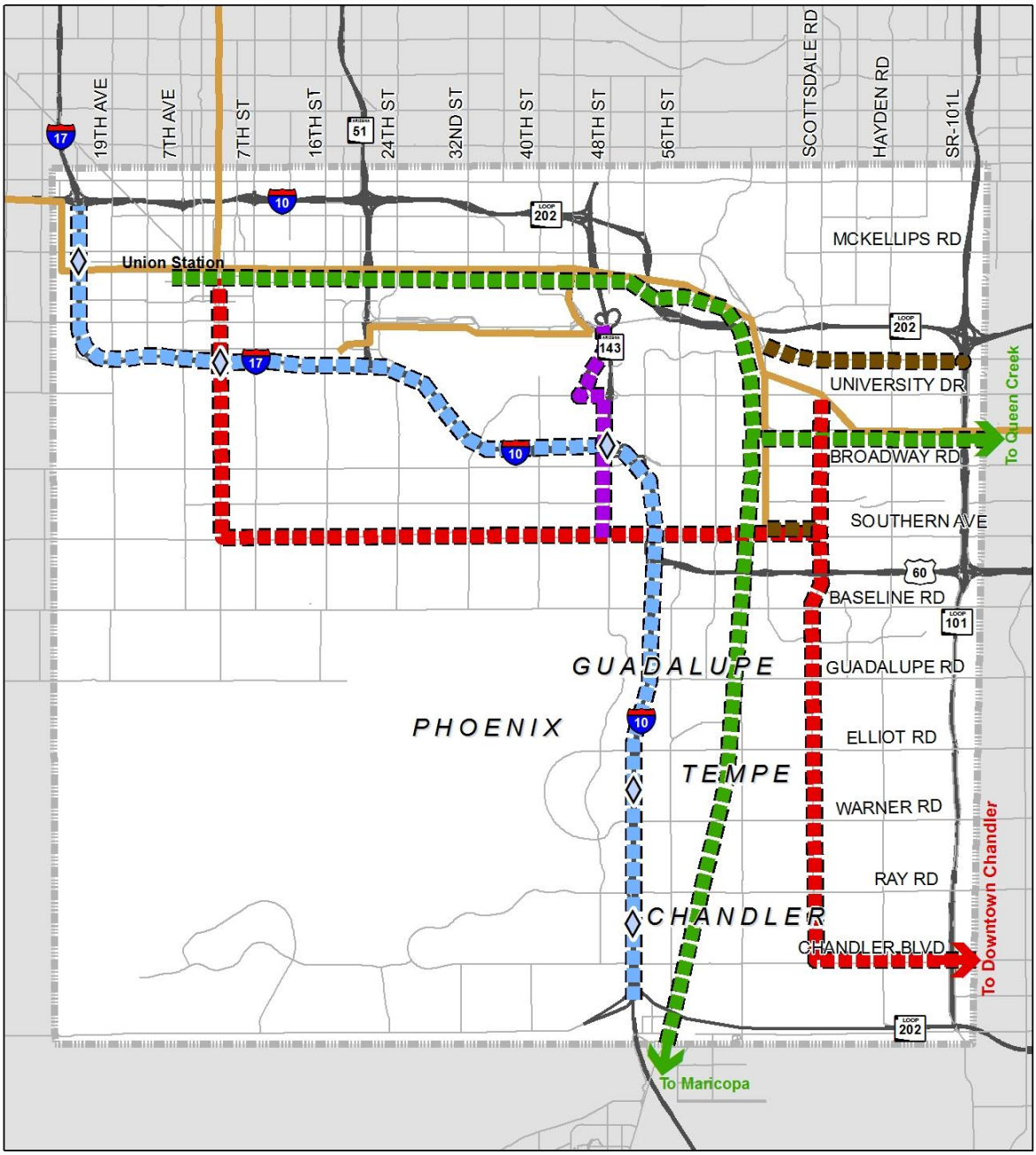
Table 8. Bundle 3 Elements

Concept	Description	Corridor Miles in Study Area
Managed Lanes	I-10 and I-17 - Pecos Stack to Stack	20.0
New DHOV Ramps	I-17/Washington Street I-17/Central Avenue I-10/SR-143 I-10/Carver Road I-10/Galveston Road	---
Exclusive Guideway Transit	Southern Avenue/Central Avenue – Phoenix CBD to Rural Road	13.5
Exclusive Guideway Transit	Rural Road – Chandler CBD to University Drive	10.0
Modern Streetcar	Rio Salado Parkway - Extension from Mill Avenue to SR-101L	3.5
Modern Streetcar	Southern Avenue - Extension from Mill Avenue to Rural Road	1.0
Commuter Rail	Pinal County to Phoenix	19.0
Commuter Rail	Queen Creek to Phoenix	4.5[1]
Automated Guideway Transit – People Mover	48th St – Southern Avenue to east side of Sky Harbor International Airport	3.5

Source: HDR Engineering, 2011

[1]Service would share a portion of the Pinal County to Phoenix commuter rail corridor between downtown Tempe and Downtown Phoenix

Figure 18. Bundle 3 Concept



6.3.4 Alternate Bundles

Six additional alternate bundles were developed as part of the MIS. The alternate bundles, all of which are variations of Bundle 3, provide additional potential solutions for addressing the study area traffic and mobility conditions documented in Chapters 3 and 4 of this study.

Alternate bundles 3.2.A through 3.2.C provide different configuration and operations strategies for the freeway managed lanes concepts. Bundle 3.2.A eliminates tolls in the managed lanes, allowing SOV travelers to use the express lanes. Bundle 3.2.B reduces access to the managed lane network by eliminating three DHOV ramps (SR-143 Interchange, Carver Street, and Galveston Street). Bundle 3.2.C is a hybrid of bundles 3.2.A and 3.2.B. This alternate bundle eliminates tolls in the managed lanes, allowing SOV travelers to use the express lanes and reduces access to the managed lane network by eliminating the three previously listed DHOV ramps.

Alternate bundles 3.2.D through 3.2.F provide different transit network configurations for Bundle 3. Bundle 3.2.D removes exclusive guideway transit on Rural Road south of Southern Avenue and adds exclusive guideway transit from Southern Avenue and Rural Road to the Chandler CBD via Arizona Avenue. Bundle 3.2.D also includes new BRT service on Rural Road from north Scottsdale to Chandler Boulevard (proposed Proposition 400 service levels and alignment). Bundle 3.2.E includes the transit network adjustments from 3.2.D, but also eliminates all proposed commuter rail and automated guideway transit services. Finally, Bundle 3.2.F only removes the Bundle 3 proposed commuter rail and automated guideway transit services.

The alternate bundles are summarized below and compared to each other in Table 9.

Bundle 3.2.A
This alternate bundle, similar to alternate bundles 3.2.B and 3.2.C, attempts to isolate the impacts and benefits of the express lanes and DHOV ramps. The only adjustment included in Bundle 3.2.A (compared to Bundle 3) is a change in the operation of the express lanes to allow single occupied vehicle (SOV) use. This adjustment includes eliminating tolls in the managed lanes. A comparison of the cost and performance of each bundle considered is provided in the following sections of this report.

Bundle 3.2.B
Alternate Bundle 3.2.B reduces the number of access points for the express lane system by removing three DHOV ramps at the following locations: SR-143 Interchange, Carver Street, and Galveston Street.

Bundle 3.2.C
Alternate Bundle 3.2.C is a hybrid of alternate bundles 3.2.A and 3.2.B. It assumes a change in the operation of the express lanes to allow SOV use and removes the DHOV ramps at the SR-143 Interchange, Carver Street, and Galveston Street.

Bundle 3.2.D
Alternate Bundles 3.2.D, 3.2.E, and 3.2.F attempt to isolate the impacts and benefits associated with alternate transit investments. All three alternate bundles include tolls in managed lanes (no SOV access) and the development of five (5) DHOV lanes. Alternate Bundle 3.2.D includes three transit adjustments to the base Bundle 3. These adjustments include removing LRT service on Rural Road south of Southern Avenue, extending LRT service to Chandler's Historic CBD via Southern and Arizona avenues, and restoring Proposition 400 BRT service on Rural Road.

Bundle 3.2.E

Alternate Bundle 3.2.E assumes the same transit service adjustments identified in alternate Bundle 3.2.D; however, alternate Bundle 3.2.E also includes the removal of both commuter rail lines (Pinal County to Phoenix and Queen Creek to Phoenix) and the People Mover between 48th Street/Southern Avenue and the east side of Sky Harbor International Airport.

Bundle 3.2.F

Alternate Bundle 3.2.F retains the proposed LRT and modern streetcar configurations originally identified in base Bundle 3, but removes both commuter rail lines (Pinal County to Phoenix and Queen Creek to Phoenix) and the People Mover between 48th Street/Southern Avenue and the east side of Sky Harbor International Airport.

Figure 19 through Figure 24 illustrate the six alternate bundles.

Table 9. Alternate Bundle Elements

Bundle	Tolls in Managed Lanes	Roadway Adjustments	Transit Adjustments
Bundle 3.2.A	No	- Open Express lanes to SOV	- None
Bundle 3.2.B	Yes	- Remove DHOV Ramps at: SR-143 Interchange Carver Street Galveston Street	- None
Bundle 3.2.C	No	- Open Express lanes to SOV - Remove DHOV Ramps at: SR-143 Interchange Carver Street Galveston Street	- None
Bundle 3.2.D	Yes	- None	- Remove LRT on Rural Road south of Southern Avenue - Add LRT to Chandler CBD via Arizona Avenue - Add BRT on Rural Road (restore Prop 400 service)
Bundle 3.2.E	Yes	- None	- Remove LRT on Rural Road south of Southern Avenue - Add LRT to Chandler CBD via Arizona Avenue - Add BRT on Rural Road (restore Prop 400 service) - Remove CRT and People Mover
Bundle 3.2.F	Yes	- None	- Remove CRT and People Mover

Source: HDR Engineering, 2011

Figure 19. Alternate Bundle 3.2.A Concept

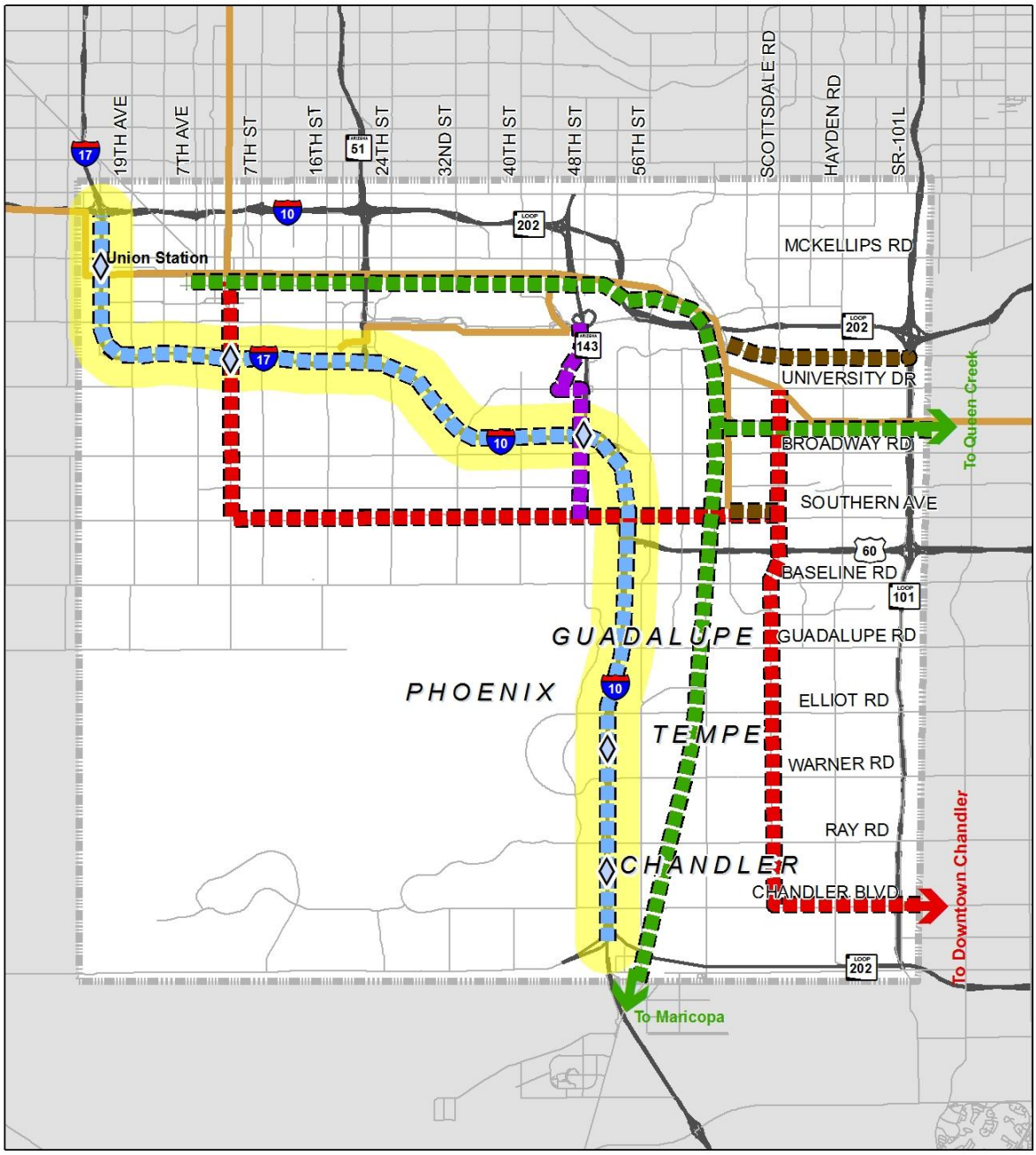


Figure 20. Alternate Bundle 3.2.B Concept

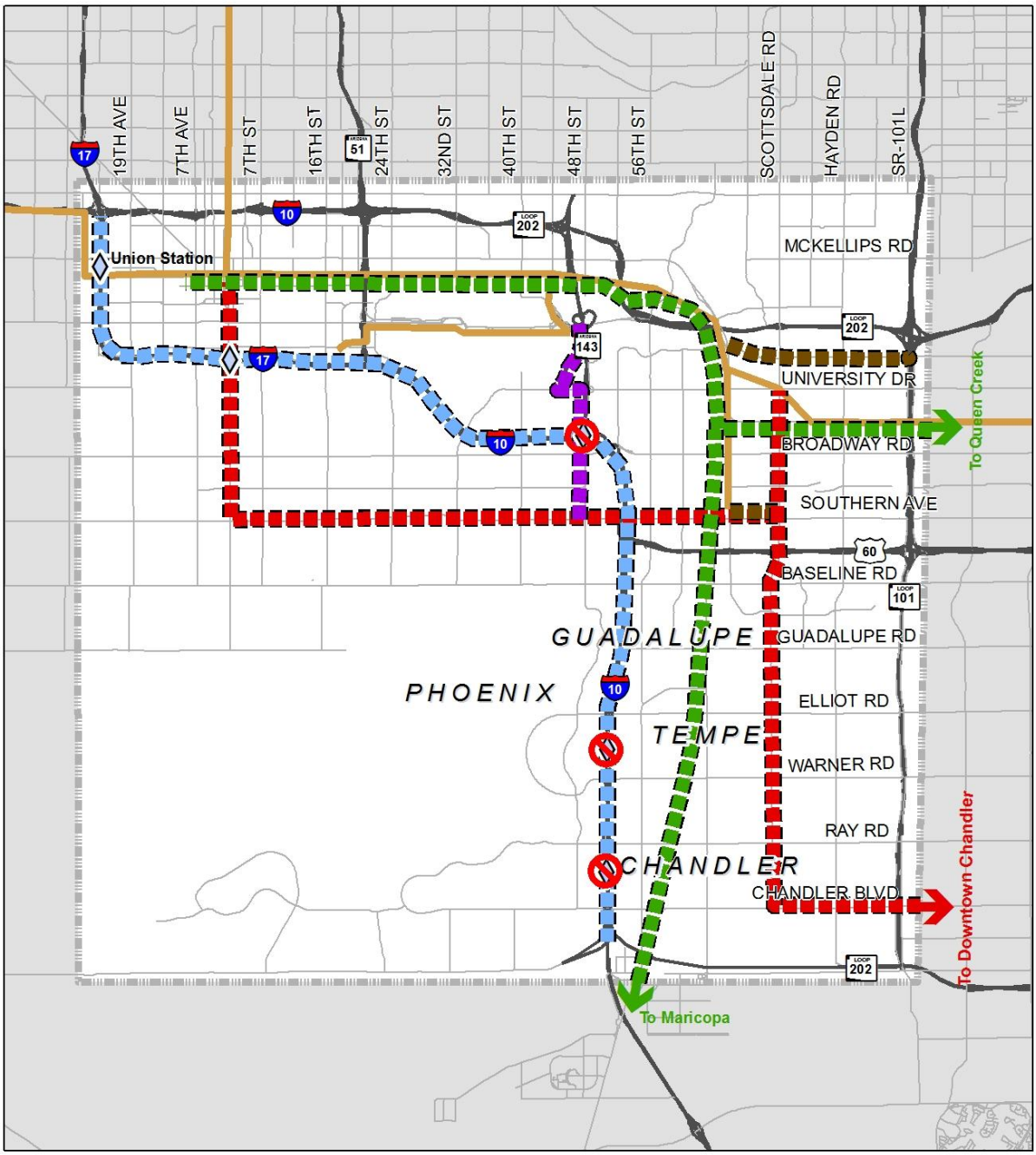


Figure 21. Alternate Bundle 3.2.C Concept

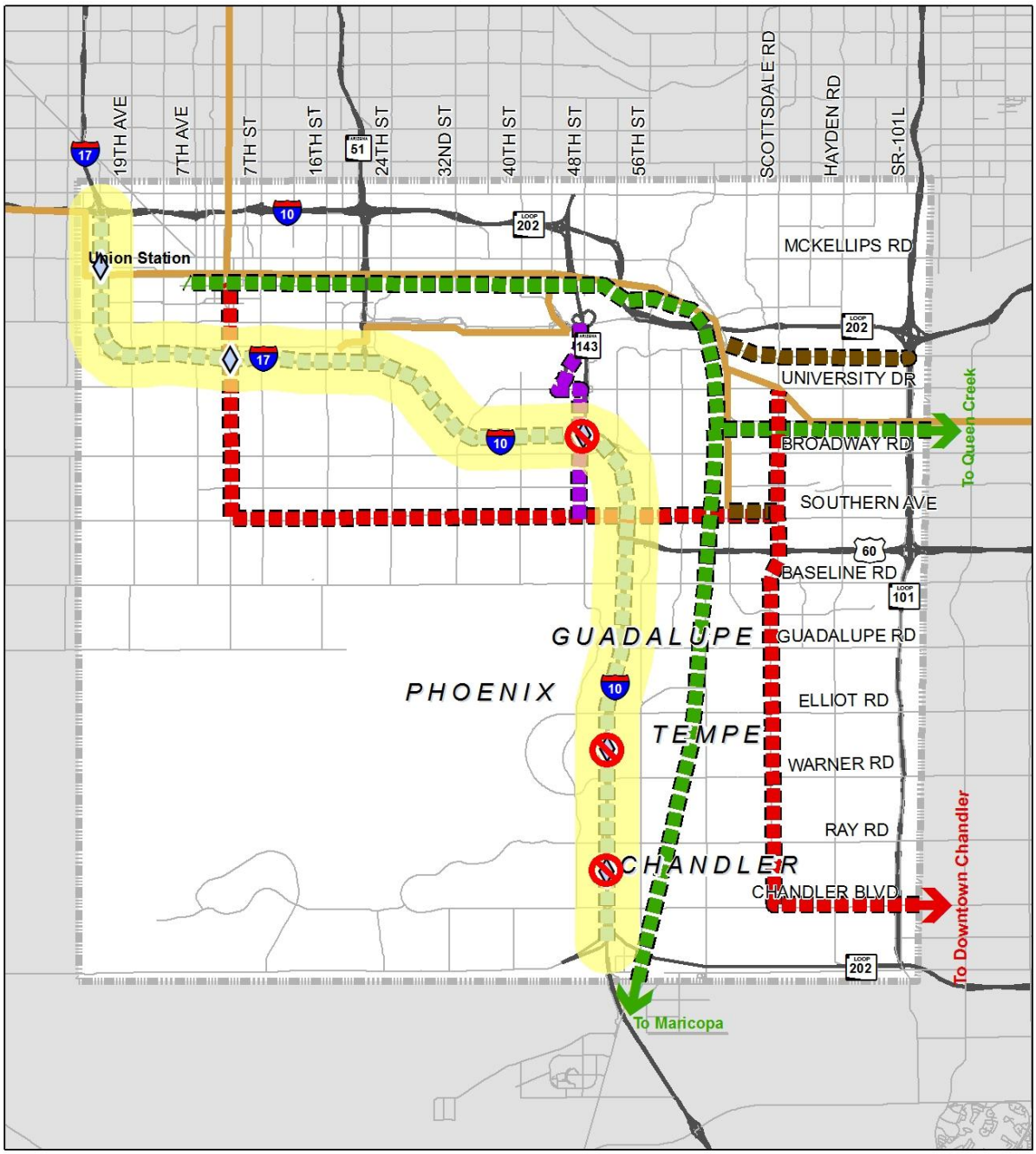
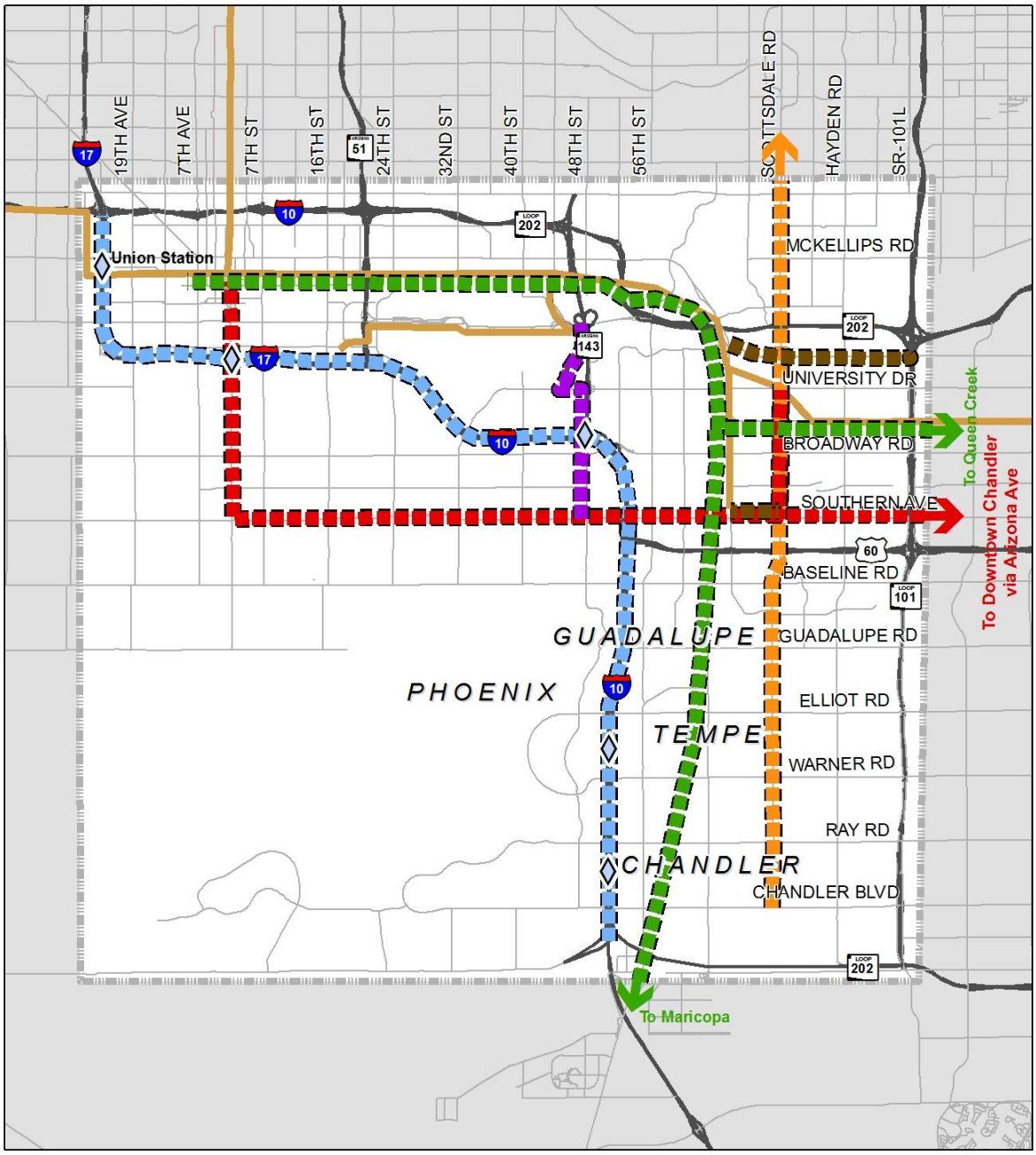


Figure 22. Alternate Bundle 3.2.D Concept



Maricopa Association of Governments
Southeast Corridor MIS

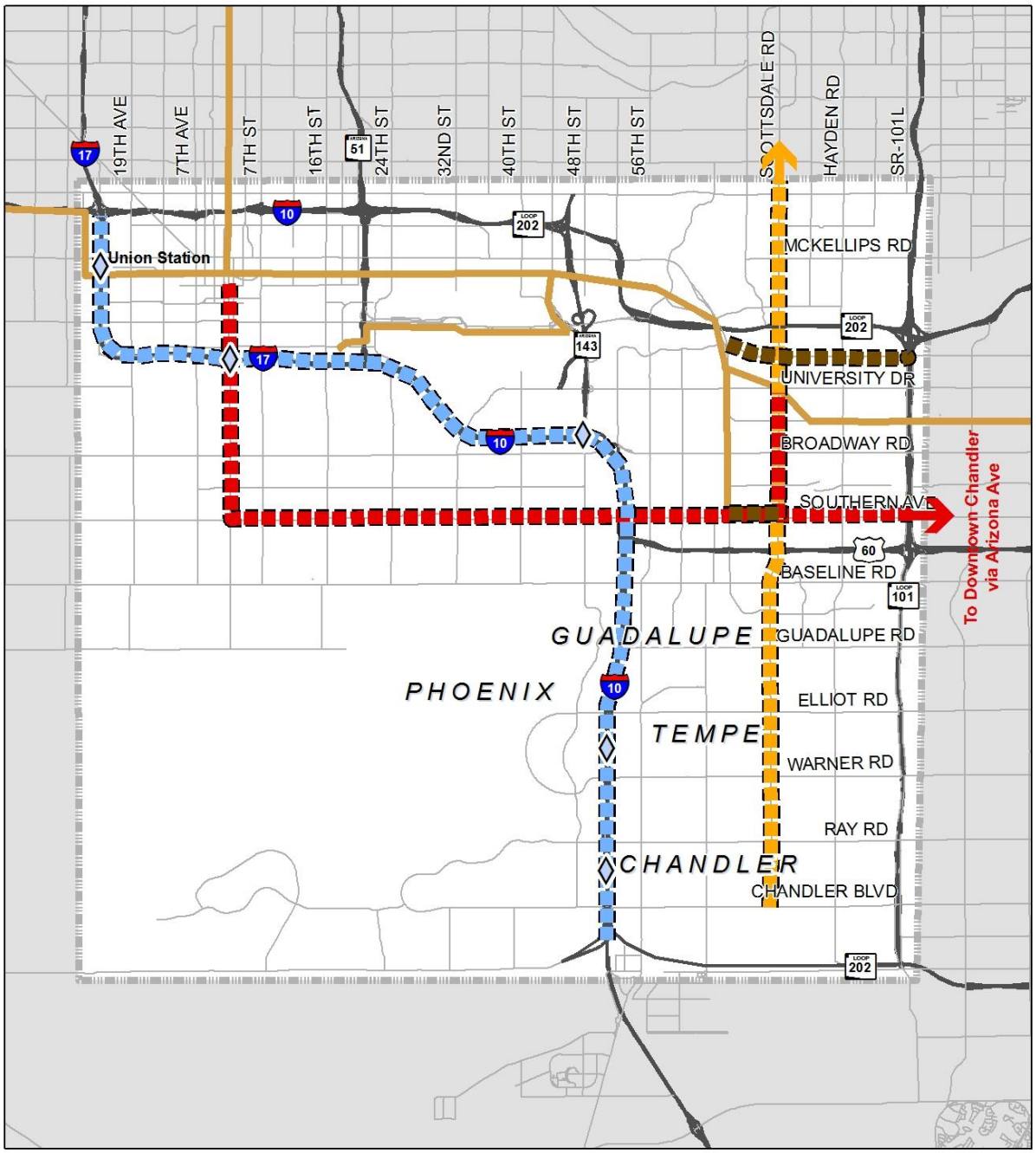
Bundle 3.2.D

Legend

- Southeast Corridor Study Area
- Highways
- Major Roads
- Planned High Capacity Transit
- New Direct HOV Ramp
- Automated Guideway Transit
- Commuter Rail Transit
- Modern Streetcar
- Exclusive Guideway Transit
- Bus Rapid Transit
- Managed Lanes

0 1 2 Miles

Figure 23. Alternate Bundle 3.2.E Concept



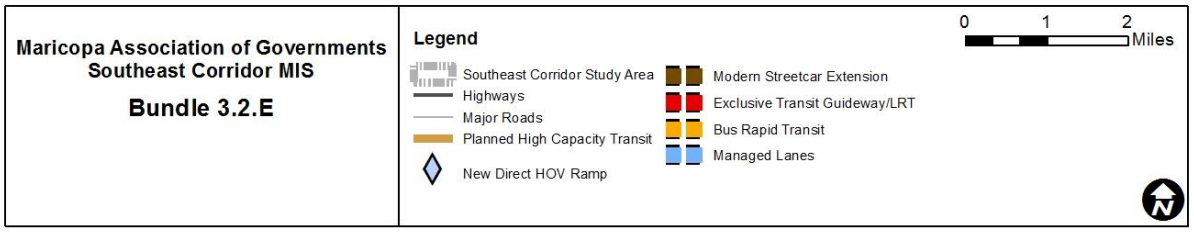
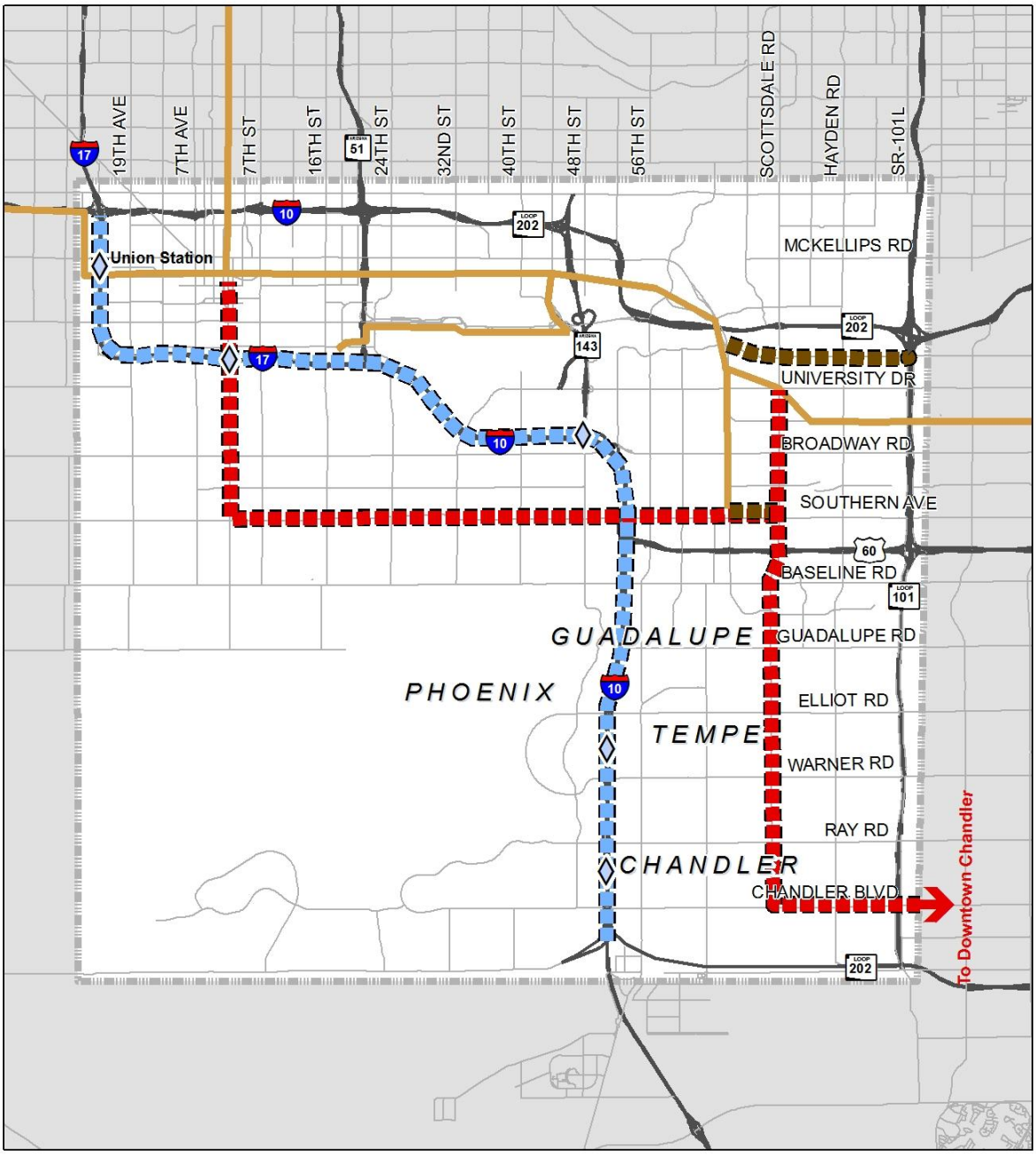


Figure 24. Alternate Bundle 3.2.F Concept



6.4 Bundle Investment Comparison

There are several common elements between the bundle concepts; however, the combination of projects included in each bundle results in distinguishable options for further consideration. Attributes of each bundle are compared in this section to more clearly observe the differences between each option. The primary attributes compared include a capital investment inventory (measured in corridor miles improved) and costs.

Table 10 provides a summary of the total corridor miles improved in each scenario, as well as the number of corridor miles that are dedicated for transit use or directly benefit transit services. The comparison shows that Bundle 3.2.D includes the greatest number of total corridor miles; however, the difference between Bundle 3 (including Bundle 3.2.A through Bundle 3.2.C) and Bundle 3.2.D is relatively small (4 miles). Compared to all other bundles, Bundle 3.2.D also has the highest number of corridor miles dedicated to or directly benefiting transit operations.

Table 10. Bundles Comparison – Corridor Miles

Bundle	Total Corridor Miles	Transit Corridor Miles	Percent Miles Transit
Bundle 1 – "Basic Mobility Alternatives"	45.9	21.9	48%
Bundle 2 – "Peer Competitive"	65	45	69%
Bundle 3 – "Transit Focus"	75	55	73%
Bundle 3.2.A	75	55	73%
Bundle 3.2.B	75	55	73%
Bundle 3.2.C	75	54	73%
Bundle 3.2.D	78	58	74%
Bundle 3.2.E	51	31	63%
Bundle 3.2.F	48	28	58%

Source: HDR Engineering, 2011

Costs associated with each bundle vary accordingly with the amount of investment in transit service and capital infrastructure. Table 11, provides a summary of the total cost by bundle. The costs associated with each bundle represent the cost within the study area limits only. For example, in Bundle 3, the CRT service proposed to Queen Creek only includes the estimated cost to construct and operate the service between downtown Phoenix and the eastern boundary of the study area (SR-101L – Price Freeway). Projected costs are provided as the 20-year inflated cost for highway and transit improvements. The estimated total costs (operations + capital) are $1.082B for Bundle 1 (Basic Mobility Alternatives), $2.835B for Bundle 2 (Peer Competitive), and $5.101B for Bundle 3 (Transit Focus). Estimated total costs for the six Bundle 3 alternatives range from $3.736B (Bundle 3.2E) to $5.101B (Bundle 3.2A).

Table 11. Bundles Comparison – Estimated Costs

Bundle	Capital Cost per Corridor Mile	Total Cost Highways *(capital)*	Total Cost Transit *(operations + capital)*	Total Cost *(operations + capital)*
Bundle 1 – "Basic Mobility Alternatives"	$21.1 M	$0.958 B	$0.124 B[1]	**$1.082 B**
Bundle 2 – "Peer Competitive"	$34.0 M	$0.724 B	$2.111 B	**$2.835 B**
Bundle 3 – "Transit Focus"	$56.8 M	$0.724 B	$4.514 B	**$5.238 B**
Bundle 3.2.A	$56.8 M	$0.724 B	$4.514 B	**$5.238 B**
Bundle 3.2.B	$55.2 M	$0.603 B	$4.514 B	**$5.117 B**
Bundle 3.2.C	$55.2 M	$0.603 B	$4.514 B	**$5.117 B**
Bundle 3.2.D	$44.2 M	$0.724 B	$3.643 B	**$4.367 B**
Bundle 3.2.E	$58.2 M	$0.724 B	$2.739 B	**$3.462 B**
Bundle 3.2.F	$78.8 M	$0.724 B	$3.610 B	**$4.334 B**

Source: HDR Engineering, 2011

[1] *BAT lane capital cost included in Total Cost Highways (capital)*

6.5 Bundle Performance

Travel demand modeling results were used to measure the performance of each bundle and specific projects included in each. The modeling process requires basic assumptions of future transportation and land use conditions to forecast cost and operational characteristics. Managed lanes were considered at the sketch toll level. The model used MAG 2031 Transportation Networks (South Mountain Freeway included) and MAG 2031 adopted land use (no transit oriented development overlay). Transit assumptions included removal of redundant transit service, no feeder service added, and Rural LRT was not interlined.

For modeling purposes, the modern streetcar is a special consideration because it has operating and ridership characteristics outside of the general parameters of the MAG TDM. First, benefit/cost (B/C) calculations used time savings as a factor; however, the modern streetcar is not intended for travel time savings. In addition, boardings for the modern streetcar generally come from specialized markets (special events, walk trips, etc.) that were not included in the models.

Three performance categories are summarized in this section:

- Transit system performance
- Peak period highway lane performance
- Benefit/cost analysis

6.5.1 Transit System Performance

Transit system level performance information for each bundle includes transit ridership and transit revenue miles. Bundle 3 had an estimated ridership of 435,800, compared to 418,400 and 423,600 for bundles 1 and 2 respectively. Each of the Bundle 3 alternatives had a higher estimated average ridership than bundles 1 or 2. Bundle 3.2.B had an estimated average ridership of 436,000, the highest of all nine bundles. These ridership estimates compare positively to the FY 2011 average weekday fixed route and light rail ridership of 220,000 (*Valley Metro Fiscal Year 2011 Annual Ridership Report*).

The performance of each bundle based on the LOS invested is nearly equivalent for each bundle. Average passenger boardings (riders) per revenue mile are 2.69 for Bundle 1, 2.66 for Bundle 2, and 2.68 for Bundle 3. The Bundle 3 alternatives have estimated average riders per revenue mile that range from

2.67 (Bundle 3.2.D) to 2.72 (Bundle 3.2.E). This statistic is very favorable compared to 2.1 passenger boardings per revenue mile for all existing fixed route and light rail service provided in FY 2011 (*Valley Metro Fiscal Year 2011 Annual Ridership Report*). Transit performance by bundle is provided in Table 12.

Table 12. Transit System Level Performance

Bundle	Average Ridership	Average Revenue Miles	Average Riders/Rev Mile	Daily Transit Ridership on NEW Services
Base (No-Build)	413,900	154,600	2.67	--
Bundle 1 – "Basic Mobility Alternatives"	418,400	155,500	2.69	7,100
Bundle 2 – "Peer Competitive"	423,600	159,500	2.66	15,100
Bundle 3 – "Transit Focus"	435,800	162,600	2.68	27,500
Bundle 3.2.A	435,500	162,600	2.68	28,100
Bundle 3.2.B	436,000	162,600	2.68	27,400
Bundle 3.2.C	435,600	162,600	2.68	28,000
Bundle 3.2.D	434,500	163,000	2.67	36,300
Bundle 3.2.E	429,500	157,800	2.72	29,400
Bundle 3.2.F	426,700	157,400	2.71	19,700

Source: HDR Engineering, 2011

6.5.2 Peak Period Highway Lane Performance

Peak period highway lane performance compares the traffic volume and average speed within I-10 between I-17 and SR-202L (San Tan Freeway) for each bundle and the base year scenario. For both the proposed express HOV lanes and the GP lanes there is very little difference in performance between the bundles; however, the bundles provide significant performance advantages over the base scenario. Please note that the express HOV lanes defined in the nine alternate scenarios differ in design from the proposed express GP lanes included in the base scenario (2031 RTP). During the AM peak (6:00 - 9:00 AM) the average inbound express lane speed is only 50.0 mph for the base scenario, but the average speed in all of the bundles (with the exception of 3.2.A and 3.2.C) is nearly 53 mph. While the average speed is slightly higher, the traffic volume for all nine bundles (5,277 vehicles to 7,280 vehicles) is significantly higher than the base scenario (785 vehicles). Peak period volumes and speed for the proposed I-10 express HOV lanes are documented in Table 13.

During the PM peak (3:00 - 6:00 PM) the average GP outbound lane speed is only 28.1 mph for the base scenario, while the average speed in all nine bundles ranges between 40.5 mph and 41.4 mph. Outbound PM GP lane traffic volumes for all nine bundles (40,229 vehicles to 43,764 vehicles) are lower than the base scenario (43,485 vehicles). Part of the reduction in GP lane traffic volumes is a result of more vehicles using the available HOV/managed lanes. Peak period volumes and speed for I-10 GP lanes are documented in Table 14.

Table 13. Peak Period Express HOV Lanes Volume and Speed

		Base *(2031 RTP)*	Bundle I *(Basic Mobility)*	Bundle 2 *(Peer Competitive)*	Bundle 3 *(Transit Focus)*	Bundle 3.2.A	Bundle 3.2.B	Bundle 3.2.C	Bundle 3.2.D	Bundle 3.2.E	Bundle 3.2.F
Outbound (Eastbound I-10)	Volume	603 (3,224)	3,534 (9,247)	3,522 (9,260)	3,481 (9,084)	4,875 (10,064)	3,033 (9,367)	3,812 (8,542)	4,032 (11,047)	4,312 (11,106)	4,032 (10,803)
	Speed	68.5 (46.9)	68.5 (44.8)	68.5 (45.0)	68.5 (45.4)	**63.5 (33.8)**	68.3 (47.6)	**63.8 (34.8)**	68.2 (44.6)	68.2 (44.2)	68.2 (45.9)
Inbound (Westbound I-10)	Volume	3,661 (785)	9,971 (7,280)	9,947 (7,266)	9,897 (7,255)	8,988 (5,496)	9,044 (5,277)	8,653 (5,506)	10,717 (7,189)	10,756 (7,199)	10,765 (6,995)
	Speed	50.0 (68.3)	52.9 (62.1)	53.1 (62.1)	53.1 (62.1)	**40.6 (53.0)**	56.0 (64.3)	**40.7 (52.9)**	52.5 (62.0)	52.3 (62.0)	52.3 (62.6)

XXX – Morning Peak 6:00 – 9:00 AM, (XXX) – Evening Peak 3:00 – 6:00 PM.

Source: MAG TDM, 2011

Table 14. General Purpose Lanes Volume and Speed

		Base *(2031 RTP)*	Bundle I *(Basic Mobility)*	Bundle 2 *(Peer Competitive)*	Bundle 3 *(Transit Focus)*	Bundle 3.2.A	Bundle 3.2.B	Bundle 3.2.C	Bundle 3.2.D	Bundle 3.2.E	Bundle 3.2.F
Outbound (Eastbound I-10)	Volume	20,350 (43,485)	17,770 (40,278)	17,736 (40,229)	17,255 (41,825)	17,333 (43,764)	18,153 (42,092)	18,149 (43,462)	17,242 (41,785)	17,259 (41,879)	17,260 (40,683)
	Speed	61.3 **(28.1)**	62.4 **(40.5)**	62.4 **(40.6)**	62.7 **(40.4)**	63.5 (35.9)	62.3 **(40.5)**	63.5 (35.7)	62.7 **(40.4)**	62.7 (40.4)	62.7 (41.4)
Inbound (Westbound I-10)	Volume	44,856 (32.908)	38,437 (26,781)	38,374 (26,691)	39,837 (28,481)	43,308 (31,149)	40,486 (29,754)	42,433 (30,474)	39,786 (28,458)	39,936 (28,457)	39,977 (28,100)
	Speed	34.8 **(46.3)**	46.6 **(54.6)**	46.7 **(54.7)**	46.4 **(54.4)**	42.2 (53.2)	46.3 **(53.7)**	42.0 (53.3)	46.2 **(54.4)**	46.0 (54.7)	46.1 (54.8)

XXX – Morning Peak 6:00 – 9:00 AM, (XXX) – Evening Peak 3:00 – 6:00 PM

Source: MAG TDM, 2011

6.5.3 Benefit/Cost Analysis

A B/C analysis was used to evaluate individual projects and bundles. The B/C analysis incorporates estimated travel time savings (estimated base person travel hours - estimated project or bundle person travel hours) and energy savings (fuel savings). The analysis was based on outputs from the MAG TDM as well as standard assumptions for average vehicle fuel economy (22.6 mpg) and average fuel costs ($3.25/gallon).

Results of the analysis indicate that Bundle 1 has the highest B/C ratio for transit investments: 1.55. The remaining bundles do not have benefits that exceed costs, and range from 0.33 (Bundle 3.2.E) to 0.61 (Bundle 3.2.A). To emphasize the transit investments, several highway projects were excluded from the

transit B/C analysis. These projects include the freeway managed lanes, 7th Street restripe, 7th Avenue restripe, and the Southern Parkway (as parkway alone).

Four highway/roadway projects are highlighted in the B/C analysis: 7th Street restripe, 7th Avenue restripe, freeway managed lanes, and the Southern Parkway. The restriping projects have very high B/C ratios due to the low cost for this type of improvement. The B/C ratios for these projects are 119.64 (7th Street restripe) and 160.71 (7th Avenue restripe). Excluding the restriping projects, the managed lanes project (B/C=1.04) performs better than the Southern Avenue Parkway (B/C=0.68). It is important to note that the B/C ratio for the Southern Avenue Parkway does not include the additional benefits that could potentially be gained from public transportation investments in the corridor. These benefits potentially include increased transit mode share in the southeast corridor area by attracting new transit riders from other modes and incrementally improved transit system productivity [transit boardings per revenue mile] (see Sections 6.6.2 and 6.7.2). Table 15 and Table 16 show the B/C data for the transit projects by bundle and individual major highway projects.

Table 15. Transit Benefit/Cost by Bundle

	Bundle I *(Basic Mobility)*	Bundle 2[1] *(Peer Competitive)*	Bundle 3[1] *(Transit Focus)*	Bundle 3.2.A[1]	Bundle 3.2.B[1]	Bundle 3.2.C[1]	Bundle 3.2.D[1]	Bundle 3.2.E[1]	Bundle 3.2.F[1]
Benefit/Cost	1.55	0.44	0.60	0.61	0.60	0.60	0.43	0.33	0.43

Source: MAG TDM, 2011
[1] *Benefit/Cost calculations exclude modern streetcar*

Table 16. Highway Benefit/Cost by Project

Projects	Benefit/Cost
7th Street Restripe	119.64
7th Avenue Restripe	160.71
Managed Lanes[1]	1.04
Southern Parkway[2]	0.68

Source: MAG TDM, 2011
[1] *Public sector contribution only; does not include revenue potential*
[2] *Includes Southern Avenue conversion to a TOPS configuration*

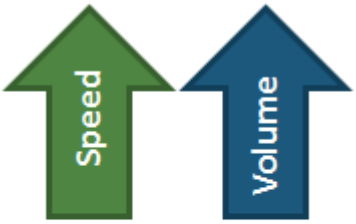
6.6 Top Performing Transportation Investment Options – Initial Bundles

Based on the evaluation of the options within the three initial bundles, several of the transportation investment options performed well. The top performing transportation investment options include: freeway based managed lanes, exclusive guideway transit, and arterial roadway capacity enhancements.

6.6.1 Freeway Based Managed Lanes

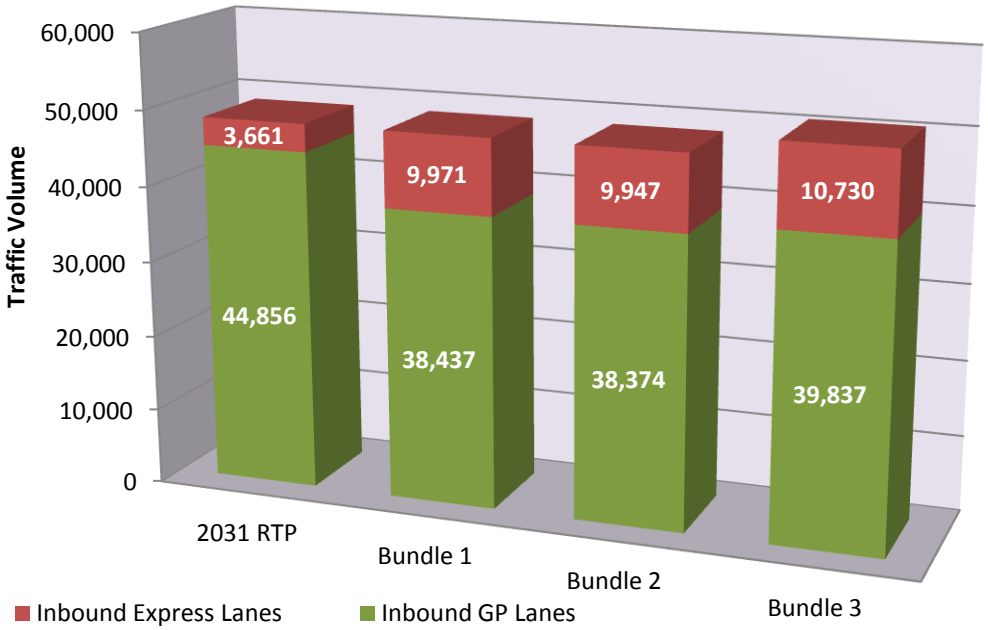
All three initial bundles include managed lanes on sections of I-10 and I-17 within the study area. To support the managed lanes, five (5) DHOV access ramps were included. The bundle and project level evaluation identified that the inclusion of managed lanes and DHOV access ramps improved average travel speeds in GP lanes on I-10 at the Broadway Curve. With the inclusion of managed lanes and the DHOV ramps, outbound (eastbound) evening peak period average operating speed in GP lanes increased from 28.1 mph (2031 RTP) to over 40 mph (all three initial bundles). Likewise, inbound (westbound) morning peak period average operating speed in general purpose lanes increased from 34.8 mph (2031 RTP) to over 46 mph (all three initial bundles).

In addition to improved average travel speeds, results from the 2031 MAG TDM indicate that the overall estimated traffic volumes at the Broadway Curve will remain nearly the same or increase with the inclusion of the managed lanes concept (including DHOV lanes). This is true for all three initial bundles. Without managed lanes, the estimated 2031 inbound and outbound peak period traffic volumes (GP lanes volumes + express lanes volume) are 48,517 and 46,563 respectively. Comparatively, the estimated total peak period inbound traffic volumes for the managed lanes concepts range from 48,321 (Bundle 2) to 50,567 (Bundle 1), while the outbound concepts range from 50,840 (Bundle 2) to 52,884 (Bundle 3). Figure 25 and Figure 26 illustrate the estimated 2031 inbound and outbound I-10 traffic volumes at the Broadway Curve.



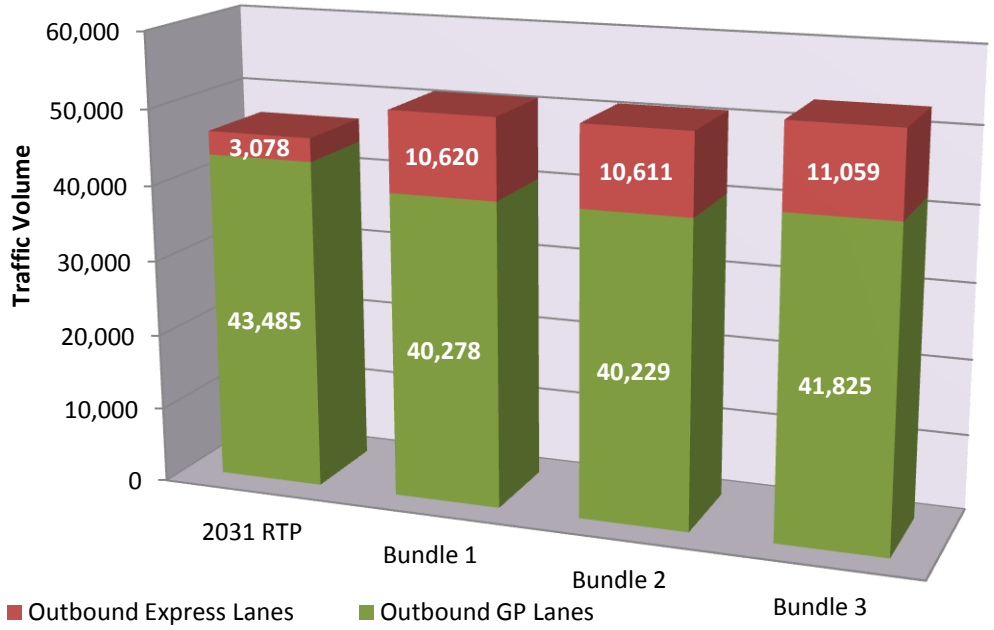
MAG TDM results indicate that managed lanes can increase GP lane average travel speeds while accommodating increased total traffic volumes.

Figure 25. Estimated 2031 Inbound I-10 Traffic Volumes: Broadway Curve (Initial Bundles)



Source: 2031 MAG TDM

Figure 26. Estimated 2031 Outbound I-10 Traffic Volumes: Broadway Curve (Initial Bundles)



Source: 2031 MAG TDM

6.6.2 Exclusive Guideway Transit

The inclusion of exclusive guideway transit (modeled as LRT for this study) in two of the three initial bundles demonstrated the potential of this transportation improvement option's ability to attract new passengers to a non-auto transportation mode. Bundle 1 did not include the expansion of exclusive guideway transit service, but included BRT operating in an Arizona Parkway configuration on Southern Avenue. This bundle attracted the lowest number of estimated daily passenger boardings on new transit services. Overall estimated system-wide new transit riders is approximately 2,400.

Bundles 2 and 3 included an expansion of the region's exclusive guideway transit, which produced higher gains in new transit riders. Bundle 2 included the expansion of exclusive guideway transit within the Rural Road corridor between University Drive and Chandler Boulevard. The inclusion of this 8 mile exclusive guideway transit corridor and BRT service on Southern Avenue and minor expansion of the Tempe streetcar attracted an estimated 15,100 daily passenger boardings on new transit services, while attracting approximately 5,500 new transit riders to the regional transit system. Bundle 3 included exclusive guideway transit on Central Avenue, Southern Avenue and Rural Road, including a connection from Rural Road and Chandler Boulevard to downtown Chandler. Other transit investment options included the expansion of the Tempe streetcar and Sky Train people mover (automated guideway transit). These transit investments generated an estimated 27,500 daily passenger boardings on new transit services, with most of the new riders utilizing the exclusive guideway transit services. This bundle attracted an estimated 11,900 new transit riders to the regional transit system.

6.6.3 Arterial Roadway Enhancements

Four arterial roadway enhancement options were considered as part of the initial three bundles: 7th Street capacity enhancement, 7th Avenue capacity enhancement, and Southern Avenue upgrade from an arterial roadway classification to a parkway classification. The capacity enhancements on 7th Street and 7th Avenue assumed restriping the existing roadways between Southern Avenue and I-17. The Southern Avenue conversion from arterial roadway to a parkway configuration was assumed from Rural Road to SR-202L (South Mountain).

The three arterial roadway enhancements ranked among the highest performing elements based on benefit/cost ratios. The estimated benefit/cost values for the 7th Street and 7th Avenue capacity enhancements were 119.64 and 160.71 respectively. The estimated benefit/cost value for the Southern Avenue upgrade from an arterial roadway classification to a parkway classification is 0.68 excluding any benefits or costs associated with upgraded transit service in the corridor.

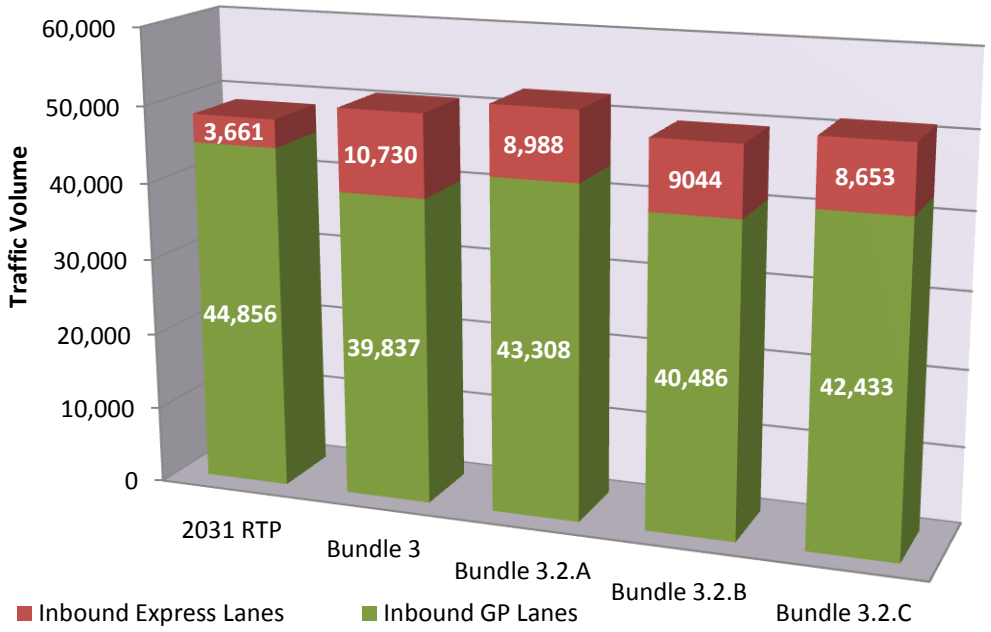
6.7 Top Perfoming Transportation Investment Options – Alternate Bundles

To better isolate the performance and benefits of each transportation investment option, six additional alternate bundles were developed and evaluated. The results of the alternate bundles, which are based off of the top performing bundle (Bundle 3), are documented and evaluated in Chapters 6 and 7 respectively. The results indicate the relative performance of alternate managed lane concepts and transit network concepts.

6.7.1 Alternate Managed Lanes Concepts

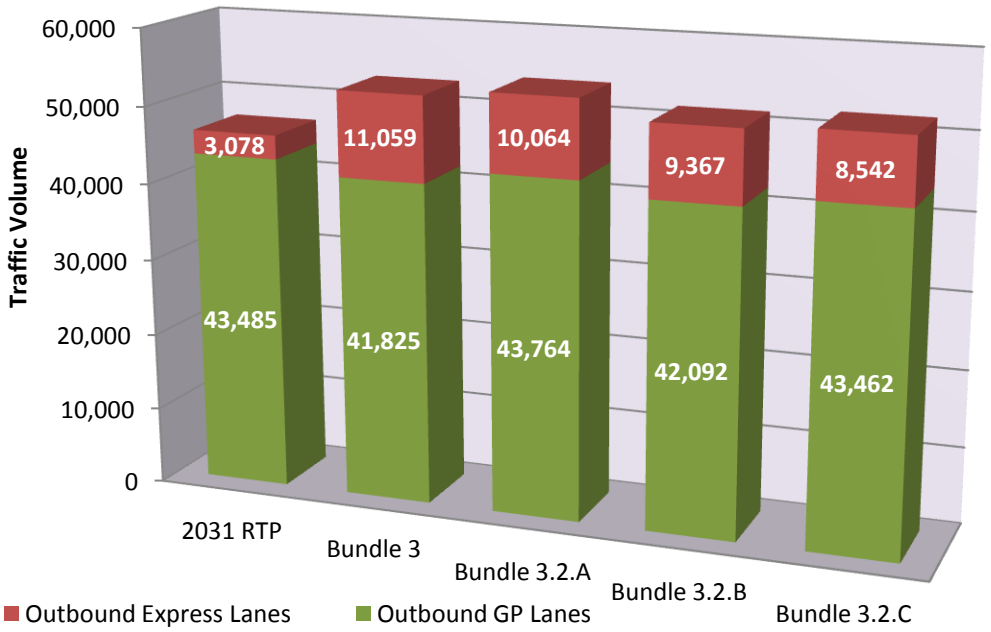
Alternate bundles 3.2.A through 3.2.C provide different configuration and operations strategies for the freeway managed lanes concepts. For all three alternate bundles, the estimated average peak period travel speed in the GP lanes on I-10 at the Broadway Curve remain higher than the estimated 2031 RTP; however, the average peak period travel speed for alternate bundles 3.2.A and 3.2.C are lower than Bundle 3. This is true for both the inbound and outbound directions of travel. The reduced GP lane average speed, compared to bundle 3, is a result of removing the tolls on the managed lanes. Bundle 3.2.A has the highest total inbound and outbound volume at the Broadway curve, resulting from increase capacity for SOV travelers. However, the increased volume is only 1,729 inbound and 944 outbound. Figure 27 and Figure 28 illustrate the estimated 2031 inbound and outbound I-10 traffic volumes at the Broadway Curve for alternate bundles 3.2.A through 3.2.C.

Figure 27. Estimated 2031 Inbound I-10 Traffic Volumes: Broadway Curve (Alternate Bundles)



Source: 2031 MAG TDM

Figure 28. Estimated 2031 Outbound I-10 Traffic Volumes: Broadway Curve (Alternate Bundles)

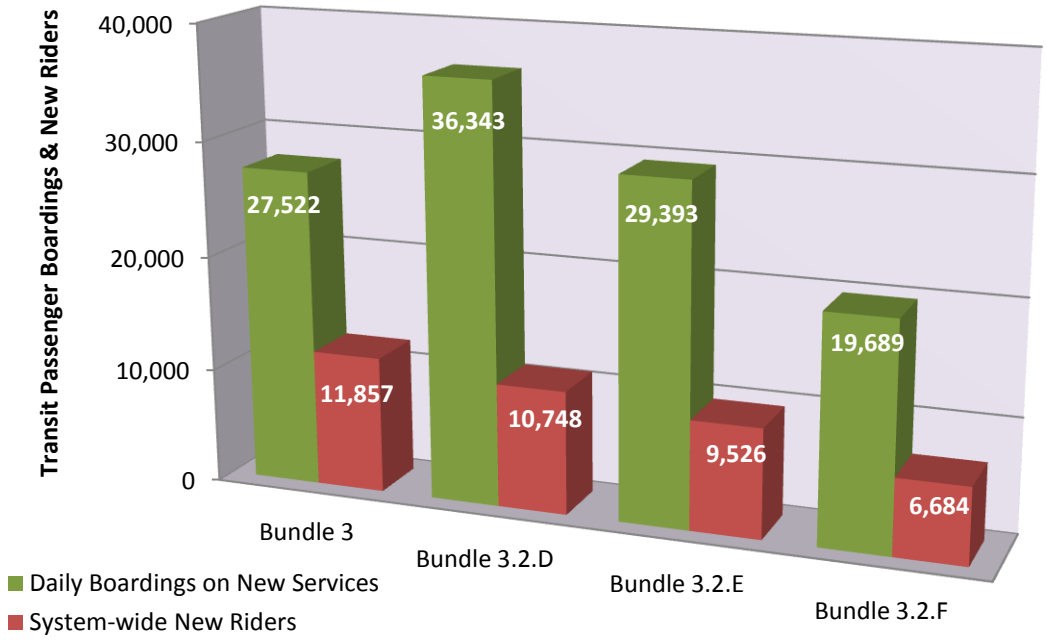


Source: 2031 MAG TDM

6.7.2 Alternate Transit Network Concepts

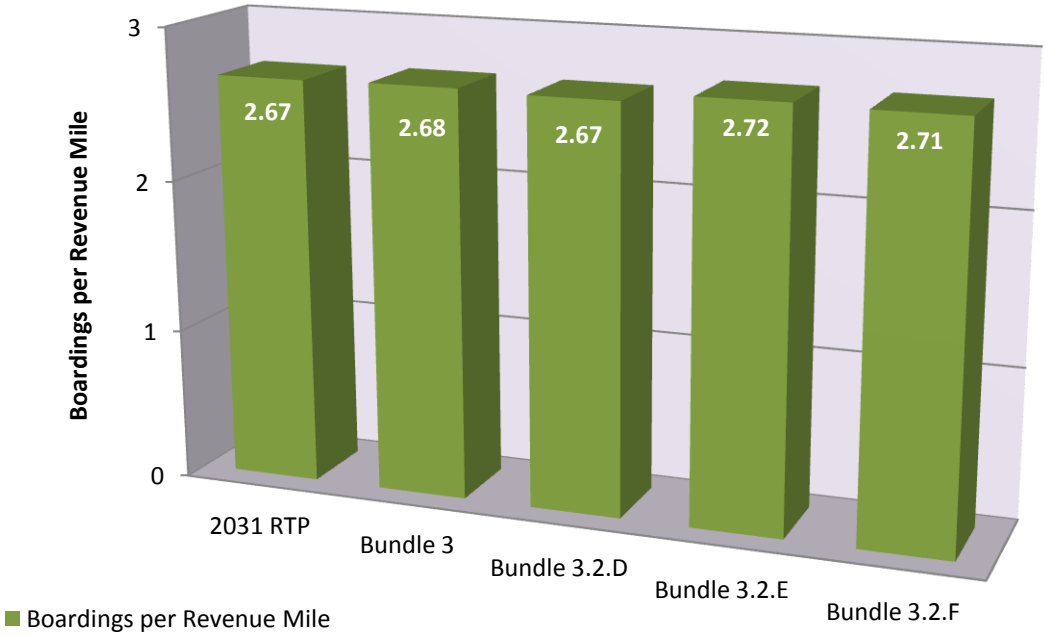
Alternate bundles 3.2.D through 3.2.F provide different transit network configurations for Bundle 3. Alternate Bundle 3.2.D has the highest level of estimated daily passenger boardings on new transit services (36,343), but generates approximately 1,100 fewer new transit riders. The large gain in transit passenger boardings on Alternate Bundle 3.2.D (compared to Bundle 3) is the result of transit passengers switching from an existing transit service to one of the new Bundle 3.2.D transit services. While alternate bundles 3.2.E and 3.2.F have lower daily passenger boardings on new transit services and lower new system-wide transit riders, they have a higher ratio of transit passenger boardings per revenue mile than bundles 3 and 3.2.A. Figure 29 provides a comparison of the estimated transit utilization by alternate bundle, while Figure 30 compares system-wide boardings per revenue mile, a measure of transit service effectiveness.

Figure 29. Estimated Transit Utilization Comparison (Alternate Bundles)



Source: 2031 MAG TDM

Figure 30. Estimated Boardings per Revenue Mile (Alternate Bundles)



Source: 2031 MAG TDM

7.0 Evaluation of Transportation Investment Bundles

An evaluation methodology has been developed for this study to create a framework to evaluate potential solutions to the identified transportation needs and deficiencies in the study corridor. This chapter defines the evaluation criteria and measures and the results of the bundle evaluation.

7.1 Evaluation Criteria and Measures

The evaluation criteria consist of factors selected to identify one or more bundles that best meet the stated objectives of the study. To provide a relative rating of alternatives, this study examines the level of mobility improvement, combined with factors such as environmental impacts, capital and operational feasibility, and performance. Table 17 describes the evaluation criteria and measures defined for this analysis.

Table 17. Bundle Evaluation Criteria and Measures

Evaluation Criteria	Description	Measures
Environmental Impacts	This criterion looks at the extent of impacts to natural resources and neighborhoods. Alternatives with beneficial environmental impacts receive higher ratings than those with negative impacts. This includes impacts to air quality, the local economy, residential/business displacement, traffic/construction impacts.	**Displacement** - Examination of potential residential and business displacement using existing and future aerial maps. **Reduction in Drive Alone Vehicles** – The reduction in drive alone vehicles is an indicator of the impact that each bundle is expected to have on traffic congestion. Lower traffic congestion has beneficial air quality impacts. *Note - No significant impacts to biological resources are expected as all potential projects are located within areas with built out conditions (environmental impacts will be consistent with previously planned projects).*
Socioeconomic Conditions	Determination if costs and benefits of the alternatives are distributed fairly across different population groups. This includes environmental justice concerns about health, environmental, social, and economic impacts to minority and low-income populations.	**Equity** - Equity in transportation investments by providing improved access to transportation services, while limiting negative impacts in areas with high concentrations of low income and minority populations. **Economic Development** - Potential for investment to increase economic development opportunities.
Capital Development Feasibility	The level the proposed capital development is compatible with available engineering, construction and financial resources. The more complex of an engineering solution required and the greater amount of private right-of-way (ROW) needed, the lower the alternative rating.	**Engineering Complexity** - Analysis of the complexity of the engineering solution proposed. **ROW** - Analysis of the ROW needed and cost associated.

Evaluation Criteria	Description	Measures
Operational Feasibility	Evaluation of the capacity of existing agencies to operate a proposed facility or service. New services that are not currently operated in the region (no demonstrated local expertise or capacity to operate) would get a lower rating than a service already operated within the region. Considerations for facilities will include availability of ROW and ability to integrate into existing built environment.	**Operational Feasibility** – Service or mode already operated within the region.
Performance	Utilization of proposed transportation investment. Comparison between alternatives to understand the potential user benefits that may be generated.	**Roadway Speed** - Average speed at point locations on GP lanes for each bundle. **Roadway Volume** - Average volume at point locations on GP lanes for each bundle. **Transit Ridership** – Estimated patronage on transit network.
Financial Feasibility	Measures the likelihood that funds required for construction and operation will be available for the specified transportation improvement alternative.	**Cost** - Provide a comparative cost value (e.g., lower cost projects are more feasible).
Cost Effectiveness	This criterion focuses on the extent to which the cost of alternatives measure up to their benefits. Cost effectiveness considers unitized benefits associated with the financial investment required to construct or operate and proposed transportation improvement alternative.	**Cost Effectiveness** – B/C of bundle or primary projects in bundle.

Source: HDR Engineering, 2011

7.2 Bundles Screening

Using the criteria and measures defined in Section 7.1, the nine bundles were evaluated to compare the relative impact and effectiveness of each individual bundle. Table 18 through Table 31 provide the relative score and rationale for the assigned scores for each of the evaluation measures.

The scores are provided using symbols to indicate relative performance compared to the other bundles. Five symbols rate relative bundle performance on a scale from lowest performance to best performance, as follows:

● = best or most preferred performance
◕ = very good performance
◑ = modest performance
○ = poor performance
○ = lowest or least preferred performance

Table 18. Environment - Displacement

Category	Description								
Measure:	Displacement								
Unit:	Types of proposed improvements that have a high potential to require additional ROW. Expressed by total miles of proposed improvements.								
Rationale:	Projects that require additional ROW have the potential to displace existing land uses. Projects such as commuter rail have a greater potential to displace existing land use than restriping existing roadways. Impacts from displacement are important to consider because they result may disrupt existing neighborhoods, businesses and the overall sense of community in an area.								
Discussion:	Proposed exclusive guideway transit and CRT may cause displacement of adjacent land uses due to technology specific operational requirements such as track construction, vehicle turning radius, and station areas. Bundle 1 has the lowest number of project miles with a high potential to cause displacement, therefore relative to the other bundles, it receives a high rating, '●' for best or most preferred performance.								
	Total Miles of Commuter Rail and Exclusive Guideway Transit								
	Bundle 1	**Bundle 2**	**Bundle 3**	**Bundle 3.2.A**	**Bundle 3.2.B**	**Bundle 3.2.C**	**Bundle 3.2.D**	**Bundle 3.2.E**	**Bundle 3.2.F**
	8.4 miles	27.0 miles	47.0 miles	47.0 miles	47.0 miles	47.0 miles	38.0 miles	14.5 miles	23.5 miles
Relative Rating:	●	◕	○	○	○	○	◯	◕	◕

Source: HDR Engineering, 2012

Table 19. Environment – Reduction in Drive Alone Vehicles

Category	Description								
Measure:	Reduction in Drive Alone Vehicles								
Unit:	Number of drive alone vehicles per day that would be removed from roads within the study area by each bundle, compared to the base scenario.								
Rationale:	The reduction in drive alone vehicles is an indicator of the impact that each bundle is expected to have on traffic congestion. Lower traffic congestion has beneficial air quality impacts.								
Discussion:	Bundle 3.2.B is expected to remove over 11,892 drive alone vehicles from roadways in the study area compared to the number of vehicles that would be on the roads under the base scenario. Of the bundles, Bundle 3.2.B would remove the most vehicles from the road; therefore it receives '●' for best or most preferred performance.								
	Number of Drive Alone Vehicles Removed per Day								
	Bundle 1	**Bundle 2**	**Bundle 3**	**Bundle 3.2.A**	**Bundle 3.2.B**	**Bundle 3.2.C**	**Bundle 3.2.D**	**Bundle 3.2.E**	**Bundle 3.2.F**
	2,429	5,442	11,744	11,039	11,892	11,137	10,628	9,346	6,559
Relative Rating:	○	○	◕	◕	●	◕	◕	◕	○

Source: HDR Engineering, 2012

Table 20. Socioeconomic Conditions – Equity Minority

Category	Description
Measure:	Equity - Minority
Unit:	Total population as minority within census tracts 0.75 miles of improvements (2010 Census). The five minority groups addressed by Title VI and Executive Order 12898, Environmental Justice, are: **(1)** American Indian and Alaska Native, which refers to people having origins in any of the original peoples of North and South America (including Central America), and who maintain tribal affiliation or community attachment; **(2)** Asian, which refers to people having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam; **(3)** Black or African American Populations, which refers to peoples having origins in any of the Black racial groups of Africa; **(4)** Hispanic or Latino Populations, which includes persons of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race; or **(5)** Native Hawaiian and Other Pacific Islander, which refers to people having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.
Rationale:	National studies indicate that the presence of minority populations is one of several indications that an area could have a potentially strong transit market[1]. In addition, to receive federal funding, public transportation projects must provide minority populations, as defined above, with equitable access to transportation services (Title VI and Executive Order 12898, Environmental Justice).
Discussion:	According to 2010 U.S. Census data, the transportation projects in Bundle 3.2D would serve a population of approximately 153,596 minorities within an area 0.75 mile to each side of proposed transportation corridors. As a result, Bundle 3.2.D receives a rating of '●'for best or most preferred performance with the largest minority population in its service area.

	Number of Minorities within 0.75 Mile of each Bundle								
	Bundle 1	**Bundle 2**	**Bundle 3**	**Bundle 3.2.A**	**Bundle 3.2.B**	**Bundle 3.2.C**	**Bundle 3.2.D**	**Bundle 3.2.E**	**Bundle 3.2.F**
	137,908	134,088	149,315	149,315	149,315	149,315	153,596	119,961	115,249
Relative Rating:	◎	○	◎	◎	◎	◎	●	○	○

Source: HDR Engineering, 2012

[1] *National Research Council, Transportation Research Board, TCRP Report 28: Transit Markets of the Future - The Challenge of Change, Washington, D.C.: National Academy Press. 1998*

Table 21. Socioeconomic Conditions – Equity Low-Income

Category	Description								
Measure:	Equity – Low Income								
Unit:	Low income population within census tracts 0.75 miles of improvements (2009 ACS).								
Rationale:	Low-income populations include people living in households with an income at or below the U.S. Department of Health and Human Services poverty guidelines. Transportation projects that have beneficial impacts to low income neighborhoods, such as providing increased access to public transit services and/or reducing congestion, are encouraged.								
Discussion:	Bundle 3.2.D has the most corridor miles of improvements and has the highest number of low income people within 0.75 miles. As a result, Bundle 3.2.D receives a rating of '●' for best or most preferred performance for its provision of service to the highest number of people living at or below poverty level.								
	Number of Low Income People within 0.75 Mile of each Bundle								
	Bundle 1	**Bundle 2**	**Bundle 3**	**Bundle 3.2.A**	**Bundle 3.2.B**	**Bundle 3.2.C**	**Bundle 3.2.D**	**Bundle 3.2.E**	**Bundle 3.2.F**
	47,459	61,873	68,611	68,611	68,611	68,611	73,027	54,767	50,084
Relative Rating:	○	◎	◎	◎	◎	◎	●	○	○

Source: HDR Engineering, 2012

Table 22. Socioeconomic Conditions – Economic Development

Category	Description								
Measure:	Economic Development								
Unit:	Number of activity centers within 0.75 miles of proposed improvements. Activity centers are identified as Tier I, II and III. Tier I activity centers are projected to have a higher level of activity than Tier II and Tier III activity centers, or are designated as a community core area.								
Rationale:	It is important to address transportation to activity centers because they are projected to have a high level of activity and demand for access in the future. Bundles will be assigned a ranking that corresponds to the level of access to activity centers provided by proposed transportation improvements.								
Discussion:	The higher number of Tier I and II activity centers within 0.75 miles of a bundle, the more highly it ranked. Bundles 3, 3.2.A, 3.2.B, and 3.2.C had the highest numbers of Tier I and II activity centers and receives a rating of '●' for best or most preferred performance.								
	Number of Activity Centers within 0.75 Miles of each Bundle								
	Bundle 1	**Bundle 2**	**Bundle 3**	**Bundle 3.2.A**	**Bundle 3.2.B**	**Bundle 3.2.C**	**Bundle 3.2.D**	**Bundle 3.2.E**	**Bundle 3.2.F**
	2 Tier I / 4 Tier II	4 Tier I / 6 Tier II	4 Tier I / 8 Tier II	4 Tier 1 / 8 Tier II	4 Tier 1 / 8 Tier II	4 Tier I / 8 Tier II	4 Tier I / 7 Tier II / 1 Tier III	3 Tier I / 5 Tier II / 1 Tier III	3 Tier I / 6 Tier II
Relative Rating:	○	◎	●	●	●	●	◎	○	○

Source: HDR Engineering, 2012

Table 23. Capital Development Feasibility – Engineering Complexity

Category	Description								
Measure:	Engineering Complexity								
Unit:	Analysis of the complexity of the engineering solution proposed.								
Rationale:	This criterion focuses on the difficulty in designing an engineering solution that fits within the existing roadway network and meets current design standards, including horizontal alignment, vertical profile, cross section and drainage considerations.								
Discussion:	Bundles 1, 2 and 3 all contain the managed lanes project with DHOV traffic interchanges. For the most part, designing the managed lanes will be fairly reasonable for an urban retrofit project. The DHOV interchanges at US-60, Washington Street and Central Avenue will be a challenge to fit all the ramp connections and structures into the available space; however, the complexity is the same for all three bundles. The only difference between the three bundles is that Bundle 1 converts Southern Avenue from an arterial roadway to a TOPS corridor, which will be very challenging. It will be difficult to construct the parkway to provide the necessary travel lanes and a median wide enough to accommodate U-turns without the acquisition of a substantial amount of ROW. In addition, drainage accommodations along the Southern Avenue corridor could further complicate the project, especially if it becomes a TOPS corridor. For this reason, Bundle 1 received a lower ranking.								
	Complexity of Engineering Solution Proposed								
	Bundle 1	**Bundle 2**	**Bundle 3**	**Bundle 3.2.A**	**Bundle 3.2.B**	**Bundle 3.2.C**	**Bundle 3.2.D**	**Bundle 3.2.E**	**Bundle 3.2.F**
	Challenging	Reasonable	Reasonable	Reasonable	Reasonable	Reasonable	Reasonable	Moderate	Reasonable
Relative Rating:	○	◎	◎	◎	◎	◎	◎	○	◎

Source: HDR Engineering, 2012

Table 24. Capital Development Feasibility – Potential ROW Impacts Associated with Transit

Category	Description								
Measure:	Potential ROW Impacts Associated with Transit Investments.								
Unit:	The potential for ROW impacts is assessed based on the number of parkway, exclusive guideway transit, and CRT corridor miles proposed in each bundle. It is assumed that proposed managed lanes and HOV lanes would have neutral ROW impact.								
Rationale:	The overall total mileage of proposed improvements with the greatest likelihood to require additional ROW provides the best estimate of potential ROW impacts from each bundle.								
Discussion:	The bundles with the most miles of projects that potentially require new ROW, bundles 3, 3.2.A, 3.2.B and 3.2.C receive a rating of '○'for lowest or least preferred performance relative to the other bundles.								
	Total Miles of Parkway, Exclusive Guideway Transit, and CRT								
	Bundle 1	**Bundle 2**	**Bundle 3**	**Bundle 3.2.A**	**Bundle 3.2.B**	**Bundle 3.2.C**	**Bundle 3.2.D**	**Bundle 3.2.E**	**Bundle 3.2.F**
	8.4 miles	27.0 miles	47.0 miles	47.0 miles	47.0 miles	47.0 miles	38.0 miles	14.5 miles	23.5 miles
Relative Rating:	●	◎	○	○	○	○	○	◎	◎

Source: HDR Engineering, 2012

Table 25. Operational Feasibility

Category	Description								
Measure:	Operational Feasibility								
Unit:	Corridor miles of proposed CRT service within the region. CRT is the only mode of transportation or roadway improvement option, in all three bundles, that will not be operated within the region by the time the bundles are proposed for implementation.								
Rationale:	Types of service already in operation will require less initial investment to build because some of the infrastructure will be in place.								
Discussion:	Rankings were assigned according to the miles of CRT proposed in each bundle. Bundle 1 does not contain any recommendations for CRT, so it receives a rating of '●' for best or most preferred performance.								
	Corridor Miles of CRT								
	Bundle 1	**Bundle 2**	**Bundle 3**	**Bundle 3.2.A**	**Bundle 3.2.B**	**Bundle 3.2.C**	**Bundle 3.2.D**	**Bundle 3.2.E**	**Bundle 3.2.F**
	0 miles	19 miles	23.5 miles	23.5 miles	23.5 miles	23.5 miles	23.5 miles	0 miles	0 miles
Relative Rating:	●	◘	○	○	○	○	○	●	●

Source: HDR Engineering, 2012

Table 26. Performance – Roadway Speed

Category	Description								
Measure:	I-10 at Broadway Road GP Lane Speed								
Unit:	Average speed (mph) on I-10 GP lanes at Broadway Road for each bundle, provided for morning peak (6:00 – 9:00 AM) and evening peak (3:00 – 6:00 PM) travel times.[1]								
Rationale:	Average travel speed is one measure of performance for GP lanes. The faster the average travel speed, within legal limits, the greater the user benefit and the higher the ranking applied for this measure.								
Discussion:	The morning and evening peak travel speeds for each of the bundles are very similar with the exception of bundles 3.2.A and 3.2.C. However, when compared to the base year, the GP lanes for all three bundles perform at significantly higher speeds. Morning peak hour GP lane speeds are expected to be approximately 11 mph faster for the bundles than for the base. Evening peak hour GP lane speeds are expected to be approximately 13 mph faster for the bundles than for the base. GP lane speeds for all three bundles are consistently high compared to expected speeds for the base; therefore, each bundle receives a rating of '◘' for modest or relatively equal performance.								
	Average I-10 at Broadway Rd GP Lane Speed (mph)								
Base AM: 34.8 PM: 28.1	**Bundle 1**	**Bundle 2**	**Bundle 3**	**Bundle 3.2.A**	**Bundle 3.2.B**	**Bundle 3.2.C**	**Bundle 3.2.D**	**Bundle 3.2.E**	**Bundle 3.2.F**
	AM: 46.6 PM: 40.5	AM: 46.7 PM: 40.6	AM: 46.4 PM: 40.4	AM: 42.2 PM: 35.9	AM: 46.3 PM: 40.5	AM: 42.0 PM: 35.7	AM: 46.2 PM: 40.4	AM: 46.0 PM: 40.4	AM: 46.1 PM: 41.4
Relative Rating:	◘	◘	◘	◘	◘	◘	◘	◘	◘

Source: HDR Engineering, 2012
[1] *MAG TDM, 2011*

Table 27. Performance – Roadway Volume

Category	Description								
Measure:	I-10 at Broadway Road GP Lane Traffic Volumes								
Unit:	Traffic volumes on I-10 GP lanes at Broadway Road for each bundle, provided for morning peak (6:00 – 9:00 AM) and evening peak (3:00 – 6:00 PM) travel times.								
Rationale:	Traffic volumes are one way to measure roadway performance. In general, the higher the average traffic volume, the higher the level of traffic congestion and lower the overall roadway performance.								
Discussion:	The morning and evening peak traffic volumes for each of the bundles are very similar. However, when compared to the base year, the bundles all have significantly lower traffic volumes. Morning peak hour GP lane traffic volumes for bundles 1, 2, 3, 3.2.D, 3.2.E, 3.2.F are expected to be approximately 5,000 vehicles lower than the base. Bundles 3.2.A, 3.2.B, and 3.2.C have expected morning peak hour GP lane traffic volumes approximately 1,000 to 3,000 vehicles lower than the base. Bundle 3.2.A has an expected evening peak hour GP lane traffic volume that is higher than the base. Bundle 3.2.C has an expected evening peak hour GP lane traffic volume that is only slightly lower than the base. Evening peak hour traffic volumes for bundles 3.2.A and 3.2.C are expected to be greater than or almost equal to the base, and AM peak hour volumes are moderately higher than the base. Bundles 3.2.A and 3.2.C receive a rating of 'O' for poor performance relative to the other bundles.								
Base AM: 44,856 PM: 43,485	**Average I-10 at Broadway Road GP Lane Traffic Volume**								
	Bundle 1	**Bundle 2**	**Bundle 3**	**Bundle 3.2.A**	**Bundle 3.2.B**	**Bundle 3.2.C**	**Bundle 3.2.D**	**Bundle 3.2.E**	**Bundle 3.2.F**
	AM: 38,437 PM: 40,278	AM: 38,374 PM: 40,229	AM: 39,837 PM: 41,825	AM: 43,308 PM: 43,764:	AM: 40,486 PM: 42,092	AM: 42,433 PM: 43,462	AM: 39,786 PM: 41,785	AM: 39,936 PM: 41,879	AM: 39,977 PM:40,683
Relative Rating:	O	O	O	○	O	○	O	O	O

Source: HDR Engineering, 2012
[1] MAG TDM, 2011

Table 28. Performance – Transit Ridership

Category	Description								
Measure:	Transit Ridership								
Unit:	Average weekday transit ridership on NEW transit services.								
Rationale:	There are a number of benefits to attracting more riders to public transit. Higher transit ridership would contribute to lower traffic congestion and improved mobility within the study area. In addition, lower traffic congestion is a contributing factor to improved air quality.								
Discussion:	Bundle 3.2.D offers the most new transit service, and is expected to attract the highest average weekday ridership. As a result, Bundle 3.2.D receives a rating of '●' for best or most preferred performance.								
	Average Weekday Transit Ridership on NEW Transit Services								
	Bundle 1	**Bundle 2**	**Bundle 3**	**Bundle 3.2.A**	**Bundle 3.2.B**	**Bundle 3.2.C**	**Bundle 3.2.D**	**Bundle 3.2.E**	**Bundle 3.2.F**
	7,100	15,100	27,500	28,100	27,400	28,000	36,300	29,400	19,700
Relative Rating:	○	○	O	O	O	O	●	O	○

Source: HDR Engineering, 2012

Table 29. Financial Feasibility

Category	Description								
Measure:	Cost								
Unit:	The estimated total cost for each bundle.								
Rationale:	Measures the likelihood that funds required for construction and operation will be available for the specified transportation improvement alternative.								
Discussion:	Bundle 1 has the lowest estimated total cost, $1.082 B, therefore has the greatest likelihood that funds required for construction will be available.								
	Estimated Roadway Capital and Transit Capital and Operating Costs[1]								
	Bundle 1	**Bundle 2**	**Bundle 3**	**Bundle 3.2.A**	**Bundle 3.2.B**	**Bundle 3.2.C**	**Bundle 3.2.D**	**Bundle 3.2.E**	**Bundle 3.2.F**
	$1.082 B	$2.835 B	$5.238 B	$5.238 B	$5.117 B	$4.980 B	$4.367 B	$3.462 B	$4.334 B
Relative Rating:	●	◉	○	○	○	○	○	◉	○

Source: HDR Engineering, 2012

[1] Includes a value for 20 years of transit operating costs (includes inflation)

Table 30. Cost Effectiveness – Transit

Category	Description								
Measure:	Transit Cost Effectiveness								
Unit:	Transit B/C of each bundle excluding modern streetcar.								
Rationale:	This criterion focuses on the extent to which the cost of alternatives measure up to their benefits. Cost effectiveness considers unitized benefits associated with the financial investment required to construct or operate and proposed transportation improvement alternative.								
Discussion:	Results of the analysis indicate that Bundle 1 has the only B/C ratio (1.55) for transit investments that is greater than 1.00. Bundles 2 through 3.2.F have costs that exceed benefits. Bundle 3.2.E has the lowest B/C ratio (0.33) of all bundles compared.								
	Transit Benefit-Cost								
	Bundle 1	**Bundle 2**	**Bundle 3**	**Bundle 3.2.A**	**Bundle 3.2.B**	**Bundle 3.2.C**	**Bundle 3.2.D**	**Bundle 3.2.E**	**Bundle 3.2.F**
	B/C = 1.55	B/C = 0.44	B/C = 0.60	B/C = 0.61	B/C = 0.60	B/C = 0.60	B/C = 0.43	B/C = 0.33	B/C = 0.43
Relative Rating:	●	○	◉	◉	◉	◉	○	○	○

Source: HDR Engineering, 2012

Table 31. Cost Effectiveness – Roadways

Category	Description								
Measure:	Roadway Cost Effectiveness								
Unit:	Roadway B/C of each bundle								
Rationale:	This criterion focuses on the extent to which the cost of alternatives measure up to their benefits. Cost effectiveness considers unitized benefits associated with the financial investment required to construct or operate and proposed transportation improvement alternative.								
Discussion:	Bundle 1 includes more roadway improvements than the other bundles. The 7th Street and 7th Avenue restripe projects have very high B/C ratios due to the relatively low cost for the striping improvements.								
	Roadway Benefit-Cost								
	Bundle 1	**Bundle 2**	**Bundle 3**	**Bundle 3.2.A**	**Bundle 3.2.B**	**Bundle 3.2.C**	**Bundle 3.2.D**	**Bundle 3.2.E**	**Bundle 3.2.F**
	Southern Pkwy[1] = 0.68 Managed Lanes[2] = 1.04 7th St Restripe = 119.64 7th Ave Restripe = 160.71	Managed Lanes[2] = 1.04	Managed Lanes[2] = 1.04	Not Calculated	Not Calculated	Not Calculated	Managed Lanes[2] = 1.04	Managed Lanes[2] = 1.04	Managed Lanes[2] = 1.04
Relative Rating:	●	○	○	---	---	---	○	○	○

Source: HDR Engineering, 2012

[1] Parkway improvement only, BRT was not included.

[2] Public sector contribution only; does not include revenue potential

8.0 Key Findings and Recommended Bundle

The MIS identified and evaluated a range of transportation improvements focused on increasing transportation productivity and efficiency in the southeast corridor study area. The development of the initial bundles (Bundle 1 through Bundle 3) was accomplished through an interactive multi-agency Charrette process. The bundles included the following key transportation investment options:

- Freeway based managed lanes
- DHOV access ramps
- Exclusive guideway transit
- Bus rapid transit
- Commuter rail transit
- Modern streetcar
- Automated guideway transit
- Arterial roadway capacity enhancements

8.1 MIS Evaluation Key Findings

Through assembling different, but complementary combinations of the above transportation investment options, nine total bundles were developed and evaluated. The key findings from the bundle evaluation, which are outlined below, generally show that the managed lanes concept and exclusive guideway transit options perform well relative to other concepts considered. These MIS key findings include:

- Managed lane operations in I-10 and I-17 between the Pecos Stack TI and the Stack TI, including the five identified DHOV access ramps, provides the highest level of performance including increased peak period operating speeds, while accommodating increased traffic volumes (GP lanes volume + managed lanes volume) in the freeway corridor.
- A strategically focused network of high capacity transit services featuring exclusive guideway transit offers the most productive transit investment (highest system-wide ratio of boardings per revenue mile).
- An east/west transit connection between Central Avenue and the east valley in a corridor parallel to I-10 (including Southern Avenue or Baseline Road) and a north/south connection along either Rural Road or Arizona Avenue produces the highest number of new system-wide transit riders. This configuration improves direct transit access between central Phoenix (including south central Phoenix) and the southeast valley.
- Results of the MAG TDM indicates that an exclusive guideway transit investment in either the Rural Road or Arizona Avenue corridors will not have a significantly discernible impact on traffic volumes or speeds on I-10. Both corridors have attributes to potentially support a future exclusive guideway transit investment; however, additional study is necessary to determine if such an investment should be made in one or both of the corridors.

8.2 MIS Recommended Bundle

The key findings of the MIS serve as an outline of the primary elements required to develop a recommended bundle of transportation investment options. The transportation improvement options included in the recommended bundle offer a relatively high level of performance (average freeway travel speeds, average freeway volumes, and new system-wide transit riders) and efficiency (benefit/cost and transit boarding per revenue mile) compared to the other transportation

improvement options considered. In addition, they generally performed well under the evaluation factors outlined in Chapter 7.

The recommended bundle includes the freeway managed lanes on I-10/I-17 (including the five initially identified DHOV ramps) and exclusive guideway transit service on Southern and Central Avenues between the Phoenix CBD and Rural Road. Other transportation improvement options proposed to be included in the recommended bundle include an extension of the Tempe modern streetcar on Rio Salado Parkway and Southern Avenue, as well as potential exclusive guideway transit extensions to Chandler's CBD via Rural Road or Arizona Avenue.

Excluding the optional exclusive guideway transit extension, the total estimated capital and operating cost (operating cost for transit only) for the recommended bundle is $2.96 billion. Approximately 75% of the total estimated cost is for public transit investments ($2.23 billion) including 20-year operating costs. The total estimated capital cost per corridor mile constructed (managed lanes + transit) is approximately $68.6 million.

Table 32 includes a summary of the transportation investment options included in the recommended bundle, while Figure 31 provides a graphic illustration of the recommended investments.

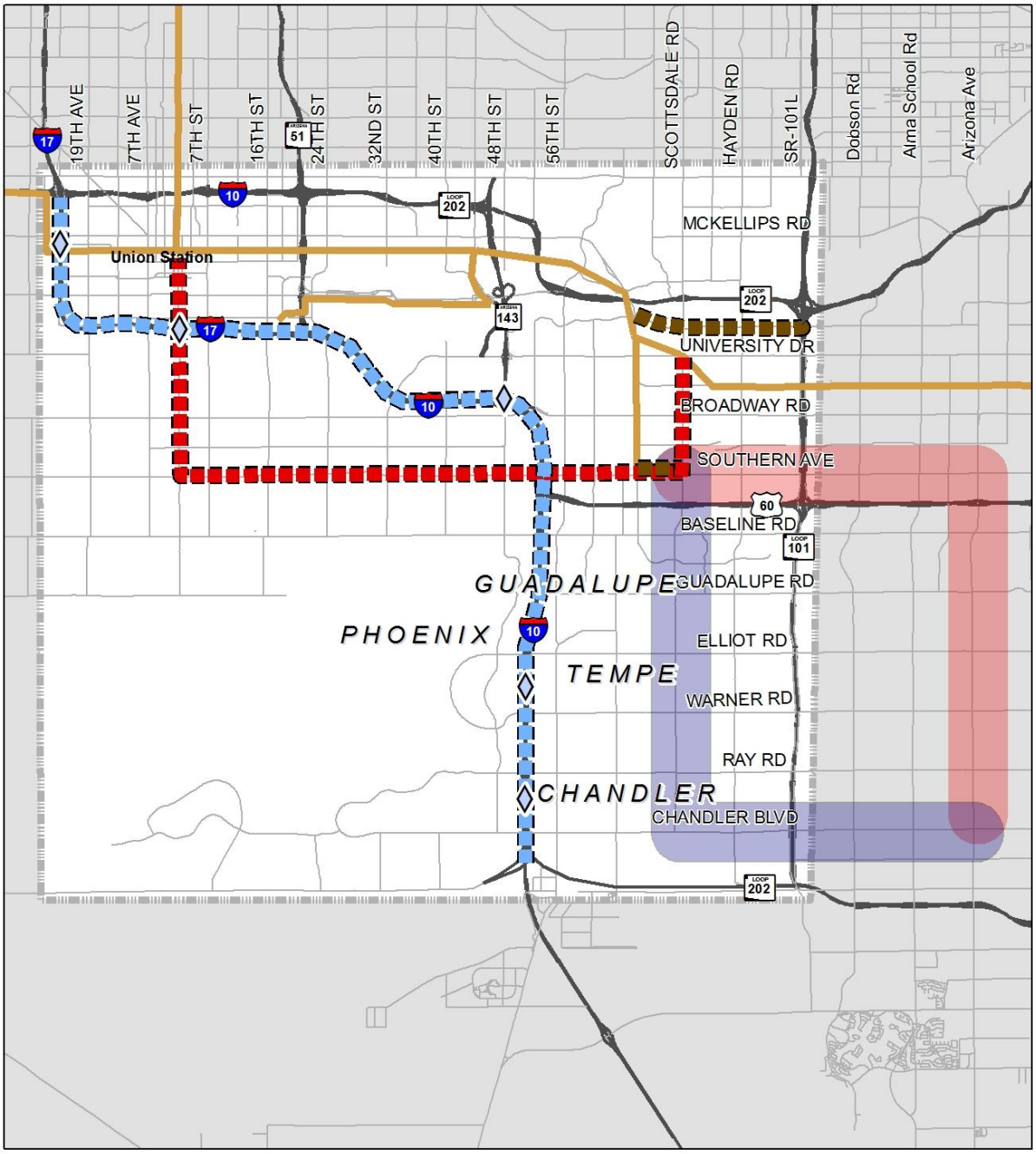
Table 32. Recommended Bundle

Concept	Description	Length in Study Area (miles)
Managed Lanes	I-10 and I-17 - Pecos Stack TI to Stack TI	20.0
New Direct HOV Ramps	I-17/Washington Street I-17/Central Avenue I-10/SR-143 I-10/Carver Road I-10/Galveston Road	---
Exclusive Guideway Transit	Southern Avenue/Central Avenue – Phoenix CBD to Rural Road	11.5
Exclusive Guideway Transit	Rural Road – Southern Avenue to University Drive	2.0
Potential Exclusive Guideway Transit	Arizona Avenue – Chandler CBD to Rural Road and Southern Avenue via Arizona Avenue	2.0[1]
Potential Exclusive Guideway Transit	Rural Road – Chandler CBD to Rural Road and Southern Avenue via Rural Road	8.0[1]
Modern Streetcar	Rio Salado Pkwy - Extension from Mill Avenue to SR-101L	3.5
Modern Streetcar	Southern Avenue - Extension from Mill Avenue to Rural Road	1.0

Source: HDR Engineering, 2011

[1] *Total miles of extension (within study area + outside of study area) = ~11.0 miles*

Figure 31. Recommended Bundle



Maricopa Association of Governments
Southeast Corridor MIS

Recommended Bundle

Legend

- Southeast Corridor Study Area
- Highways
- Major Roads
- Planned High Capacity Transit
- New Direct HOV Ramp
- Modern Streetcar Extension
- Exclusive Guideway Transit
- Managed Lanes
- Potential Exclusive Guideway Transit Extension - Via Rural Rd
- Potential Exclusive Guideway Transit Extension - Via Arizona Ave

0 1 2 Miles

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Appendix A – Existing Conditions and Planned Transportation Improvements Report

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Existing Conditions and Planned Transportation Improvements Report

Prepared for:

Maricopa Association of Governments

Prepared by:
HDR Engineering, Inc.
Burgess & Niple, Inc.
Hexagon Transportation Consultants, Inc.

Original Draft Submittal - August 25, 2010
Updated - December 2, 2011

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Existing Conditions and Planned Transportation Improvements Report

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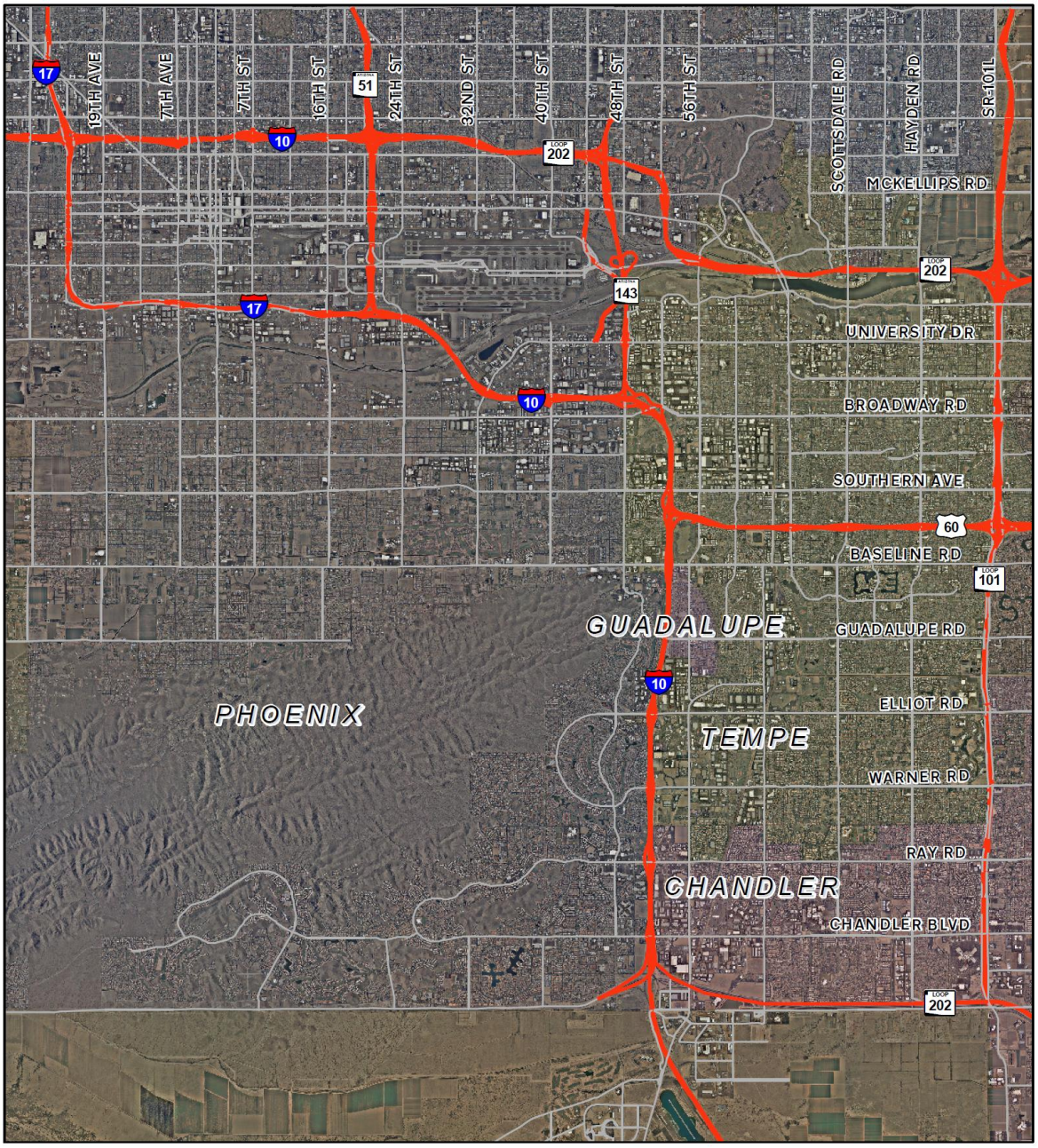
1.0 INTRODUCTION

The Southeast Corridor Major Investment Study (SE MIS) will identify area compatible transportation elements designed to improve overall mobility within the Southeast Corridor and adjacent area. This initial background report documents a review of recently completed relevant studies and plans, provides a summary level inventory of existing and planned highway, arterial roadway, and public transportation investments, and identifies general travel demand patterns.

Study Area

The Southeast Corridor Major Investment Study Area is bounded by Interstate 10 (Papago Freeway) and SR-202L (Red Mountain Freeway) on the north, SR-101L (Price Freeway) on the east, the Gila River Indian Community border on the south, and Interstate 17 (Black Canyon Freeway) and the 23rd Avenue alignment on the west. **Figure 1** illustrates the general study area.

Figure 1: Study Area



Maricopa Association of Governments Southeast Corridor MIS **Base Map**	**Legend** Major Roads Highways 0 1 2 Miles

2.0 REVIEW OF EXISTING PLANS AND STUDIES

The Maricopa Association of Governments has recently completed or updated three significant regional transportation related plans or studies that are specifically relevant to the Southeast Corridor Major Investment Study. These planning efforts include the MAG Regional Transportation Plan (RTP), MAG Regional Transit Framework (RTF), and MAG Commuter Rail System Study (CRSS). Each of these plans and studies, which were developed in coordination with other local and regional planning efforts, include the most complete documentation of the area's planned regional transportation investments. A summary of the planned regional transportation improvement projects, including planned illustrative projects\corridors, identified in the study area are documented in Section 2.1.

In addition to a review of existing transportation related studies and plans, relevant community general plans or master plans were reviewed to identify any potential significant changes in community land-use or circulation plans. The most recently adopted plans from the cities of Chandler, Guadalupe, Phoenix, and Tempe were reviewed. A summary of relevant information from each community is provided in Section 2.2

2.1 Transportation Plans

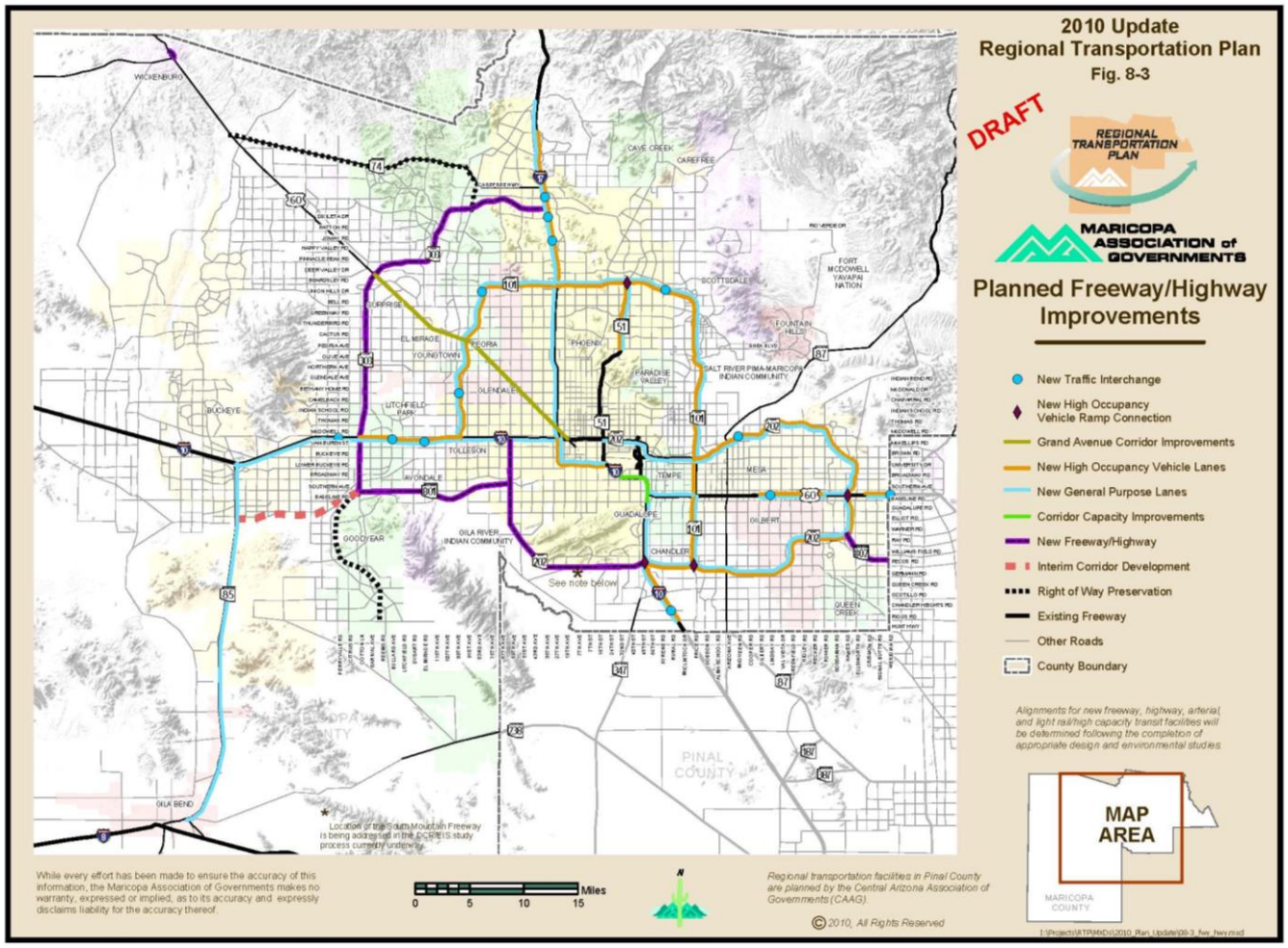
2.1.1 Regional Transportation Plan

The *MAG Draft RTP – 2010 Update* is a regional plan that outlines transportation improvements in Maricopa County through Fiscal Year 2031. The RTP was initially developed in 2003; however, the current edition of the plan was updated in June 2010. The RTP is organized into three sections: planning process, transportation modes, and system management and operations. The planning process section includes the approach to developing the RTP, a description of goals and objectives, a review of existing and future conditions, the public involvement process, and the role of government agencies in developing the plan. The transportation modes section includes a financial plan, an overview of each of the region's planned transportation modes as well as a funding and expenditure summary for each, an overview of the Transportation Enhancements Program, and the extended regional transportation planning outlook. The system management and operations section identifies various measures that are in place to improve the performance of the transit system.

For purposes of this background report, three specific elements of the RTP were reviewed to identify planned and illustrative projects within the Southeast Corridor MIS study area. These elements include: freeways and highways, arterial streets, and public transportation.

Freeways and Highways
Within the study area, the RTP identifies multiple planned freeway/highway improvements. This includes the new SR-202L/South Mountain Freeway and corridor capacity improvements along I-10, from the bridge over the Salt River through the I-10/US-60 system interchange. New HOV ramp connections are planned for the I-10/SR-202L and SR-101L/SR-202L system traffic interchanges. Additional general purpose and HOV lanes are planned along existing facilities. **Figure 2** illustrates the planned freeway/highway improvements within the region and Study Area.

Figure 2: Planned Freeway/Highway Improvements



Source: MAG Regional Transit Framework, 2010

Arterial Streets

Five regionally funded arterial street projects are located within the study area. Four projects are intersection improvements, all of which are located within the City of Chandler. These include the intersection of Chandler Boulevard and Kyrene Road, and the intersections of Ray Road with Kyrene Road, McClintock Road, and Rural Road. The fifth project, Avenida Rio Salado between 51st Avenue and 7th Street, is a new/improved arterial within the City of Phoenix.

Illustrative Roadway Projects

One illustrative roadway project is located within the study area, and involves improving I-10 to a local/express lane configuration between the I-10/SR-51/SR-202L traffic interchange and 32nd Street. This project, which was originally part of the 2003 plan, is no longer included in the current planning horizon.

Public Transportation

Within the SE Corridor study area, the RTP identifies several high capacity transit and illustrative corridors. Three high capacity transit (HCT) corridors\projects were identified in the RTP. These include the Tempe South, Phoenix West, and Phoenix Sky Train (Phase 1). The RTP also identifies three Arterial Bus Rapid Transit (BRT) corridors, which include Scottsdale/Rural Arterial BRT, South Central Avenue Arterial BRT, and Chandler Boulevard Arterial BRT. **Table 1** identifies the HCT and Arterial BRT corridors and the planned initial service operations year for each.

Table 1: Planned HCT and Arterial BRT Corridors

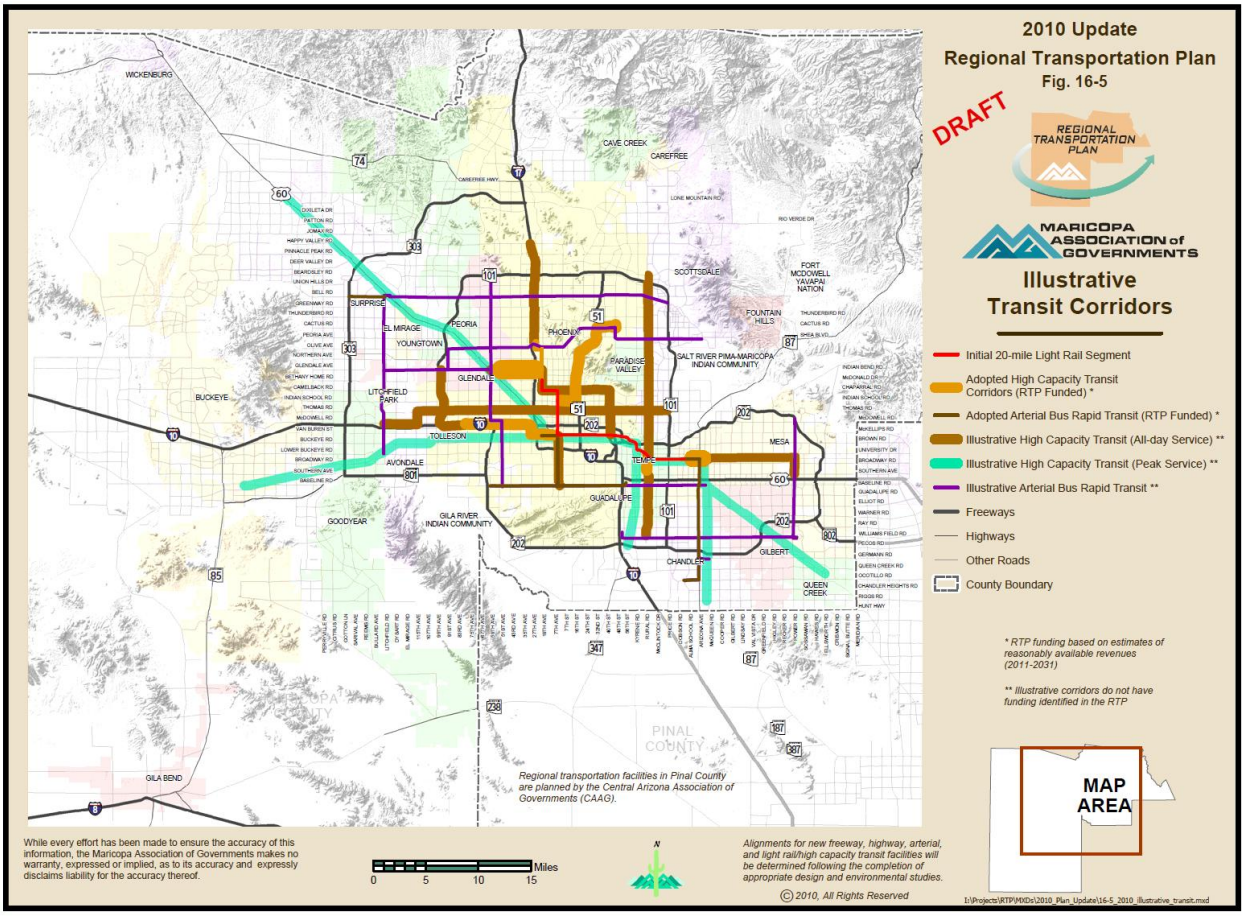
Corridor	Fiscal Year of Operation
High Capacity Transit	
Tempe South	2015
Phoenix West	2021
PHX Sky Train – Stage 1	2013
Arterial BRT	
Scottsdale/Rural Arterial BRT	2016
South Central Avenue Arterial BRT	Beyond 2026
Chandler Boulevard Arterial BRT	Beyond 2026

Source: MAG RTP, 2010 Update

Illustrative Public Transportation Projects

The RTP 2010 Update also includes illustrative transit corridors/projects which identify potential corridors or improvements that may be included in future RTP updates. Three illustrative HCT corridors are identified within the study area. These include two potential HCT all day service corridors along Scottsdale/Rural Road and Central Avenue (south of Jefferson Street) and one HCT peak period service corridor near the Tempe Kyrene Branch freight rail line. **Figure 3** identifies the illustrative transit corridors within the region.

Figure 3: Illustrative Transit Corridors

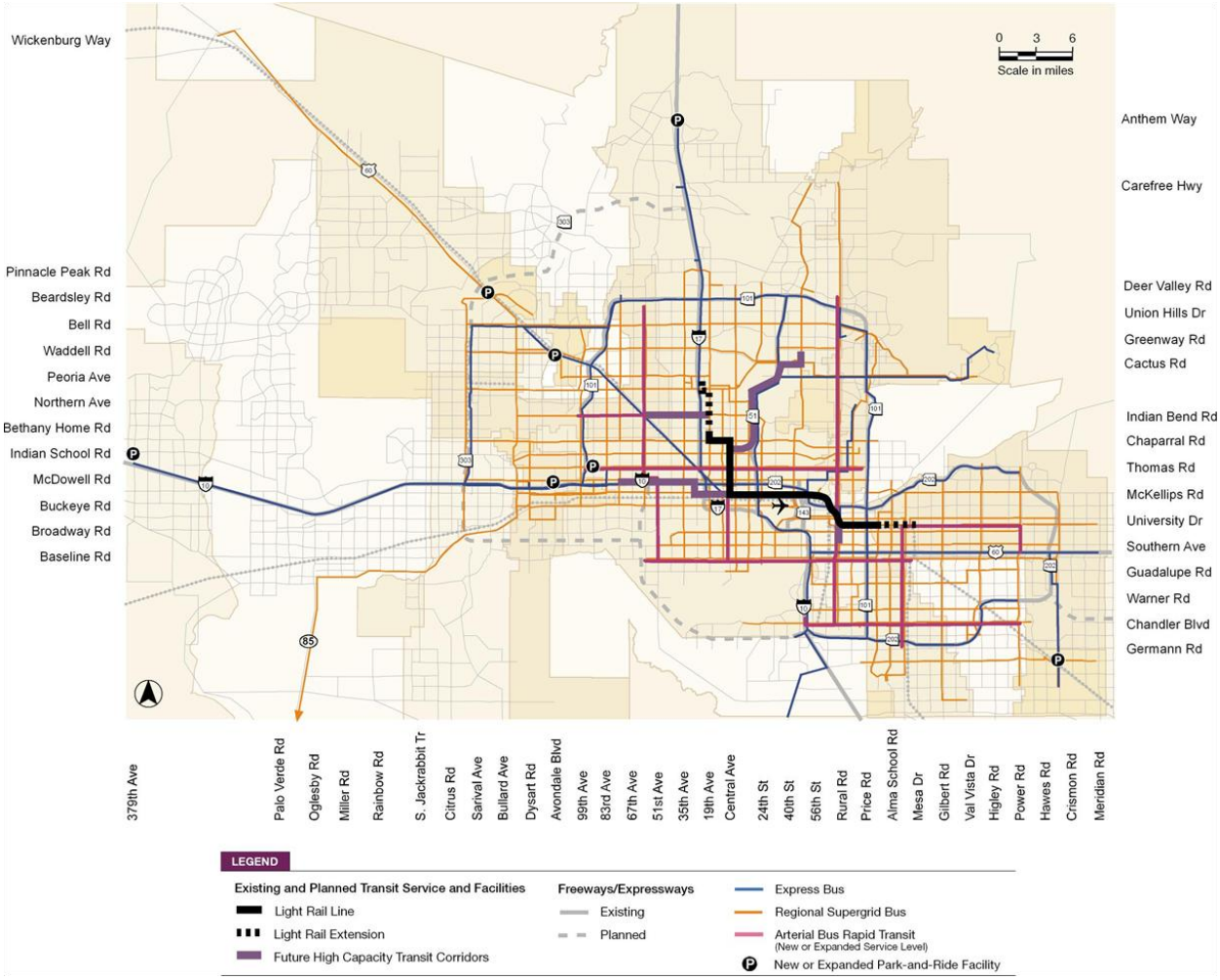


Source: MAG Regional Transit Framework, 2010

2.1.2 Regional Transit Framework

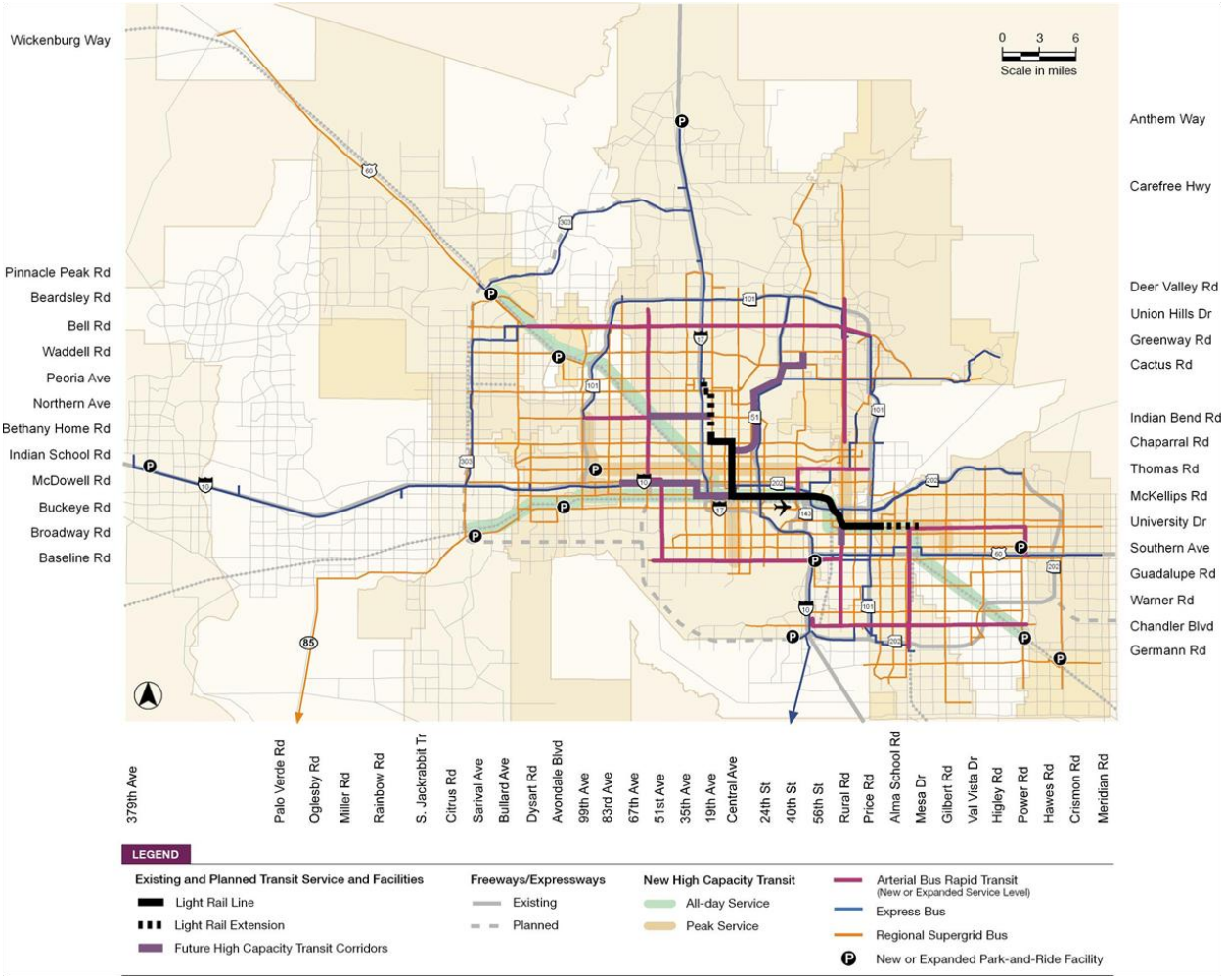
The *MAG Regional Transit Framework* (RTF) sought to understand the region's transit needs and deficiencies with the goal of identifying high-leverage transit investments that can attract a significant number of new passengers while improving transit service for existing patrons. The study developed three transit mobility scenarios which represent distinct alternatives that provide demand based solutions for addressing regional transit deficiencies and needs through different funding level assumptions. The three transit mobility scenario concepts are: Basic Mobility (Scenario I), Enhanced Mobility (Scenario II), and Transit Choice (Scenario III). The Basic Mobility Scenario contains new service or service enhancements (including capital investments) in corridors that were screened as some of the highest-priority corridors, with consideration given to regional transit system connectivity and functionality. The other two scenarios include additional transit investments not identified in the Basic Mobility scenario. With each scenario building on the previous, the mode or level of investment in a corridor may differ from one scenario to another. For example, a corridor designated for express bus service in one scenario may be designated as HCT Peak Period in a subsequent scenario. **Figures 4** though **6** depict the transit mobility scenarios.

Figure 4: Basic Mobility Scenario



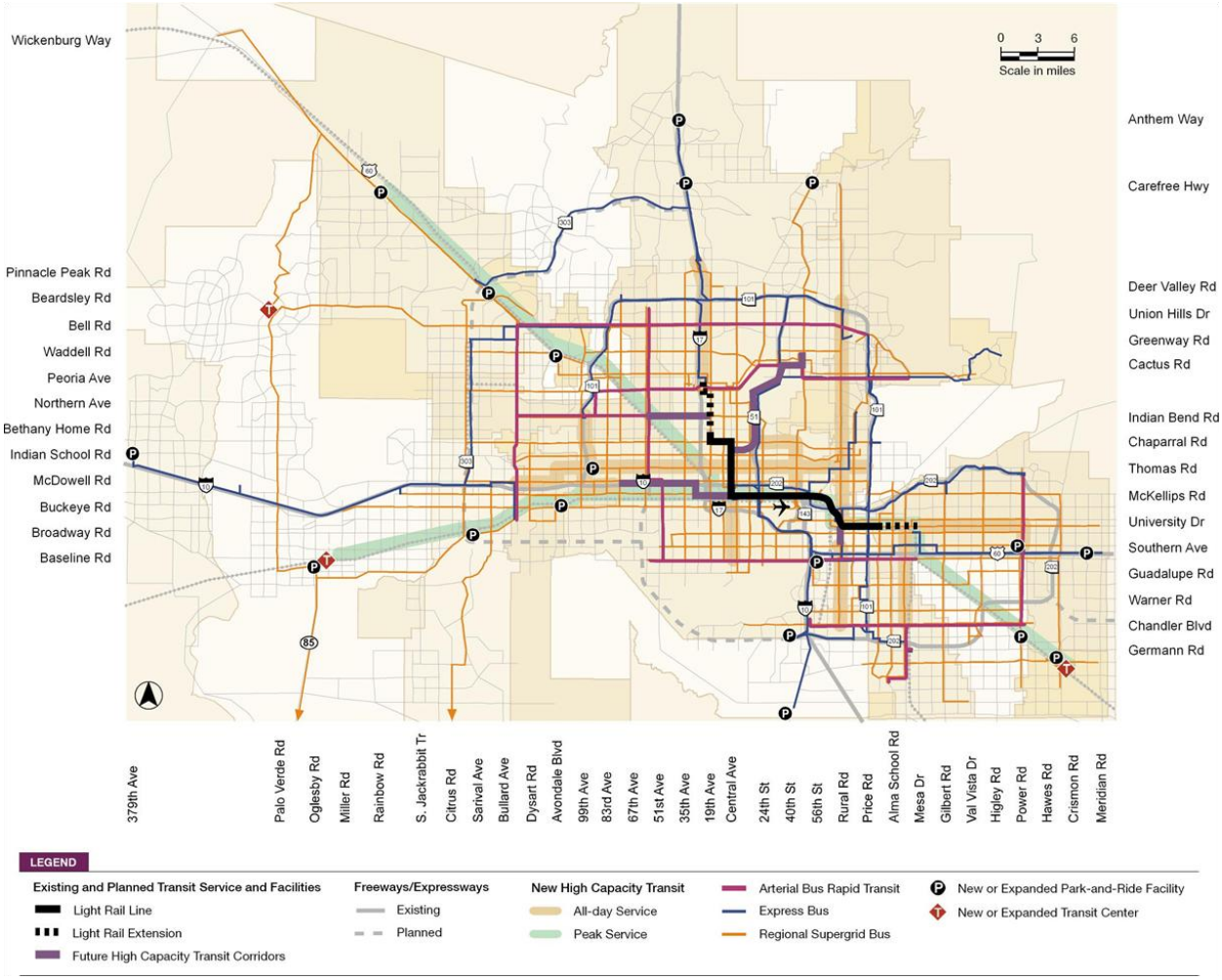
Source: MAG Regional Transit Framework, 2010

Figure 5: Enhanced Mobility Scenario



Source: MAG Regional Transit Framework, 2010

Figure 6: Transit Choice Scenario



Source: MAG Regional Transit Framework, 2010

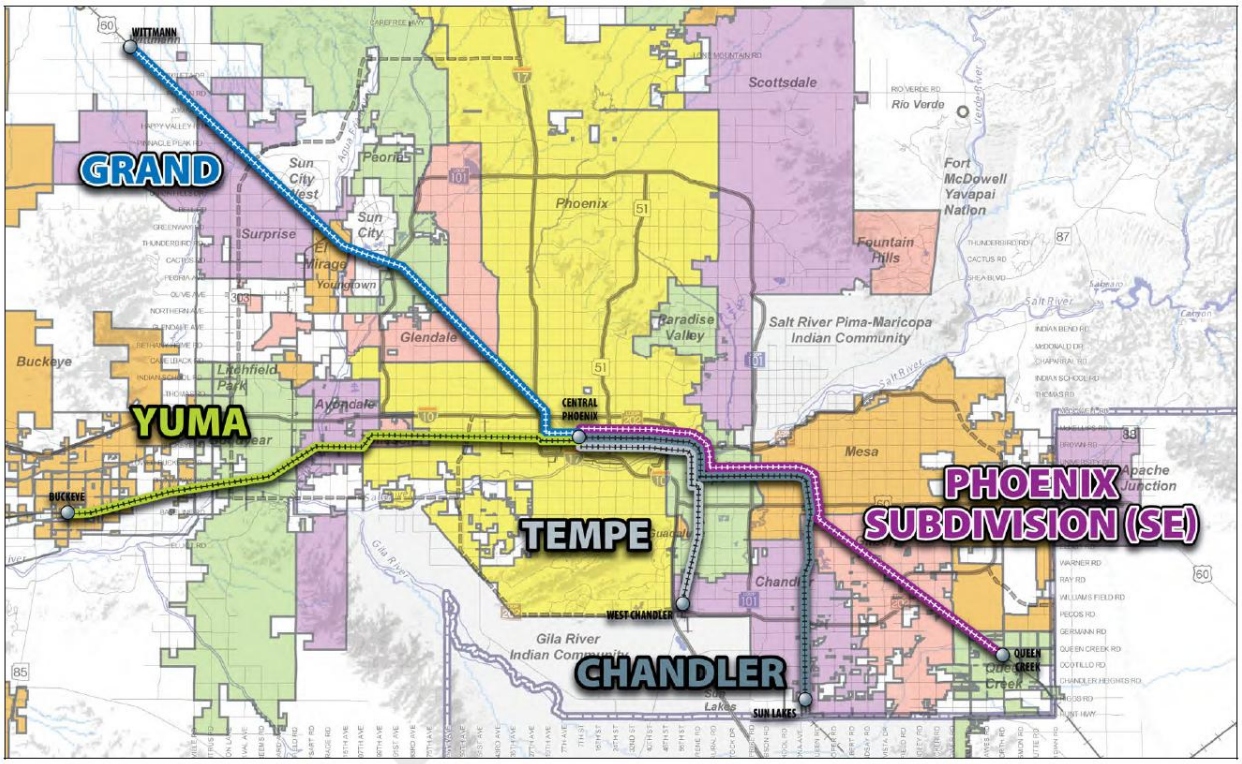
2.1.3 Commuter Rail System Study

The MAG Commuter Rail System Study (CRS) explored the viability of commuter service in the MAG region through an analysis of both stand-alone and interlined alternatives that would result in an optimized commuter rail network. In addition, this study also outlined steps for implementing commuter rail service including coordination with railroads, governance of the system, and funding. This study analyzed five existing rail corridors within the MAG region: Grand Avenue (BNSF), Yuma West (UPRR), Southeast (UPRR), Tempe (UPRR), and Chandler (UPRR). **Figure 7** illustrates the general location of the of the five rail corridors analyzed as part of the MAG CRS.

The Tempe Corridor identified for analysis is located entirely within the MAG Southeast Corridor study area, operating along the existing UPRR (including the Kyrene Branch). The study corridor is approximately 18 miles in length, serving the area between downtown Phoenix and around the vicinity of I-10/SR-202L. In terms of what commuter rail line to implement first, the study recommended that this corridor be apart of the Start-Up Scenario 1C, which was one of two corridors that could be

implemented as an alternative to the Southeast Corridor, if right-of-way constraints were to limit its implementation, or if plans suggested that this corridor would be viable for inter-city passenger rail service between Phoenix and Tucson. The proposed start-up alignment, which is shorter than the full corridor studied, would operate along the existing UPRR with 5 stations and begin at I-10/SR-202L and end around Airport/38th Street. Transit riders requiring access to downtown Phoenix could transfer to light rail at the Airport/38th Street station location.

Figure 7: MAG Commuter Rail Corridors



Source: URS Corp., 2009.

Source: MAG Commuter Rail System Study, 2010

2.2 Community General Plans

2.2.1 Chandler General Plan 2008

The Chandler General Plan 2008 was adopted on November 4, 2008. The plan is a tool used to aide in the development of the city. Future land uses proposed within the SE Corridor study area are primarily non-residential (i.e. knowledge-intensive centers, industrial, business parks) and commercial (i.e. malls, large single-use retail development, and other major commercial developments). Of particular relevance to the SE Corridor Study, there are two areas along I-10 designated as *Growth Expansion Nodes.* The plan identifies these areas as "compact, business accommodation growth areas". The Circulation Element of the plan does not identify any significant future circulation changes within the SE Corridor study area.

2.2.2 Guadalupe Master Plan 1992-2010

The Guadalupe Master Plan, adopted in November 1992, presents the community's existing conditions and outlines the goals, needs, and aspirations of the town as they relate to achieving the community's overall vision. The future land use within the study area is comprised of mainly residential, commercial, and commercial mixed uses. Park/open space is primarily identified along the I-10 corridor, south of Guadalupe Road. The Circulation section of the plan does not identify any significant changes in the community's circulation plan.

2.2.3 Phoenix General Plan 2002

The Phoenix General Plan 2002 (adopted on November 7, 2001) outlines the City's goals, policies, and recommendations to aide in future growth. The City of Phoenix is organized into 14 Urban Villages, with four located within the study area including: Encanto, Central City, South Mountain, and Ahwatukee Foothills. The projected land use for these four areas within or adjacent to the I-10 corridor is primarily commercial (including business parks) and industrial with pockets of mixed-use and low to medium residential development. The study area also includes Sky Harbor International Airport which is adjacent to I-10 and surrounded by commercial uses and business park areas. Planned transportation improvements that may be relevant to the SE corridor study include the construction of the South Mountain Parkway as well as improving overall circulation within each urban village.

2.2.4 City of Tempe General Plan 2030

The City of Tempe General Plan 2030, adopted on December 4, 2003, provides a vision for the City of Tempe's future development. Adjacent to the I-10 corridor, the projected land uses within the City of Tempe are mainly comprised of industrial and commercial uses with some pockets of public open space, residential, and mixed-use. The General Plan does not identify any significant changes to the current transportation system within the study area.

3.0 EXISTING AND PLANNED ROADWAY FACILITIES

For the purpose of this Study, the sources of information for the existing and planned freeway/highway and arterial street systems are the MAG 2010 Update to the Regional Transportation Plan (RTP) and the 2010 and 2031 MAG Travel Demand Models (TDM).

3.1 Existing Roadway Facilities

3.1.1 Freeways and Highways

The existing freeway/highway system in the Southeast Corridor Study Area (study area) consists of facilities constructed, maintained, and operated by the Arizona Department of Transportation (ADOT). These facilities include:

I-10 Maricopa Freeway	**I-17** Black Canyon Freeway	**US-60** Superstition Freeway	**SR-51** Piestawa Freeway
SR-101L Price Freeway	**SR-202L** Red Mountain Freeway	**SR-202L** Santan Freeway	**SR-143** Hohokam Expressway

Two interstate highways are located with the study area. I-10 is the predominant freeway/highway facility that spans the country and bisects the study area. I-17 is located in the northern portion of the study area, and is a north-south connection between I-10 and I-40. US-60 extends beyond the region and varies in functional classification. Within the study area, US-60 is a multiple lane freeway. The remaining freeways/highways within the study area are regional routes. **Figure 8** illustrates the existing freeway/highway system, and **Figure 9** depicts the number of existing (2010) freeway/highway lanes by direction as coded in the MAG Travel Demand Model.

High Occupancy Vehicle Lanes

The study area has a developed High Occupancy Vehicle (HOV) lane system. HOV facilities are located on several of the freeway/highways within the study area. Current HOV facilities consist of one-lane for each direction of travel. The location of existing HOV facilities are illustrated on **Figure 8**.

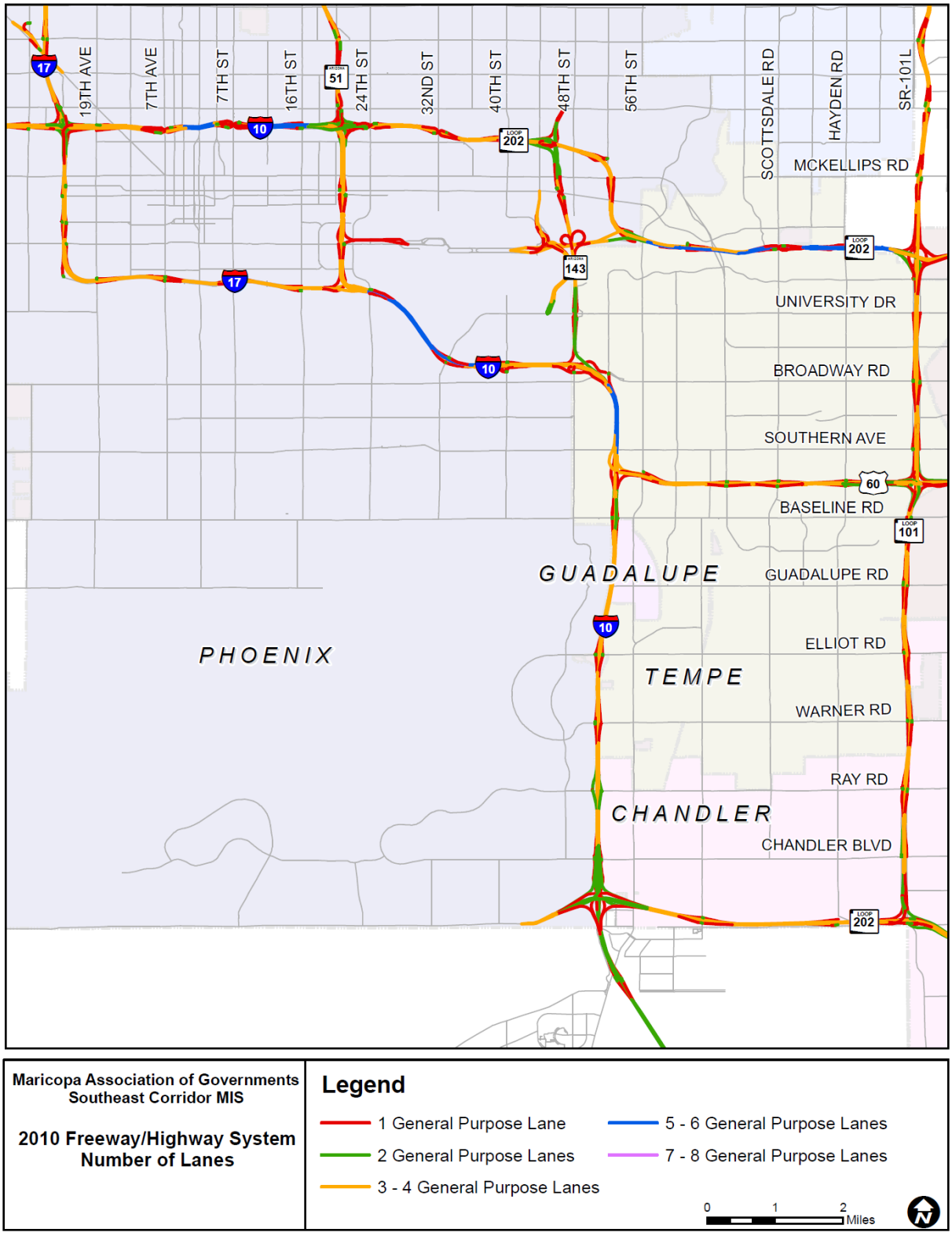
Traffic Interchanges

Traffic interchanges (TI) provides access between freeways/highways (system TI) and between freeways/highways and the arterial street system (service TI). Service TI spacing within the study area varies; however, it is typically one mile corresponding with the one-mile arterial street grid. **Figure 8** illustrates the location of existing system and service TIs, including TIs that provide direct HOV connectivity.

Figure 8: Existing Freeway/Highway and Arterial Street Systems

Source: HDR Engineering Inc., 2010

Figure 9: 2010 MAG Travel Demand Model Freeway/Highway System Lanes by Direction



Source: MAG Travel Demand Model, July 2010

3.1.2 Arterial Streets

The existing arterial street system extends throughout the study area, except for the Phoenix South Mountain Park in the southwest portion of the study area. The arterial street system consists of the one-mile grid that is typical for the metro area, and is oriented north-south/east-west. The typical number of through lanes for arterials within the study area ranges from four to six lanes. **Figure 8** illustrates the existing arterial street system. **Figure 10** depicts the total number of through lanes (both directions of travel combined) of the 2010 arterial street system, based on the conditions defined in the 2010 MAG Travel Demand Model.

3.2 Planned Roadway Facilities

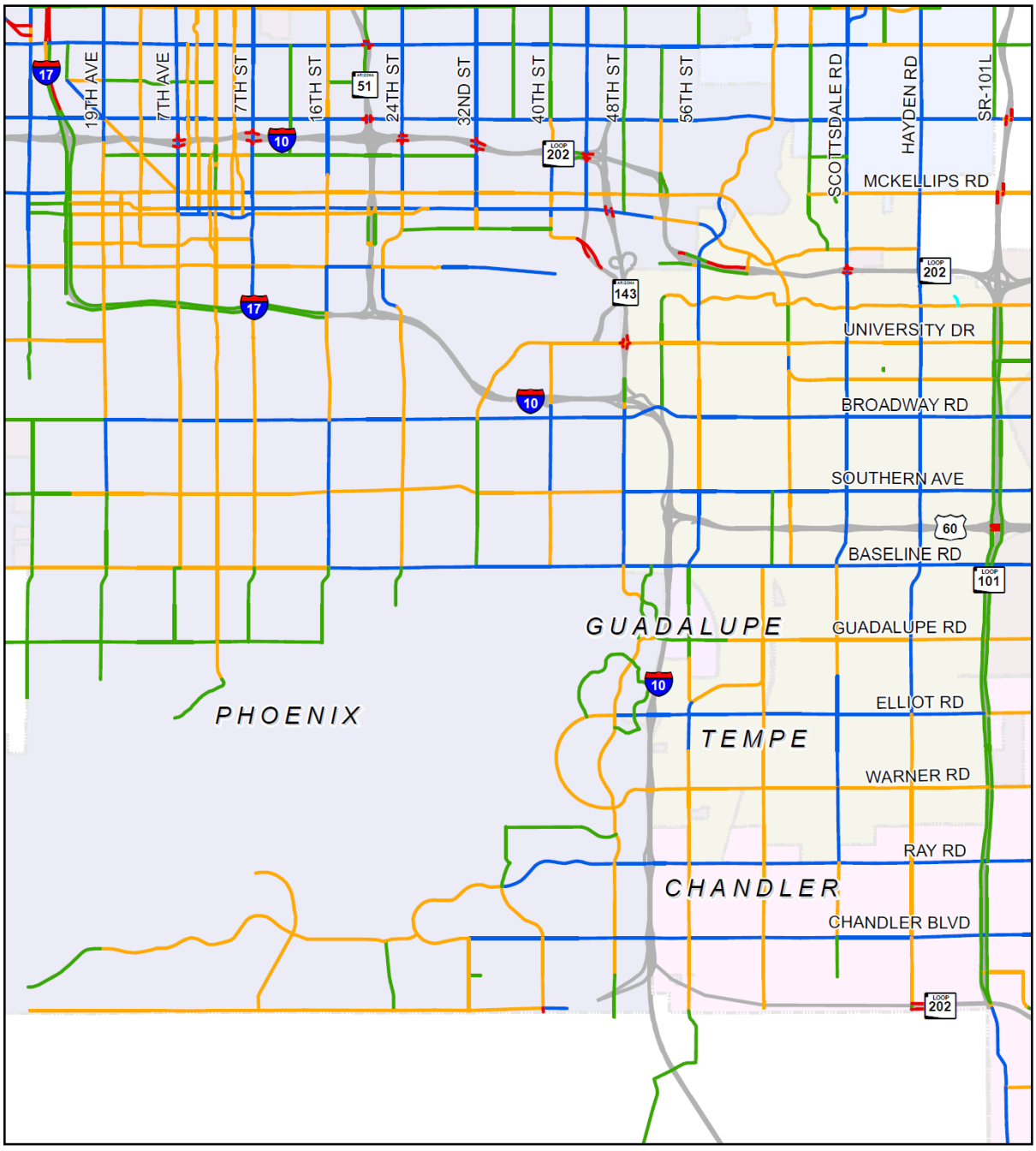
3.2.1 Freeways and Highways

The RTP identifies substantial freeway/highway improvements in the study area; which includes varying levels of improvement on nearly every freeway/highway. This includes corridor capacity improvements along I-10 and a new South Mountain Freeway along the southern border of the Study Area. New HOV ramp connections are planned for the I-10/SR-202L (Pecos Stack) and SR-101L/SR-202L system TIs. Additional general purpose and HOV lanes are planned along existing facilities. **Figure 11** illustrates the planned freeway/highway improvements within the region and study area identified in the RTP, while **Figure 12** illustrates the planned number of freeway/highway lanes indicated in the RTP.

Improvements to I-10 include reconfiguring the current facility to a local/express lane arrangement. The current RTP funds these improvements from 32nd Street to the I-10/SR-202L TI (Pecos Stack TI). This improvement provides additional general purpose and HOV lanes for through traffic. HOV lanes throughout the Study Area are typically one lane in each direction; however, two will be provided in the same direction from the I-10/-17 TI (The Split) to the I-10/US-60 TI. New multiple lane collector-distributor (C-D) roads will be provided to address local access to the arterial streets over the same approximate length. The South Mountain Freeway is a new facility. It is an extension of SR-202L west from the Pecos Stack TI and will span along the southern border of the study area, and then turn north outside of the Study Area and connect to I-10, near 59th Avenue.

Also programmed in the RTP within the Study Area are additional general purpose and HOV lanes along I-17, from the I-10/I-17 TI (Stack TI) on the northwest corner of downtown Phoenix, to the I-10/-17 TI (The Split) on the southeast corner of downtown Phoenix. Further, additional general purpose and HOV facilities, including direct ramp connections and additional lanes, are programmed for the SR-202L (Santan Freeway), from I-10 to east of the study area.

Figure 10: 2010 Arterial System Number of Through Lanes Combined (both Directions of Travel)



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Southeast Corridor MIS

2010 Arterial Street System Number of Lanes

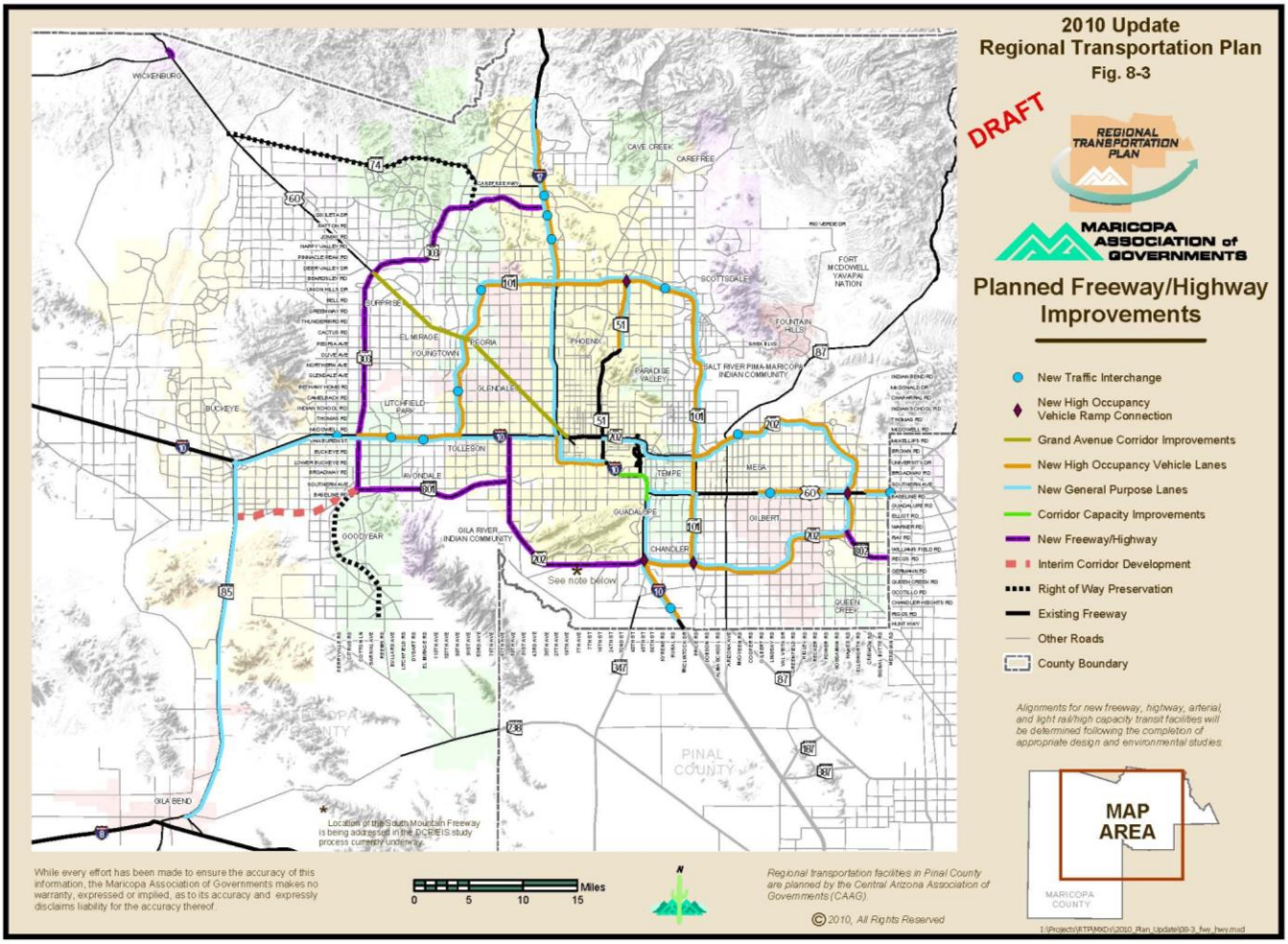
Legend

- 1 General Purpose Lane
- 2 General Purpose Lane
- 3 - 4 General Purpose Lane
- 5 - 6 General Purpose Lane
- 7 - 8 General Purpose Lane

0 1 2 Miles

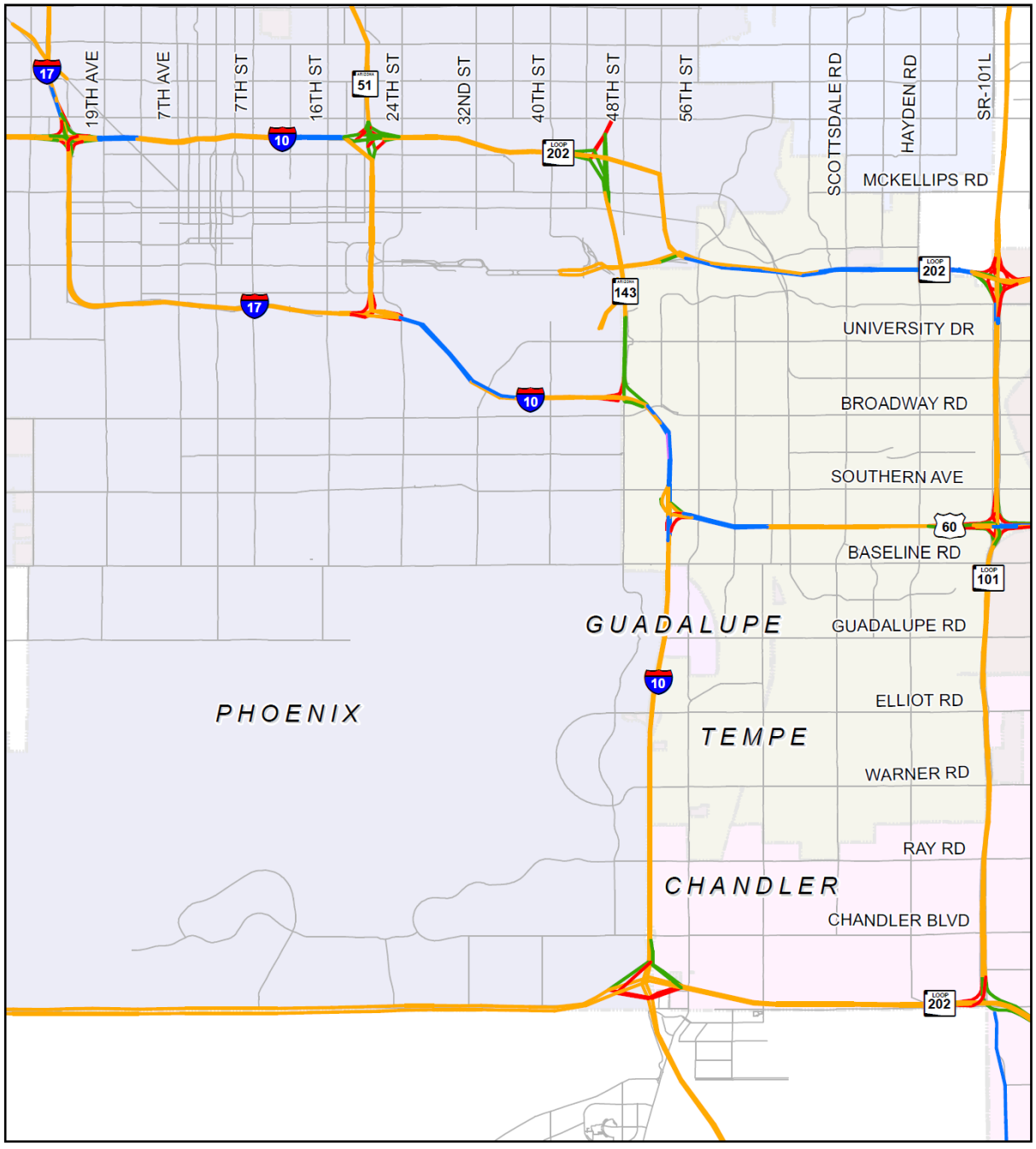
Source: MAG Travel Demand Model, July 2010

Figure 11: RTP Planned Freeway/Highway Improvements



Source: MAG 2010 Update Regional Transportation Plan

Figure 12: 2031 Freeway/Highway System Number of Lanes



Maricopa Association of Governments
Southeast Corridor MIS

2031 Freeway/Highway System Number of Lanes

Legend

- 1 General Purpose Lane
- 2 General Purpose Lanes
- 3 - 4 General Purpose Lanes
- 5 - 6 General Purpose Lanes
- 7 - 8 General Purpose Lanes
- 9 - 10 General Purpose Lanes

0 1 2 Miles

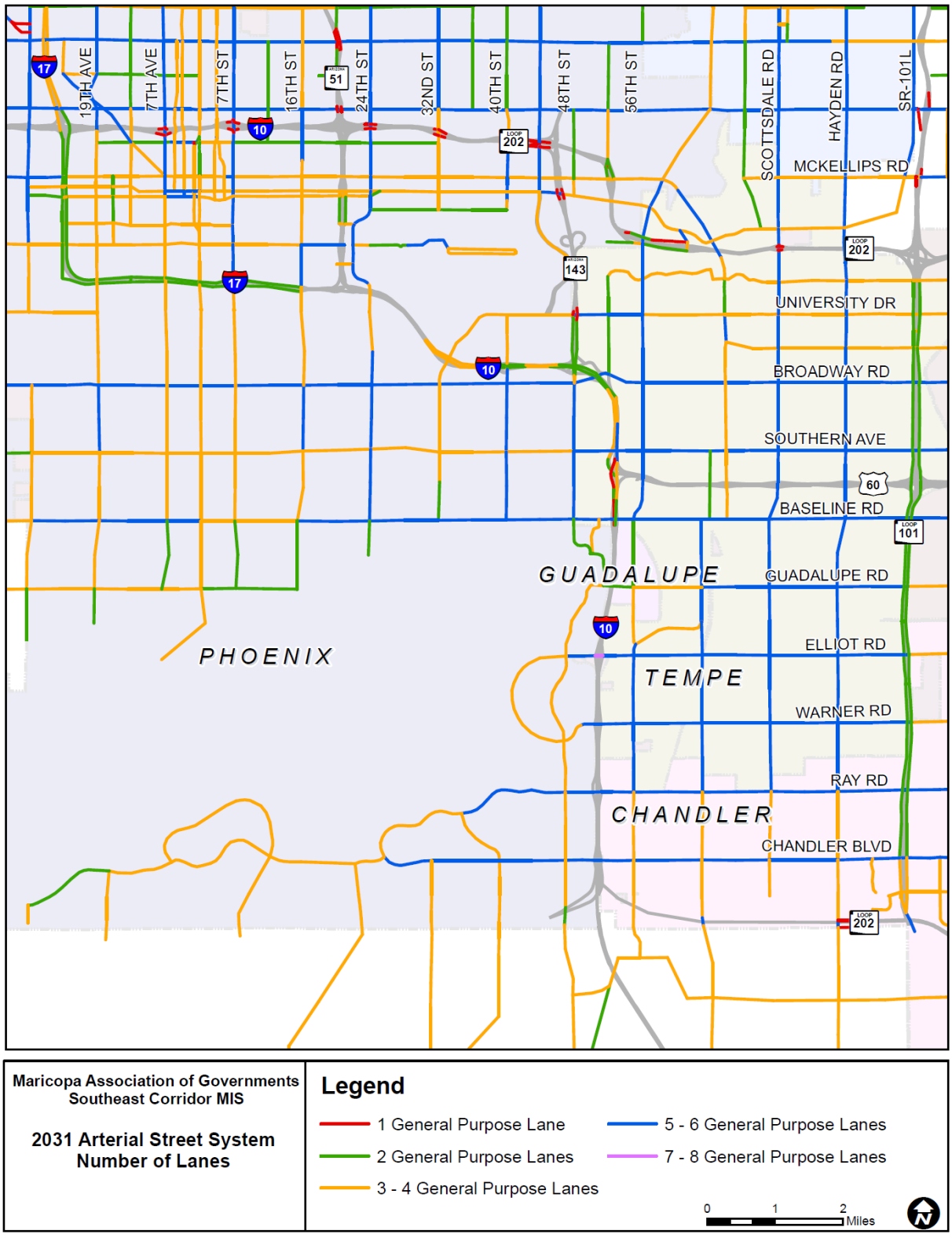
Source: MAG Travel Demand Model, July 2010

3.2.2 Arterial Streets

Five regionally funded arterial street projects identified in the RTP are located within the study area. Four projects are intersection improvements, all of which are located within the City of Chandler. These include the intersection of Chandler Boulevard and Kyrene Road, and the intersections of Ray Road with Kyrene Road, McClintock Road, and Rural Road. The fifth project, Avenida Rio Salado between 51st Avenue and 7th Street, is a new/improved arterial roadway within the City of Phoenix.

In addition to the five regionally funded arterial improvements, additional improvements are planned for the majority of the arterial streets within the study area. **Figure 13** illustrates the total number of through lanes of the 2031 arterial street system, based on the 2031 TDM, and highlights the differences between the 2010 and 2031 systems.

Figure 13: 2031 Arterial Street System Number of Lanes



Source: MAG Travel Demand Model, July 2010

4.0 EXISTING AND PLANNED TRANSIT SERVICES AND FACILITIES

4.1 Existing Transit Services

The existing transit services in the Southeast Corridor Study Area (study area) consist of local bus, circulators, express bus, and light rail. For the purpose of this review, only the routes that directly impact the study area were included in this section. Service frequencies presented in this report were obtained from Valley Metro's Transit Book for July 2010 to January 2011.

Local Bus

A total of 29 local bus routes provide service seven days a week in the study area. On the weekdays, 5 local bus routes operate every 20 minutes or more frequent all day, 8 local bus routes operate 20 minutes or more frequent during peak periods and provide 30-minute off-peak service, while the remaining routes operate 30-minute or less frequent service all day. On the weekends, 14 routes operate 30-minute, all day service, and 15 routes operate all day service less frequent than 30 minutes. **Table 2** shows the service frequencies for all local bus routes that operate in the study area. **Figure 14** illustrates the existing local bus service.

Circulators

Eleven circulator routes operate in the study area with two routes operated by the City of Phoenix and eight routes operated by the City of Tempe. The City of Phoenix operates the Downtown Area Shuttle (DASH), providing service between Central Station (downtown Phoenix) and the State Capitol area. DASH operates Monday through Friday with service every 10 minutes. The City of Phoenix also operates the ALEX route which provides service in Ahwatukee. This route provides service every 60 minutes, seven days a week. The City of Tempe operates three routes around the downtown Tempe/ASU known as FLASH. Service is provided every 10 to 30 minutes, Monday through Friday. In addition, the City of Tempe also operates five other circulator routes branded as Orbit. Service is provided every 15 minutes, Monday through Saturday, and every 30 minutes on Sunday. **Table 3** shows service frequencies for all circulator routes that operate in the study area. The existing circulator routes are shown in **Figure 14.**

Express Bus

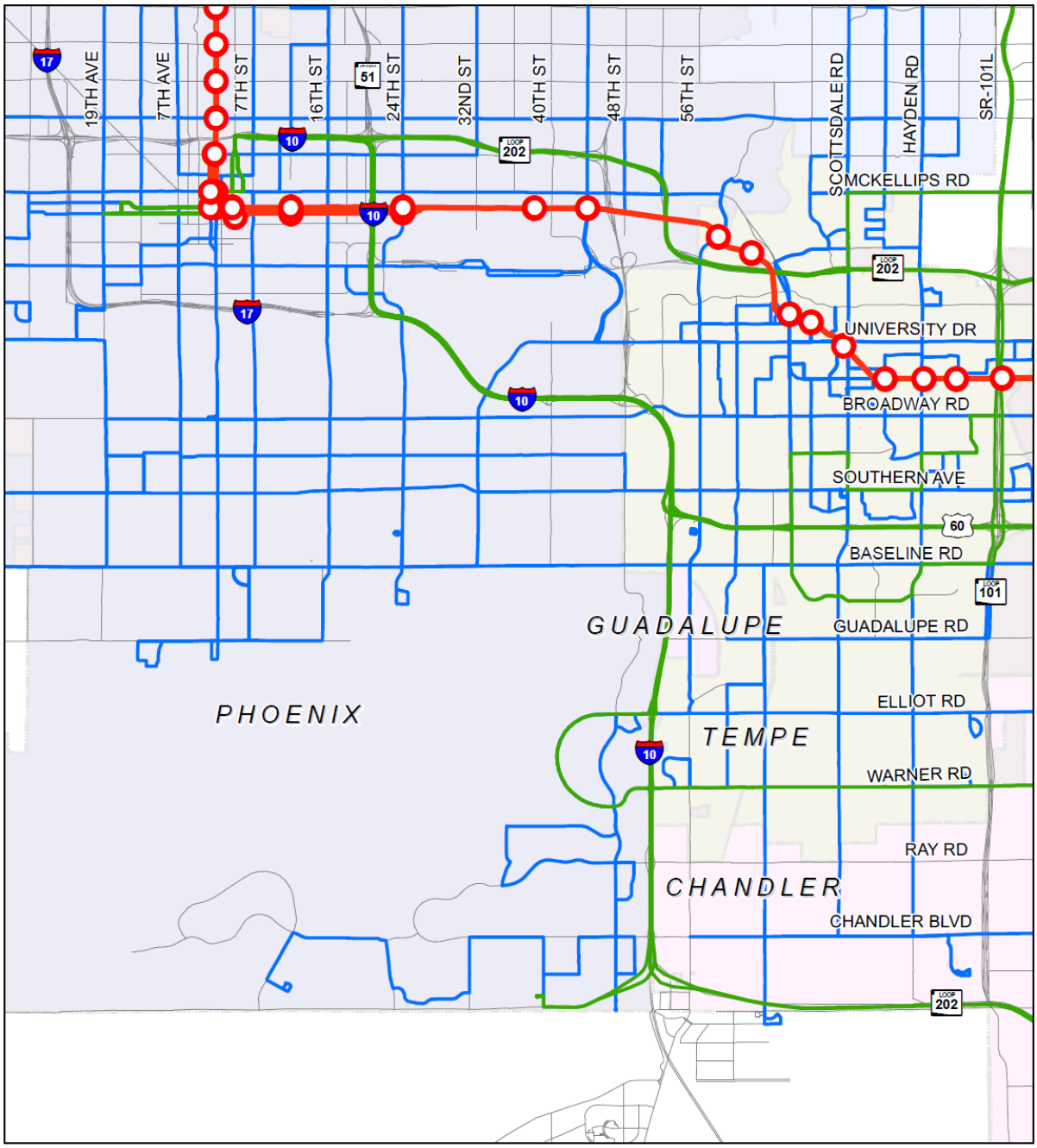
Eleven express bus routes provide service within the study area. Ten of the express routes provide peak period, peak direction service to downtown Phoenix. One route (511) provides two-way, peak period, suburb to suburb service. **Table 4** documents service frequencies for all express routes that operate within the study area, while **Figure 14** illustrates the express route network.

Table 2: Existing Local Bus Service within the Study Area

Route	Description	Weekday Headway (min)		Saturday Headway (min)	Sunday Headway (min)
		Peak	Base		
0	Central	10	20	30	30
1	Washington/Jefferson	45	45	60	60
3	Van Buren	15	15	30	30
7	7th Street	20	30	30	30
8	7th Avenue	30	30	30	30
10	Roosevelt/Grant	30	30	30	30
12	12th Street	30	30	60	60
13	Buckeye	30	30	60	60
15	15th Avenue	30	30	60	60
16	16th Street	15	30	30	30
17	McDowell	15	15	30	30
19	19th Avenue	15	15	30	30
30	University	30	30	30-60	60
40	Apache/Main St	30	30	30	30
44	44th St/Tatum	30	30	45	45
45	Broadway	15-30	30	30-60	30
52	Roeser	30	30	60	60
56	Priest Drive	15	30	30	30
61	Southern	15	30	30	30
62	Hardy/Guadalupe	15	30	30	30
65	Mill/Kyrene	30	30	60	60
66	Mill/68th Street/Kyrene	30	30	60	60
70	Glendale/24th Street	15	30	30	30
72	Scottsdale/Rural	20	20	30	30
76	Miller	30	30	60	60
77	Baseline	30	30	30-60	30-60
81	Hayden/McClintock	15-30	30	60	60
108	Elliot Rd	30-60	30-60	60	60
156	Chandler Blvd/ Williams Field Rd	30	30	30	30

Source: Valley Metro Transit Book (July 2010-January 2011)

Figure 14: Existing Transit Service within the Study Area



Source: Valley Metro Transit Book (July 2010)

Table 3: Existing Circulator Services within the Study Area

Route	Weekday Headway (min)		Saturday Headway (min)	Sunday Headway (min)
	Peak	Base		
DASH	12	12	N/A	N/A
ALEX	60	60	60	60
Orbit - Earth	15	15	15	30
Orbit - Venus	15	15	15	30
Orbit - Mercury	10-15	10-15	15	30
Orbit - Mars	15	15	15	30
Orbit - Jupiter	15	15	15	30
FLASH[1]	9-30	9-30	N/A	N/A

Source: Valley Metro Transit Book (July 2010-January 2011)

Table 4: Existing Express Services within the Study Area

Route	Description	No. of Trips	
		Inbound	Outbound
511	Tempe/Scottsdale Airpark Express	2-AM / 2-PM	2-AM / 2-PM
520	Tempe Express	4	4
521	Tempe Express	7	6
531	Mesa/Gilbert Express	8	7
532	Mesa Express	4	4
533	Mesa Express	5	5
535	Northeast Mesa/Downtown Express	3	3
540	Chandler Express	4	4
541	Chandler Express	5	5
542	Chandler/Downtown Express	5	5
I-10E	RAPID - I-10 East	16	15

Source: Valley Metro Transit Book (July 2010-January 2011)

Light Rail

The Central Phoenix/East Valley Light Rail Line (CP/EV LRT Line) is a 20-mile route that operates within the study area. This route has 28 stations and 8 park-and-ride facilities. The CP/EV LRT Line connects the cities of Phoenix, Tempe, and Mesa with stations in downtown Phoenix, downtown Tempe/ASU, and Phoenix Sky Harbor International Airport. **Table 5** shows current service frequencies for light rail, while **Figure 14** illustrates the existing light rail service corridor.

Table 5: Existing Light Rail Service within the Study Area

Route	Weekday Headway (min)		Saturday Headway (min)	Sunday Headway (min)
	Peak	Base		
Central Phoenix – East Valley	12	20	15-20	20

Source: Valley Metros Transit Book (July 2010-January 2011)

4.2 Planned Transit Services

A variety of transit service improvements are planned for the study area and include local bus/supergrid, express bus, Arterial Bus Rapid Transit (Arterial BRT), and high capacity transit.

Local Bus/Supergrid

According to the Regional Transportation Plan 2007 Update, 10 Supergrid routes are planned to be operated with regional sales tax revenues. Supergrid service is local bus service which provides consistent levels of service through multiple jurisdictions. Nine of the routes currently operate today, while one of the routes (Ray Rd) is a new route. Two routes (Buckeye Rd and Tatum Blvd\44th St) are identified for implementation beyond 2026. Routes postponed beyond 2026 were originally included in the RTP; however, current economic conditions have delayed their implementation or transition to regional funding beyond 2026. Depending upon future economic conditions, regional funding for these routes could be restored. **Table 6** identifies the planned transit headways, and year that each Supergrid route will be funded through regional revenue sources. Planned Supergrid routes are illustrated in **Figure 15**.

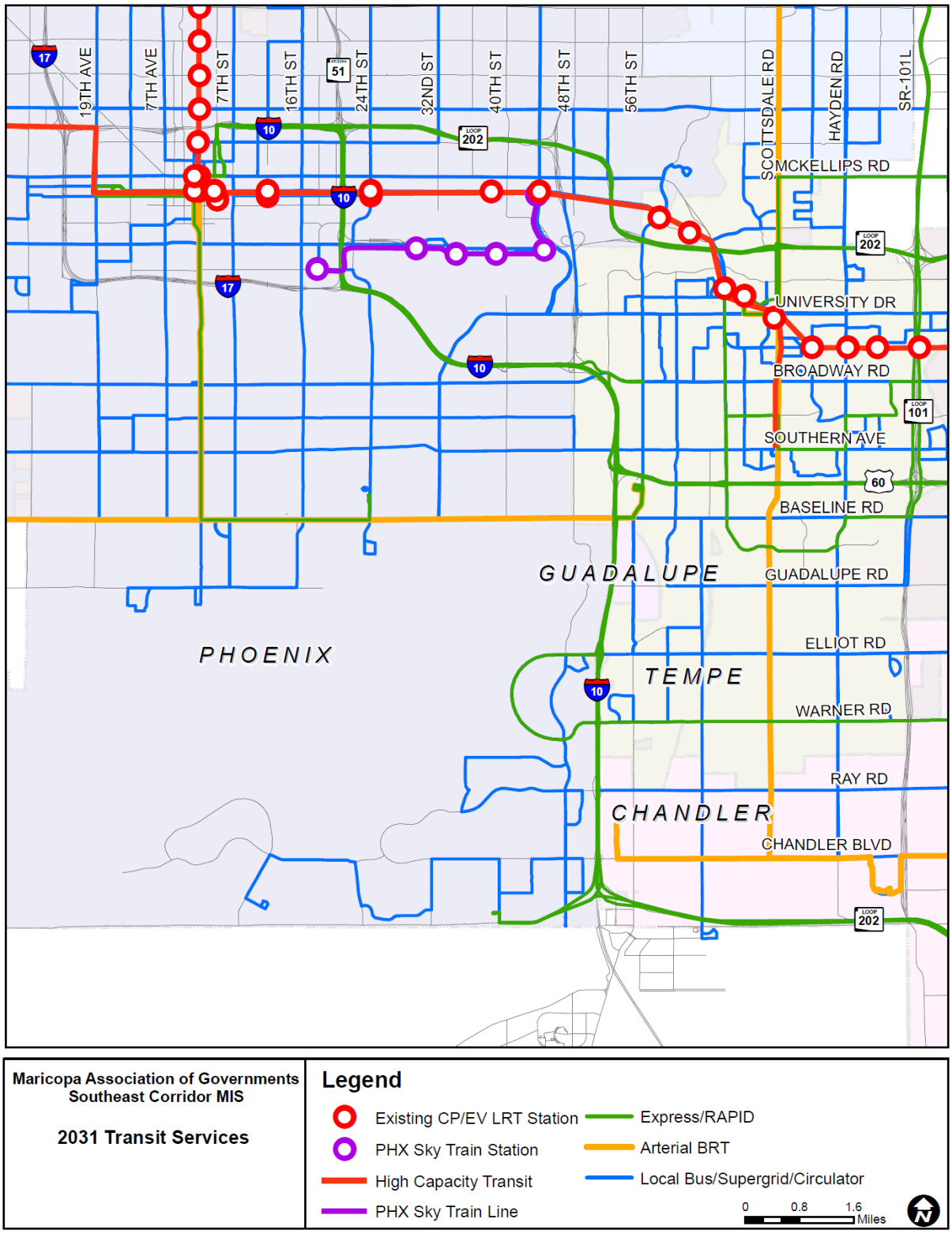
Table 6: Planned Regional Local Bus/Supergrid Service within the Study Area[1]

Supergrid	Weekday Headway (min)		Saturday Headway (min)	Sunday Headway (min)	Fiscal Year of Operation
	Peak	Base			
Elliot Road	30	30	60	60	2013
McDowell/McKellips Road	15	30	30	30	2014
Baseline Road	30	30	30	30	2015
University Drive	15	30	60	60	2016
Broadway Avenue	15	30	30	30	2018
Hayden/McClintock	15	30	60	60	2021
Van Buren	15	30	30	30	2021
Ray Road	30	30	60	60	2023
Buckeye Road	N/A	N/A	N/A	N/A	Beyond 2026
Tatum Boulevard/44th Street	N/A	N/A	N/A	N/A	Beyond 2026

Source: Regional Transportation Plan, 2010 Update; TLCP Final Report, 2010

[1]Includes regionally funded transit service improvements only

Figure 15: Planned Transit Service within the Study Area



Source: MAG RTP and Valley Metro Transit Life Cycle Program, 2010

Express Bus

Eight new express bus routes are planned for study area. One route is planned to operate by 2015 with a total of 48 daily trips. The remaining routes are planned to be implemented beyond 2026. **Table 7** identifies the planned express bus routes and **Figure 15** depicts the planned express bus routes.

Table 7: Planned Express Bus within the Study Area[1]

Express Bus	No. of Trips		Fiscal Year of Operation
	Inbound	Outbound	
South Central Express	24	24	2015
Apache Junction Express	N/A	N/A	Beyond 2026
Superstition Freeway Connector	N/A	N/A	Beyond 2026
Pima Express	N/A	N/A	Beyond 2026
Ahwatukee Connector	N/A	N/A	Beyond 2026
Santan Express	N/A	N/A	Beyond 2026
Red Mountain Freeway Connector	N/A	N/A	Beyond 2026
Superstition Springs Express	N/A	N/A	Beyond 2026

Source: Regional Transportation Plan, 2010 Update; TLCP Final Report, 2010
[1]Includes regionally funded transit service improvements only

Arterial BRT

Three new Arterial BRT routes are identified in the study area. Arterial BRT is a branded, limited stop bus route that has enhanced stations and takes advantage of queue jumper lanes, signal priority, or other travel time saving methods. The planned Arterial BRT routes are designed to feed into existing or planned high capacity transit. **Table 8** identifies the planned Arterial BRT routes within the study area. **Figure 15** shows the planned Arterial BRT service. Two of the routes have been postponed to a year beyond 2026.

Table 8: Planned Arterial BRT within the Study Area[1]

Arterial BRT	Weekday Headway (min)		Number of Daily Trips	Fiscal Year of Operation
	Peak	Base		
Scottsdale/Rural Road Arterial BRT	30	30	48	2016
South Central Avenue Arterial BRT	N/A	N/A	N/A	Beyond 2026
Chandler Boulevard Arterial BRT	N/A	N/A	N/A	Beyond 2026

Source: Regional Transportation Plan, 2010 Update; TLCP Final Report, 2010
[1]Includes regionally funded transit service improvements only

High Capacity Transit

Three high capacity transit corridors are identified within the study area. The Tempe South corridor would provide service from downtown Tempe/ASU to the south. The Phoenix West corridor would provide service between downtown Phoenix and West Phoenix. PHX Sky Train is an automated people mover that is planned to provide a transit connection between the 44th/Washington Street LRT Station and Phoenix Sky Harbor International Airport. PHX Sky Train will be implemented in two phases, with the first phase connecting the 44th/Washington Street LRT Station to Terminal 4. By 2020, PHX Sky Train will have stations at Terminal 3, a future terminal, and the rental car center. **Table 9** and **Figure 15** identify the planned high capacity transit services within the study area. Planning work is concurrently ongoing for the Tempe South and Phoenix West corridors and final HCT station locations have not been defined yet; therefore, the stations for these corridors are not depicted in **Figure 15**.

Table 9: Planned High Capacity Transit within the Study Area

High Capacity Transit	Fiscal Year of Operation
Tempe South	2017
Phoenix West (I-10 West)	2021
PHX Sky Train - Stage 1	2013
PHX Sky Train - Stage 2	2020

Source: METRO, 2010; Phoenix International Airport, 2010

5.0 Transportation System Performance

Understanding how existing transportation infrastructure and services are performing today along with projected travel demand is invaluable for identifying overall transportation system deficiencies and needs. Existing performance of the study area's highway, arterial street, and transit networks is documented in this chapter. All reported data is sourced from previously completed studies or from agency provided performance reports.

5.1 Existing Roadway Performance

Recurring weekday congestion in the Study Area has been well documented by the Maricopa Association of Governments (MAG). Three particular documents that have recently quantified congestion in the corridor are the: 1) 2006 MAG Freeway Level of Service Study; 2) 2007 MAG Regional Travel Time and Speed Study; and 3) MAG 2010 Update Regional Transportation Plan (RTP). The first two studies involved the collection and analysis of field data related to traffic operations and the third included simulation analysis using the regional MAG Travel Demand Model (MTDM). From these sources four separate performance measures are available to quantify existing roadway performance. These measures include freeway level of service, freeway travel times and speed, freeway bottle necks, and intersection level of service.

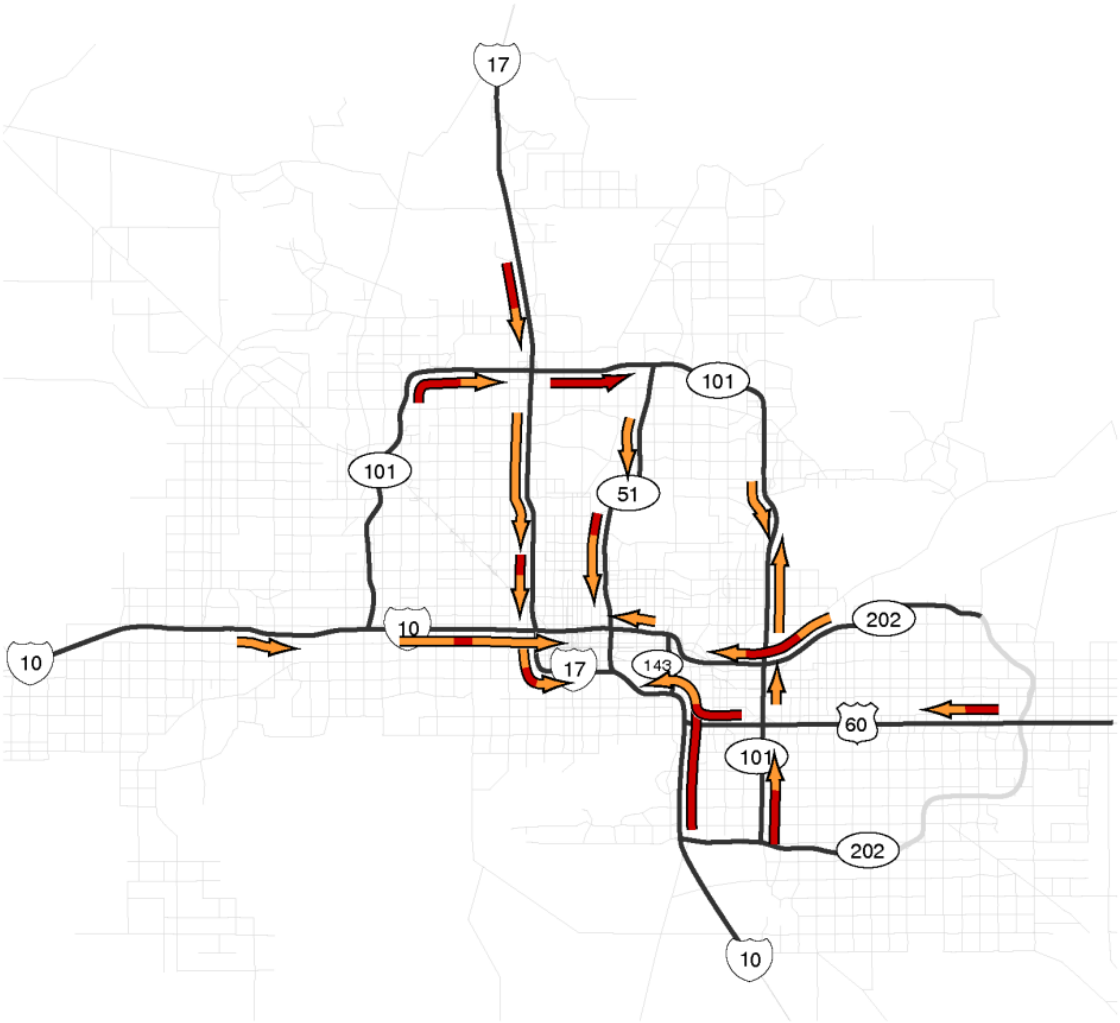
2006 MAG Freeway Level of Service Study

This study involved the analysis of aerial photography shot during morning and afternoon periods to record traffic densities on freeways in the region. The densities were then correlated to speed and level of service. **Figures 16** and **17** illustrate the congested freeway locations identified in the AM and PM peak hours by the study.

As can be seen, every freeway within the Southeast Corridor study area experiences recurring congestion. The report goes on to discuss in light detail the locations and potential causes of congestion in these corridors, and makes comparisons to the results of a study performed for the same study area in 2001 using the same methods. The report also contains detailed level of service results for each photographed freeway in map and tabular forms, including levels of service in 30-minute time intervals during the morning and afternoon periods, 5:30 to 9:30 a.m. and 3:00 to 7:00 p.m., respectively.

Figure 16: AM Congested Locations (2006 MAG Freeway Level of Service Study)

Locations Where Congestion was Found
Morning (5:30 - 9:30 a.m.)

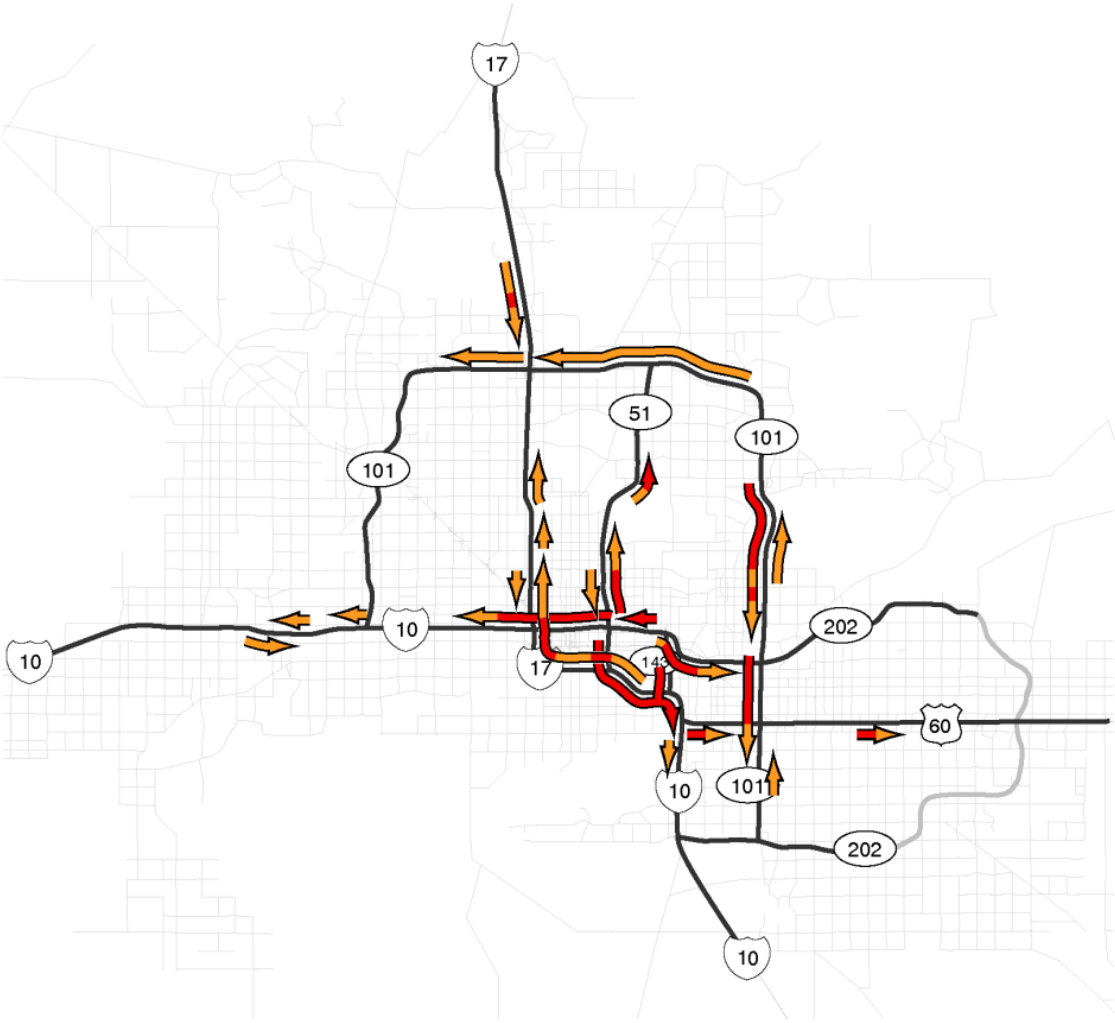


Legend

- Congested flow (Estimated average speed 30-50 mph)
- Congested flow (Estimated average speed < 30 mph)

Figure 17: PM Congested Locations (2006 MAG Freeway Level of Service Study)

Locations Where Congestion was Found
Evening (3:00 - 7:00 p.m.)



Legend

Congested flow (Estimated average speed 30-50 mph)

Congested flow (Estimated average speed < 30 mph)

2007 MAG Regional Travel Time and Speed Study

This study was performed to provide data to validate and calibrate the regional MTDM and to provide trend analysis in speed and delay on the region's roadway network. Both freeways and arterials were included in this study. The study included an extensive number of travel time and delay field runs (using the "floating car method"). This study provides a detailed and comprehensive view of average daily traffic operations within the MAG region. **Figures 18** and **19** are figures directly from the study that highlight the regional freeway delay, and **Figures 20** and **21** illustrate the average travel speeds on the freeway sections. The results are fairly consistent with the findings of the *2006 MAG Freeway Level of Service Study* already discussed and further illustrate the existing congestion within the corridor.

The study collected separate data for the freeway HOV lanes. The study verified that somewhat, but not drastically, higher average speeds are experienced on the HOV facilities than the general freeway during peak hours as illustrated in **Figures 22** and **23**.

The study also collected travel time and speed data for the regional arterial network. This study includes extensive information about travel time in the region with segment specific travel time information. Maps and tables illustrating travel times, delay, speeds, level of service, and stopped delay are included. On an arterial network it is generally the nodes (intersections) that are the primary source of delay. **Figures 24**, **25**, and **26** are examples from the report that illustrate the level of service (LOS) of the arterial intersections within the study area. Per the report, the following methodology was used for determining LOS:

Delay calculations were provided for through vehicles only. No analyses were conducted for turning movements. The delay in seconds was then compared with the Highway Capacity Manual, Transportation Research Board, 2000, Exhibit 16-2, criteria for level of service (LOS) for signalized intersections. These criteria categorize vehicle delay into levels of service ranging from LOS A, meaning less than or equal to 10 seconds of delay, to LOS F, meaning more than 80 seconds of delay.

As such, it is not the typical definition of intersection LOS (no turning movements); however, the LOS findings reveal congested intersections in the study area. Through traffic at numerous intersections within the Southeast Corridor Study Area experiences significant delay in the morning peak hours, although it is moving in a coordinated traffic signal system. In the afternoon peak hours, through traffic at even more intersections begins to experience delay including some severe delays, especially on arterials that feed the freeway system. Such delays are not experienced in the mid-day hours indicating that the congestion is primarily a peak-hour problem.

Figure 18: AM Average Freeway Segment Delay per Mile (2007 MAG Travel Time and Speed Study)

Figure 50 - Average Freeway Segment Delay per Mile – AM

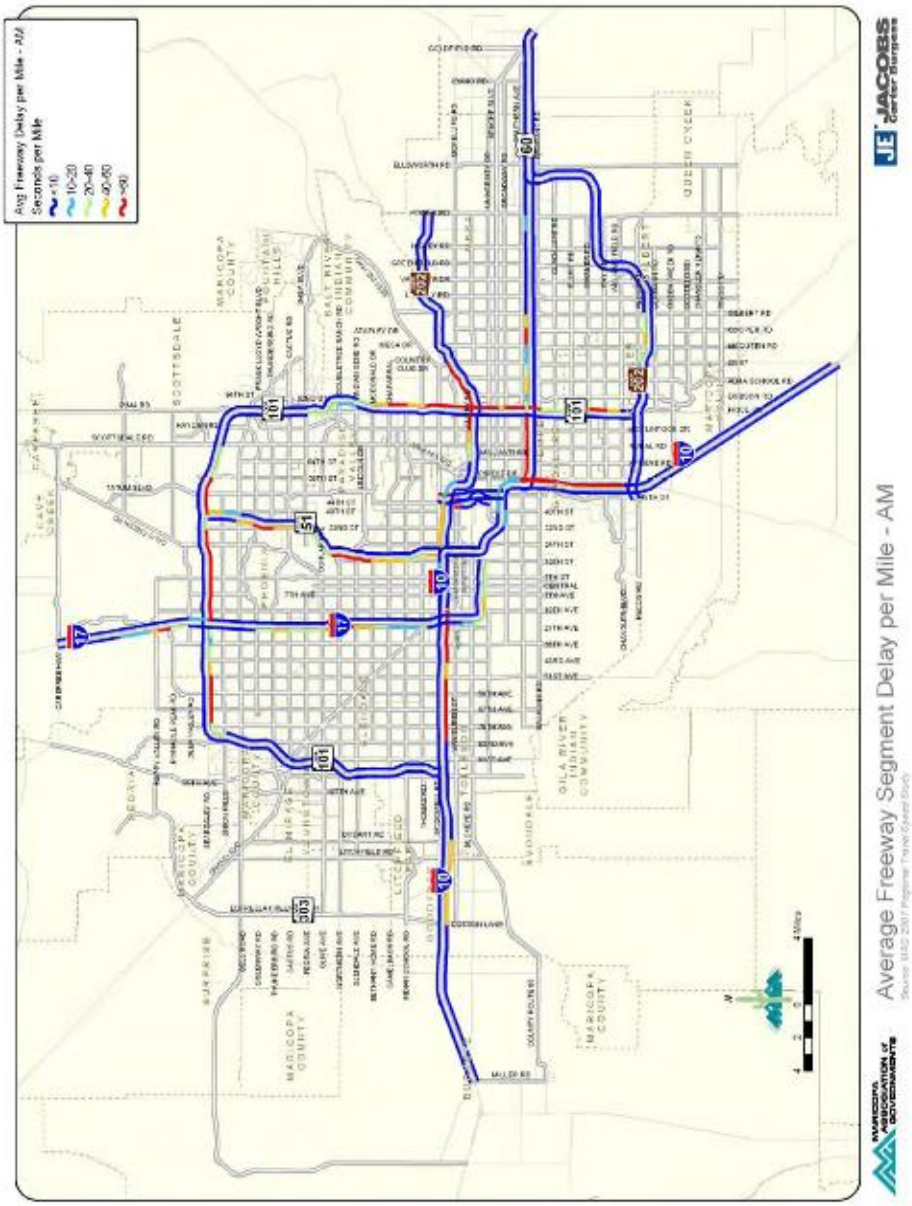


Figure 19: PM Average Freeway Segment Delay per Mile (2007 MAG Travel Time and Speed Study)

Figure 52 - Average Freeway Segment Delay per Mile – PM

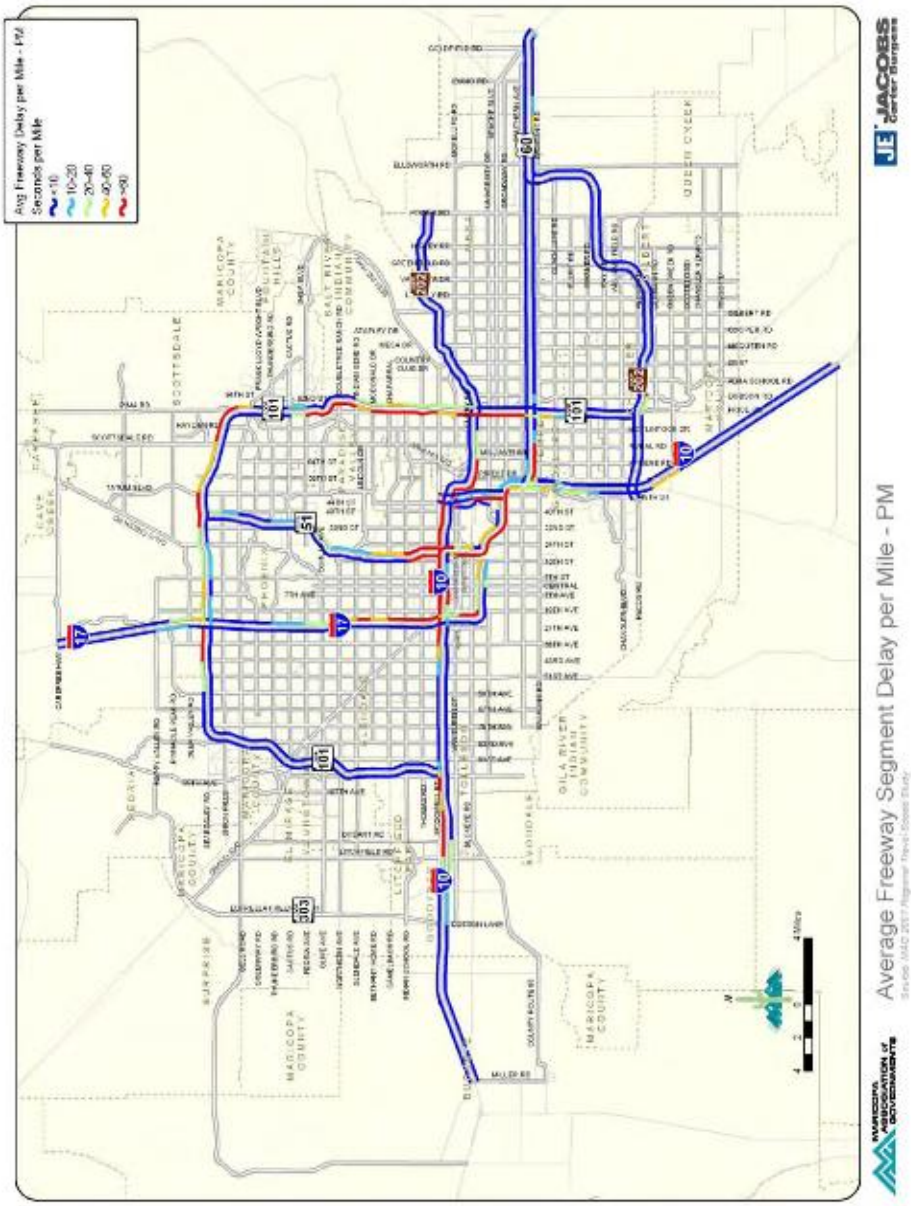


Figure 20: AM Average Freeway Speed (2007 MAG Travel Time and Speed Study)

Figure 23 - Average Freeway Speed - AM

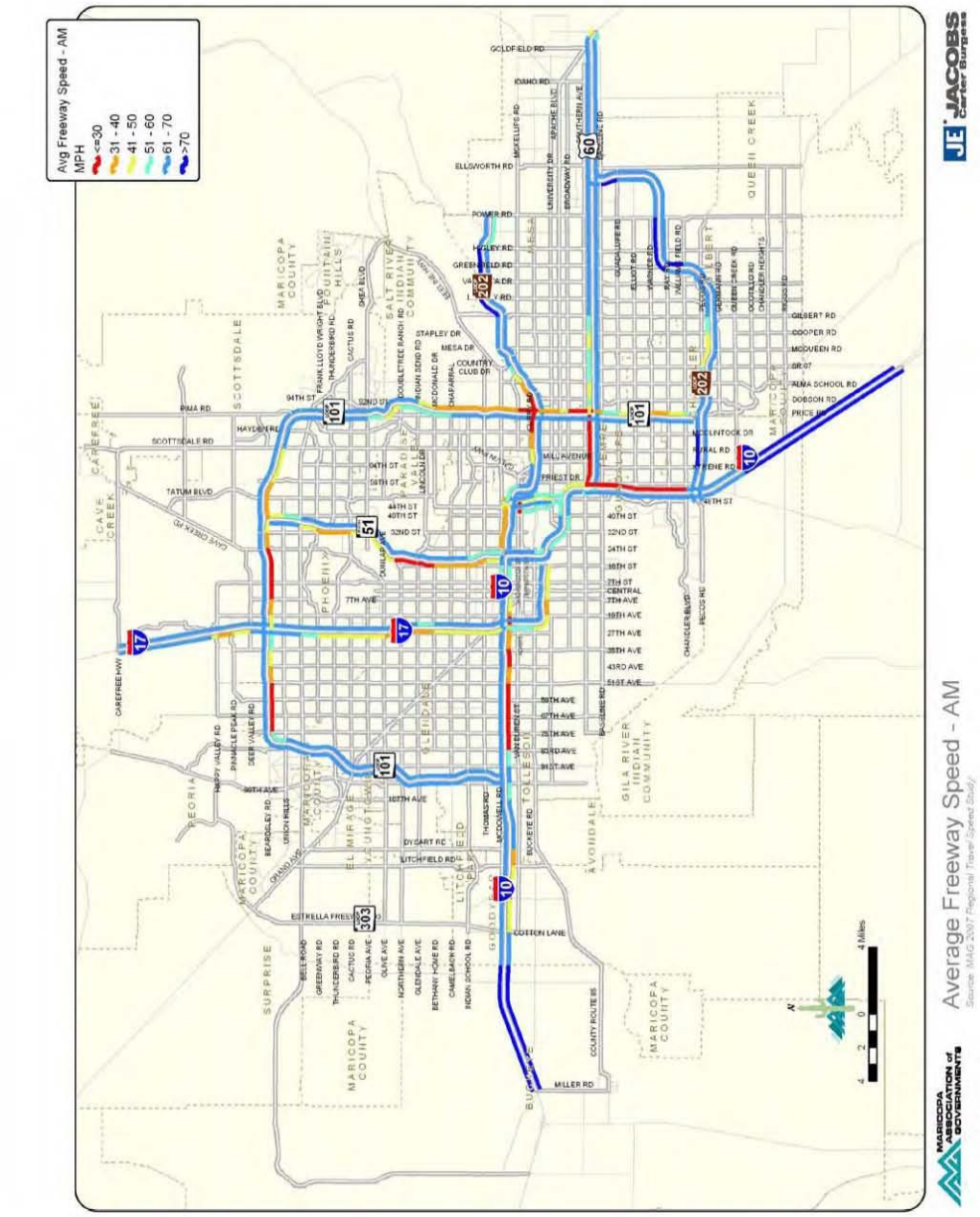


Figure 21: PM Average Freeway Speed (2007 MAG Travel Time and Speed Study)

Figure 25 – Average Freeway Speed – PM

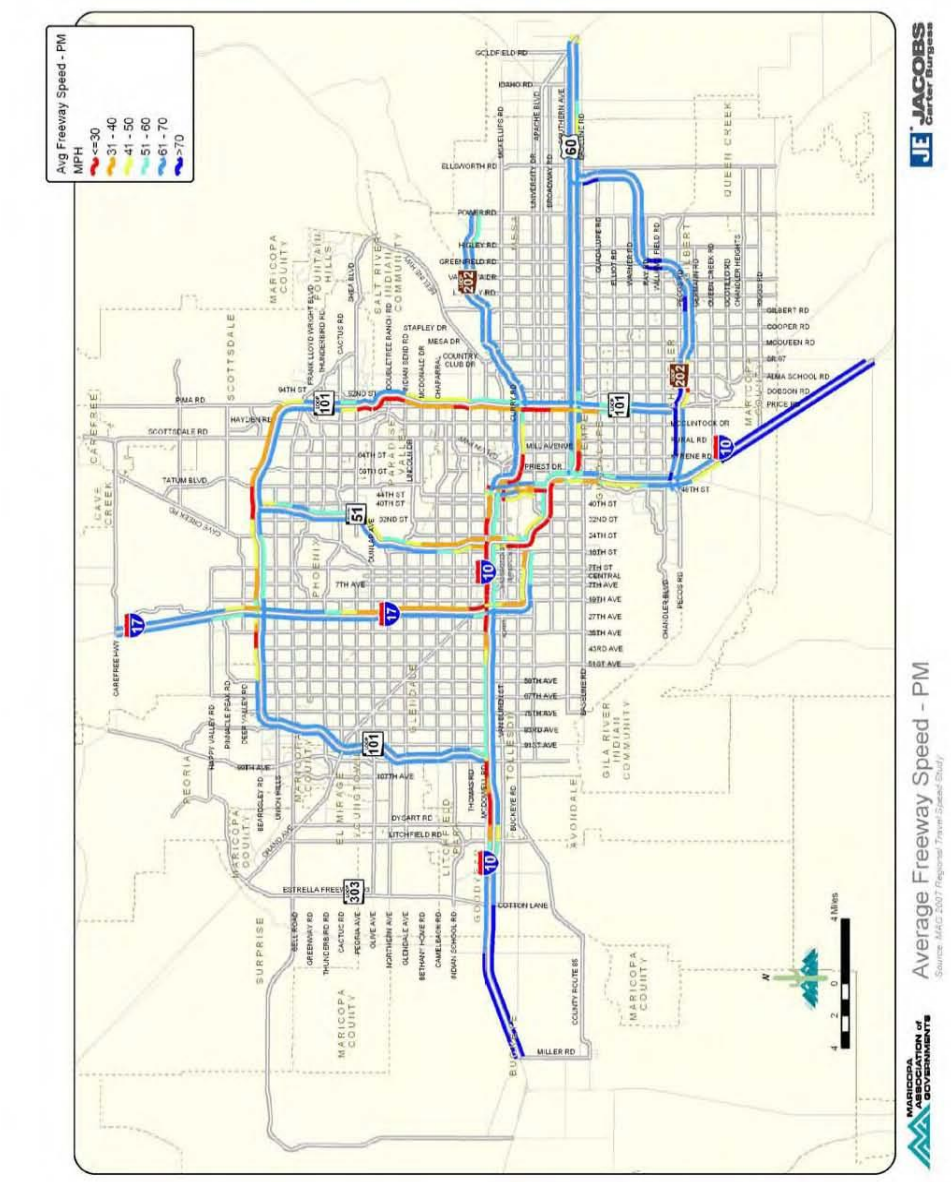


Figure 22: AM Average HOV Speed (2007 MAG Travel Time and Speed Study)

Figure 26 - Average HOV Speed - AM

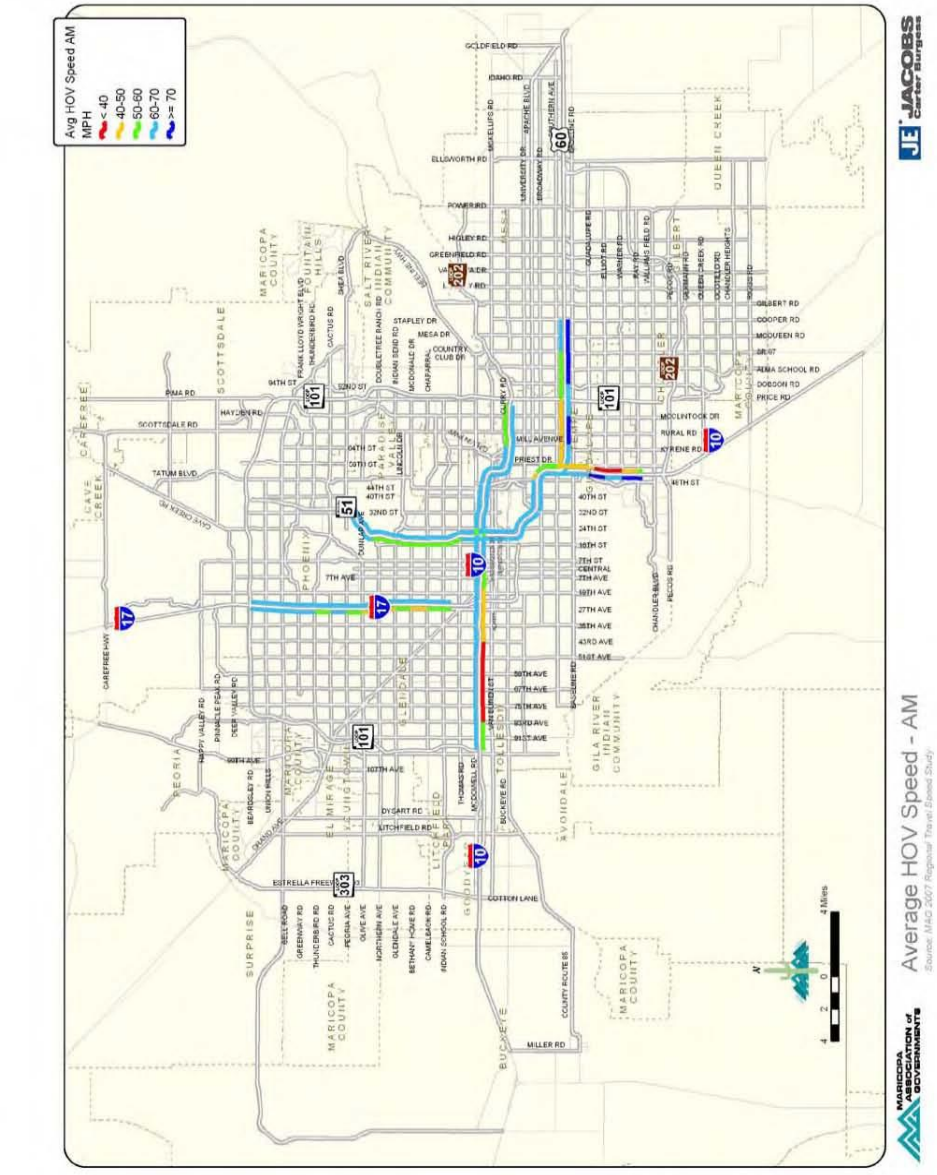


Figure 23: PM Average HOV Speed (2007 MAG Travel Time and Speed Study)

Figure 27 - Average HOV Speed - PM

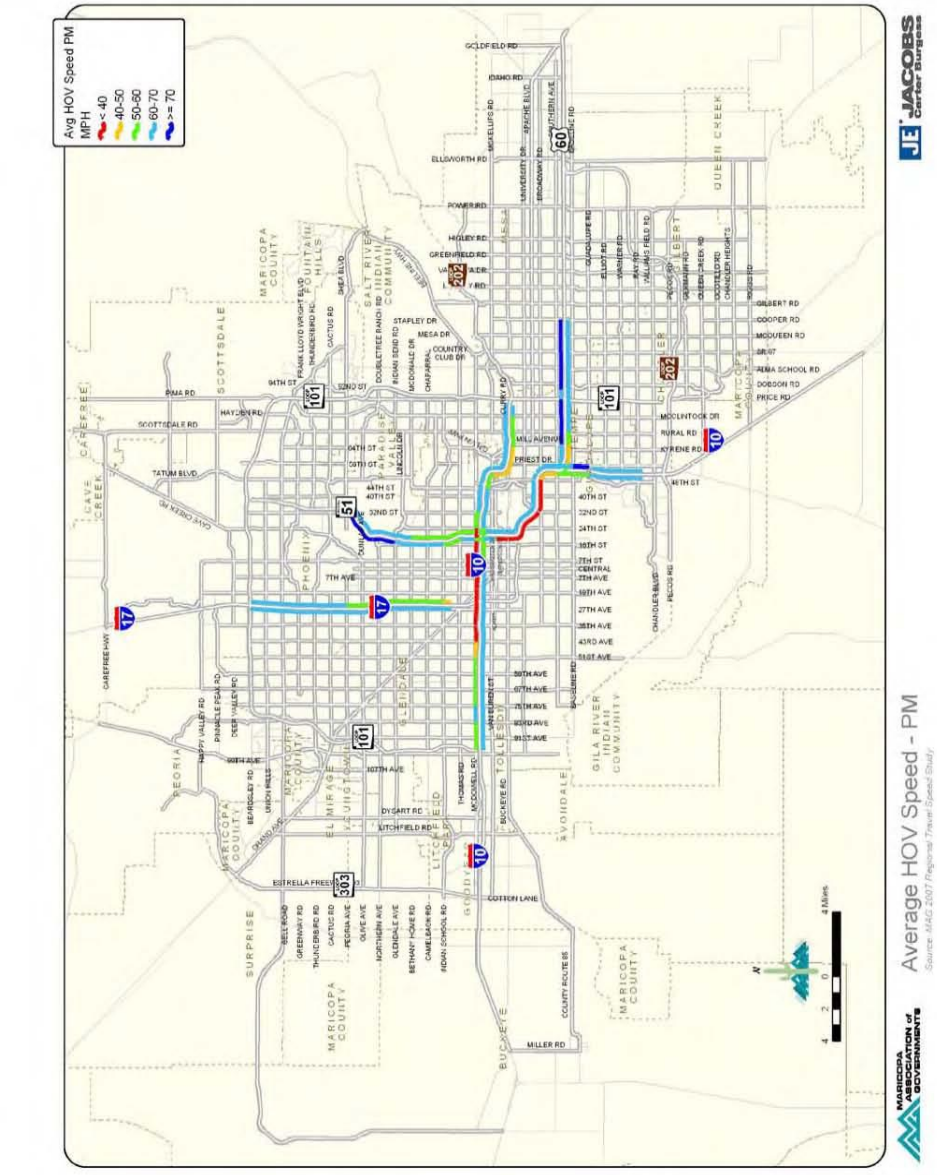


Figure 24: AM Intersection Level of Service (2007 MAG Travel Time and Speed Study)

Figure 53 – Intersection LOS – AM

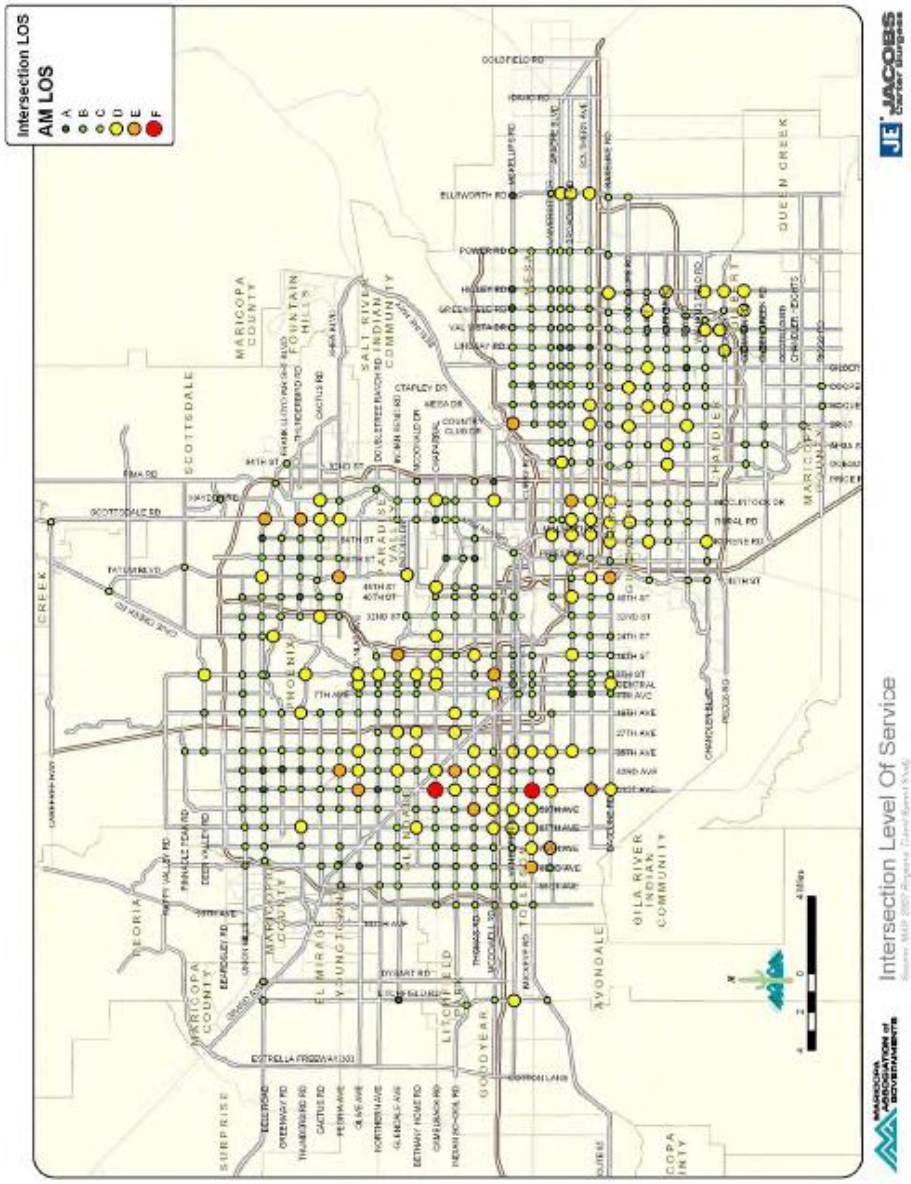


Figure 25: Mid-day Intersection Level of Service (2007 MAG Travel Time and Speed Study)

Figure 54 – Intersection LOS – Mid-Day

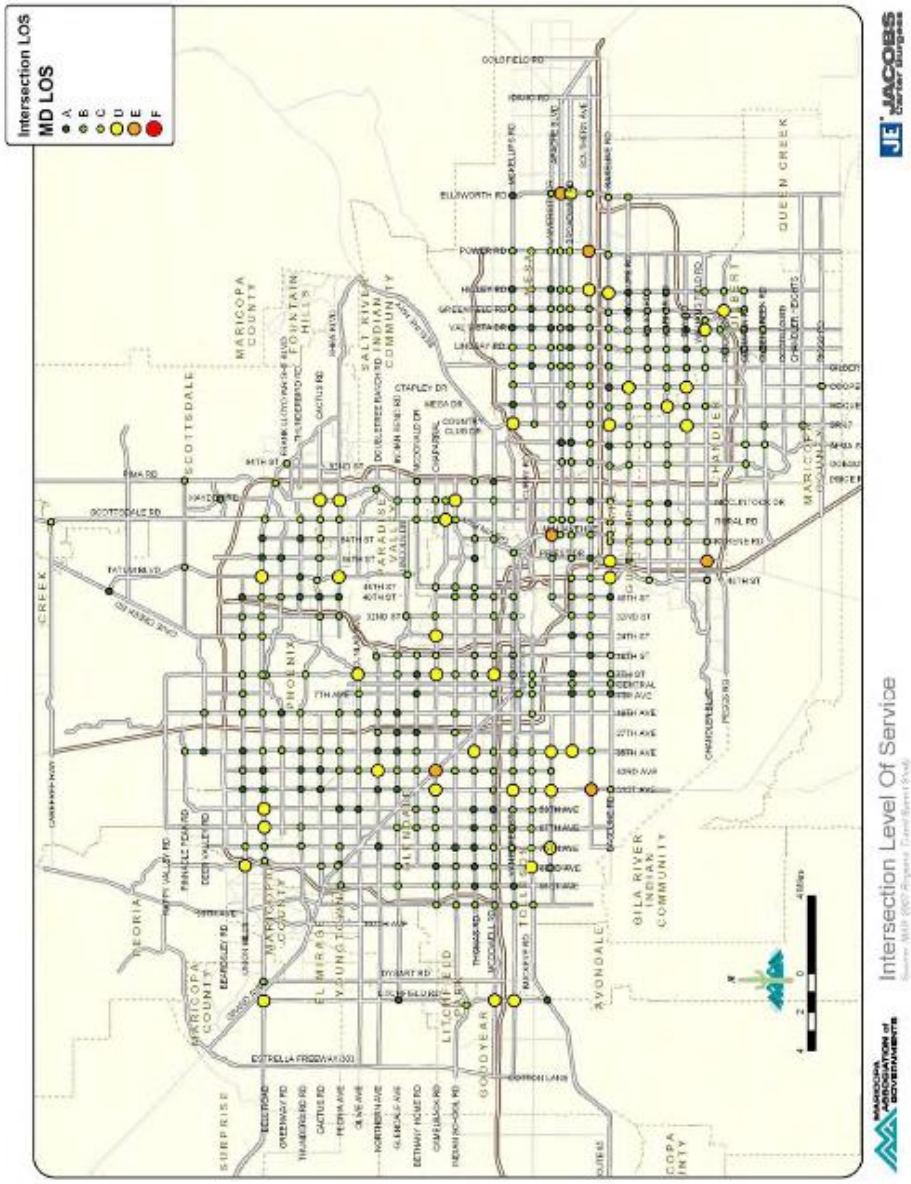
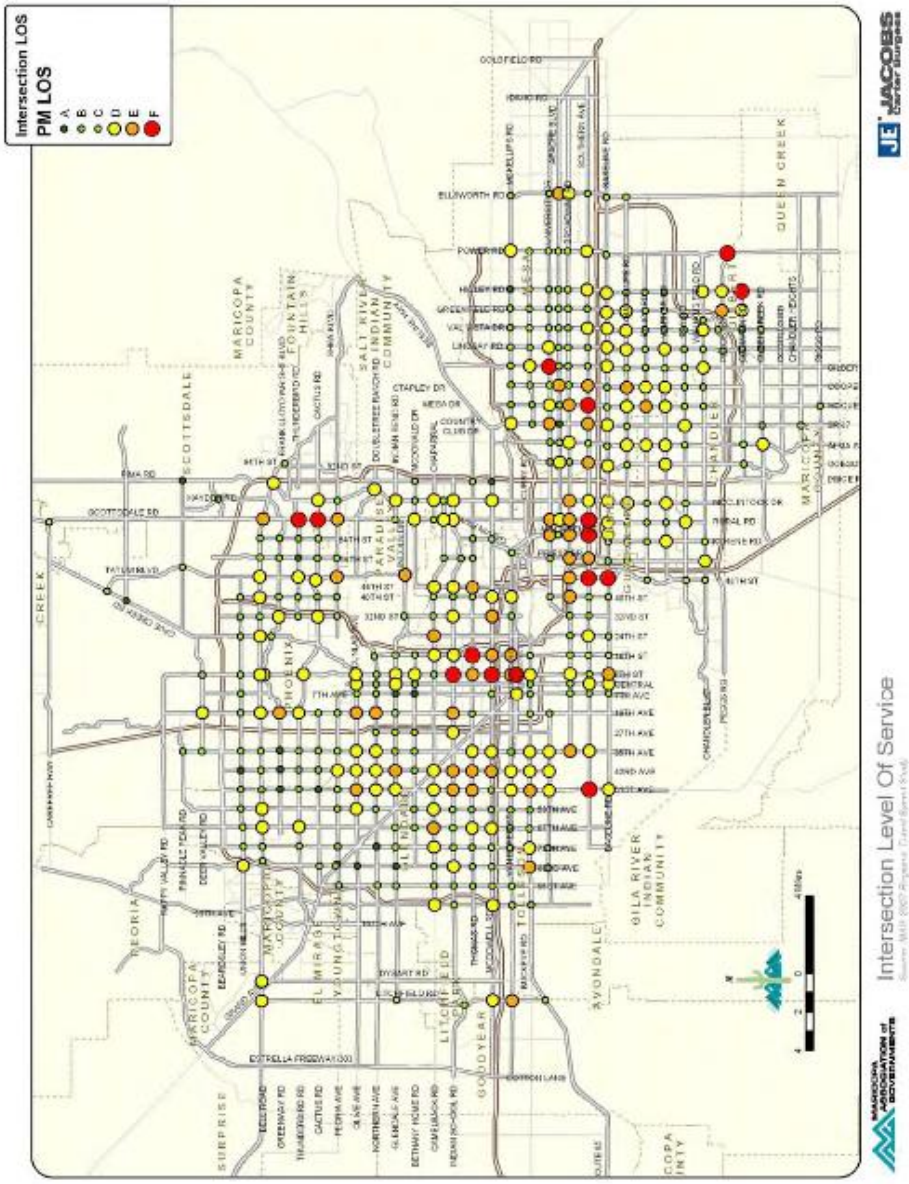


Figure 26: PM Intersection Level of Service (2007 MAG Travel Time and Speed Study*)*

Figure 55 – Intersection LOS – PM



MAG 2010 Update Regional Transportation Plan (RTP)

For the development of the RTP, MAG performed travel demand model simulations of the traffic performance of the regional roadway network based on 2008 travel demand and 2030 travel demand forecasts. This is the only document of the three discussed herein that addresses future conditions.

The following figures (**Figures 27** through **Figure 30**) provide a summary of the findings with respect to congestion in terms of level of service in the network for the afternoon (PM) peak hours of travel. For the freeways in the Southeast Corridor study area, significant congestion (LOS E & F) is shown to exist in 2008 for all freeways within the corridor, which is consistent with the other two studies discussed. By 2030, freeway congestion levels are predicted by the model to worsen significantly, which is not surprising given that population forecasts in the region predict that population will double between 2000 and 2030.

Similar findings can be seen from the arterial intersection level of service findings which indicate that several intersections currently experience LOS of E & F during the PM peak period, and a major increase in the number of congested intersections will occur between now and 2030 even with the arterial improvements included in the current RTP.

Figure 27: 2008 Freeway Level of Service E and F (MAG RTP)

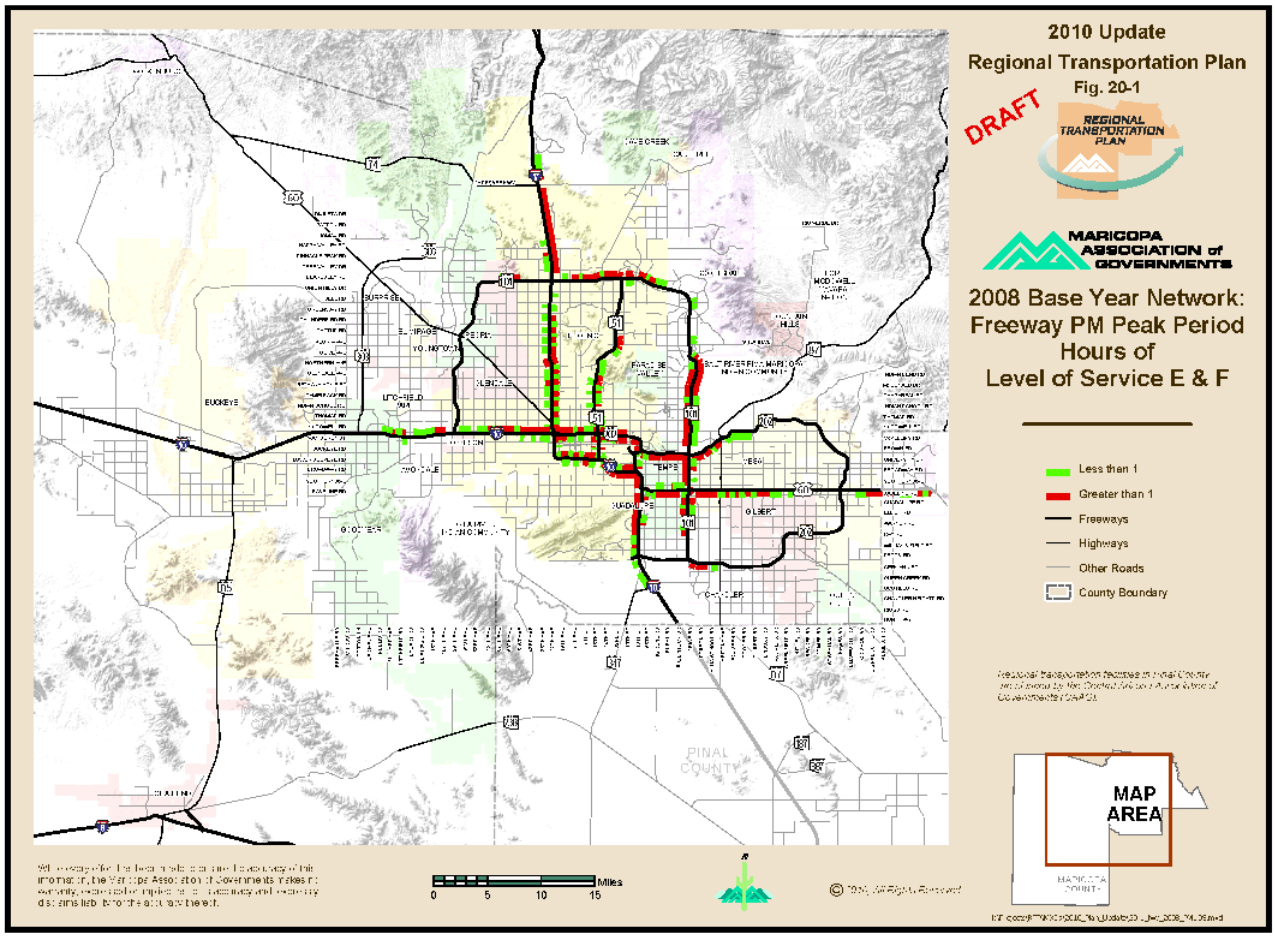


Figure 28: 2030 Freeway Level of Service E and F (MAG RTP)

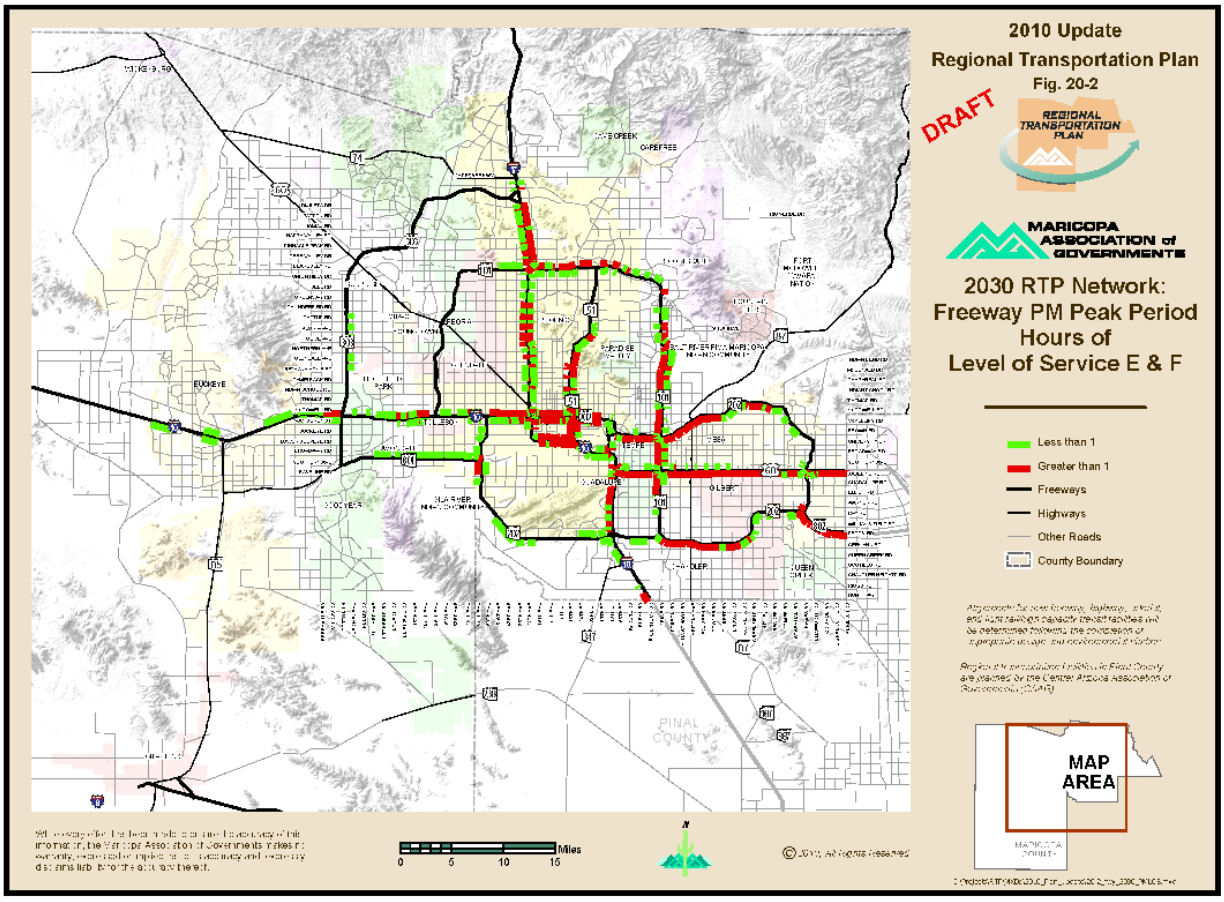


Figure 29: 2008 PM Intersection Level of Service E and F (MAG RTP)

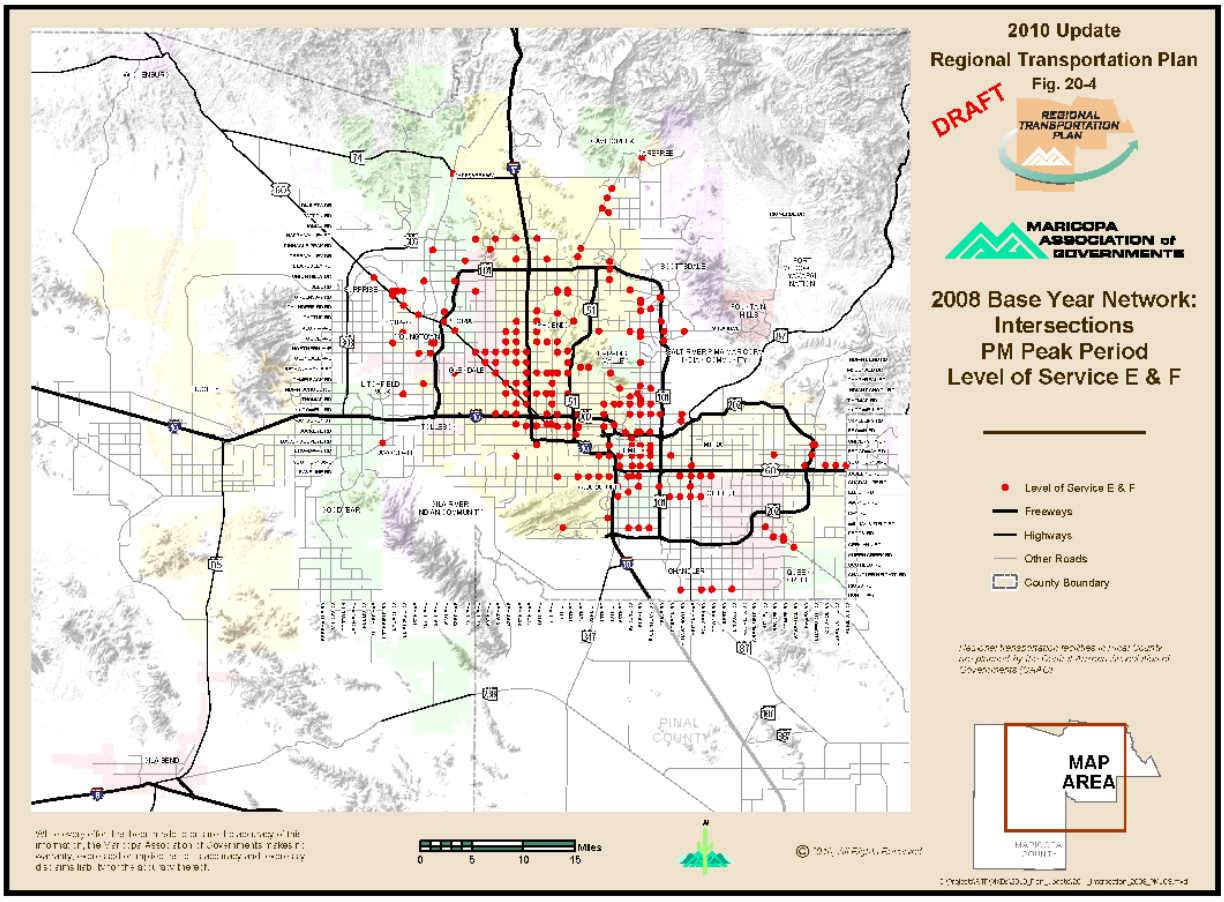
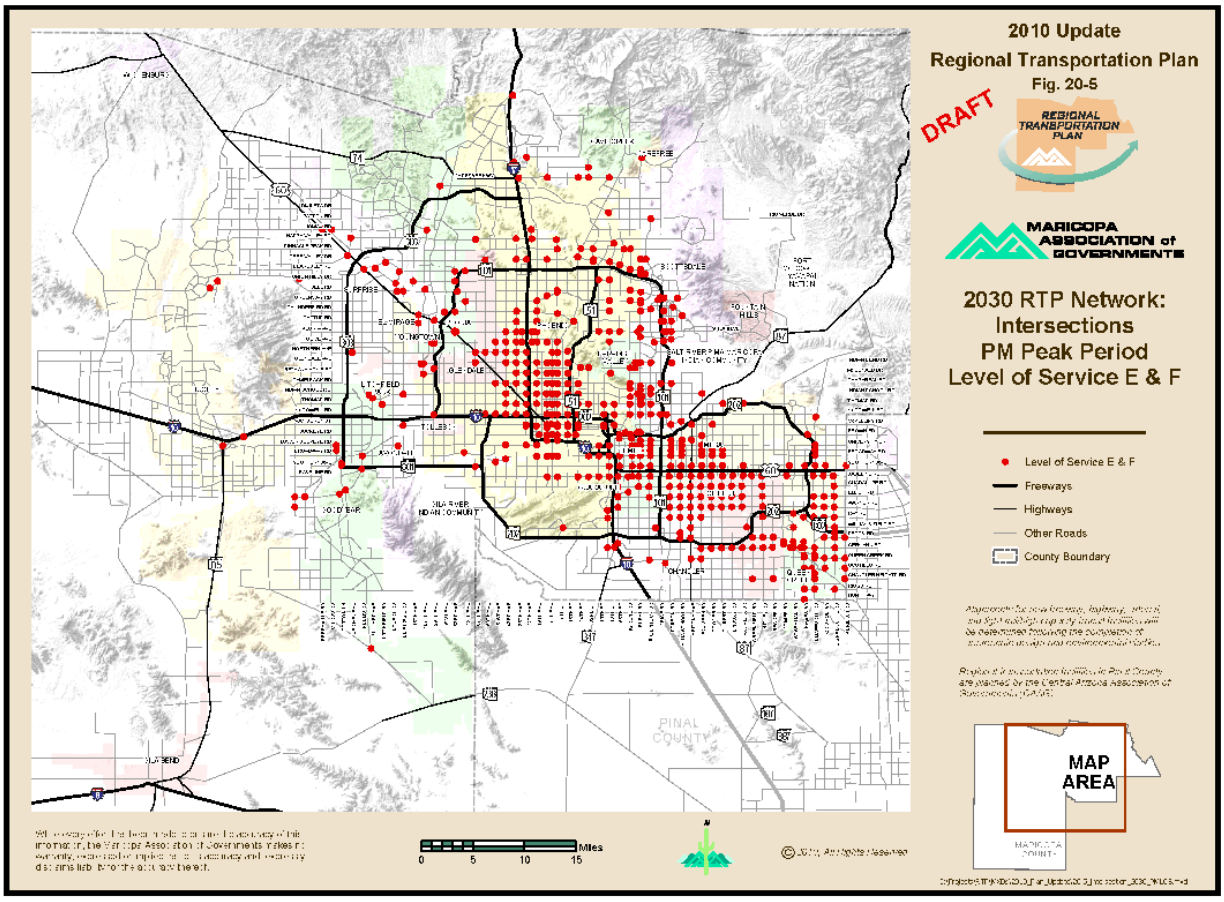


Figure 30: 2030 Intersection Level of Service for 2030 RTP Network (MAG RTP)



Additional Freeway Bottleneck Information

Based on the 2007 MAG Regional Travel Time and Speed Study data, and the ADOT FMS, the following maps (**Figures 31** and **32**) were generated by MAG, which highlights the regional freeway recurring bottleneck locations. These maps indicate that there are segments within the I-10 and US 60 corridors located within the study area that are experiencing traffic delays between 30 and 120 minutes in duration with person hour delays as high has 600 to 900 person hours per mile. The most significant delays are found on I-10 northbound between Chandler Blvd and US 60 and on US 60 westbound between Mill Ave and Priest Dr during the AM peak period. During the PM peak period, the most significant bottle necks in the study area are on I-10 eastbound between I-17 and Guadalupe Rd and on eastbound US 60 between I-10 and Rural Rd.

Figure 31: 2007 MAG Freeway Bottleneck Locations – AM Peak Period

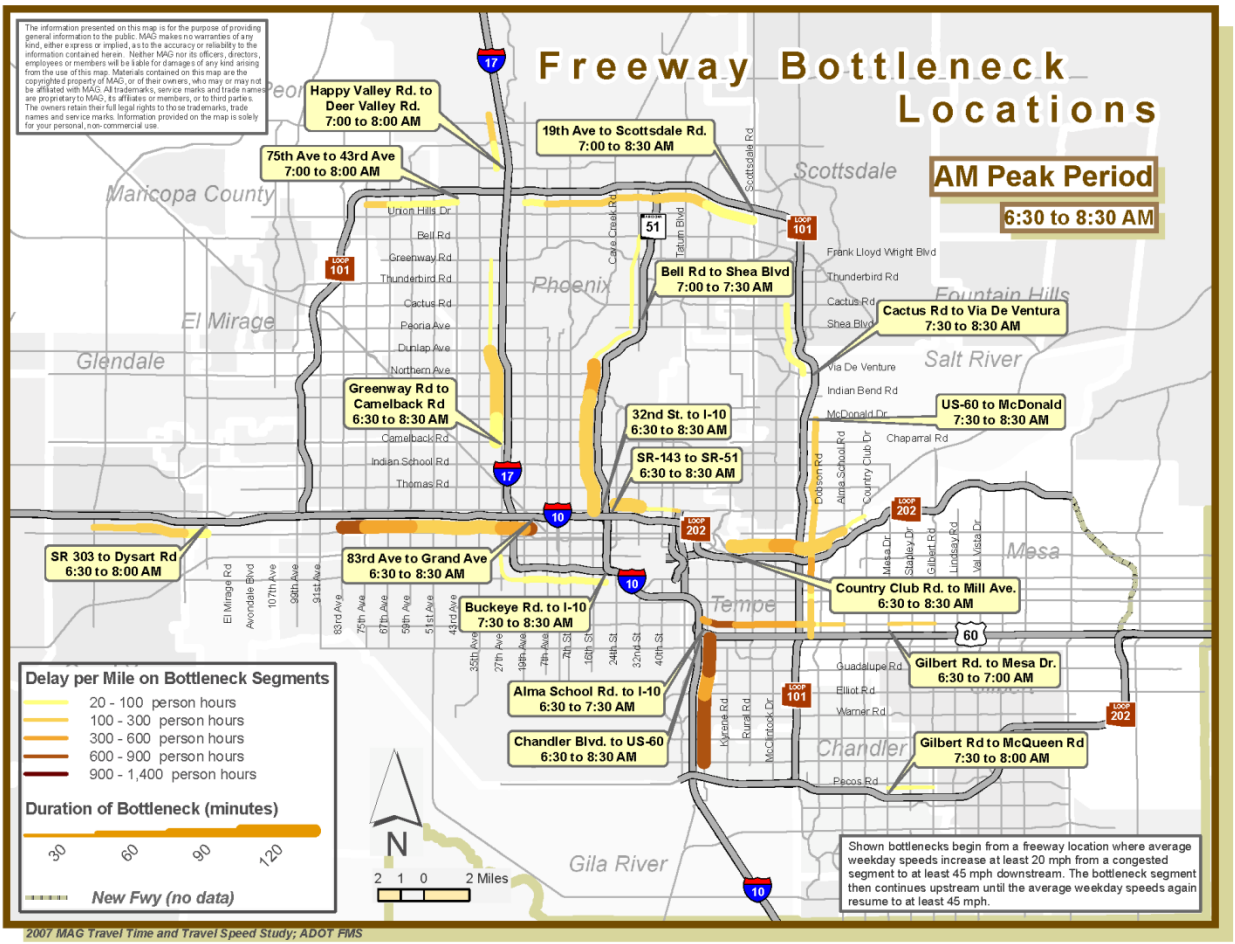
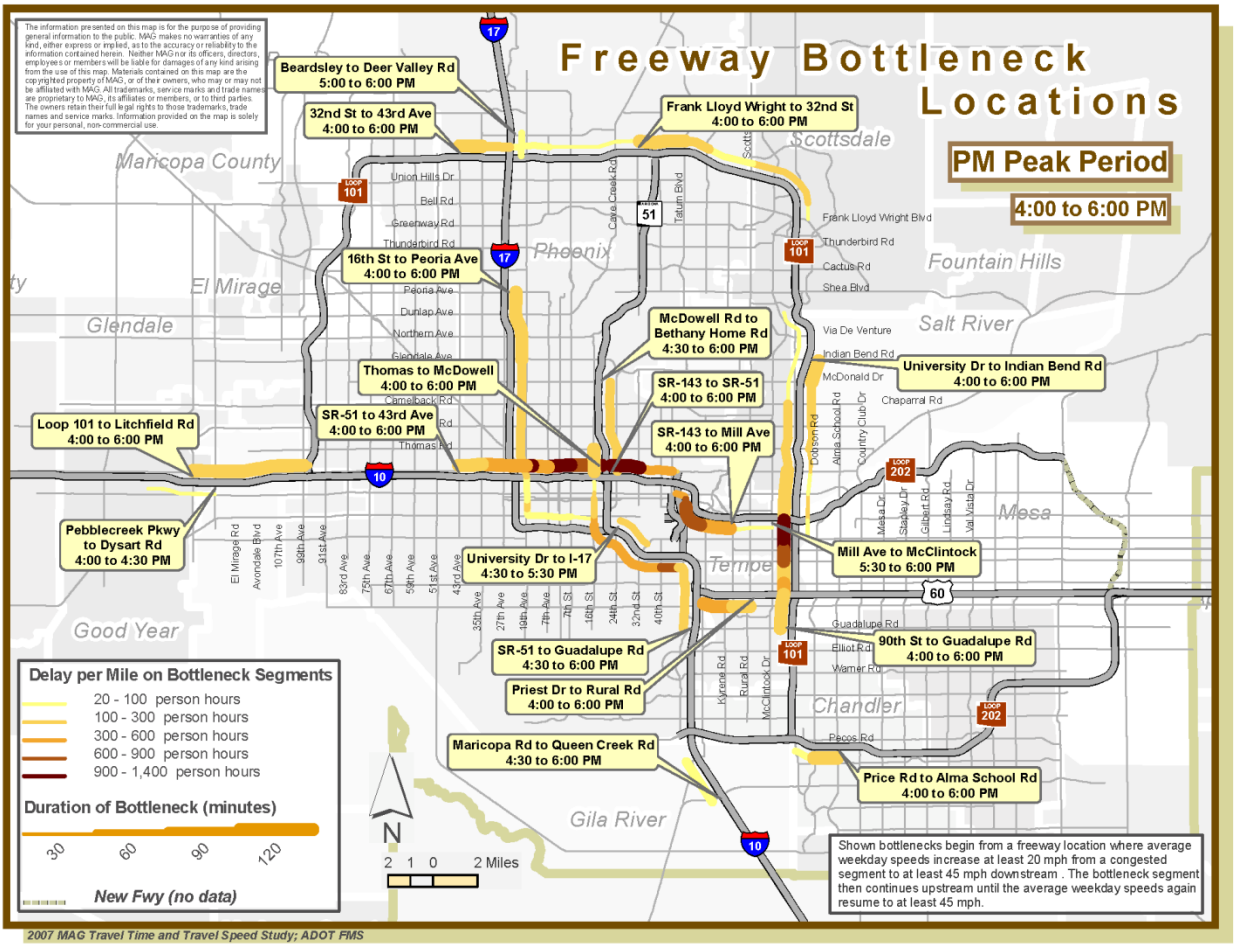


Figure 32: 2007 MAG Freeway Bottleneck Locations – PM Peak Period



5.2 Existing Transit Service Performance

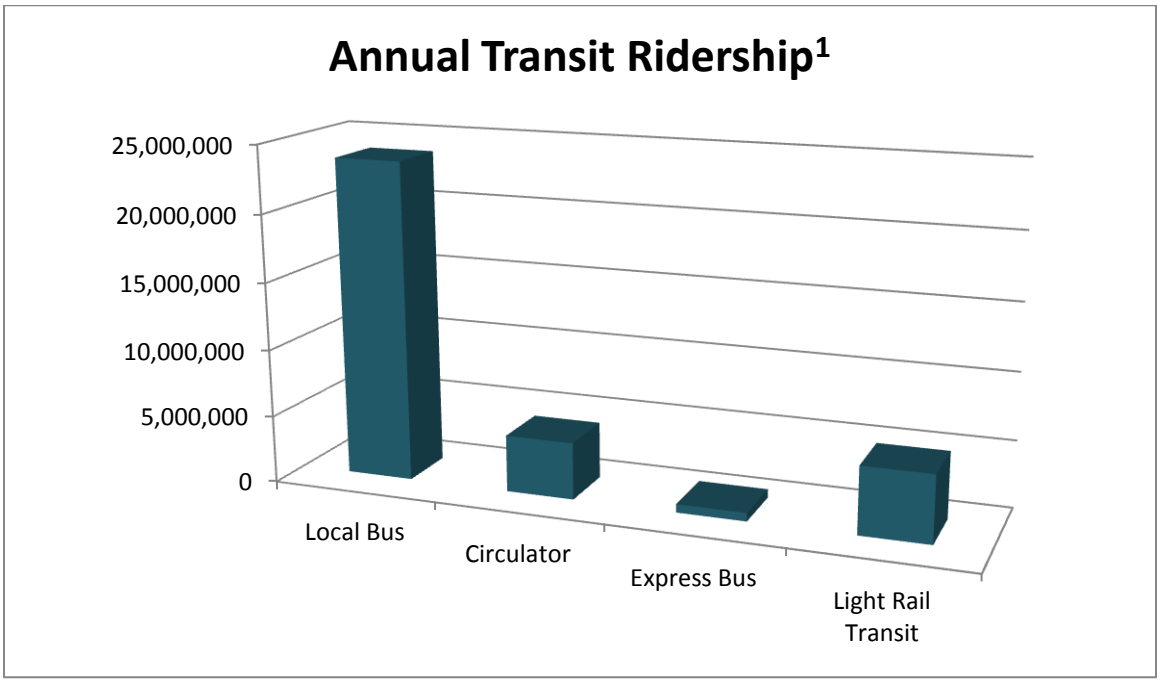
Transit service performance is tracked by the Regional Public Transportation Authority\Valley Metro on a regular basis through monthly and annual performance reports. Information from these reports is aggregated by service productivity (ridership) at the route and jurisdiction level. Route segment performance data, other than jurisdiction, and stop level performance data is not available for all routes and stops. Therefore, the transit performance data presented in this report is limited to the route and jurisdiction level.

Annual ridership by mode for fiscal year 2008-2009, the most recent year of complete ridership data, is presented in **Tables 10** through **13**. The data presented in the tables are limited to the communities within the study area. For example, ridership on Southern Avenue (Route 61) is provided for Phoenix and Tempe only; however, ridership statistics for the segment of the route that operates in Mesa is excluded from the summary tables.

Based on Valley Metro's reported ridership data, local fixed route bus service carried more passengers than any other transit mode, followed by light rail, circulator bus and express bus. The data reported for light rail transit is incomplete as it only represents ridership for half a year (January 2009 – June 2010). Extrapolated to a full year, ridership for light rail transit in Phoenix and Tempe would still be less than

fixed route local bus. If compared on a route level basis, light rail does carry more passengers than any other single route. Annual study area transit ridership by mode is reported in **Figure 33**.

Figure 33: Annual Study Area Transit Ridership by Mode



Source: Valley Metro Annual Ridership Report for Fiscal Year 2008-2009
[1]Annual ridership for light rail is for January 2009 through June 2009

Overall, the local bus routes with the highest ridership in the study area operate within or through the central Phoenix area. These services include Route 19 (19th Ave), Route 17 (McDowell Rd), Route 0 (Central Ave), Route 16 (16th St), and Route 7 (7th Ave). However, several other local bus routes have relatively high ridership, including Route 61 (Southern Ave), Route 45 (Broadway Rd) and Route 77 (Baseline Rd). These three routes show a strong existing demand for east-west local transit service.

While express bus service has the lowest total ridership of any mode in the study area, it also has the lowest service levels (weekday peak period only) and serves a specific market: downtown Phoenix commuters. The I-10 East RAPID route accounts for more than one-third (37%) of the express route ridership in the service area, despite that the study area has a total of 11 express bus routes. The I-10 East RAPID route provides direct express bus service primarily using the I-1O HOV lanes between the Pecos Park-and-Ride located in the Ahwatukee area and downtown Phoenix. Following the I-10 East RAPID route, the three Chandler Express routes (540, 541, and 542) combined account for approximately 24% of the express bus ridership in the study area. These routes provide service between the historic Chandler CBD area and downtown Phoenix utilizing a combination of arterial roadways and freeway HOV lanes.

Table 10: Existing Local Bus Service Performance

Route	Description	City	Annual Ridership			
			Weekday	Saturday	Sunday	Total
0	Central	Phoenix	1,553,689	145,359	97,282	1,796,330
1	Washington/Jefferson	Tempe	54,187	3,022	2,747	59,956
		Phoenix	189,475	18,264	13,320	221,059
		Total	*243,662*	*21,286*	*16,067*	281,015
3	Van Buren	Phoenix	1,517,714	159,139	115,657	1,792,510
7	7th Street	Phoenix	1,407,726	140,203	102,529	1,650,458
8	7th Avenue	Phoenix	827,971	98,213	60,474	986,658
10	Roosevelt/Grant	Phoenix	809,681	96,414	41,688	947,783
12	12th Street	Phoenix	473,934	29,829	26,910	530,673
13	Buckeye	Phoenix	283,936	28,490	20,475	332,901
15	15th Avenue	Phoenix	720,201	87,146	53,943	861,290
16	16th Street	Phoenix	1,348,492	146,766	108,547	1,603,805
17	McDowell	Phoenix	1,881,666	186,804	134,688	2,203,158
19	19th Avenue	Phoenix	2,412,271	222,203	196,420	2,830,894
30	University	Tempe	309,497	32,425	8,434	350,356
		Phoenix	111,221	7,698	3,399	122,318
		Total	*420,718*	*40,123*	*11,833*	472,674
40	Apache/Main St	Tempe	76,623	9,228	7,906	93,757
		Phoenix	29,429	4,764	5,035	39,228
		Total	*106,052*	*13,992*	*12,941*	132,985
44	44th St/Tatum	Tempe	154,834	14,156	9,992	178,982
		Phoenix	574,104	67,789	46,995	688,888
		Total	*728,938*	*81,945*	*56,987*	867,870
45	Broadway	Tempe	353,439	39,772	22,686	415,897
		Phoenix	438,760	44,329	29,644	512,733
		Total	*792,199*	*84,101*	*52,330*	928,630
52	Roeser	Phoenix	248,017	17,817	13,252	279,086
56	Priest Drive	Tempe	404,389	54,967	36,829	496,185
		Phoenix	103,531	14,136	10,812	128,479
		Guadalupe	30,743	5,611	4,045	40,399
		Total	*538,663*	*74,714*	*51,686*	665,063
61	Southern	Tempe	382,800	40,981	28,113	451,894
		Phoenix	578,430	62,199	47,720	688,349
		Total	*961,230*	*103,180*	*75,833*	1,140,243

Route	Description	Annual Ridership				
		City	Weekday	Saturday	Sunday	Total
62	Hardy/Guadalupe	Tempe	370,743	38,081	26,740	435,564
65	Mill/Kyrene	Tempe	206,090	21,957	14,860	242,907
		Chandler	16,636	1,070	1,197	18,903
		Total	*222,726*	*23,027*	*16,057*	261,810
66	Mill/68th Street/Kyrene	Tempe	200,223	25,843	20,959	247,025
70	Glendale/24th Street	Phoenix	1,606,843	169,642	120,411	1,896,896
72	Scottsdale/Rural	Tempe	680,405	75,228	57,244	812,877
		Chandler	135,218	13,322	13,184	161,724
		Total	*815,623*	*88,550*	*70,428*	974,601
76	Miller	Scottsdale	54,835	6,304	3,266	64,405
		Tempe	105,198	10,685	4,732	120,615
		Total	*160,033*	*16,989*	*7,998*	185,020
77	Baseline	Tempe	316,889	43,159	29,218	389,266
		Phoenix	310,642	33,222	22,514	366,378
		Total	*627,531*	*76,381*	*51,732*	755,644
81	Hayden/McClintock	Tempe	493,222	37,925	27,755	558,902
		Chandler	35,159	NA	NA	35,159
		Total	*528,381*	*37,925*	*27,755*	594,061
108	Elliot Rd	Tempe	114,143	9,719	6,728	130,590
		Chandler	23,549	1,826	NA	25,375
		Guadalupe	17,439	1,645	792	19,876
		Total	*155,131*	*13,190*	*7,520*	175,841
156	Chandler Blvd/ Williams Field Rd	Chandler	229,412	27,784	20,201	277,397
		Phoenix	63,741	8,399	6,184	78,324
		Total	*293,153*	*36,183*	*26,385*	355,721
Total			***20,132,492***	***2,094,252***	***1,480,546***	***23,707,290***

Source: Valley Metro Annual Ridership Report for Fiscal Year 2008-2009

Table 11: Existing Circulator Services within the Study Area

Route	City	Annual Ridership			
		Weekday	Saturday	Sunday	Total
DASH[1]	Phoenix	531,250	N/A	N/A	531,250
ALEX	Phoenix	325,498	36,436	29,801	391,735
Orbit - Earth	Tempe	411,451	80,075	64,930	556,456
Orbit - Venus	Tempe	288,155	43,080	43,010	374,245
Orbit - Mercury	Tempe	557,260	64,444	65,305	687,009
Orbit - Mars	Tempe	159,372	22,010	17,988	199,370
Orbit - Jupiter	Tempe	635,964	89,983	76,740	802,687
FLASH[2]	Tempe	687,456	N/A	N/A	687,456
Total		**3,596,406**	**336,028**	**297,774**	**4,230,208**

Source: Valley Metro Annual Ridership Report for Fiscal Year 2008-2009

[1]Includes the Downtown and Government Loops. DASH Downtown was discontinued in July 2010.

[2]Includes FLASH Forward, FLASH Backward, and FLASH University. FLASH University was replaced with FLASH McAllister in July 2010.

Table 12: Existing Express Services within the Study Area

Route	Description	Annual Ridership	
		City	Weekday
511	Tempe/Scottsdale Airpark Express	Chandler	4,805
		Tempe	1,390
		Total	*6,195*
520	Tempe Express	Tempe	20,586
		Phoenix	13,688
		Total	*34,274*
521	Tempe Express	Tempe	33,702
		Phoenix	24,780
		Total	*58,482*
531	Mesa/Gilbert Express	Phoenix	41,540
532	Mesa Express	Tempe	3,959
		Phoenix	18,373
		Total	22,332
533	Mesa Express	Phoenix	48,724
535	Northeast Mesa/Downtown Express	Mesa	15,407
		Phoenix	13,408
		Total	*28,815*
540	Chandler Express	Tempe	8,119
		Chandler	10,867
		Phoenix	33,904
		Total	*52,890*
541	Chandler Express	Chandler	33,434
		Phoenix	45,413
		Total	*78,847*
542	Chandler/Downtown Express	Chandler	11,210
		Phoenix	9,949
		Total	*21,159*
I-10E	RAPID - I-10 East	Phoenix	233,318
Total			**626,576**

Source: Valley Metro Annual Ridership Report for Fiscal Year 2008-2009

Table 13: Existing Light Rail Service within the Study Area

Route		Annual Ridership[1]			
	City	Weekday	Saturday	Sunday	Total
Central Phoenix – East Valley	Phoenix	2,665,283	468,742	341,892	3,475,917
	Tempe	1,152,662	201,902	169,562	1,524,126
	Total	***3,817,945***	***670,644***	***511,454***	**5,000,043**

Source: Valley Metro Annual Ridership Report for Fiscal Year 2008-2009
[1]Annual ridership for light rail is for January through June 2010

5.3 Existing and Projected Travel Demand

An initial review of travel demand was completed to identify general travel patterns between the study area and other areas of the region. In addition, other travel patterns were reviewed to identify where trips to two of the study area's highest demand activity centers are projected to originate from. These activity centers include downtown Phoenix and downtown Tempe\ASU.

5.3.1 Study Area Travel Demand

Trip Destinations

General travel demand in the study area was measured using outputs from the MAG regional travel demand model. Based on the results of the model, presented in **Table 14** and **Figure 34**, the top general destinations for trips originating in the south Tempe, Chandler and Northern Pinal County area include:

- Southeast and east valley areas (Mesa, Gilbert and Pinal County)
- North Tempe (north of Baseline Rd)
- Central Phoenix north area (including Sky Harbor Airport, Uptown Phoenix, and Camelback\Biltmore area)

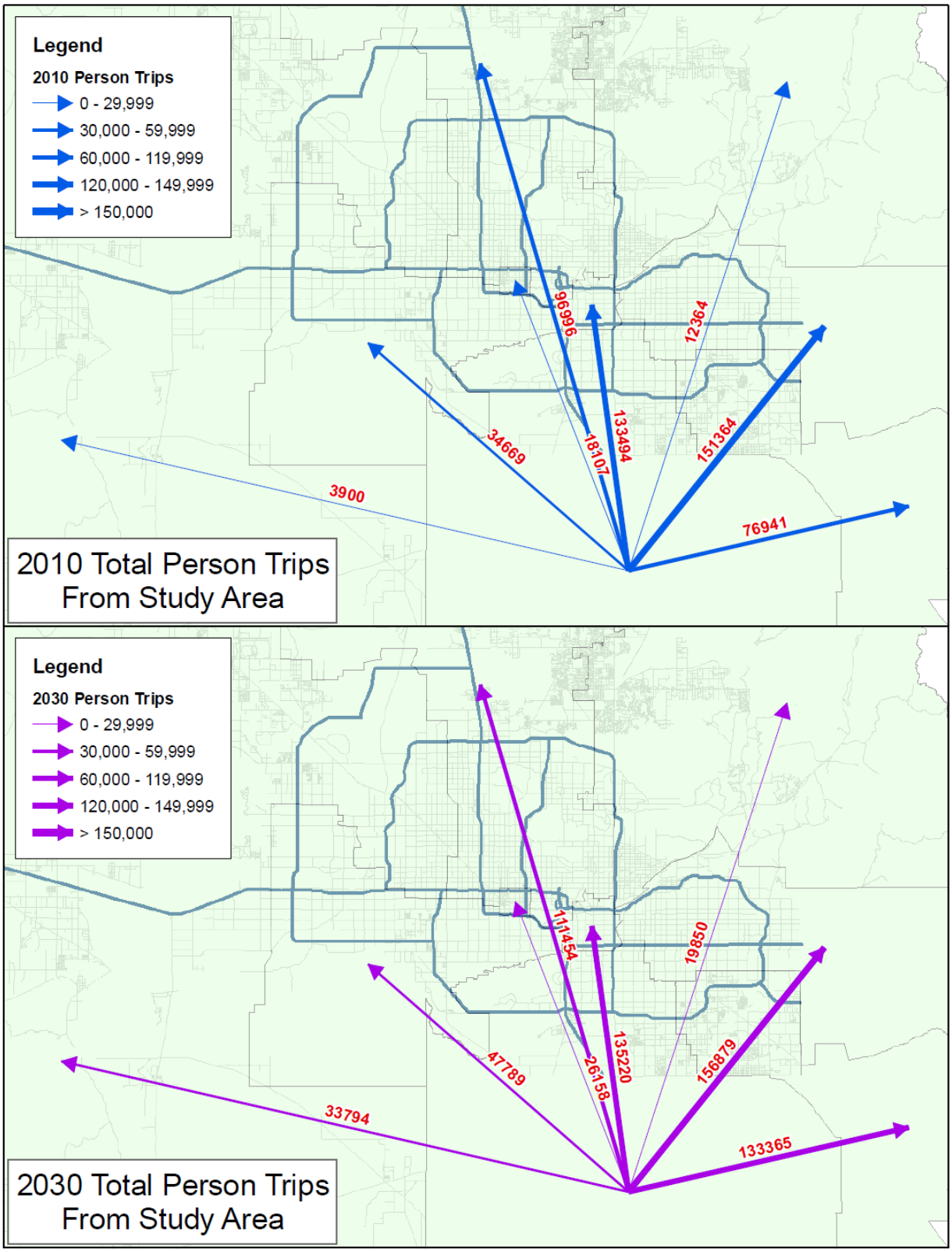
Table 14: 2010 and 2030 Total Study Area Person Trips – Trips from Study Area

Sub-Area	2010 - Percent of Trips	2030 – Percent of Trips
Southeast and East Valley Areas	43%	44%
North Tempe	25%	20%
Central Phoenix North Area	18%	17%
All Other Areas Combined	13%	19%
Total	100%	100%

Source: MAG Travel Demand Model, 2010

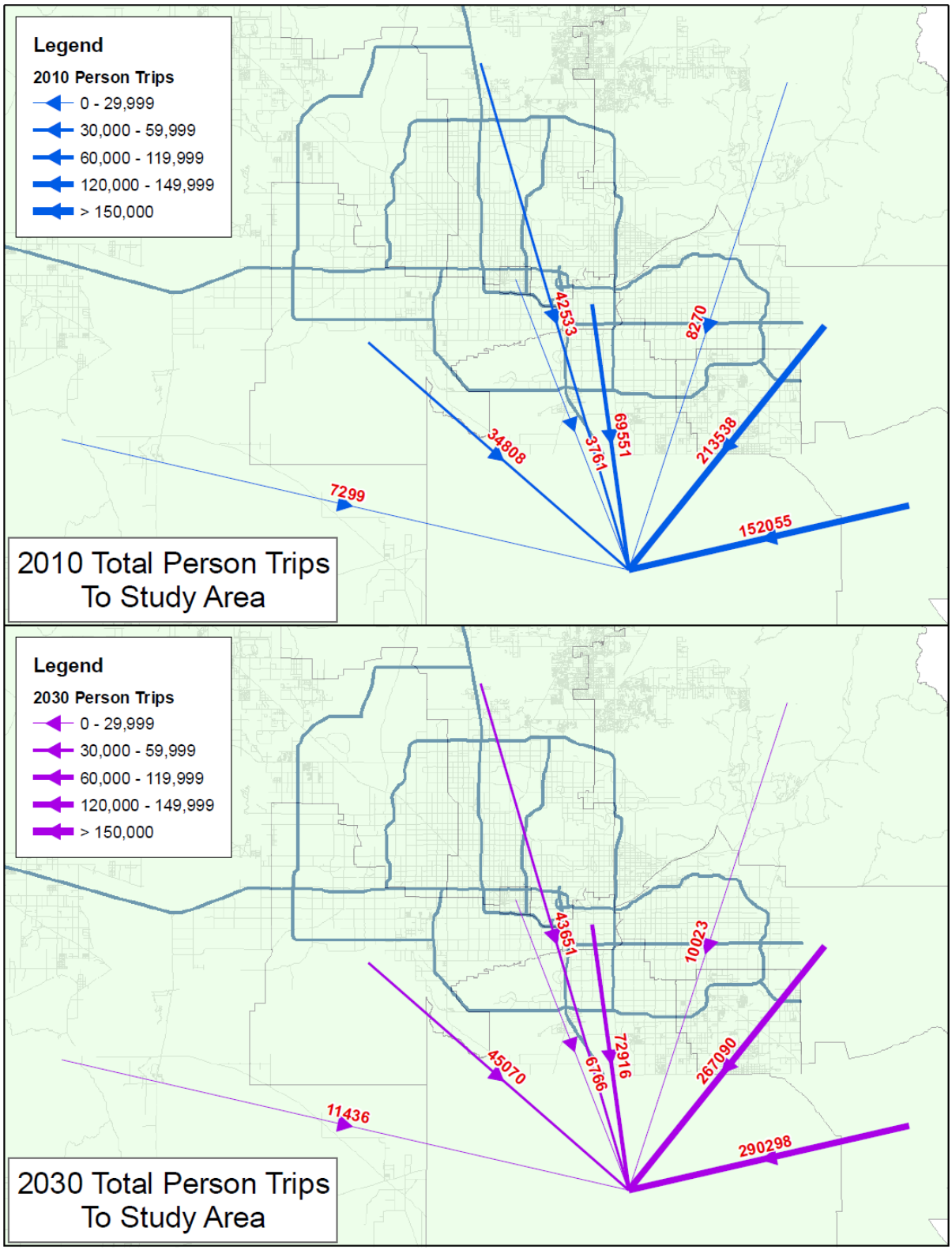
When comparing between 2010 and 2030, there appears to be limited change in the projected travel demand patterns. The highest destinations in 2010 are projected to remain strong destinations in 2030.

Figure 34: 2010 and 2030 Total Study Area Person Trips – Trips from Study Area



Source: MAG Travel Demand Model, 2010

Figure 35: 2010 and 2030 Total Study Area Person Trips – Trips to Study Area



Source: MAG Travel Demand Model, 2010

Trip Origins

From a trip origin perspective, the travel demand pattern is nearly a reverse of the destination patterns. The areas of the region that generate the most trips destined to the south Tempe, Chandler and Northern Pinal County area include:

- Southeast east and east valley area (Mesa, Gilbert and Pinal County)
- North Tempe (north of Baseline Rd)

Trips from the central Phoenix north area, which is considered a leading destination, represent only 6% of the total daily person trip origins. However, it should be noted that a significant number of trips, approximately two-thirds in 2010 and three-quarters in 2030 originate from the southeast and east valley areas. **Table 15** and **Figure 35** identify the general location of the trip origins (total daily person trips) destined to the south Tempe, Chandler and Northern Pinal County area.

Table 15: 2010 and 2030 Total Study Area Person Trips – Trips to Study Area

Sub-Area	2010 - Percent of Trips	2030 – Percent of Trips
Southeast and East Valley Areas	69%	75%
North Tempe	13%	10%
All Other Areas Combined	18%	16%
Total	100%	100%

Source: MAG Travel Demand Model, 2010

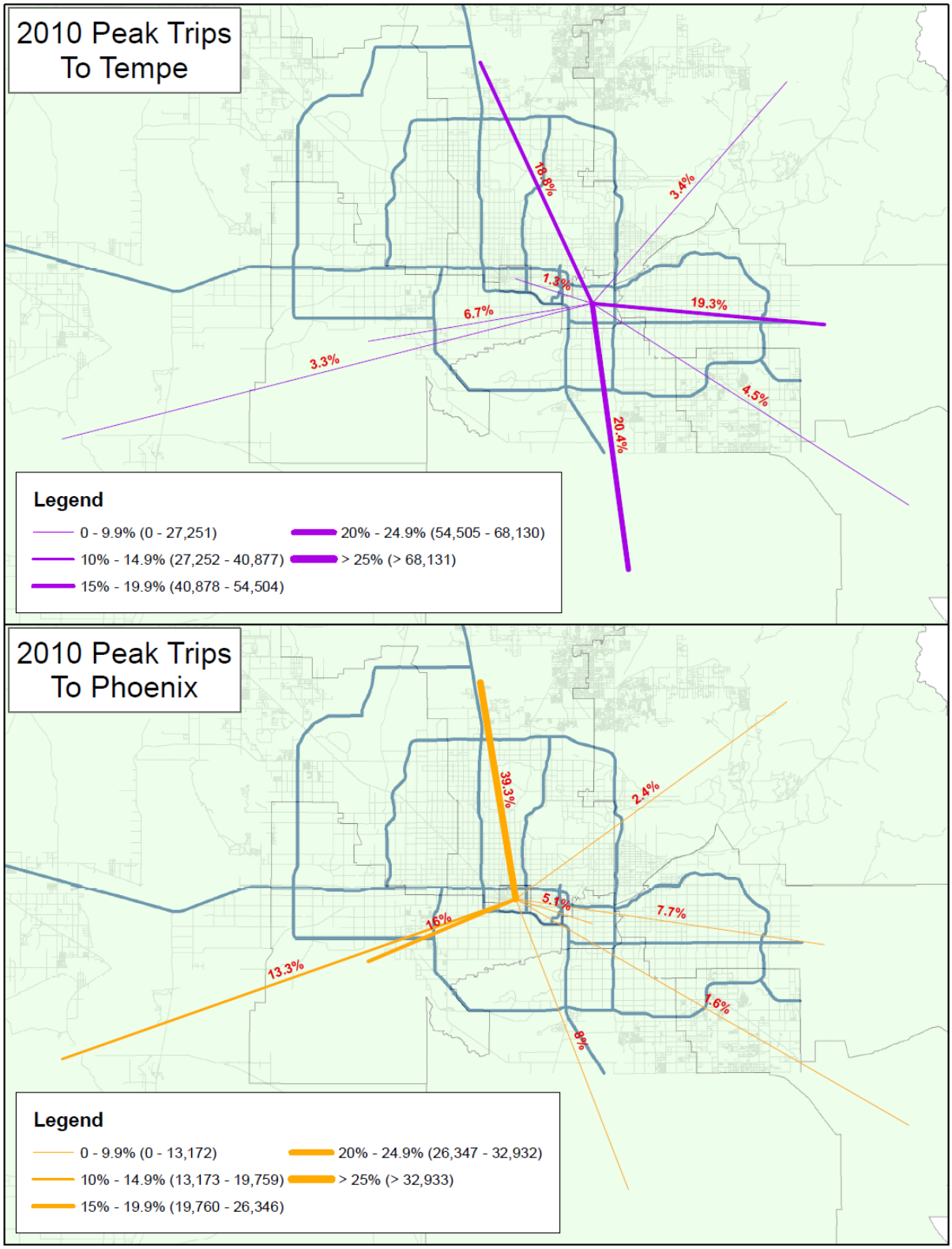
5.3.3 Activity Center Demand

Activity center demand was reviewed for the two most desired activity centers in the study area: downtown Phoenix and downtown Tempe\ASU. This review was completed to identify where trips are originating from for these high demand activity centers and to better understand their potential affects on transportation needs within the study area. **Figures 36** and **37** illustrate the projected peak period trip generation levels from each of the sub-areas defined for travel demand analysis in this study. For the downtown Tempe\ASU area, approximately one-fifth (20.4% in 2010 and 19.5% in 2030) of the peak period trips destined for this area originate from the south Tempe, Chandler and Northern Pinal County area. Other areas that have a high level of trips destined for the downtown Tempe\ASU area include:

- Southeast valley area (Mesa and Apache Junction)
- Central Phoenix north area (including Sky Harbor Airport, Uptown Phoenix, and Camelback\Biltmore area)

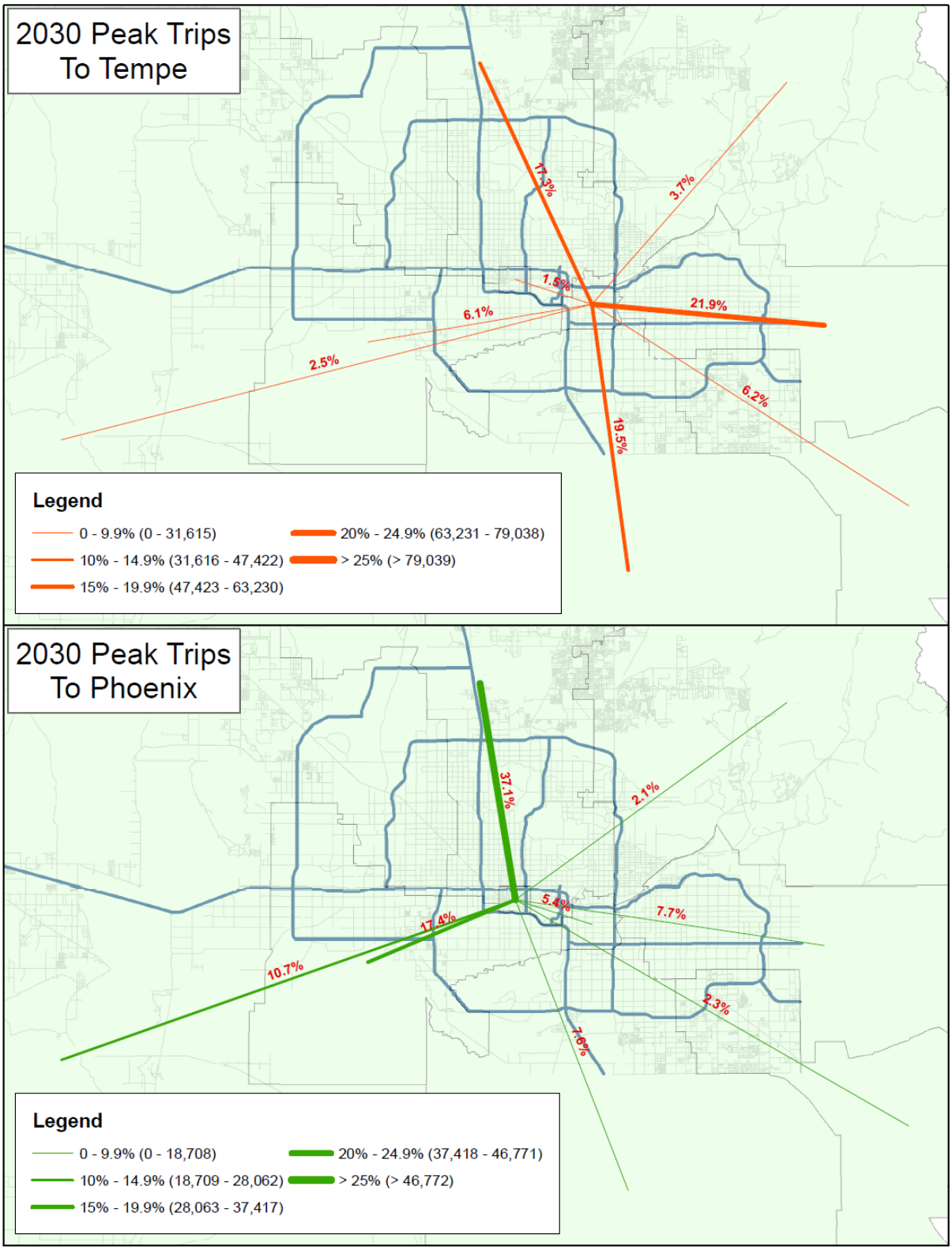
Nearly 40% of the trips destined for the downtown Phoenix area are originating from the Central Phoenix north area in both 2010 and 2030. Trips from the south Tempe, Chandler and Northern Pinal County area only comprise approximately 8% of the trips destined for downtown Phoenix. However, all east valley areas combined (excluding Scottsdale) comprise approximately 20% of the trips.

Figure 36: 2010 Trip Origins Destined to Downtown Phoenix and Downtown Tempe\ASU



Source: MAG Travel Demand Model, 2010

Figure 37: 2030 Trip Origins Destined to Downtown Phoenix and Downtown Tempe\ASU



Source: MAG Travel Demand Model, 2010

6.0 Key Findings

The information documented in this report provides background information essential for understanding existing and planned transportation investments, current performance of the study area's highway, roadway and transit networks and general travel demand patterns. The key findings identified through the background research will help inform the development of new transportation concepts and strategies for improving overall mobility within and through the SE Corridor and adjacent area. The transportation related key findings in the study area include:

Planned Major Transportation Investments

- There are several planned freeway/highway improvements in the study area
  - New SR-202L/South Mountain Freeway
  - Corridor capacity improvements along I-10, from the bridge over the Salt River through the I-10/US-60 system interchange
  - New HOV ramp connections for the I-10/SR-202L and SR-101L/SR-202L system traffic interchanges
  - Additional general purpose and HOV lanes along existing facilities
- Additional arterial roadway improvements are planned in the study area
  - Intersection improvements at Chandler Boulevard and Kyrene Road, and the intersections of Ray Road with Kyrene Road, McClintock Road, and Rural Road
  - New/improved arterial roadway; Avenida Rio Salado between 51st Avenue and 7th Street
- One illustrative roadway project is identified
  - Improve I-10 to a local/express lane configuration between the I-10/SR-51/SR-202L traffic interchange and 3rd Street
- Three new HCT and three new arterial BRT are corridors planned
  - HCT; Tempe South, Phoenix West, and Phoenix Sky Train (Phase 1)
  - BRT; corridors on Scottsdale/Rural Road, South Central Avenue, and Chandler Boulevard
- Three illustrative HCT corridors identified
  - Two potential HCT all day service corridors along Scottsdale/Rural Road and Central Avenue (south of Jefferson Street)
  - One HCT peak period service corridor near the Tempe Kyrene Branch freight rail line
- New local and express bus routes are planned within the study area; however, planned service levels are very modest

Transportation Performance

- Previous studies indicate that every freeway within the Southeast Corridor study area experiences some recurring congestion
- The most significant freeway delays are found on I-10 northbound between Chandler Blvd and US 60 and on US 60 westbound between Mill Avenue and Priest Drive during the AM peak period. During the PM peak period, the most significant bottle necks in the study area are on I-10 eastbound between I-17 and Guadalupe Road and on eastbound US 60 between I-10 and Rural Road

- Slightly higher average speeds are experienced on the HOV facilities than the general freeway lanes during peak hours
- The primary source of delay on the arterial street network is generally from intersections
- Within the study area, local fixed route bus service carried more passengers than any other transit mode, followed by light rail, circulator bus and express bus in Fiscal Year 2009
- The local bus routes with the highest ridership in the study area operate within or through the central Phoenix area; however the south Phoenix and Tempe east-west crosstown routes (Broadway, Southern, and Baseline) have strong existing ridership
- The I-10 East RAPID (Ahwatukee to Downtown Phoenix express) accounts for more than one-third (37%) of the express route ridership in the service area while the three Chandler express routes (540, 541, and 542) account for approximately 24% of the express bus ridership

Travel Demand

- The top general destinations for trips from the south Tempe, Chandler and Northern Pinal County area include:
  - Southeast and east valley areas (Mesa, Gilbert and Pinal County)
  - North Tempe (north of Baseline Rd)
  - Central Phoenix north area (including Sky Harbor Airport, Uptown Phoenix, and Camelback\Biltmore area)
- The areas of the region that generate the most trips destined to the south Tempe, Chandler and Northern Pinal County area include:
  - Southeast east and east valley area (Mesa, Gilbert and Pinal County)
  - North Tempe (north of Baseline Rd)
- Trips from the central Phoenix north area, which is considered a leading destination, represents only 6% of the total daily person trips; however, it should be noted that a significant number of trips, approximately two-thirds in 2010 and three-quarters in 2030, are from the southeast and east valley areas
- Approximately one-fifth (20.4% in 2010 and 19.5% in 2030) of the peak period trips destined for the downtown Tempe\ASU area are from the south Tempe, Chandler and Northern Pinal County area. Other areas that have a high level of trips destined for the downtown Tempe\ASU area include:
  - Southeast valley area (Mesa and Apache Junction)
  - Central Phoenix north area (including Sky Harbor Airport, Uptown Phoenix, and Camelback\Biltmore area)
- Nearly 40% of the trips destined for the downtown Phoenix area are from the Central Phoenix north area in both 2010 and 2030. Trips from the south Tempe, Chandler and Northern Pinal County area only comprise approximately 8% of the trips to downtown Phoenix; however, all east valley areas combined (excluding Scottsdale) comprise approximately 20% of the trips

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Appendix B – HOV Direct Access Ramps

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The information contained in Appendix B was obtained directly from Washington State Department of Transportation's (WSDOT) HOV Direct Access Ramps web page. The full web page can be accessed here:

http://www.wsdot.wa.gov/HOV/directaccessramps.htm

What are direct access ramps?

Direct access ramps allow buses, carpools, vanpools, and motorcycles to directly access the high occupancy vehicle (HOV) lanes in the center of the freeway. They come down from above the mainline, or up from below, and merge into the HOV lane from inside the median.

Aerial view of HOV direct access ramps serving the Eastgate Park-and-Ride.

Why build direct access ramps?

Direct access ramps improve safety, reduce congestion, save time, and increase travel time reliability for both HOVs and general purpose freeway traffic. High occupancy vehicles can have a hard time merging left through general purpose lanes to gain access to the HOV lane during congested periods, creating a safety problem for all freeway users. When buses, particularly articulated (extra-long) buses attempt this merge, they can cause congestion in the lanes they pass through for quite a distance back. By enabling carpools, vanpools, buses, and motorcycles to connect directly with HOV lanes, these vehicles avoid the need to weave across the other lanes of traffic.

How do direct access ramps work?

Direct access ramps work much like other left-side on- and off-freeway ramps, except they are restricted to HOVs. Vehicles access the ramps from an adjacent park-and-ride facility or surface street. They merge into the left side of the freeway and enter the HOV lane. As with other leftside on- and off-ramps, drivers enter traffic to their right. Visibility is limited so ramp users need to use extra caution when merging into a freeway HOV lane from a direct access ramp.

When using a direct access ramp to exit the freeway, HOV drivers should watch for signs and then exit to the left where indicated. This takes them up (or down) the direct access ramp and into a park-and-ride lot or to an intersection with a local street.

Who can use direct access ramps?

Nine of the ten direct access ramps currently operating are open to vehicles carrying two or more people. Generally, they are subject to the same eligibility and usage limitations that apply to HOV lanes; however, direct access ramps remain HOV-only, 24 hours a day, seven days a week.

Carpools, vanpools, buses, single-occupant motorcycles and emergency vehicles are permitted on direct access ramps. Trucks that weigh more than 10,000 pounds gross vehicle weight are prohibited, regardless of the number of occupants. Buses and recreational vehicles (RV) are exempt from this weight limit.

How do drivers benefit from direct access ramps?

Results from WSDOT's installation of direct HOV access ramps have been positive. Data indicate that vehicles merge smoothly and safely from the ramps to the HOV lanes, and HOV users are saving up to 10 minutes per trip.