MARICOPA ASSOCIATION of GOVERNMENTS

YUMA WEST

COMMUTER RAIL CORRIDOR DEVELOPMENT PLAN

FINAL REPORT • MAY 2010

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FINAL

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List of Acronyms

ABS	Automatic Block Signaling
ACE	Altamont Commuter Express
ADA	Americans with Disabilities Act
ADOT	Arizona Department of Transportation
ARRA	American Recovery and Reinvestment Act of 2009
ASU	Arizona State University
CMAQ	Congestion Mitigation and Air Quality
COASTER	The San Diego Coast Express Rail
DMU	Diesel Multiple Unit
DTC	Direct Traffic Control
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GUS	Glendale Urban Shuttle
HBW	home-based work
HOV	high occupancy vehicle
HSIPR	High-Speed Intercity Passenger Rail
HURF	Highway Users Revenue Fund
I-10	Interstate 10
JPA	Joint Powers Authority
LBG	Lights, Bells and Gates
LHC	Locomotive Hauled Coaches
LRT	light rail transit
MAG	Maricopa Association of Governments
MC	Maricopa County
METRO	Valley Metro Rail, Inc.
MnDOT	Minnesota Department of Transportation
MOU	Memorandum of Understanding
mph	miles per hour
MPO	Metropolitan Planning Organization
NEPA	National Environmental Policy Act
NTD	National Transit Database
O&M	operating and maintenance
PCJPB	Peninsula Corridor Joint Powers Board
PMT	Project Management Team
PRIIA	Passenger Rail Investment and Improvement Act of 2008
PRT	Project Review Team
PTC	Positive Train Control
RPTA	Regional Public Transportation Authority
RTD	Regional Transportation District
RTP	Regional Transportation Plan
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SHF	State Highway Fund
SS	Stop Sign
STAN	Statewide Transportation Acceleration Needs
STB	Surface Transportation Board
STP	Surface Transportation Program
TAZ	transportation analysis zone

The T	The Fort Worth Transportation Authority
TRID	Transit Revitalization Investment District
UPRR	Union Pacific Railroad
VLT	Vehicle License Tax
VMT	Vehicle Miles Traveled
XB	Railroad Crossbuck

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1.0 PROJECT OVERVIEW

The Phoenix metropolitan area has experienced unprecedented population growth over the last several decades, impacting all aspects of community development, land use, public service delivery, and particularly the demand on the Valley's transportation system. The western metropolitan region (or West Valley) has contributed a significant portion of the region's overall growth and, with developable land still available, is projected to continue to do so in the years ahead. This Corridor Development Plan explores the feasibility of commuter rail to enhance mobility in the West Valley. It is assumed that commuter rail would share existing right-of-way owned by the Union Pacific Railroad (UPRR), similar to systems in other parts of the country. UPRR management has stated to the Maricopa Association of Governments (MAG) that the Yuma West Corridor is a part of their "core system" of mainline trackage and is therefore not a candidate for any form of shared use or parallel commuter rail passenger service. However, MAG intends to contribute to continued dialogue with UPRR as future plans evolve to assess the feasibility of shared use of the corridor for passenger rail service and overall coordination on regional rail issues.

The study area is defined by a two-mile buffer on either side of the alignment (Figure 1-1). As shown in Figure 1-1, the existing railroad track connects central Phoenix to the far West Valley, and crosses the following local jurisdictions:

- City of Phoenix
- City of Tolleson
- City of Avondale
- City of Goodyear
- Town of Buckeye
- Unincorporated Maricopa County

Interstate 10 (I-10) is the only major freeway that connects downtown Phoenix with the communities in the West Valley. In addition to I-10, Buckeye Road is a major arterial roadway that provides a connection into downtown Phoenix and generally parallels the UPRR corridor. As the population of this area has grown, more residents are commuting along the I-10 and Buckeye Road corridors to key employment destinations in the central metropolitan area, such as downtown Phoenix. Commuter rail technology can provide an additional tool to serve commuter travel demand. In addition, the implementation of commuter rail may promote economic and land use development opportunities if paired with local efforts to facilitate transit-supportive development. Many jurisdictions in the West Valley are identifying a public interest in such development in ongoing planning efforts.

In 2003, MAG completed the High Capacity Transit Study which recommended a transit network designed to meet the travel demand needs of the region in the forecast year of 2040. The Study identified the Yuma West Corridor as a proposed commuter rail corridor, and operating requirements were recommended to implement a commuter rail system.

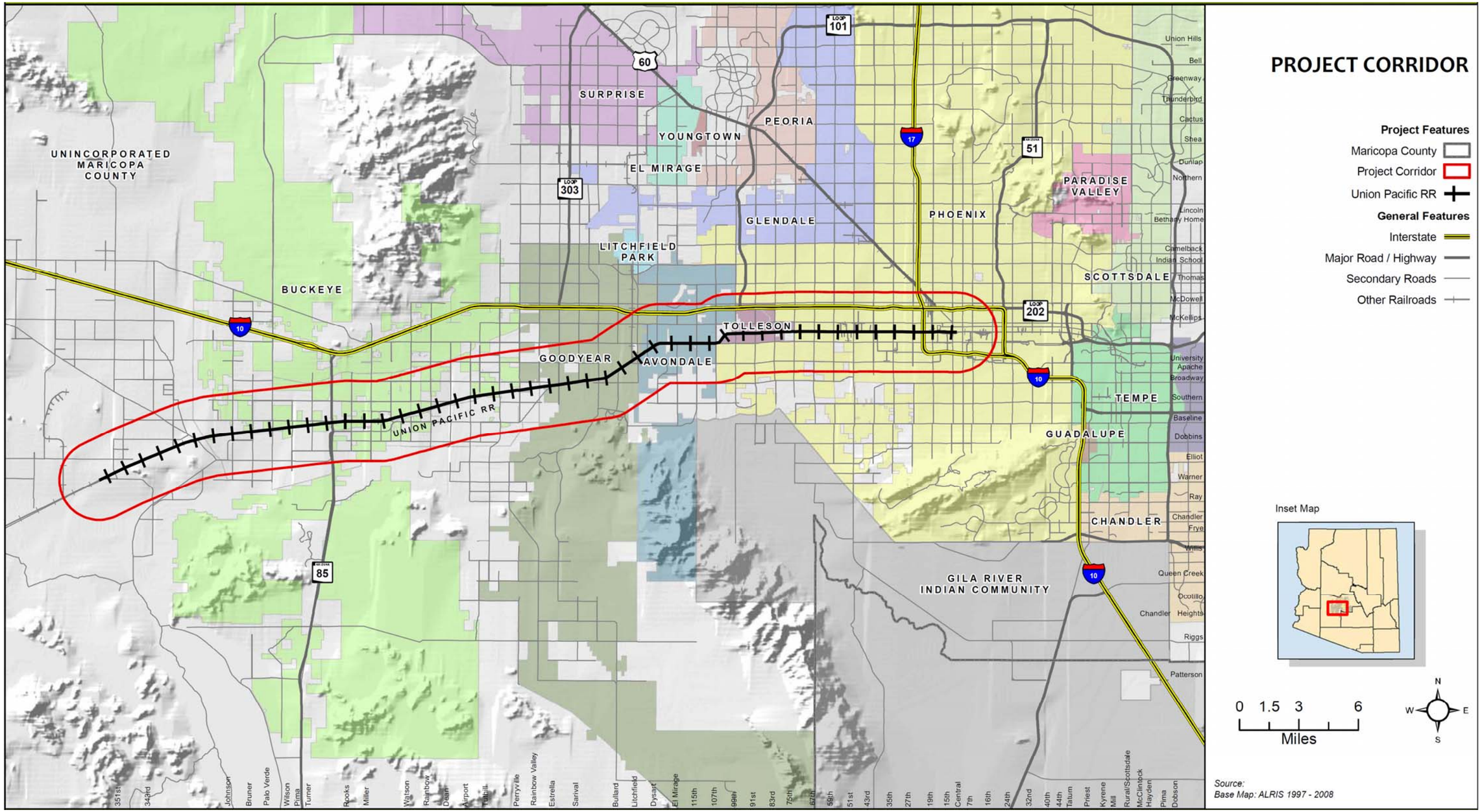
To further the study of commuter rail, MAG allocated funding for the creation of multiple commuter rail development plans. In 2008, MAG completed the Commuter Rail Strategic Plan

which outlined the steps that the implementation of commuter rail service in the Maricopa County and northern Pinal County region should follow. Among the recommendations made from that study was to produce corridor development plans for each potential commuter rail corridor. The Yuma West Commuter Rail Corridor Development Plan is a result of that recommendation.

This chapter provides an overview and background information on commuter rail technology and the planning effort that was undertaken to produce this plan. The chapter is organized as follows:

- Section 1.1 provides background information on commuter rail.
- Section 1.2 summarizes the potential benefits of implementing commuter rail, including proposed goals to guide further development of a commuter rail system in the region.
- Section 1.3 describes the study process through which this Corridor Development Plan was developed.
- Section 1.4 highlights previous, relevant transportation studies that provide context for considering commuter rail within the region.
- Section 1.5 describes the organization of the remainder of this report.

Figure 1-1: Project Corridor



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1.1 Description of Commuter Rail

Commuter rail trains typically provide service between suburbs and urban centers to access activity centers such as employment nodes, special events, and intermodal connections. Commuter rail trains are typically optimized for maximum passenger capacity and are equipped with comfortable seating and minimal luggage capacity. Service typically occurs at a lower frequency than light rail, serving primarily peak travel needs for commuters. Travel distance between a rail line's termini generally ranges between 30 and 40 miles, but may be longer. Stations are typically 5 to 10 miles apart.

Rail Runner Express Commuter Train; Albuquerque, NM
Source: MRCOG/HDR.

Sounder Commuter Train; Seattle, WA
Source: MAG.

To enable commuter rail service in the Yuma West Corridor, an agreement must occur with the railroad to establish how to share facilities and operate passenger service concurrently with ongoing freight service. As currently conceived, commuter rail would share tracks and facilities with existing UPRR service. Local jurisdictions and UPRR would need to coordinate on acquisition of track rights or right-of-way, short and long term/sustainable monies to fund rights or purchase of rail facilities, and the determination of maintenance and operation costs that may be associated with a funding agreement with the UPRR. These issues are explored further in Chapter 5. Additional information on commuter rail technology is provided in Appendix A, Commuter Rail Vehicle Technology.

1.2 Potential Benefits of Commuter Rail in the Yuma West Corridor

There are a series of potential benefits associated with commuter rail service in the Yuma West Corridor, as described below.

Improved mobility, particularly reduced travel time for the commuter. Alternate modes of transportation such as commuter rail are considered in congested urban areas to improve travel times, mitigate congestion, add convenience, and provide other means to travel. Demands on the Valley's highway system have resulted in increased travel times for commuters, as well as less predictable travel times that vary with congestion levels. These will only worsen in the future as the region continues to grow. Public transportation service investment in bus and light rail services mitigates these impacts; however, the addition of commuter rail service within the

Yuma West Corridor would provide another tool for commuters to reach their destinations efficiently. In addition, more connections among modes will make the entire transit system more robust in meeting travel demands within this transportation corridor. The improvement of mobility through the corridor, especially during peak congestion commuter times, would result in a shorter trip for the commuter compared with single-occupancy vehicles.

Opportunities to support local development in station areas. Low-density residential development is dominant in the West Valley. This type of development pattern often causes longer trips to employment centers, medical services, educational institutions, and shopping. Commuter rail service can solidify the connections between suburban population growth and key destinations by providing an efficient travel option. Improved travel options can allow families and individuals to chose more freely where to live, knowing that they can commute to work, special events, or other destinations reasonably. Proximity to commuter rail or other transit options may be a significant amenity for many residents and employers who experience mobility benefits throughout the corridor. In addition, a well-designed approach to station development can assure that commuter rail is a neighborhood asset and supports local businesses throughout the corridor. Transit-oriented development may provide opportunities for mixed use development and public-private partnerships to support local economic development goals. Local jurisdictions may view commuter rail as an opportunity to facilitate the conversion of underutilized areas along the corridor to meet local development goals.

Provide a higher quality commuter experience. A trip on a commuter rail train will reduce personal vehicle trips and the time spent on daily commutes. Commuter rail service and stations can be designed to meet passenger needs, reduce individual carbon footprints, and provide a pleasant environment for travel during what is normally a time of peak congestion and delays.

Provide connections to employment or activity centers for everyday life. Commuter rail service can efficiently connect passengers directly to employment or activity centers. Activity centers may include employers, medical appointments, educational institutions, shopping, or special events such as baseball or basketball games. In evaluating the feasibility of commuter rail corridors, MAG is considering the overall impacts on connectivity throughout the region, including linkages to other modes for travel. These links may include connectivity to other commuter rail service lines, park-and-ride facilities, and other transit modes such as local or regional bus service and light rail.

At the onset of this planning process, a set of goals was developed to assess the effectiveness of commuter rail in the corridor and possibly to guide further development of a commuter rail system. They are as follows:

Goal 1: Improve mobility through and within the corridor and to major activity centers

- Objective: Increase overall corridor capacity for all modes.
- Objective: Improve overall travel safety for all modes of travel in the corridor.

Goal 2: Provide an alternative to the single-occupant vehicle for travel in the corridor

- Objective: Provide alternative transportation travel options in the corridor.
- Objective: Maximize the reduction in roadway travel demand through management practices and programs.

Goal 3: Improve the image of public transit in the corridor by providing rapid and convenient service

- Objective: Maintain or improve travel times within the corridor.
- Objective: Maintain or improve transportation reliability in the corridor.

Goal 4: Improve the local economy

- Objective: Enhance access to jobs, entertainment, recreation, and shopping for existing and future residents.
- Objective: Facilitate the improvement of freight operations and its related economic impact on the corridor.
- Objective: Support and promote land use objective for transit-oriented or other development in accordance with local land use plans and policies.

Goal 5: Provide a high-quality transportation alternative in the corridor

- Objective: Provide a cost-effective transit option.
- Objective: Provide a system that integrates effectively and efficiently with current and future transportation modes and systems.

1.3 Study Process

The initial study area—a corridor along the UPRR right-of-way from downtown Phoenix to Arlington—was identified as the portion of the UPRR right-of-way that crossed existing and planned development in the West Valley. The 2003 High Capacity Transit Study identified a conceptual commuter rail line along the UPRR corridor from Phoenix west to Buckeye. For the analysis that informed this plan, the corridor was extended to Arlington to consider potential future development.

The study process to develop this Corridor Development Plan followed a series of steps:

- Review of previous transportation studies and plans.
- Initiation of stakeholder involvement, which continued throughout the planning process.
- Inventory of the existing UPRR conditions between Phoenix and Arlington.
- Development of a conceptual commuter rail operating plan.
- Identification of infrastructure improvements needed for the implementation of commuter rail service.
- Development of capital cost estimates.
- Development of annual operating cost estimates for commuter rail service.

The development of a conceptual operating plan was informed by site visits and ridership forecasting. Projected ridership results influenced decisions about service levels and phasing, fleet size, and target station areas. Chapter 3 summarizes the operating plan and results of the forecasting effort. Additional information on the methodology for cost estimating is provided in Chapter 4 and Appendix F.

The stakeholder involvement component of the planning process was extensive. Throughout the entire study process, several groups met regularly to review project information and provide feedback. These groups included:

Project Management Team (PMT). The PMT included representatives from MAG, the Regional Public Transportation Authority (RPTA), Valley Metro Rail, Inc. (METRO), and the Arizona Department of Transportation (ADOT). These agencies plan and/or operate highways and bus, paratransit, and light rail services throughout the region. ADOT also conducted a Statewide Rail Framework Study concurrently with this effort. The PMT met monthly to review study information and coordinate ongoing planning activities.

Project Review Team (PRT). The PRT included representatives from the local jurisdictions throughout the Yuma West Corridor. This group met quarterly throughout the year-long study process. The PRT provided feedback on study information and updated MAG's Project Team on ongoing planning efforts in their communities. Throughout the planning process, MAG also met separately with individual jurisdictions upon request, to review land use issues and future plans.

Stakeholder Meetings. Stakeholder meetings were conducted quarterly to review and provide input into the planning process. This group had the broadest representation, as it included representatives of jurisdictions from throughout the MAG region, state agencies, and interest groups. These meetings were open to the public and media.

In addition, the development of the Yuma West Corridor Development Plan occurred concurrently with the preparation of a Commuter Rail System Study for the entire region. Ridership forecasting and cost estimates were conducted at a systemwide-level to identify and prioritize corridors regionally. The analysis for the Yuma West Corridor was also presented at meetings of the System Review Team associated with that study, which included representation from throughout the MAG region. Links and references to the systemwide analysis are made throughout the Corridor Development Plan; additional information is available in the final report for that effort, the *MAG Commuter Rail System Study*.

1.4 Review of Previous Transportation Studies and Plans

At the onset of the corridor development planning process, a technical review was conducted of previous transportation studies and plans that are relevant to the Yuma West Corridor. Municipal general plans also were reviewed. These plans serve as a guide to the long-term land use, circulation, growth, and development of communities, and articulate community visions for the future. Planned development and land use trends throughout the Yuma West Corridor were identified, including any references to freight or commuter rail. Table 1-1 lists the studies and plans that were reviewed. Full documentation of the review of each study or plan can be found within *Technical Memorandum #1 – Purpose and Need.* Chapter 2 provides information on relevant existing and future conditions that were generated from this review.

Table 1-1: Previous Studies and General Plans

Previous Local, Regional, and Statewide Studies	Date
METRO I-10 West Alternatives Analysis	Ongoing
MAG Hidden Valley Framework Study	Ongoing
MAG Regional Transit Framework Study	2009
MAG Commuter Rail Strategic Plan	2008
MAG Regional Transportation Plan 2007 Update	2007
Regional Public Transportation Authority Freeway Express Bus/BRT Operating Plan	2007
Interstate 10-Hassayampa Valley Roadway Framework Study	2007
State of Arizona 2007 Railroad Inventory and Assessment	2007
MAG High Capacity Transit Study	2003
MAG Southwest Area Transportation Study	2003
Valley Metro Regional Transit System Study	2003
Municipal General Plans	**Date**
City of Phoenix	2001
City of Tolleson	2005
City of Avondale	2002
City of Litchfield Park	2001
City of Goodyear	2003
Town of Buckeye	2008
Old U.S. Highway Area Plan	2007
Maricopa County Comprehensive Plan	2002

Source: URS Corp., 2009e.

1.5 Organization of the Corridor Development Plan

The remaining chapters of this Corridor Development Plan are organized as follows:

- Chapter 2: Existing and Future Conditions, describes existing and future conditions throughout the Yuma West Corridor. This chapter includes a summary of demographics, land use, railroad conditions, highway characteristics, transit services and corridor travel patterns.

- Chapter 3: Conceptual Corridor Development Plan, provides a conceptual operating plan for commuter rail that describes the potential phasing of service, target station areas, and needed infrastructure improvements to implement commuter rail service.

- Chapter 4: Cost Estimates, summarizes the methodology and results of estimating both capital and operating costs for commuter rail.

- Chapter 5: Implementation Strategy, reviews the necessary future coordination with the railroad, governance options for commuter rail, funding options, and implementation steps.

- Chapter 6: References, provides a list of sources used in the Corridor Development Plan.

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2.0 EXISTING AND FUTURE CONDITIONS

2.1 Introduction

The purpose of this chapter is to provide an overview of current and projected demographic and travel characteristics within the Yuma West Corridor. The focus is on how the communities along the corridor are expected to evolve over the next several decades, the implications for transportation demand and mobility, and the multimodal options for meeting demand and improving service in the corridor.

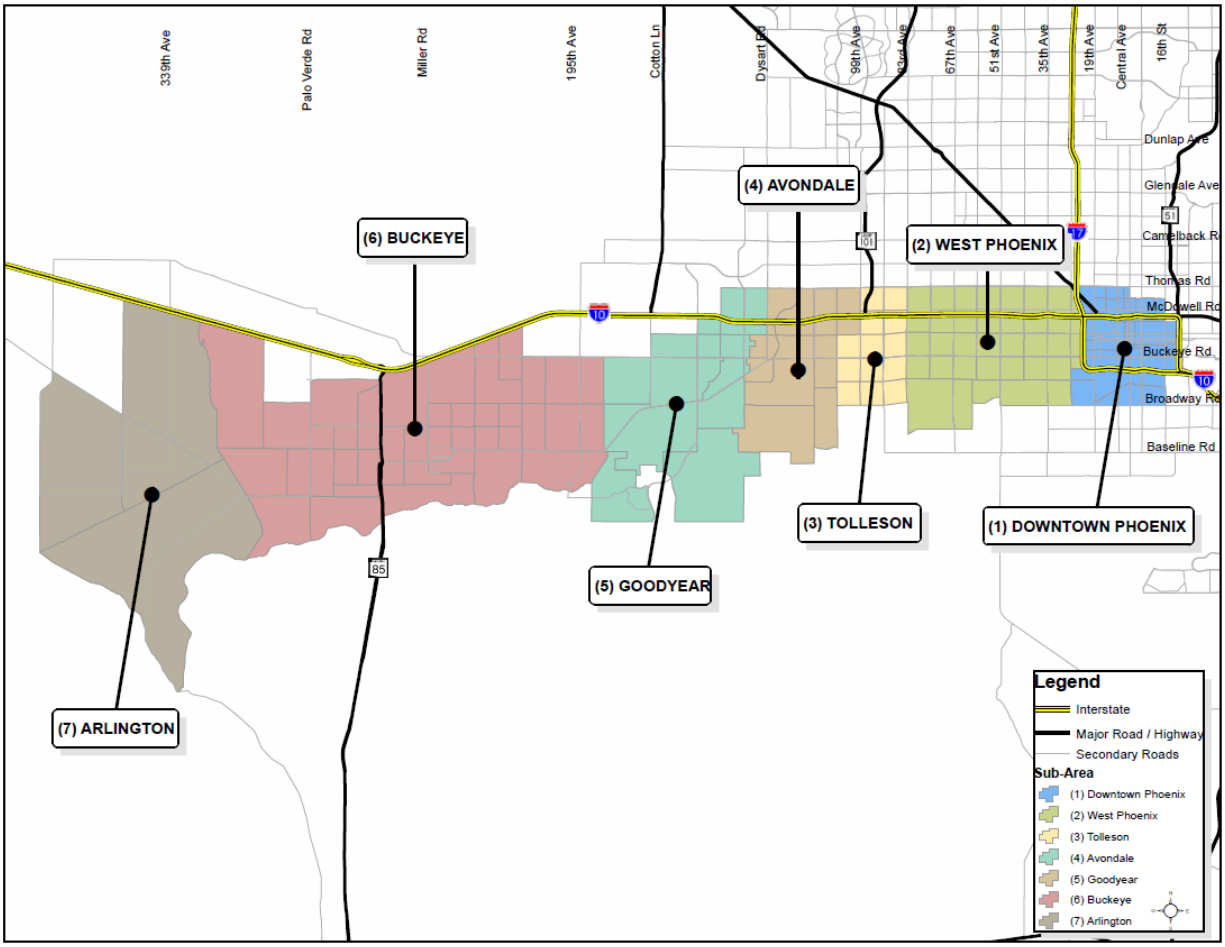
Subsequent sections of this chapter address:

- Section 2.2 summarizes the demographics—population and employment—in the area. This analysis is based on transportation analysis zones (TAZs) crossed by the Yuma West Corridor.
- Section 2.3 addresses travel patterns and how they might shift by 2030 in response to projected changes in population and employment.
- Section 2.4 summarizes current and projected land uses within two miles of the Yuma West Corridor.
- Section 2.5 describes existing conditions and future plans for area highways and transit services to meet anticipated travel demand.
- Section 2.6 provides an overview of railroad facilities in the corridor and potential safety issues.
- Section 2.7 summarizes opportunities and constraints for commuter rail in the Yuma West Corridor, based on an assessment of existing and future conditions.

2.2 Demographics

A review of existing and future population and employment projections was conducted to understand the regional characteristics associated with the Yuma West Corridor. The project corridor is defined in Section 1.0 as a two-mile buffer around the proposed alignment. For the purposes of the demographic analysis, TAZs that are within and/or touch the two-mile buffer were identified and grouped into a total of seven sub-areas based primarily on jurisdictional boundaries. The sub-areas are defined in Figure 2-1.

Figure 2-1: Sub-Area Boundaries



Source: MAG, 2007b.

2.2.1 Population

As of 2007, the Maricopa Association of Governments (MAG) region had a population of approximately 3.9 million people. According to MAG projections, that population is expected to increase approximately 56 percent to just over 6.1 million people by 2030. The seven sub-areas shown in Figure 2-1 are comprised of unincorporated Maricopa County and five cities and towns. Together, these sub-areas had a 2007 population of nearly 372,000 people with an expected 103 percent increase to just over 753,000 people by 2030.

Of the sub-areas analyzed, the (6) Buckeye sub-area is expected to experience the greatest increase in population between 2007 and 2030 with a projected 538 percent increase from nearly 33,000 people to just over 210,000 people. Other sub-areas expected to experience significant population growth by 2030 are the (7) Arlington sub-area with a 282 percent increase, and the (5) Goodyear sub-area with a 178 percent increase.

According to MAG data, the densest population in 2007 is located between State Route (SR) 303 and downtown Phoenix. However, by 2030 more population growth and increased density is projected to develop on the north side of the Union Pacific Railroad (UPRR) between

SR 303 and Maricopa County (MC) 85. Table 2-1 shows the existing and forecasted population for all sub-areas located within the project corridor.

Table 2-1: Population Growth in Project Corridor by Sub-Area

Sub-Area	2007	2015	2030	Percent Change 2007-2030
MAG Region	**3,927,827**	**4,727,248**	**6,122,490**	**56%**
(1) Downtown Phoenix	74,899	94,384	127,385	70%
(2) West Phoenix	136,180	158,653	180,801	33%
(3) Tolleson	35,397	48,573	55,360	56%
(4) Avondale	59,592	73,684	85,816	44%
(5) Goodyear	30,409	48,876	84,626	178%
(6) Buckeye	32,924	80,745	210,056	538%
(7) Arlington	2,459	4,170	9,399	282%
Total	**371,860**	**509,085**	**753,443**	**103%**

Source: MAG, 2007b.

2.2.2 Employment

In 2007, the MAG region had total employment of 1.9 million jobs. According to MAG projections, total employment is expected to increase by 74 percent and will eclipse 3.3 million jobs in 2030. Similar to the region, the project corridor is projected to experience a 76 percent increase in total employment from just over 271,000 jobs in 2007 to approximately 477,000 jobs in 2030.

Of the sub-areas that comprise the corridor, the (6) Buckeye sub-area is expected to experience the greatest increase in total employment between 2007 and 2030 with a 543 percent increase from nearly 9,000 jobs in 2007 to just over 56,000 jobs in 2030. Other sub-areas expected to experience significant employment growth are the (5) Goodyear sub-area with an increase of 265 percent, and the (7) Arlington sub-area with a 234 percent increase. Table 2-2 summarizes the existing and projected employment growth for the sub-areas located in the project corridor between 2007 and 2030.

Table 2-2: Employment Growth in Project Corridor by Sub-Area

Sub-Area	2007	2015	2030	Percent Change 2007-2030
MAG Region	**1,935,423**	**2,473,317**	**3,373,001**	**74%**
(1) Downtown Phoenix	136,967	160,104	178,893	31%
(2) West Phoenix	77,874	93,501	106,383	37%
(3) Tolleson	15,881	23,443	31,351	97%
(4) Avondale	13,924	25,443	40,327	190%
(5) Goodyear	14,918	27,480	54,432	265%
(6) Buckeye	8,766	20,869	56,360	543%
(7) Arlington	2,817	3,636	9,398	234%
Total	**271,147**	**354,476**	**477,144**	**76%**

Source: MAG, 2007b.

2.3 Travel Patterns

Travel patterns within the project corridor are largely based on the demographics of the corridor. This section provides an analysis of person trips that was conducted to aid in the understanding of existing (2007) and future (2030) travel markets.

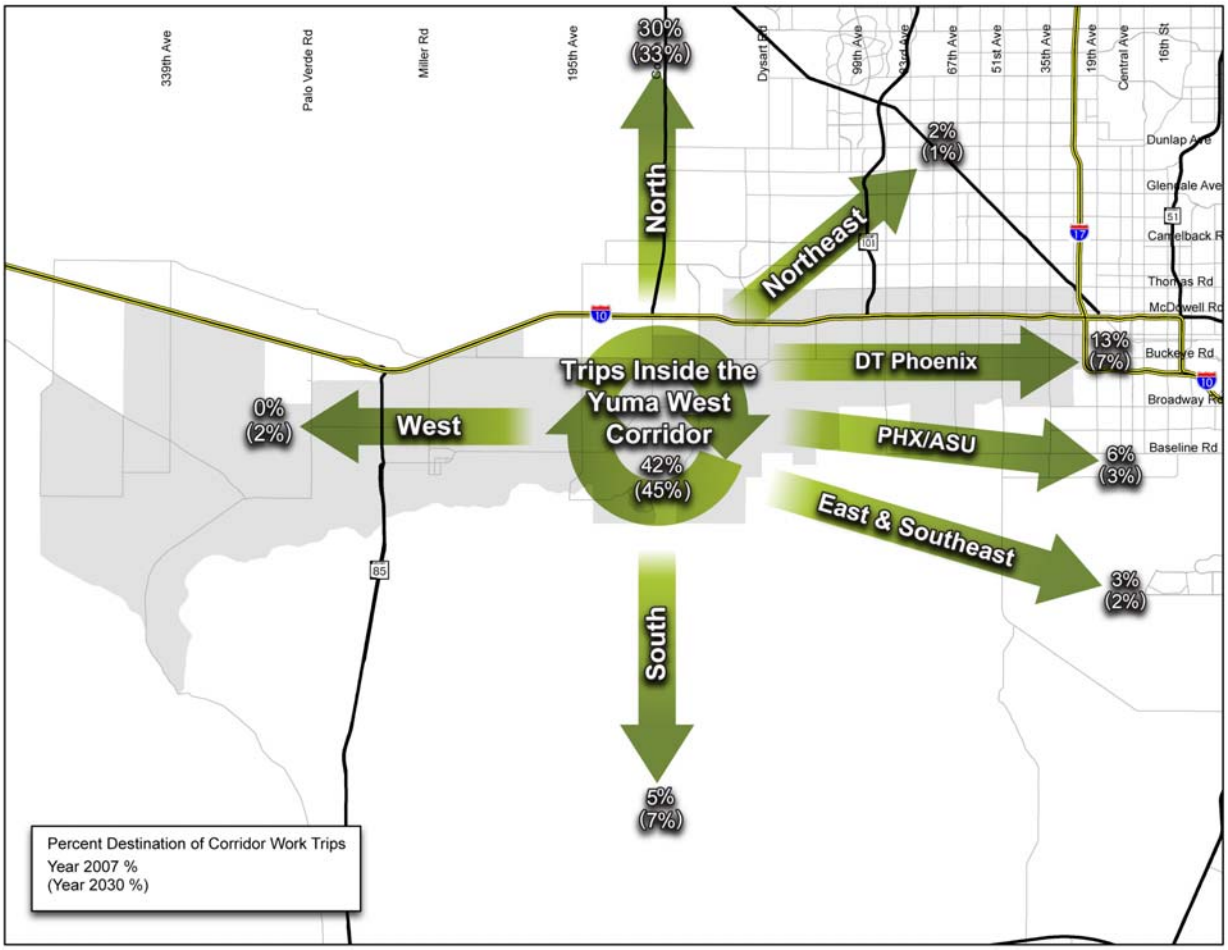
2.3.1 Travel Markets

To understand how transit could best serve the project corridor, home-based work (HBW) trips were analyzed in the MAG TransCAD Model for 2007 and 2030. HBW trips were chosen because they take place regularly and typically occur during congested periods of the day. In addition, commute trips tend to be easiest to serve by transit because employment centers often have high density of employees.

An analysis of HBW trips showed that in 2007, nearly 79,500 trips originated within the Yuma West Corridor (which, for the purposes of this analysis, is defined as the area within the TAZs shown in Figure 2-1). Figure 2-2 illustrates the percentage of work trip destinations that occur within and outside the project corridor, and provides comparative numbers for 2007 and 2030. The majority of trips are bound to destinations within the corridor or to the north. Downtown Phoenix is the destination for about 13 percent of trips, which is expected to decrease in the future. The arrow for PHX/ASU represents trips to Sky Harbor Airport and Arizona State University (ASU) in downtown Tempe, and destinations to East and Southeast are bound for other East Valley destinations.

In 2030, the number of HBW trips originating in the project corridor is projected to increase by 112 percent to approximately 168,800 trips. A comparison of HBW trips between 2007 and 2030 shows that the percentage of HBW trips traveling to areas outside the project corridor stayed relatively similar. The most notable projected change is the six percent decrease in HBW trips traveling to downtown Phoenix. This may reflect the development of more employment in communities such as Goodyear and Avondale within the corridor.

Figure 2-2: Work Trips by Residents of the Project Corridor in 2007 and 2030



Source: MAG, 2009a, 2009b.

Without additional mode choices, commuter transportation options through 2030 will be limited in the project corridor to vehicle travel by regional arterials, highway, and bus transit. Because of the projected growth in employment throughout the corridor, additional mode choices for the commuter are critical to improving mobility. The implementation of the commuter rail mode provides an opportunity for an additional choice and would be expected to serve numerous employment and activity destinations along the corridor.

2.4 Adjacent and Planned Land Uses

Land use is a critical factor influencing the success or failure of transportation systems. Land use patterns indicate the potential for ridership as well as employment or activity center destinations. Higher densities of land uses would generate more potential riders and house more potential activity centers that serve as destinations. Land use policies that are compatible with transit, such as transit-oriented development, would promote the success of potential commuter rail service in the future by facilitating better access to the rail system and to activity centers.

According to MAG data, the majority of the land within two miles of the UPRR railroad line is currently open space or vacant. Residential land uses currently account for nine percent of existing land uses in the corridor.

Future land use information is based on data collected from MAG and municipal government general plans (through 2007). The data represent land use at the projected build-out point for the corridor when all planning efforts have been realized and there is no vacant land. Much of the undeveloped land within the corridor is projected to be developed as residential uses - almost 50 percent of the total corridor. Other prevalent land uses identified at build-out include Industrial (nearly 16 percent) and Mixed Use (nearly 11 percent of future land use). Additional detail is provided in *Technical Memorandum #2: Existing and Future Conditions*.

Future/planned land use is in the process of being updated by several of the jurisdictions within the corridor. As revised plans are adopted, they will be incorporated into future MAG datasets.

2.5 Multiple Modes to Meet Travel Demand

This section describes the existing and planned transportation system in the West Valley, highlighting potential opportunities and constraints for integrating commuter rail. Section 2.5.1 addresses existing roadways and planned improvements, and existing and planned transit connections are described in Section 2.5.2.

2.5.1 Roadways

The primary travel path connecting downtown Phoenix with those living at the western edge of the project corridor and Maricopa County is the eastbound I-10 freeway. In its current state, I-10 consists of eight general use lanes in addition to a High Occupancy Vehicle (HOV) lane extending from approximately downtown Phoenix to SR 101 (see Figure 2-3). West of SR 101, the I-10 freeway consists of six general purpose lanes which are reduced to four lanes west of Dysart Road. Sections of I-10 west of SR 101 are under construction to implement freeway improvements identified in the 2007 Regional Transportation Plan (RTP) Update, as noted in Section 2.5.2 below.

I-10 at Avondale Boulevard
Source: URS Corp.

In addition to I-10, Buckeye Road/MC 85 also provides direct access from the West Valley into downtown Phoenix. This road is an arterial street located south of and parallel to I-10. Currently, the roadway consists of four through lanes (two in each direction) from downtown Phoenix to SR 303. From SR 303 west, the roadway is reduced to one lane each way.

2.5.1.1 Future Roadway Improvements

In an effort to address the current and expected increase in congestion throughout the corridor, MAG has identified multiple roadway improvements for the project corridor in the 2007 RTP update. By 2028 I-10 is anticipated to consist of ten general use lanes from downtown Phoenix to SR 101, eight general use lanes from SR 101 to SR 303, six general use lanes from SR 303 to MC 85, and four general use lanes west of MC 85. In addition, HOV lanes will be in place

extending from downtown Phoenix to SR 303. Proposed improvements to I-10 are identified in Table 2-3.

Table 2-3: Future I-10 Improvements

Phase	Extent	Improvements	Year
Phase 1	SR 101 to I-17	Add general purpose lanes	Open to traffic 2010
Phase 1	Sarival Avenue to SR 101	Add one general purpose lane and one HOV lane in each direction	Open to traffic Fall 2009
Phase 1	Sarival Avenue to Dysart Road	Add one general purpose lane and one auxiliary lane in each direction	Open to traffic Summer 2010
Phase 2	Citrus Road to Sarival Avenue	Currently under study	TBD
Phase 1	Verrado Way to Sarival Avenue	Add one general purpose lane in each direction	Open to traffic Spring 2011
Phase 4	MC 85 to Verrado Way	Add one general purpose lane in each direction	Open to traffic Summer 2024

Source: ADOT, 2009.

Along with expansion and construction of new lanes, additional interchanges on I-10 have been identified at Perryville Road, Bullard Avenue, and El Mirage Road.

In addition to improvements identified for I-10, Buckeye Road/MC 85 has been identified in the 2007 RTP Update to increase its capacity by 2028 as well. Buckeye Road/MC 85 will expand to primarily six through lanes (three each direction) between SR 101 and SR 303, and four through lanes (two each direction) from SR 303 to the west. These improvements will assist in meeting the growing demand of travel from the southwest valley into downtown Phoenix.

In an effort to relieve congestion on I-10, the RTP has identified the construction of the SR 801 freeway, also known as the I-10 reliever. When built, the SR 801 would consist of six general use lanes and provide a viable alternative to I-10 and Buckeye Road for those traveling from western Maricopa County into downtown Phoenix. The freeway would be located beginning at the southern end of SR 303 generally following the Southern Avenue alignment, connecting to the future SR 202 at approximately 59th Avenue.

2.5.1.2 Level of Service

Level of service encompasses travel time and existing and projected levels of congestion. To provide indicators of congestion along I-10, Buckeye Road, and the future SR 801, current travel characteristics between downtown Phoenix and Arlington were calculated using the MAG Regional Travel Demand Model in TransCAD. Each travel path had similar end points: 355th Avenue/Narramore Road and Central Avenue/Washington Street. From these points travel characteristics were analyzed following each separate roadway corridor.

Levels of service indicate the amount of traffic congestion on a given section of road at a given time. This is fundamentally related to the amount of traffic that a roadway experiences compared to the roadway's capacity; the closer the volume is to the roadway's capacity, the more congestion within the segment. For the purposes of categorizing congestion levels, the model can assign volumes greater than capacity which is measured by volume over capacity, or V/C. Congestion levels are assigned as follows:

- Little to No Congestion – V/C < 1;
- Moderate Congestion – V/C = 1 – 1.2; and
- Severe Congestion – V/C > 1.2.

AM Peak Period

Table 2-4 compares the traffic volume and level of congestion during the AM peak period for each route in 2007 and 2030. The screen line represents the intersection point at which congestion along the roadway is measured, ranging from Miller Road on the west end of the Yuma West Corridor to 19th Avenue in Phoenix.

Table 2-4: AM Peak Period Travel Characteristics (2007 & 2030)

2007 AM Peak Period Level of Congestion									
	I-10			Buckeye Road			*SR 801		
Screen Line	Lanes	Volume	V/C	Lanes	Volume	V/C	Lanes	Volume	V/C
(1) Miller Road	2	3,700	.46	2	500	.15	-	-	-
(2) SR 303	2	6,700	.83	1	1,600	1.02	-	-	-
(3) 99th Avenue	4	14,000	.87	2	2,200	.87	-	-	-
(4) 19th Avenue	4	22,300	1.38	2	2,800	1.00	-	-	-
2030 AM Peak Period Level of Congestion									
	I-10			Buckeye Road			*SR 801		
Screen Line	Lanes	Volume	V/C	Lanes	Volume	V/C	Lanes	Volume	V/C
(1) Miller Road	3	9,400	.78	2	100	.04	2	100	.04
(2) SR 303	3	15,500	1.28	3	3,500	.9	2	5,700	1.76
(3) 99th Avenue	4	21,900	1.35	3	3,600	.85	3	15,000	1.25
(4) 19th Avenue	5	25,900	1.28	2	3,600	1.23	5	25,900	1.28

* SR 801 is a future freeway identified as part of the 2007 RTP update; therefore it was analyzed as part of year 2030 only.
Source: MAG, 2009a, 2009b.

Between 2007 and 2030, the traffic volume and level of congestion in the AM peak period are expected to experience an increase in traffic volume at each analyzed point along I-10. Projections show that at the intersection of SR 303 and I-10, the traffic volume will increase by almost 60 percent on I-10 between 2007 and 2030. Even with the planned increase in travel lanes on I-10, severe congestion is expected to occur east of SR 303 and into downtown Phoenix in 2030.

If SR 801 is constructed as planned by 2030, congestion levels are expected to be severe immediately on segments east of SR 303. Along Buckeye Road, the model projects that other highway projects may reduce some congestion along this arterial; however, increased congestion is still anticipated at 19th Avenue in 2030.

Table 2-5 compares the travel time statistics for each primary roadway between 2007 and 2030. The travel times for each alternative between Arlington and downtown Phoenix are expected to increase by 2030, which is consistent with the expected traffic volume increases shown on Table 2-4. Overall, peak period travel times on I-10 are expected to increase even with the addition of the SR 801 reliever. If built as proposed, SR 801 would not provide a faster travel time into downtown Phoenix for commuters than I-10. Buckeye Road is expected to experience the greatest increase in travel time by 2030 increasing by 11 minutes. Although Table 2-4 shows that the level of congestion on Buckeye Road is less than what is projected on I-10 and SR 801, the travel time is greater because it is an arterial roadway rather than a limited-access freeway.

Table 2-5: AM Peak Period Travel Times (2007)

2007 AM Peak Period Travel Time						
	I-10		Buckeye Road		*SR 801	
Segment	**Distance**	**Travel Time**	**Distance**	**Travel Time**	**Distance**	**Travel Time**
355th Avenue to Miller Road	19 miles	28 minutes	16 miles	22 minutes	-	-
Miller Road to SR 303	10 miles	9 minutes	11 miles	12 minutes	-	-
SR 303 to 99th Avenue	9 miles	10 minutes	9 miles	14 minutes	-	-
99th Avenue to 19th Avenue	10 miles	19 minutes	16 miles	25 minutes	-	-
19th Avenue to Washington St	3 miles	7 minutes	2 miles	5 minutes	-	-
Total	**51 miles**	**73 minutes**	**54 miles**	**78 minutes**	**-**	**-**
2030 AM Peak Period Travel Time						
	I-10		Buckeye Road		*SR 801	
Segment	**Distance**	**Travel Time**	**Distance**	**Travel Time**	**Distance**	**Travel Time**
355th Avenue to Miller Road	19 miles	30 minutes	16 miles	23 minutes	16 miles	23 minutes
Miller Road to SR 303	10 miles	13 minutes	11 miles	19 minutes	10 miles	17 minutes
SR 303 to 99th Avenue	9 miles	11 minutes	9 miles	18 minutes	9 miles	14 minutes
99th Avenue to 19th Avenue	10 miles	19 minutes	16 miles	24 minutes	14 miles	23 minutes
19th Avenue to Washington St	3 miles	8 minutes	2 miles	5 minutes	3 miles	8 minutes
Total	**51 miles**	**81 minutes**	**54 miles**	**89 minutes**	**52 miles**	**85 minutes**

* SR 801 is a future freeway identified as part of the 2007 RTP update; therefore it was analyzed as part of year 2030 only.
Source: MAG, 2009a, 2009b.

PM Peak Period

Similar to the AM peak period travel characteristics, PM peak period traffic volumes, level of congestion and travel times were analyzed for each roadway within the Yuma West Corridor. Table 2-6 compares the traffic volume and level of congestion during the PM peak period for each route in 2007 and 2030.

Table 2-6: PM Peak Period Level of Congestion

2007 PM Peak Period Travel Characteristics									
	I-10			Buckeye Road			*SR 801		
Screen Line	Lanes	Volume	VOC	Lanes	Volume	VOC	Lanes	Volume	VOC
(1) 19th Avenue	4	24,600	1.48	2	1,700	.57	-	-	-
(2) 99th Avenue	4	20,000	1.20	2	2,600	.84	-	-	-
(3) SR 303	2	9,400	1.14	1	2,000	1.19	-	-	-
(4) Miller Road	2	4,700	.57	1	300	.39	-	-	-
2030 PM Peak Period Travel Characteristics									
	I-10			Buckeye Road			*SR 801		
Screen Line	Lanes	Volume	VOC	Lanes	Volume	VOC	Lanes	Volume	VOC
(1) 19th Avenue	5	27,100	1.31	2	2,100	.68	5	27,100	1.31
(2) 99th Avenue	5	25,300	1.22	3	3,800	.84	3	15,800	1.27
(3) SR 303	4	20,200	1.21	3	4,100	.97	3	12,800	1.03
(4) Miller Road	3	12,200	.97	1	200	.15	1	200	.15

* SR 801 is a future freeway identified as part of the 2007 RTP update; therefore it was analyzed as part of year 2030 only.
Source: MAG, 2009a, 2009b.

Between 2007 and 2030, the traffic volume and level of congestion at each screen line in the PM peak period are expected to increase along each roadway throughout the project corridor. Comparable to the AM peak period, population growth is expected to drive traffic volume increases. Despite the addition of new travel lanes on I-10, congestion is expected to worsen by 2030. SR 801 is projected to experience severe congestion east of 9th Avenue. Only Buckeye Road shows some improvements in congestion, perhaps due to increased capacity on I-10 and SR 801.

While overall traffic volumes are expected to increase, the PM peak period travel time from downtown Phoenix is also expected to increase by 2030. Table 2-7 compares the travel time statistics for each roadway between 2007 and 2030.

Table 2-7: PM Peak Period Travel Time

2007 PM Peak Period Travel Time						
	I-10		Buckeye		*SR 801	
Segment	**Distance**	**Travel Time**	**Distance**	**Travel Time**	**Distance**	**Travel Time**
Washington St to 19th Avenue	3 miles	7 minutes	2 miles	5 minutes	-	-
19th Avenue to 99th Avenue	10 miles	19 minutes	16 miles	23 minutes	-	-
99th Avenue to SR 303	9 miles	12 minutes	9 miles	15 minutes	-	-
SR 303 to Miller Road	10 miles	9 minutes	11 miles	13 minutes	-	-
Miller Road to 355th Avenue	19 miles	30 minutes	16 miles	22 minutes	-	-
Total	**51 miles**	**77 minutes**	**54 miles**	**78 minutes**	**-**	**-**
2030 PM Peak Period Travel Time						
	I-10		Buckeye		*SR 801	
Segment	**Distance**	**Travel Time**	**Distance**	**Travel Time**	**Distance**	**Travel Time**
Washington St to 19th Avenue	3 miles	9 minutes	2 miles	7 minutes	3 miles	9 minutes
19th Avenue to 99th Avenue	10 miles	18 minutes	16 miles	25 minutes	14 miles	24 minutes
99th Avenue to SR 303	9 miles	14 minutes	9 miles	19 minutes	9 miles	11 minutes
SR 303 to Miller Road	10 miles	15 minutes	11 miles	20 minutes	10 miles	24 minutes
Miller Road to 355th Avenue	19 miles	32 minutes	16 miles	23 minutes	16 miles	23 minutes
Total	**51 miles**	**88 minutes**	**54 miles**	**94 minutes**	**52 miles**	**91 minutes**

* SR 801 is a future freeway identified as part of the 2007 RTP update; therefore it was analyzed as part of year 2030 only.
Source: MAG, 2009a, 2009b.

Similar to the AM travel time projections, travel times are expected to increase on I-10 and Buckeye Road despite the freeway improvements and the addition of an I-10 reliever. SR 801 would add capacity along this general travel route but would not offer an improved travel time to downtown Phoenix from the West Valley in 2030.

Increases in projected traffic volumes and travel time for all paths between the ends of the Yuma West Corridor reflect a need for additional transportation options. Commuter rail service can provide a high-speed, high-capacity alternative to automobile travel within the corridor. Model data suggest that commuter rail could provide an additional means to reduce travel times or replace proposed roadway investments with a higher-capacity option.

2.5.2 Transit Service

The following section provides a summary of existing and planned transit services in the Yuma West Corridor. The transit services that are currently provided or planned for future implementation in the corridor include:

- Fixed route bus service
- High capacity transit (light rail)

- Demand response
- Transit passenger facilities (transit centers and park-and-ride facilities)

Bus transit service can provide or enhance connectivity among commuter rail service station locations, park-and-rides, transit centers, and other activity centers within the corridor. Shuttle service, local transit circulators, or demand response service (dial-a-ride) can act as feeders into rail stations to enhance commuter rail ridership among the general public and elderly and persons with disabilities. Overall, a more robust intermodal transit system supports all modes, by making reliable connections for daily commuters to reach their employment or other destinations.

2.5.2.1 Existing Fixed Route Bus Service

Fixed route bus service within the Yuma West Corridor is comprised of local bus, circulators, regional connectors, and express bus service.

Local Bus

Local bus routes provide mainline transit service on the region's one-mile street network. Within the project area, local bus service is provided seven days a week and operates approximately between 5:00 AM and 11:00 PM on the weekdays and between 6:00 AM and 9:30 PM on the weekends. Twenty-two local bus routes currently serve the Yuma West Corridor.

Of the 22 local bus routes that currently serve the corridor, nearly two-thirds of the routes operate with a weekday peak frequency of 30 minutes or better. The remaining routes operate at a weekday peak frequency of 35, 60, or 80 minutes. On the weekends, bus frequency is generally split between an operating frequency of 30 or 60 minutes for the routes in operation.

Circulators

Circulator services are run by individual cities and provide residents with access to various activity centers (i.e., shopping centers, community buildings, etc.) within their respective city. Two circulator routes currently operate in the eastern portions of the project corridor in downtown Phoenix. The Downtown Area Shuttle (DASH), operated by the City of Phoenix, provides service along two separate fixed routes identified as either a downtown or government route. Both DASH routes operate at a frequency of 12 minutes during the weekdays, with service operated between 6:30 AM and 6:30 PM.

The cities of Goodyear and Avondale are pursuing studies of circulator service to benefit the local communities, to help serve a growing demand for transit, and compensate for a delay in regional bus route implementation due to the recent economic downturn.

Regional Connectors

Regional connectors provide both fixed stop as well as flexible stop (upon request) service from the rural areas of Maricopa County to the urban areas. The only regional connector that operates in the project corridor is the Gila Bend Regional Connector, or Route 685. The Gila Bend Regional Connector provides the western-most transit service within the area, providing transit patrons a connection into downtown Phoenix.

Express Bus

Express bus routes provide weekday peak period commuter service between the cities in the MAG region and downtown Phoenix. Of the ten regional express routes, Express Routes 560,

562, and 573 are the only express routes that provide service in the area of the Yuma West Corridor. These three routes utilize I-10 as the primary connection to downtown Phoenix and the West Valley.

2.5.2.2 Planned Fixed Route Bus Service

Local Bus (Supergrid)

The RTP identifies a total of seven Supergrid routes that are planned to operate in the area of the Yuma West Corridor by 2021, the majority of which would serve the eastern end of the corridor. The goal of this service is to provide improved passenger access by offering a consistent level of service across all jurisdictions within the MAG region.

Express Bus

The RTP identifies one express bus route that will be funded through Proposition 400 revenues within the Yuma West Corridor. The Loop 303 Express, planned to provide service in FY 2023, would operate between Arrowhead Towne Center and the Desert Sky Mall via SR 303.

2.5.2.3 High Capacity Transit

High capacity transit, including light rail transit (LRT), refers to service that can carry large numbers of passengers per mile, per hour, typically at higher travel speeds than local buses. Currently light rail does not serve the West Valley. The RTP identifies an 11-mile high capacity transit Phoenix West extension from the existing light rail corridor along Central Avenue in downtown Phoenix to the west, potentially along I-10 West to approximately the 79th Avenue Park-and-Ride. The METRO Board extended the anticipated year of operation of the Phoenix West Extension to fiscal year 2021 from 2019, the original year of operation identified in the RTP.

2.5.2.4 Demand Response Service

Demand response service, also known as dial-a-ride or paratransit, provides door-to-door service for persons with a disability who are unable to access the existing bus system. While not federally mandated, some providers offer this service to seniors (age 65 and over) who may not qualify for Americans with Disabilities Act (ADA) service or to the general public where bus service does not exist. Unlike local and express bus service, demand response service does not necessarily follow a predetermined route. Demand response riders are transported door-to-door or curb-to-curb based on mobility needs, provided that both locations are within the service area.

The City of Phoenix provides demand response service to the eastern portion of the Yuma West Corridor, and the Southwest Valley ADA Service provides demand response service for western Phoenix, Tolleson, Avondale, and Goodyear. Maricopa County Special Transportation Service previously operated within the area until its discontinuation of service in June 2009.

2.5.2.5 Transit Centers

The sole transit center located within the area of the Yuma West Corridor is Central Station located in downtown Phoenix near Van Buren Street and Central Avenue. There are no planned transit centers within the Yuma West Corridor.

2.5.2.6 Park-and-Ride Facilities

Four existing park-and-ride facilities are located within the project corridor that provide transit riders with access to local bus service, circulators, and express bus routes. These park-and-ride

locations are located within the cities of Phoenix, Tolleson, Avondale and Goodyear. A park-and-ride is identified within the RTP in east Buckeye at I-10 and Verrado Way, to serve the Papago Freeway Connector and Buckeye Express. Planning is under way for a new park-and-ride/transit center located within the Avondale City Center development near I-10 and Avondale Boulevard. The opening date of the park-and-ride/transit center is to be determined.

2.6 Union Pacific Rail Line Track and Facilities

This section provides an overview of the UPRR track and facilities between Union Station in downtown Phoenix to the Arlington siding, located west of the Town of Buckeye. The following sections address existing conditions, major facilities in the corridor, any safety issues that may exist, and any known future conditions of the rail line within the project corridor.

2.6.1 Existing Conditions

Union Pacific Railroad Corridor adjacent to Buckeye Road in Avondale, Arizona
Source: ADOT.

The project corridor is part of what is known as the Phoenix Subdivision of the UPRR. The UPRR Phoenix Subdivision, built in 1887, extends 209.7 miles from a junction with the UPRR Sunset mainline in Welton (Milepost 770.0) east through the greater Phoenix area to Picacho (Milepost 979.7) where it rejoins the Sunset line. Currently, the Phoenix Subdivision is not operated as a through route, but as two spurs. The longest of these, still referred to at the Phoenix Subdivision, constitutes the segment from Picacho west through the Phoenix area to Milepost 802.8. The westernmost 52.3 miles of this segment—beyond Milepost 855.1—are used for freight rail car storage only. The segment of the subdivision running eastward from Welton to Milepost 802.8 is operated as the “Roll Industrial Lead.”

The line is single track with passing sidings located at 23rd Avenue in Phoenix (3,661 feet in length), Cashion (4,825 feet in length), Litchfield (3,595 feet in length), Buckeye (3,707 feet in length), Dixie (3,537 feet in length), and at 355th Avenue in Arlington (3,628 feet in length). The line is signaled with Automatic Block Signaling and is dispatched by Direct Traffic Control.

The portion of the Phoenix Subdivision within the Yuma West Corridor currently averages approximately three local/switching trains a day. UPRR is continuing to make improvements throughout the corridor and has completed the construction of Campo Yard in 2002, added three additional tracks and a trans-load track to the Phoenix Yard in 2004, and expanded the Phoenix auto facility in 2005. In spring 2009, a system tie-gang resurfaced and installed new ties along the entire mainline between Phoenix and Picacho Junction. In spring 2010, a system steel track gang installed continuous welded rail on the Phoenix Subdivision from Phoenix Harrison Street yard eastward through Tempe and Mesa and southeast to Picacho Junction (Eloy).

2.6.2 Facilities

Rail facilities located throughout the corridor would be impacted by the potential implementation of commuter rail service. These facilities are shown in Figure 2-3 and include:

UPRR through Buckeye Yard site
Source: ADOT/RL Banks.

- **Palo Verde Nuclear Power Plant Spur** is located at Milepost 859.3, west of the proposed end of line in Arlington. This spur is a single track that serves the nuclear power generation plant. Future commuter service may impact freight traffic coming from the east to serve this destination.
- **Buckeye Yard** is located at Milepost 875.7, just east of the intersection of Baseline Road and Miller Road in Buckeye. The former Buckeye depot site-footprint north of the tracks could be used as a potential commuter rail station location as it has ample room for parking and is located close to historic downtown Buckeye. The current Buckeye yard serves customers in the Buckeye area and freight service may be disrupted by passenger rail. All of the existing customers are located on the south side of the tracks, away from the historic passenger station site.
- **Litchfield Junction** was located near the intersection of Litchfield Road and SR 85 immediately southeast of the Phoenix Goodyear Airport at milepost 889.3 until it was removed in spring 2010. The 2.5-mile Litchfield Industrial Lead connected the City of Goodyear at Litchfield Junction with the City of Litchfield Park. The north-south line was built in the 1920s to serve primarily agricultural and other local heavy industries. The lead was a single track, non-signaled line composed of 90 pound rail (rolled 1918-1974) with a maximum track speed of 20 miles per hour. One customer was served on this line as of late 2006, however it relocated to a new facility on the Yuma-West mainline, which permitted the UPRR file with the Surface Transportation Board (STB) to abandon the branch. In 2009, abandonment was granted by the STB. The entire branch is expected to be removed and scrapped by spring 2010, with the right-of-way being offered for sale to adjacent landowners, City of Phoenix Aviation Department, and other commercial businesses. Two inspections of this line were performed by MAG staff in 2009 and the short corridor was deemed unsuitable for commuter rail service due to its highly industrial profile, surrounding low density residential, and the physical inability to expand the corridor north beyond I-10.
- **Campo Yard** is located at Milepost 902.0 between 43rd Avenue and 35th Avenue in Phoenix and holds 12 sets of tracks. It is located in the middle of many industrial uses and has adjacent spurs that extend both north and south to serve these customers. Should commuter service be implemented, freight traffic to these locations could be impacted based on the potential schedule conflicts.
- **Union Station** is located near Milepost 906.0 at the intersection of 4th Avenue and Harrison Street in downtown Phoenix. It served as the main station for Amtrak passenger service in downtown Phoenix until 1996 when service was discontinued.

- **Phoenix Harrison Street Yard** is located at Milepost 907.0 between 7th Street and 16th Street in downtown Phoenix, east of Union Station. It is made up of over 20 sets of tracks with spurs offering service to customers located in the industrial district to the south. Future commuter rail service could impact rail freight movement to and from the Phoenix Yard. An intermodal facility and an automobile trans-load facility are also located on the south side of the Harrison Street Yard.

2.6.3 Future Conditions

Potential future improvements have been identified throughout the Yuma West Corridor and the Phoenix Subdivision, including building a new yard in west Buckeye to serve customers in the West Valley. In addition, according to the ADOT State of Arizona 2007 Railroad Inventory and Assessment Report (2007), a private developer has expressed interest in building a cement manufacturing and distribution plant near 99th Avenue and Buckeye Road in Tolleson. These improvements would allow for enhanced freight service as well as improve the railroad infrastructure.

2.6.4 Rail Safety

There are a total of 48 grade crossings along the Yuma West Corridor between Union Station in downtown Phoenix and Arlington. These crossings have varying types of protection associated with them. The types of warning devices utilized throughout the corridor include:

- Lights, Bells and Gates (LBG)
- Railroad Crossbuck Signs (XB)
- Stop Signs (SS)

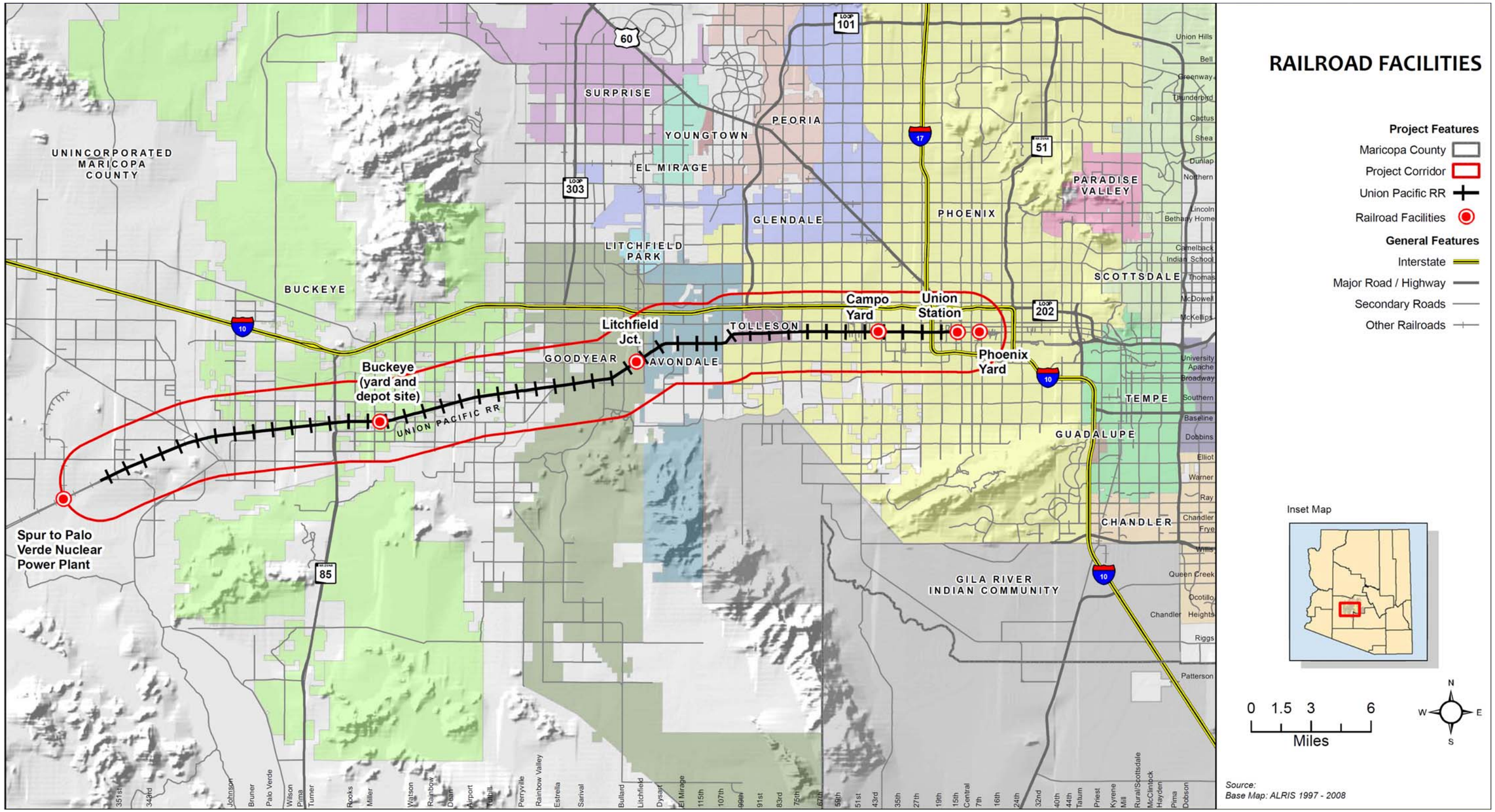
The Federal Railroad Administration (FRA) Office of Safety Analysis documents the number of accidents at highway/railroad intersections every year. This documentation includes accident data for every highway/rail crossing on every rail line in the country. The portions of the UPRR Phoenix Subdivision located within the Yuma West Corridor account for a nominal amount of highway/rail accidents. Between January 2000 and December 2008 there were a total of five incidents within the project corridor as identified in Table 2-8.

Table 2-8: Yuma West Corridor Highway/Rail Accidents (2000-2008)

Crossing ID	City	Warning Device	Total Accidents
741448R	Phoenix	LBG/w2C	1
741026X	Phoenix	LBG	1
741454U	Phoenix	LBG	1
741452F	Phoenix	LBG	1
741802V	Tolleson	LBG(4)/w2C	1
Total Accidents in Yuma West Corridor			**5**

Source: FRA, 2009.

Figure 2-3: Railroad Facilities



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2.7 Summary of Opportunities and Constraints for the Yuma West Corridor

The Yuma West Corridor has experienced substantial population and employment growth over recent decades, and future growth is projected to be significant through 2030. Existing and future population and employment growth within the Yuma West Corridor would result in high levels of automobile congestion. This congestion is expected to occur despite roadway improvements and transit service programmed within the RTP. Commuter rail provides an opportunity to increase mobility, especially for longer-distance, peak period trips.

The railroad track within the Yuma West Corridor is owned and maintained by UPRR. Current freight traffic on the line averages approximately three local/switching trains a day. UPRR has been continuing to make improvements in the corridor and may foresee additional commercial traffic as the area continues to develop. Without careful planning, concurrent operation of freight and commuter rail in the corridor may affect operations at existing UPRR yards, including Campo Yard and potentially the Phoenix Harrison Street Yard.

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3.0 CONCEPTUAL CORRIDOR DEVELOPMENT PLAN

3.1 Introduction

The purpose of this chapter is to describe the Yuma West Conceptual Corridor Development Plan, which is a framework for how commuter rail service could be developed and operated between downtown Phoenix and Buckeye. The chapter is organized as follows:

- Section 3.2 describes the assumptions that were incorporated into the Development Plan, including ridership forecasting, recommended vehicle technology, and station target areas. The planning assumptions provide the foundation for which commuter rail implementation feasibility is assessed.
- Section 3.3 summarizes the commuter rail Operations Plan, which is based on a phased approach to implementing service. This section details the service frequencies and schedules for each phase as well as the projected travel times and fleet size requirements. The Operations Plan is directly associated with costs to implement service.
- Section 3.4 presents commuter rail ridership projections for the Yuma West Corridor as a stand-alone corridor as well as ridership projections for the Yuma West Corridor as part of a larger multi-corridor commuter rail system in the region.
- Section 3.5 describes the infrastructure requirements needed to implement commuter rail in the Yuma West Corridor.
- Section 3.6 provides an overview of commuter rail layover and maintenance facility needs and potential locations for each type of facility within the corridor.

3.2 Assumptions

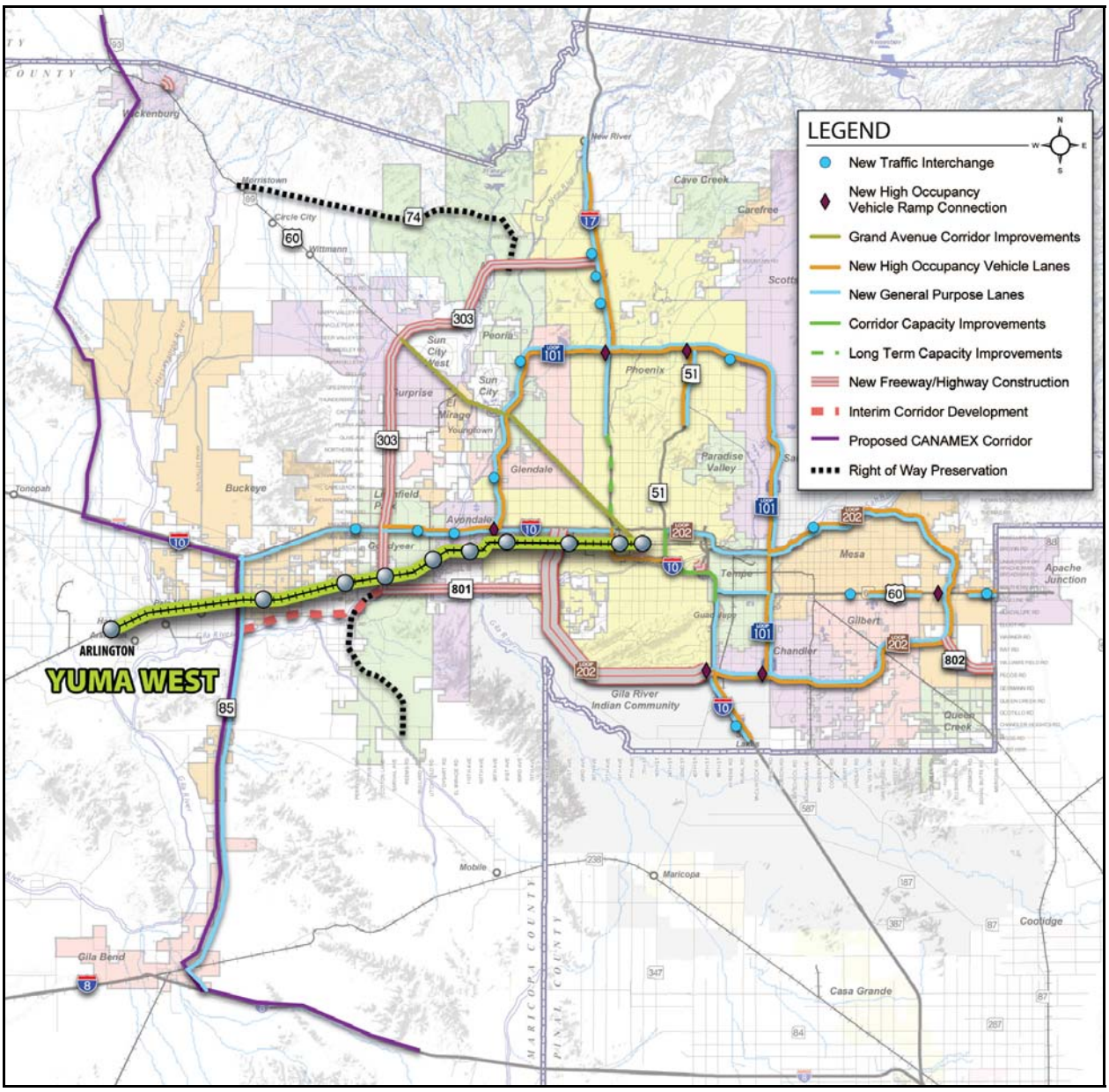
In developing the Conceptual Corridor Development Plan, a set of assumptions for ridership forecasting, vehicle technology, and station locations were applied to establish a baseline of operations from which the feasibility for the corridor could be established. The following subsections summarize these assumptions.

3.2.1 Ridership Forecasting

Ridership forecasting was performed using the MAG TransCAD travel demand model. This model was developed with a 2007 base year, an interim year of 2015, and a forecast year of 2030. The 2030 model was used for Yuma West Corridor ridership forecasting and incorporates both roadway and transit improvements specified in the 2030 Regional Transportation Plan (RTP), including approximately 57 miles of high capacity transit throughout the Phoenix metropolitan area.

Currently, the only major transportation facility serving the area of the Yuma West Corridor is Interstate 10 (I-10). There are limited existing and planned east/west travel routes serving commuters in the West Valley, and the assumptions made regarding future highway improvements are influential in assessing the demand for commuter rail. A lack of future, additional highway capacity would make the travel times for commuter rail increasingly competitive and attractive to riders. Figure 3-1 illustrates the Yuma West Corridor in relationship to planned roadway improvements in the RTP. All improvements are assumed to occur in the base modeling.

Figure 3-1: Yuma West Corridor and RTP Roadway Improvements



Source: MAG, 2007.

The delay or postponement of some highway capacity improvements is under discussion in the MAG region, which would affect the modeling results for commuter rail described in Section 3.4. To address this possibility, a sensitivity test was conducted as part of the modeling effort to assess the impact of fewer roadway improvements on commuter rail ridership. This test removed the following highway improvements west of Interstate 17, which were assumed to occur in the base modeling:

- State Route 801 (I-10 reliever)
- Loop 303 – I-10 to State Route 801

The results of the sensitivity test are discussed in Section 3.4.3. Future choices of investments in roadway and transit also have an interdependent relationship with future growth in this area, which are affected by availability of travel routes and mode choice.

3.2.2 Vehicle Technology

The Project Team evaluated Locomotive Hauled Coaches (LHC) and Diesel Multiple Unit (DMU) technologies to determine which type of commuter rail vehicles would be most appropriate for the Yuma West Corridor. The evaluation primarily took into account the feasibility of implementing LHC versus DMU. LHC systems are common on U.S. commuter rail systems, and the only current use of DMU in the U.S. is the WES Commuter Rail line operated by TriMet in Oregon. Although DMU vehicles could accommodate the expected ridership in this corridor, an "off-the-shelf" DMU that is compliant with Federal Railroad Administration (FRA) crashworthiness requirements is unavailable at the time of this report. Although a new manufacturer – US Railcar – has announced its intention to manufacture DMUs for the U.S. market, it is uncertain when this technology will become available. Therefore, FRA-compliant LHCs are the assumed vehicle technology for the corridor. For a complete description of the vehicle technology evaluation, see Appendix A: Vehicle Technology Assessment.

Example of LHC vehicles in San Diego, California
Source: NCTD

LHCs are powered by one diesel-electric locomotive engine and are configured for push-pull operation. In push-pull service, the locomotive pulls the train in one direction and pushes the train in the opposite direction. A cab car with operating controls is put on one end of the train and a locomotive at the other end. LHCs may be two-car to 12-car consists.

The seated capacity of each double-deck passenger car, typically used in LHC commuter rail operations, is approximately 140 passengers; therefore, a four-car train (three coaches and one cab control car) would seat approximately 560 passengers.

For a more detailed description of LHC features and vehicle procurement options, see Appendix A: Vehicle Technology Assessment.

3.2.3 Station Target Areas

An assessment was conducted of potential station areas along the Yuma West Corridor. Planning for station target areas at this level of analysis is based primarily on projected employment and population density nodes in the corridor and the distance between stops that determines overall expected speed and travel times. Other factors are also important, including the travel markets expected between each node and engineering feasibility associated with constructability at a particular location. To achieve balance in analyzing all factors, this assessment occurred in several steps. As ridership forecasting progressed, refinements were made to the initial station area assumptions to optimize ridership potential and reflect the input of stakeholder jurisdictions. The remainder of this section explains the decision-making process that led to the station areas reflected in the operating plan for the Yuma West Corridor.

Initial station areas were identified based on the 2003 MAG High Capacity Transit Study and MAG and stakeholder input. For the purposes of the evaluation, station locations are identified by major intersections along the rail corridor. At this level of analysis, specific parcels are not identified for potential station locations. Potential station locations were characterized and assessed based on a set of evaluation criteria, including station boardings, demographic and employment projections, land use, connectivity with existing and planned transportation systems, and major activity centers.

The initial station areas assessed along the Yuma West Corridor are listed in Table 3-1, and are listed from east to west.

Table 3-1: Distances Between Initial Target Station Areas

Corridor Segment by Station Area	Approximate Distance between Station Areas (mi)*
Special Events to Downtown Phoenix	0.6
Downtown Phoenix to State Capitol	1
State Capitol to West Phoenix	4
West Phoenix to Tolleson	5
Tolleson to Downtown Avondale	3
Downtown Avondale to Goodyear Airport	3
Goodyear Airport to Goodyear Estrella	4
Goodyear Estrella to Buckeye-Liberty	3
Buckeye-Liberty to Downtown Buckeye	7
Downtown Buckeye to Arlington	14
Total Distance	44

* Distance measured from center of station area
Source: URS Corp., 2009a.

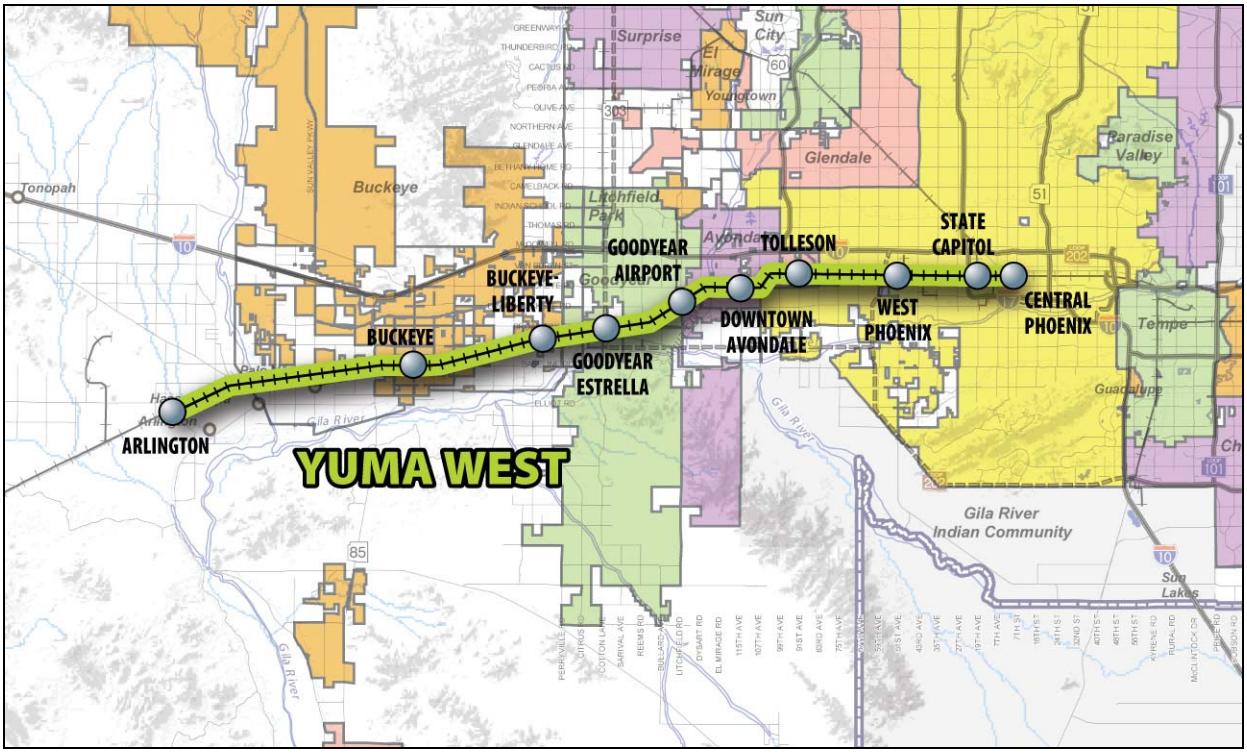
For a detailed description of the station location evaluation, see Appendix B: Conceptual Station Planning. An overview of the general location of each station area and connectivity with other transit are provided in Table 3-2. Station areas are illustrated on Figure 3-2.

Table 3-2: Characteristics of Station Areas

Station Area	General Location	Facility Type				No. of Bus Routes
		Park-and-Ride	Kiss-and-Ride	Bus Transfer	LRT Transfer	
Central Phoenix	4th Avenue/Harrison Street		✓	✓		4
State Capitol	17th Avenue/Harrison Street		✓			0
West Phoenix	51st Avenue/Harrison Street	✓	✓			1
Tolleson	91st Avenue/Harrison Street	✓	✓			0
Avondale	Avondale Boulevard/Buckeye Road	✓	✓	✓		2
Goodyear Airport	Litchfield Road/Buckeye Road	✓	✓	✓		3
Goodyear Estrella	Cotton Lane/MC 85 or Estrella Parkway/MC 85	✓	✓	✓		1
Buckeye-Liberty	Jackrabbit Trail/Broadway Road	✓	✓			0
Buckeye	Miller Road/Baseline Road	✓	✓			0
Arlington	355th Avenue/Narramore Road	✓	✓			0

Source: URS Corp., 2009b.

Figure 3-2: Yuma West Corridor



Source: URS Corp., 2009a, 2009c.

Throughout the ridership forecasting effort, station target areas were assessed in a scenario with a 2030 commuter rail system. Estimated daily boardings at Arlington were low in initial

modeling scenarios. As a result, the extension of service from Buckeye to Arlington is part of a later phase of service - beyond 2030 - as longer-term growth and development occurs.

After the base modeling was completed, the Yuma Project Review Team also suggested two additional recommendations: to consolidate the two Goodyear stations into one station located at Estrella Parkway; and to remove the Liberty station area. These changes would improve travel times and be consistent with local planning efforts. It was determined that these changes would reduce the overall travel time in the corridor by about two minutes, and would not appreciably influence the projected boardings for the overall corridor. Fewer stations would reduce costs somewhat without affecting overall boardings (see Chapter 4 for discussion of cost estimates).

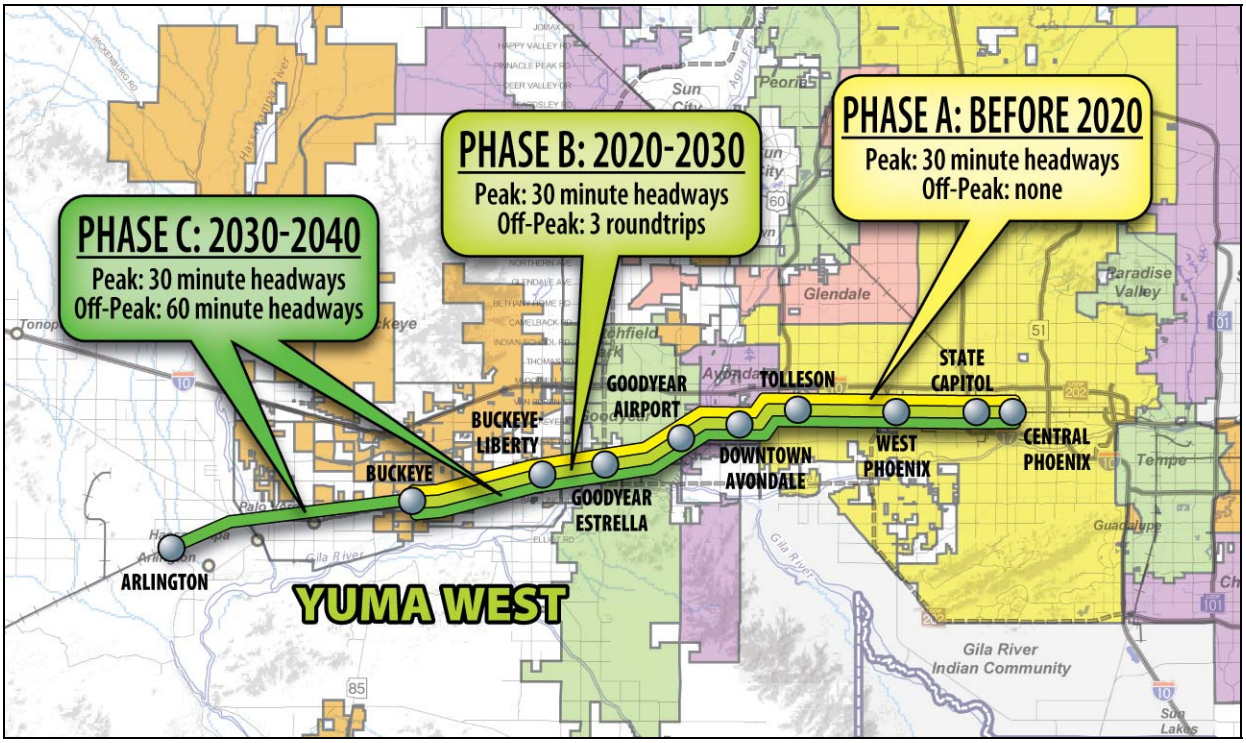
3.3 Operations

The commuter rail Operations Plan describes the proposed operations and characteristics of commuter rail service in the Yuma West Corridor. It details the proposed service levels, travel time, and commuter rail vehicle fleet size as well as other commuter rail characteristics. The following subsections summarize the key elements of the plan, which is included in Appendix C: Yuma West Corridor Operations Plan.

3.3.1 Service Levels

Proposed service levels are presented in a phased approach to developing commuter rail within the Yuma West Corridor. Each phase may be pursued in response to available funding and ridership demand, to balance costs and ridership. These phases are associated with varying levels of forecasted ridership, required infrastructure improvements, and cost to start up and expand the commuter rail system in the corridor.

Figure 3-3: Proposed Service Levels



Source: URS Corp., 2009a.

Phase A is proposed as the initial phase of operation, during which commuter rail would operate as peak period, one-way service. The second phase of operation (Phase B) would intensify the frequency of service in both directions throughout the day. Phase C entails expanded bidirectional service extended west to Arlington. Each phase is described in more detail in the following sections.

3.3.1.1 Phase A Operations – Initial Service – Before 2020

Phase A proposed commuter rail service, which is expected to be implemented before 2020, would operate between Central Phoenix and Buckeye, a distance of approximately 31 miles. Service would consist of four trains inbound to Phoenix in the AM peak and four trains outbound from Phoenix in the PM peak. Peak service would operate on 30-minute headways. Service would be provided for two and one-half hours during each peak period on weekdays and on weekends for special sporting or other events only. The scheduled weekday train departures are shown in Table 3-3.

Table 3-3: Phase A Weekday Commuter Rail Schedule

From Buckeye	
AM Peak	6:00 a.m.
	6:30 a.m.
	7:00 a.m.
	7:30 a.m.
Total Trains	4

From Central Phoenix	
PM Peak	5:00 p.m.
	5:30 p.m.
	6:00 p.m.
	6:30 p.m.
Total Trains	4

Note: Commuter rail schedule is conceptual and subject to change.
Source: URS Corp., 2009a.

3.3.1.2 Phase B Operations – Intermediate Years 2020-2030

During this phase bidirectional, non-peak, and Saturday service would be added between downtown Phoenix and Buckeye. Overall, the service would operate on 30-minute headways during peak periods in peak direction, with two reverse-direction trains during the peak periods. Off-peak service would consist of two mid-day and one evening round trips. As with Phase A, trains also would be operated for major events and sporting events as appropriate. The scheduled weekday train departures are shown in Table 3-4.

Table 3-4: Phase B Weekday Commuter Rail Schedule

From Buckeye	
AM Peak	6:00 a.m.
	6:30 a.m.
	7:00 a.m.
	7:30 a.m.
	8:00 a.m.
Mid-Day	12:00 p.m.
Mid-Afternoon	3:00 p.m.
PM Peak	5:30 p.m.
	6:30 p.m.
Evening	8:00 p.m.
Total Trains	10

From Central Phoenix	
AM Peak	7:00 a.m.
	7:30 a.m.
Mid-Morning	11:00 a.m.
Mid-Afternoon	2:00 p.m.
PM Peak	5:00 p.m.
	5:30 p.m.
	6:00 p.m.
	6:30 p.m.
	7:00 p.m.
Evening	9:00 p.m.
Total Trains	10

Note: Commuter rail schedule is conceptual and subject to change.
Source: URS Corp., 2009a.

3.3.1.3 Phase C Service – Buildout Years 2030 – 2040

During Phase C, service would be extended to Arlington and expanded to seven days a week. Peak service would operate at 30 minute headways, and off-peak service at 60-minute headways. Bidirectional service would be provided throughout the day, as shown in Table 3-5.

Table 3-5: Phase C: Weekday Commuter Rail Schedule

From Arlington	
AM Peak	5:00 a.m.
	5:30 a.m.
	6:00 a.m.
	6:30 a.m.
	7:00 a.m.
	7:30 a.m.
	8:00 a.m.
	8:30 a.m.
	9:30 a.m.
Mid-Day	10:30 a.m.
	11:30 a.m.
	12:30 p.m.
	1:30 p.m.
	2:30 p.m.
PM Peak	3:00 p.m.
	3:30 p.m.
	4:00 p.m.
Evening	4:30 p.m.
	5:00 p.m.
	5:30 p.m.
	6:00 p.m.
	7:00 p.m.
	8:00 p.m.
	9:00 p.m.
	10:00 p.m.
Total trains	25

From Central Phoenix	
AM Peak	5:15 a.m.
	5:45 a.m.
	6:15 a.m.
	6:45 a.m.
	7:15 a.m.
	7:45 a.m.
	8:15 a.m.
	8:45 a.m.
Mid-Day	
	9:45 a.m.
	10:45 a.m.
	11:45 a.m.
	12:45 p.m.
	1:45 p.m.
PM Peak	2:45 p.m.
	3:15 p.m.
	3:45 p.m.
	4:15 p.m.
	4:45 p.m.
	5:15 p.m.
	5:45 p.m.
Evening	6:15 p.m.
	6:45 p.m.
	7:45 p.m.
	8:45 p.m.
	9:45 p.m.
Total trains	25

Note: Commuter rail schedule is conceptual and subject to change.
Source: URS Corp., 2009a.

As part of a broader assessment of a regional system in the MAG Commuter Rail System Study, extensions to the Yuma West Corridor were evaluated that would serve future growth beyond the 2030 planning horizon. Potential extensions include a Hassayampa corridor that would connect the Yuma West Corridor with Grand Avenue and serve the far West Valley; a Hidden Waters – Gila Bend Extension that would connect Arlington to Gila Bend; and a Hidden Valley Extension that would connect Goodyear with Mobile through Rainbow Valley. Potential extensions were considered based on projected 2035 development scenarios; see the MAG Commuter Rail System Study for additional information.

3.3.2 Travel Times

The one-way travel time for the Yuma West Corridor is estimated to be 48 minutes between Phoenix and Buckeye and 61 minutes between Phoenix and Arlington, including stops at intermediate stations. The average speed for commuter rail trains for the 31 miles between Phoenix and Buckeye would be approximately 40 mph. The average speed for commuter rail trains for the 44 miles between Phoenix and Arlington would be approximately 43 mph. The estimated station to station and total travel times are shown in Table 3-6.

Table 3-6: Estimated Travel Times between Station Areas

Station	Cumulative Miles	Average Speed	Run Time (min)	Station Dwell (min)	Total Trip Time (min)	Cumulative Trip Time
Central Phoenix	0.0			0.0		
		20	3.3			3.3
State Capitol	1.1			0.5	3.8	3.8
		30	8.4			12.2
West Phoenix	5.3			0.5	8.9	12.7
		40	7.4			20.1
Tolleson	10.2			0.5	7.9	20.6
		45	4.4			25.0
Downtown Avondale	13.5			0.5	4.9	25.5
		45	4.3			29.8
Goodyear Airport	16.7			0.5	4.8	30.3
		50	5.0			35.3
Goodyear Estrella	20.9			0.5	5.5	35.8
		50	3.7			39.5
Liberty	24.0			0.5	4.2	40.0
		55	7.2			47.2
Buckeye	30.6			0.5	7.7	47.7
		60	13.4			60.1
Arlington	44.0			0.0	13.4	60.1
Totals		**43**	**57**	**4**	**61**	**61**

Source: URS Corp., 2009a.

If several changes to station areas are completed as recommended in Section 3.2.3, travel times would change slightly, as shown in Table 3-7. Overall, fewer stations reduces the cumulative trip time by about two minutes.

Table 3-7: Estimated Travel Times between Revised Station Areas

Station	Cumulative Miles	Average Speed	Run Time (min)	Station Dwell (min)	Total Trip Time (min)	Cumulative Trip Time
Central Phoenix	0.0			0.0		
		20	3.3			3.3
State Capitol	1.1			0.5	3.8	3.8
		30	8.4			12.2
West Phoenix	5.3			0.5	8.9	12.7
		40	7.4			20.1
Tolleson	10.2			0.5	7.9	20.6
		45	4.4			25.0
Downtown Avondale	13.5			0.5	4.9	25.5
		45	4.8			30.3
Goodyear	17.1			0.5	5.3	30.8
		55	14.7			45.5
Buckeye	30.6			0.5	15.2	46.0
		60	13.4			59.4
Arlington	44.0			0.0	13.4	59.4
Totals		**44**	**56**	**3**	**59**	**59**

Source: URS Corp., 2009a.

In comparison, the morning peak period travel times for cars to downtown Phoenix from Buckeye and Arlington are presented in Table 3-8. The vehicle travel times are projected for 2030, and assume that all roadway improvements in the RTP have been implemented. These data suggest that commuter rail provides a faster option than a low-occupancy vehicle (i.e., one that is not in the HOV lane) from Buckeye to downtown Phoenix. Commuter rail provides faster travel times than a car from Arlington regardless of whether the car is a high-occupancy vehicle.

Table 3-8: 2030 Peak Period Auto Travel Times to Downtown Phoenix (in minutes)

Corridor Endpoint	Low Occupancy Vehicle	High Occupancy Vehicle	Commuter Rail
Buckeye	49.5	42.8	45.0
Arlington	67.9	61.2	58.4

Notes: Commuter Rail travel time assumes the revised station recommendations (see Section 3.2.3).
Source: MAG model, 2009.

3.3.3 Fleet Size

Fleet size is based upon the total round trip time from end to end, plus terminal turn-back time, divided by the peak-period headway, multiplied by the number of cars in a peak period train, plus one or two operational spare trains (for one or both ends of the corridor depending upon its length and trip time), and a maintenance spare train. The Operations Plan assumes 15 minutes for terminal turn-back time at each terminal. Table 3-9 shows the estimated fleet size requirements by phase for the Yuma West Corridor. Fleet size requirements are identical for Phases A and B.

Table 3-9: Fleet Size Requirements

Phase	Number of Locomotives	Number of Cab Cars	Number of Coaches
Phase A – Phoenix to Buckeye	5	5	5
Phase B – Phoenix to Buckeye	5	5	5
Phase C – Phoenix to Arlington	7	7	7

Source: URS Corp., 2009a.

3.4 Ridership Projections

The stand-alone, base Yuma West Corridor terminates in downtown Phoenix. A downtown Phoenix terminus was identified for all base corridors as part of the Commuter Rail System Study to minimize corridor overlap to the extent possible during the overall evaluation process. However, the potential changes to ridership along the Yuma West Corridor that would result from access to Sky Harbor Airport, downtown Tempe, or other destinations east of Phoenix was assessed as part of the analysis of multiple, interlined corridors. As part of that analysis, the Yuma West Corridor was interlined with several East Valley corridors, which would enable a "one-seat ride" from the West to the East Valley. The comparison of the base corridor (terminating in downtown Phoenix) and the interlined corridors allows for a comparison of the impacts of building the line farther east. The following section provides the ridership forecasting results for both the base, stand-alone Yuma West Corridor and multi-corridor interlined options that would travel farther east. Please note that the multi-corridor scenarios described in Section 3.4.2 assume Phase B service along the Yuma West Corridor, which would be implemented between the years 2020 and 2030.

3.4.1 Stand-alone Corridor Scenario

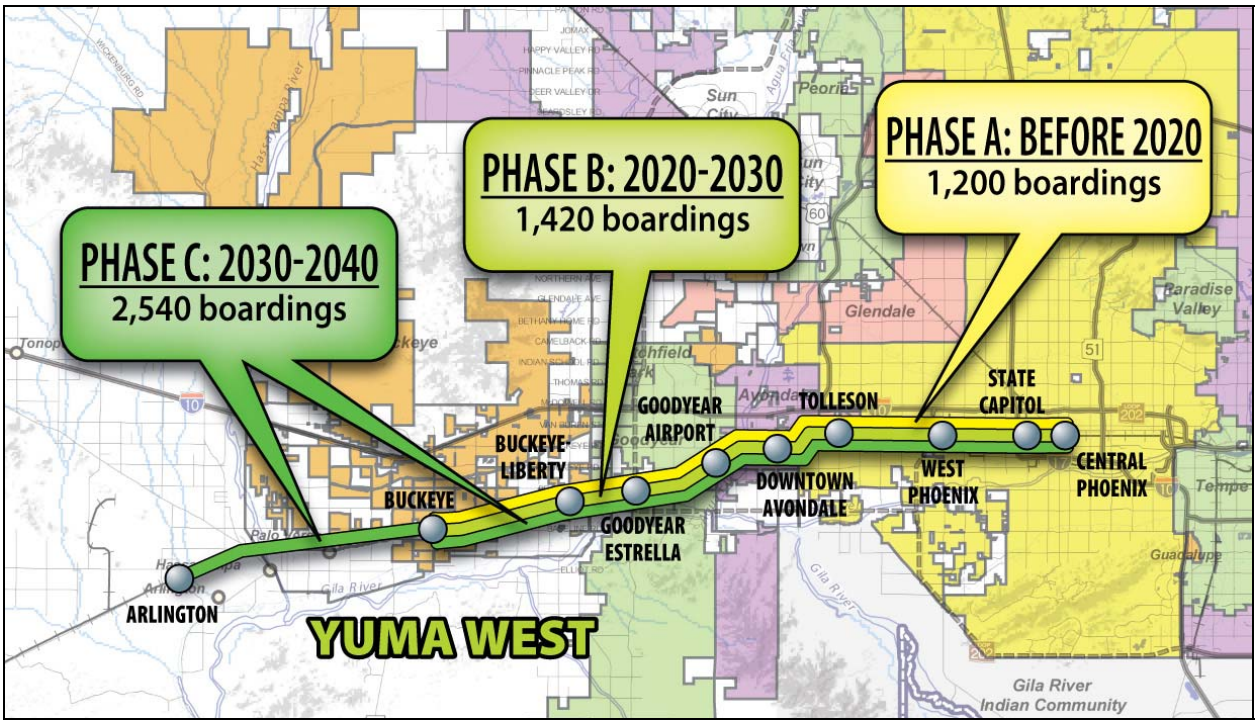
As shown in Table 3-8, forecasted ridership for the Yuma West Corridor as a stand-alone corridor ranges from about 1,200 to 2,540 daily boardings. The majority of the ridership occurs in the peak period. Figure 3-4 illustrates the projected boardings by phase.

Table 3-7: Projected Daily Boardings by Phase

Corridor Development Phases	Daily Boardings
Phase A: Phoenix – Buckeye (Before 2020)	1,200
Phase B: Phoenix – Buckeye (2020 – 2030)	1,420
Phase C: Phoenix – Arlington (2030 – 2040)	2,540

Source: URS Corp., 2009.

Figure 3-4: Projected Daily Boardings for Yuma West Corridor by Phase



Source: URS Corp., 2009.

Throughout all phases, the highest boardings are in downtown Phoenix, Goodyear, and Buckeye during the peak periods. Projected ridership increases with each phase due to projected growth in population and employment over time as well as the convenience of more frequent service. West of the State Capitol, the majority of riders arrive by car to take commuter rail. Suburban walk access is comparatively higher at the stations in downtown Avondale and Goodyear, and overall transit connections by bus are low outside of downtown Phoenix (less than five percent of riders connect to or from bus transit west of West Phoenix).

Planning for station areas in the Yuma West Corridor generally should assume access by car with corresponding parking provided at each location. However, System Study modeling also suggests that bus transit improvements may increase commuter rail ridership by maximizing connectivity to other modes.

3.4.2 Multi-Corridor Scenarios

The Yuma West Corridor was evaluated as part of a larger commuter rail system in the region. In multi-corridor scenarios, the Yuma West Corridor was connected to other corridors in downtown Phoenix that would provide a continuous route and one-seat ride between corridors to the northwest and east valley. Phase B service on the Yuma West Corridor is assumed in the following assessment of these multiple corridor combinations, with similar service levels on the interlined corridors (30-minute peak headways).

The corridors interlined with the Yuma West Corridor in this assessment consist of the following:

Southeast Corridor: A potential 36-mile commuter rail corridor along the Union Pacific Railroad (UPRR) between downtown Phoenix and the intersection of Ellsworth Road and Rittenhouse

Road in Queen Creek. The corridor would connect central Phoenix to Tempe, Mesa, Chandler, Gilbert, and Queen Creek.

Tempe Corridor: A potential 17-mile commuter rail corridor along the UPRR tracks between downtown Phoenix and Chandler Boulevard in West Chandler, just south of the Tempe city limits. The corridor would connect central Phoenix to Tempe, Guadalupe, and Chandler.

Chandler Corridor: A potential 29-mile commuter rail corridor along existing UPRR tracks between downtown Phoenix and Sun Lakes in south Chandler. The corridor would connect Tempe, Mesa, and downtown and southern Chandler with central Phoenix.

Service along a **Grand Avenue Corridor** is included in some of the scenarios, although this corridor is not interlined with the Yuma West Corridor. The Grand Avenue Corridor is a potential 36-mile commuter rail corridor along the BNSF Railway Company rail line that would connect central Phoenix with the far northwest valley in Wittmann.

Table 3-9 provides the projected daily boardings both overall and along the Yuma West Corridor in each of these combination scenarios.

Figures 3-4 through 3-8 illustrate the geographic extent and forecasted ridership for each interlined alternative.

Table 3-8: Estimated 2030 Daily Boardings on Multi-Corridor Combinations

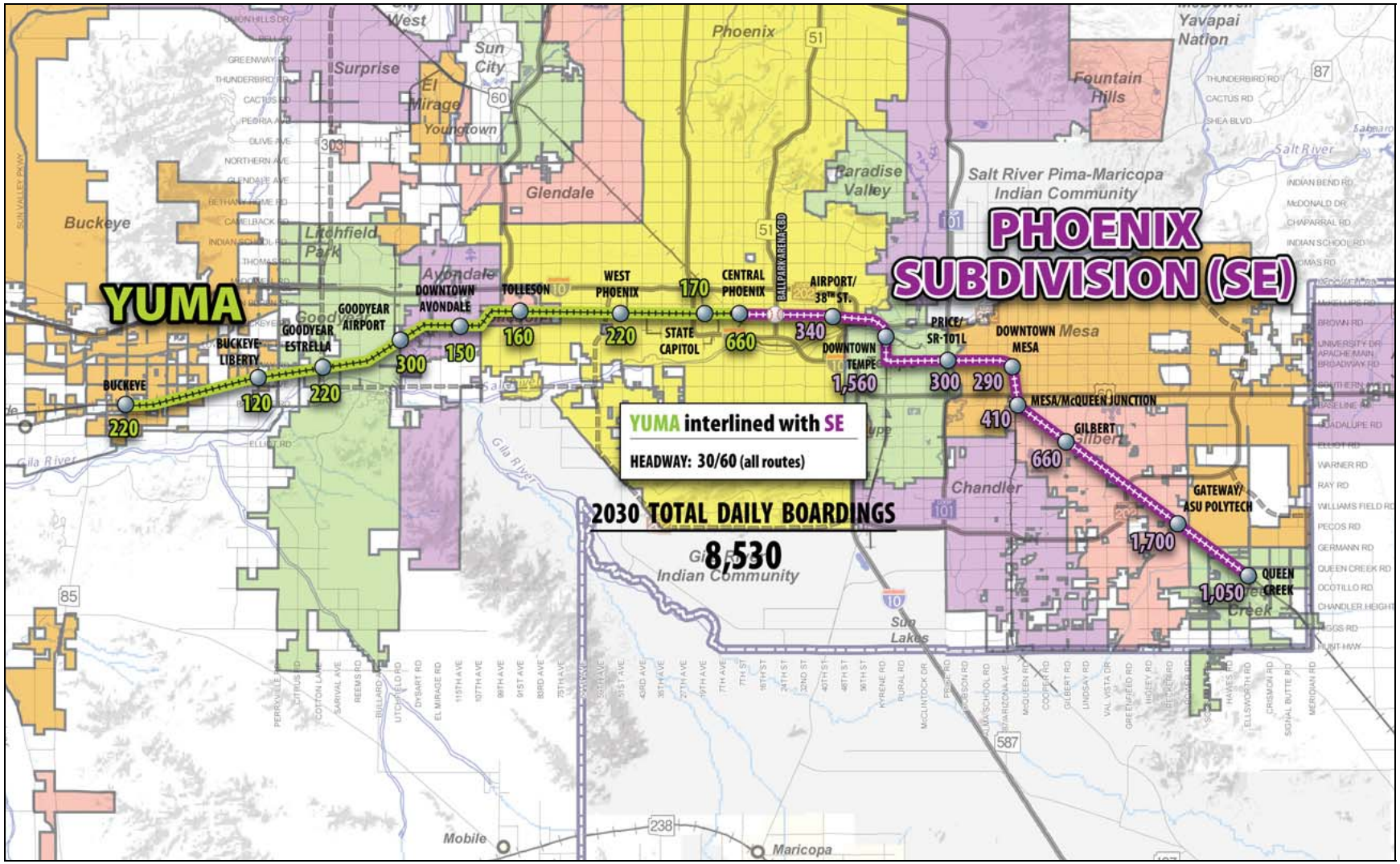
Interlined Alternatives	Description	Overall Daily Boardings	Yuma West Corridor Boardings
2 – Corridor Interlined Alternative			
Yuma West Interlined with SE	Service between downtown Buckeye and downtown Queen Creek via central Phoenix	8,530	2,220
3 – Corridor Interlined Alternative			
Yuma West Interlined with SE and Grand Avenue Interlined with SE*	Service between downtown Buckeye and downtown Queen Creek via Central Phoenix	11,290	1,620
	Service between Wittmann and downtown Queen Creek via central Phoenix		
4 – Corridor Interlined Alternatives			
Yuma West Interlined with SE and Grand Avenue Interlined with Tempe	Service between downtown Buckeye and downtown Queen Creek via central Phoenix	17,960	3,970
	Service between Wittmann and West Chandler via central Phoenix		
Grand Avenue Interlined with SE and Yuma West Interlined with Tempe	Service between Wittmann and downtown Queen Creek via central Phoenix	15,100	2,570
	Service between downtown Buckeye and West Chandler via central Phoenix		
Yuma West Interlined with Chandler and Grand Avenue Interlined with Tempe	Service between downtown Buckeye and south Chandler via central Phoenix and	13,230	3,110
	Service between Wittmann and West Chandler via central Phoenix		

* Note: Yuma West Corridor runs at 60 minute headways during both peak and off-peak service in this combination; the change in headway was needed to allow feasible operations at the common meeting point in downtown Phoenix.

Source: URS Corp., 2009.

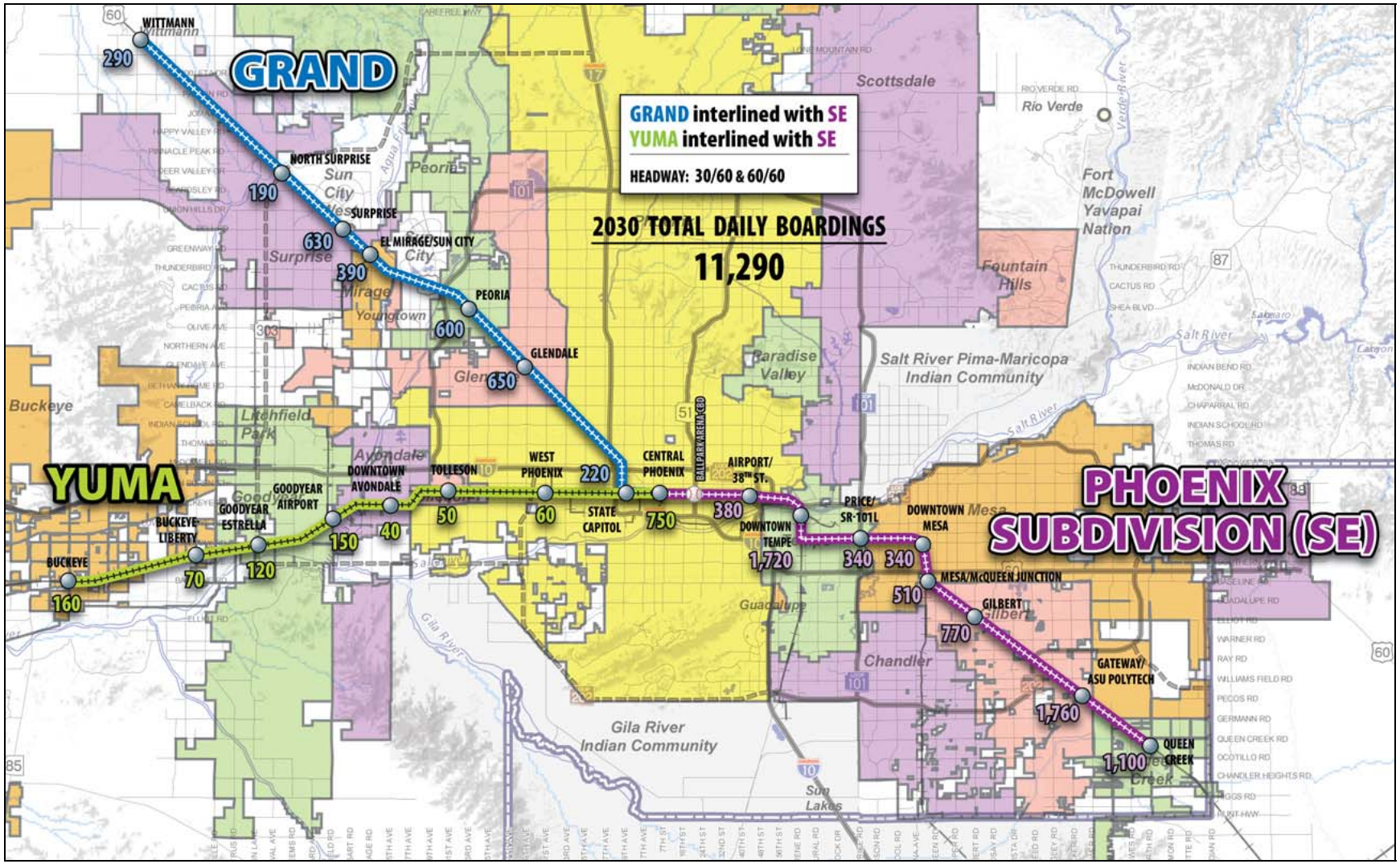
The greatest positive impacts on ridership occur when the Yuma West Corridor is combined as one of the 4-corridor alternatives. In the scenario in which the Yuma West Corridor is interlined with the Southeast Corridor, and Grand Avenue is interlined with the Tempe Corridor, daily boardings at Yuma West Corridor stations increases by 55 percent over Phase C projected boardings. [Note: in this scenario, this increase is partly the result of more frequent service (20-minute headways versus 30-minute headways), as well as more riders in the downtown Phoenix station.] For a more detailed discussion of potential commuter rail system operations and ridership forecasts, see the MAG Commuter Rail System Study.

Figure 3-5: Yuma West Corridor Interlined with Southeast Corridor



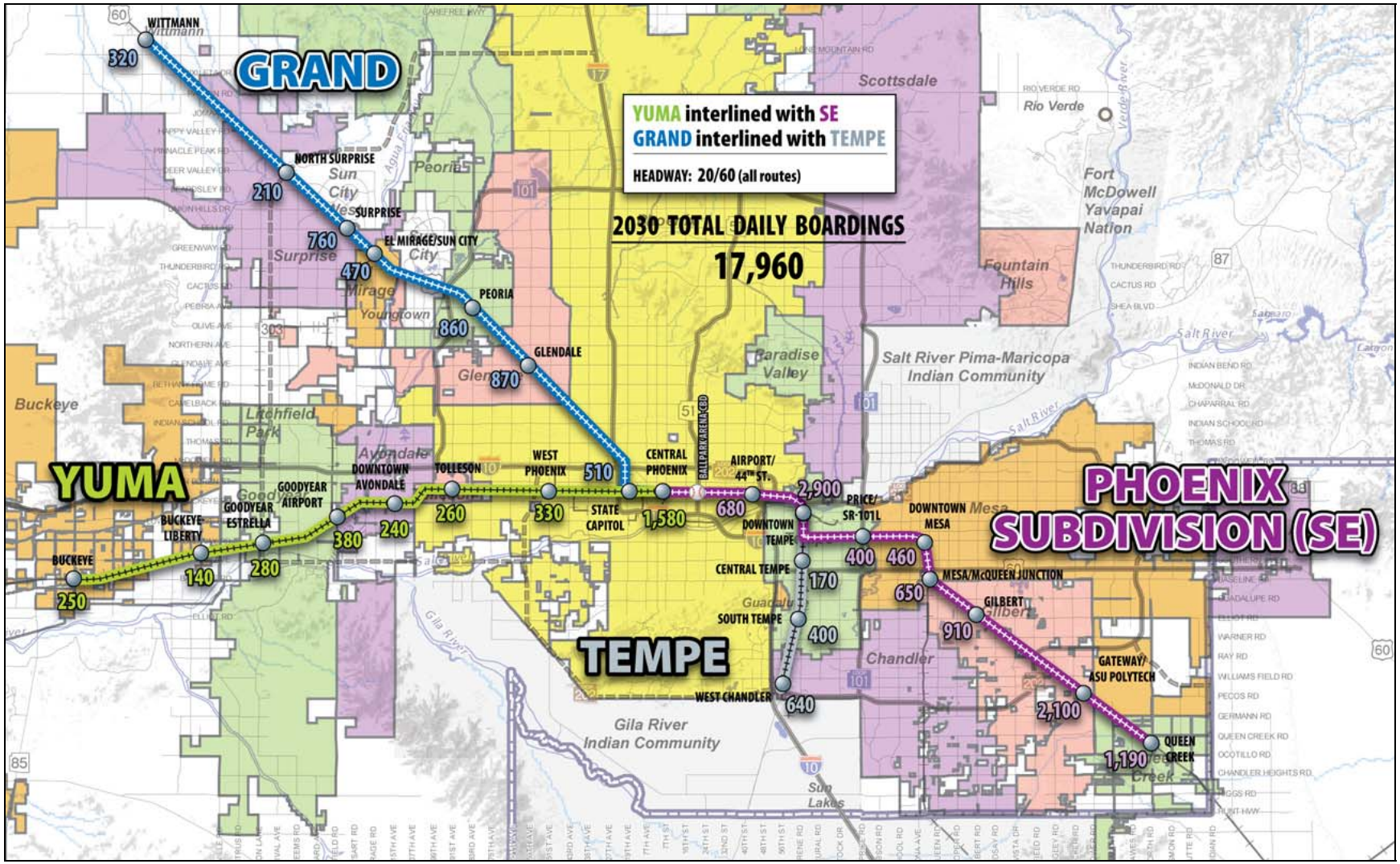
Source: URS Corp., 2009.

Figure 3-6: Yuma West Interlined with Southeast and Grand Avenue Interlined with Southeast



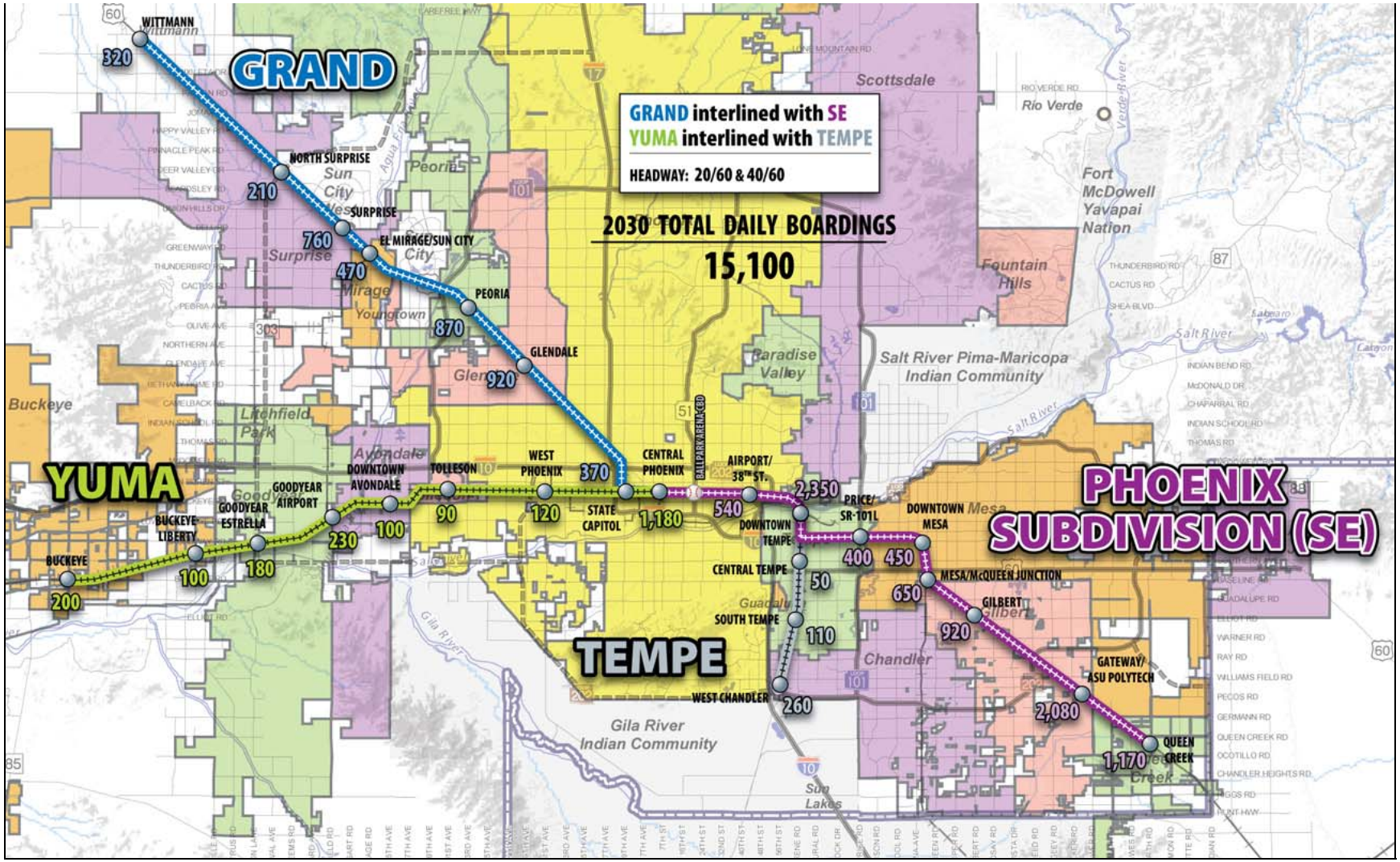
Source: URS Corp., 2009.

Figure 3-7: Yuma West Interlined with Southeast and Grand Avenue Interlined with Tempe



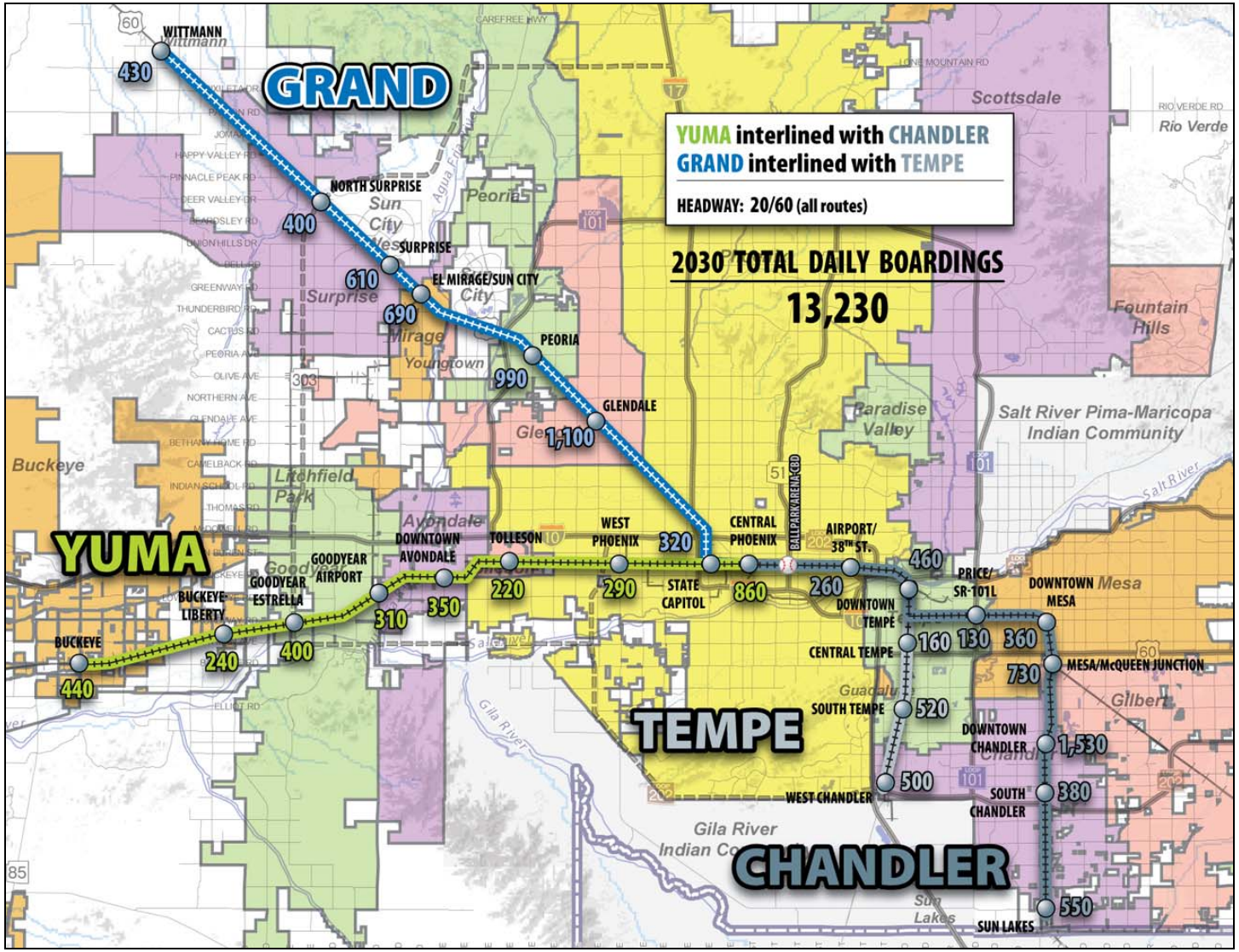
Source: URS Corp., 2009.

Figure 3-8: Grand Avenue Interlined with Southeast and Yuma West Interlined with Tempe



Source: URS Corp., 2009.

Figure 3-9: Yuma West Interlined with Chandler and Grand Avenue Interlined with Tempe



Source: URS Corp., 2009.

3.4.3 Other Influences on Ridership

Several considerations that could impact ridership are not reflected in the modeling. A key factor that cannot be measured by the model output relates to the uncertainty of development of planned roadway and transit improvements in the West Valley. In addition, special event ridership and the influence of employment at the Palo Verde Generating Station are important considerations that are not quantified by model data.

Planned Mobility Improvements in the West Valley. The only major transportation corridor currently connecting downtown Phoenix with the West Valley is I-10. The travel model included consideration of all planned transit and roadway improvements outlined in the RTP, as shown previously in Figure 3-1. Recent decisions to delay some projects suggest that some planned highway capacity may not actually be in service in 2030. To consider the possibility that additional West Valley highways (particularly State Route 801) are not realized within the timeframe proposed for commuter rail service, a sensitivity test was conducted to evaluate how ridership could change under those conditions. This test indicated that commuter ridership could increase by a factor of about 12 percent along the Yuma West Corridor by 2030 if State Route 801 and the Loop 303 between I-10 and 801 were not realized.

In addition to the model output, there is a reciprocal relationship between land use and transportation. Future population, employment, and development in the West Valley are all highly dependent upon mobility improvements, and development patterns are influenced by mode choice. Therefore changes from the model assumptions about mobility (e.g., regarding highway improvements) could affect development pace and patterns, and the implementation of high-capacity transit could attract growth opportunities. Development patterns and station development could influence each other along the Yuma West Corridor.

Special Events Ridership. Special events ridership has proven to be a substantial contributor to light rail ridership in the region, but it is difficult to quantify the impact on commuter rail ridership using available model information. The Operations Plan summarized in Section 3.3 indicates that special events service would occur in all phases. Special event venues in downtown Phoenix include but are not limited to the U.S. Airways Arena, Chase Field, the Dodge Theater, the Phoenix Convention Center, and Symphony Hall. Downtown Tempe is also a center for special events that attract attendees from throughout the region.

To assess the magnitude of the potential impact on ridership, special events were considered through a review of major events and their expected attendance in these two downtown areas. Downtown Phoenix is the home of two major sports teams, the Arizona Diamondbacks and the Phoenix Suns. The Phoenix Civic Center hosts a number of large events throughout the year, such as the International Auto Show. First Fridays Artlink is a monthly event that continues to grow in popularity and attract people downtown. The annual attendance of these events in downtown Phoenix is estimated in Table 3-10.

Downtown Tempe hosts a number of large events that could be served in part by commuter rail. Arizona State University football games as well as the college bowl game draw large numbers of people from the entire Phoenix area. In addition, Tempe hosts a number of annual events including: the Tempe Arts Fest, New Year's Block Party, Tempe 4th of July Celebration, and the Tempe Music Fest. The estimated attendance for these events is shown in Table 3-10.

Table 3-10: Estimated Major Special Events Attendance

Special Event	Typical Annual Attendance
Downtown Phoenix	
Arizona Diamondbacks games	2,400,000
Phoenix Suns games	855,000
Phoenix Civic Center	1,000,000
First Fridays Artlink	300,000
Total for Downtown Phoenix	**4,555,000**
Downtown Tempe	
ASU football	400,000
College Bowl Game	50,000
Tempe Arts Fest	250,000
New Year's Block Party	100,000
Fourth of July	100,000
Tempe Music Fest	25,000
Total for Downtown Tempe	**925,000**

Source: URS Corp., 2009.

Both downtown Phoenix and Tempe host many other events, as well. However, the events listed above are some of the largest and are thus most likely to have a threshold of attendees high enough to benefit from and be attracted to commuter rail service.

Annual attendance to large special events in downtown Phoenix and Tempe is estimated at 5,480,000. Studies of other regions have found that transit may capture between 10 and 25 percent of special event trips. A conservative estimate of 10 percent of trips that would use some form of transit would equate to 548,000 trips annually (one-way). The Yuma West Corridor could serve a portion of these transit trips to both downtown Phoenix and Tempe.

Additional major activity centers in the vicinity of the corridor include the Phoenix International Raceway, the Goodyear Spring Training Complex, and Cricket Pavilion. These facilities likely would require shuttle or circulator service to connect with commuter rail.

Palo Verde Generating Station. The Palo Verde Nuclear Generating Station, operated by APS, is a major employer near the Arlington station area. APS maintains a fleet of approximately 170 vans that operate daily, providing employees with transportation between Palo Verde and the larger region. The majority of trips drops off workers at Palo Verde between 6:00 AM and 7:00 AM and departs in the afternoon at about 5:30 PM on weekdays. The majority of pick-up and drop-off points throughout the region are at existing park-and-ride locations. APS began operating this service in 1994 and nearly 62 percent of the roughly 2,200 permanent APS employees participate; total daily ridership for the vanpool service surpasses 1,350 people. It is possible that commuter rail would capture a portion of this ridership, although these numbers are not reflected in the model data. If commuter rail were to capture half of the vanpool ridership, it could increase estimated boardings by more than 25 percent in Phase C. Trips to Palo Verde would provide reverse-commute trips during the peak hours, so trains in the reverse of the peak direction would also be productive.

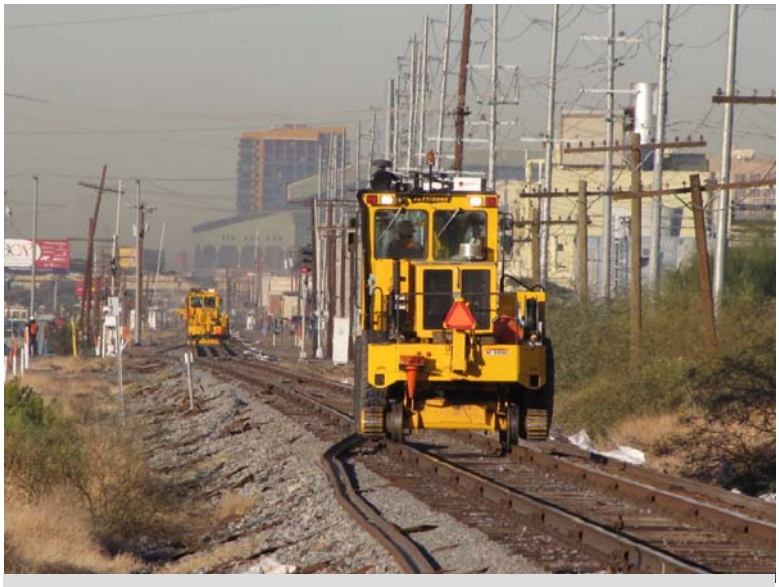
3.5 Infrastructure Requirements

The Yuma West Corridor is a portion of the 208-mile Phoenix Line of the UPRR. The Phoenix Line hosted Amtrak's Sunset Limited until June 1996, when Amtrak began to use the Gila Line south of Phoenix. When Amtrak used the line for passenger service, the maximum operating speed was 50 to 60 mph for passenger trains. Ongoing freight activity on the line today consists of local traffic only, with an average of four to six local train movements per day.

The Yuma West Corridor is a single track with few sidings and frequent industrial leads and spur tracks. Passing sidings are located at 23rd Avenue in Phoenix, Cashion, Buckeye, Dixie, and Arlington. The primary issue along this corridor with regard to concurrently operating passenger and current local freight traffic is the use of Campo Yard, which is located between 35th Avenue and 43rd Avenue in Phoenix. Campo Yard is an industrial yard that serves local industries, where rail cars coming from local industries are assembled into trains and rail cars going to local customers are broken down from incoming trains. Due to limited right-of-way, routing commuter rail tracks through or around the facility without interfering with yard activities will be a challenge. To address this issue, several infrastructure improvements are proposed and coordination with UPRR on operations will be critical.

Table 3-11 shows infrastructure improvements that potentially would be required as the level of commuter rail service increases. It is expected that some of these improvements (such as Positive Train Control, or PTC, and quiet zones) may be implemented by UPRR or other parties independently of commuter rail to address FRA requirements or meet community needs. Fundamental improvements, such as upgrading the existing main line to accommodate higher train speeds, would be needed with the initial service levels of commuter rail. Sidings would also be provided at critical commuter rail stations where passenger train meets would be expected.

Conceptual drawings showing the proposed infrastructure improvements for each operations scenario are provided in Appendix D: Yuma West Design Concepts.



Union Pacific Railroad installs new welded rail on the Phoenix Subdivision near 36th Street in Phoenix, January 2010.
Source: MAG.

Table 3-11: Potential Infrastructure Improvements by Phase

Phase A – Phoenix to Buckeye Start-Up Commuter Rail Operations 4 Trains, 1-way, AM and PM Peak Periods 30-Minute Headway, 2-Hour Window (5 days/week)	Phase B – Phoenix to Buckeye Intermediate Service Commuter Rail Operations 30-Minute AM and PM Peak Service 3 Roundtrip Off-peak Service (6 days/week)	Phase C – Phoenix to Arlington Maximum Service Commuter Rail Operations 30-Minute AM and PM Peak Service 60-Minute Off-peak Service (7 days/week)
	Assumes all of Phase A improvements plus:	**Assumes all of Phase A and Phase B improvements plus:**
1. Install PTC on all new track required for commuter rail.	1. Install PTC on all new track required for commuter rail.	1. Install PTC on all new track required for commuter rail.
2. Upgrade existing main track to FRA Class 3 and 4 and UPRR standards for about 31 miles between Phoenix and Buckeye.	2. Install double track for about 5.5 miles between Phoenix and 59th Avenue.	2. Upgrade existing main track to FRA Class 3 and 4 and UP standards for about 14 miles between Buckeye and Arlington.
3. Provide 2,000-foot siding at each of 9 commuter rail stations.	3. Install 2 passing sidings, each 1 mile in length, between Tolleson and Avondale/Goodyear Stations and between West Goodyear and Liberty Stations	3. Install 1-mile-long siding between Buckeye and Arlington Stations. Provide 2,000-foot siding at Arlington Station.
4. Provide layover facilities at Phoenix and Buckeye. Central Phoenix terminal located south of BNSF.	4. Install new bridges where necessary for second track or sidings.	4. Install new bridges where necessary for new sidings.
5. Upgrade crossing active warning devices and install constant warning predictors at grade crossings between Phoenix and Buckeye.	5. Extend culverts where necessary for second track or sidings.	5. Extend culverts where necessary for new sidings.
6. Provide initial maintenance facility in downtown Phoenix area.	6. Modify industrial leads, sidings, and spur tracks as necessary.	6. Modify industrial leads, sidings, and spur tracks as necessary.
7. Relocate utilities as necessary.	7. Provide new industrial lead tracks and sidings as necessary.	7. Upgrade crossing active warning devices and install constant warning predictors at grade crossings between Buckeye and Arlington.
	8. Expand maintenance facility as necessary.	8. Extend station platforms to accommodate longer trains.
	9. Relocate utilities as necessary.	9. Relocate utilities as necessary.

Note: These improvements are potential only and may not reflect the requirements or agreement of UP.
Source: URS Corp., 2009.

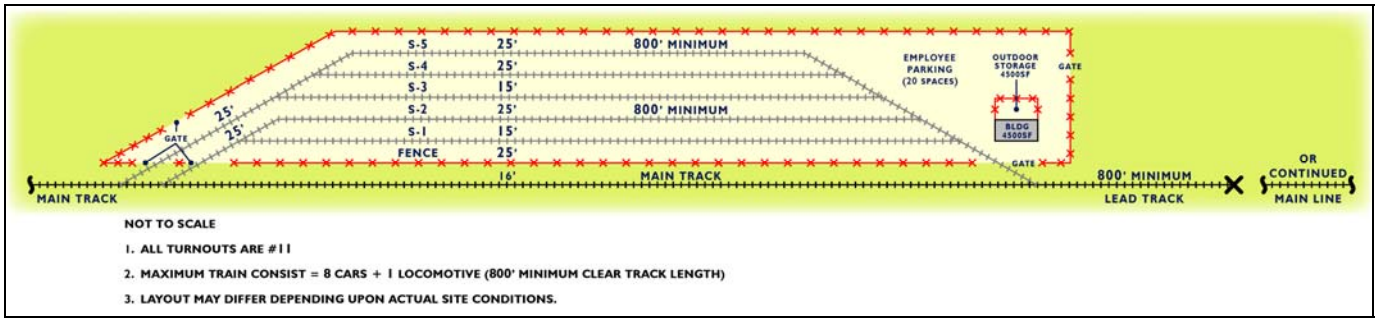
3.6 Layover and Maintenance Facilities

Commuter rail layover and maintenance facilities would be needed to support the commuter rail operations in the Yuma West Corridor. Advance planning for these facilities is important, as the space needs and locational requirements may limit where they can be sited. For a complete description of layover and maintenance facility functions and requirements, see Appendix E: Commuter Rail Maintenance Facility. The following subsections provide an overview of each type of facility and potential locations along the Yuma West Corridor.

3.6.1 Layover Facility

Layover facilities (or tracks) serve the primary purpose of vehicle storage and minor vehicle cleaning and inspection. Even when a train storage and maintenance facility is provided on-line, layover facilities need to also be provided at the opposite end, or ends, of the corridor. Some trains are kept at the storage and maintenance facility and some are kept at the layover facility in order to allow trains to begin or end the service day from each end of the system. This allows equal service to be operated in both directions much sooner than if all of the trains had to start or end from one end of a corridor. The layover facility should be located near the terminal station, or stations, at the end of the line in order to minimize the travel distance between the station and the layover facility. Figure 3-10 depicts a typical layover facility site plan.

Figure 3-10: Typical Layover/Trail Track Facility



Source: URS Corp., 2009.

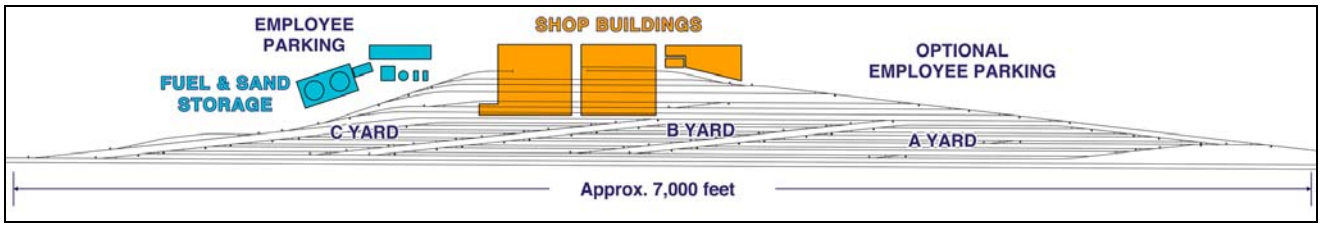
The potential locations for layover facilities for the Yuma West Corridor are central Phoenix, Buckeye, and Arlington station areas. Available data suggests that there is sufficient land available to develop these facilities at Buckeye and Arlington. Development of co-use of facilities in central Phoenix will require close coordination with UPRR.

3.6.2 Maintenance Facility

Commuter rail maintenance facilities are the facilities used to repair, maintain, clean, fuel, and store commuter rail vehicles that serve a commuter rail line or system. In addition, control center rail operations and maintenance-of-way (MOW) facilities are necessary and are often components of larger maintenance facilities. MOW includes facilities required to maintain the track, stations, signaling, bridges, at-grade crossings and other fixed facilities along a given passenger rail corridor. The commuter rail maintenance facility would accommodate train operations and maintenance functions that involve daily, routine activities that are of short duration. A maintenance facility could either be provided on the corridor or be performed at a local UPRR facility, even if the heavy repair functions are contracted to an outside vendor. Locating the maintenance facility on-line precludes the need to constantly move vehicles to and

from an off-line facility for basic, routine inspection, servicing, and maintenance. Figure 3-11 depicts a typical commuter rail facility site plan.

Figure 3-11: Typical CRMF Site Layout



Source: URS Corp., 2009.

In addition to a maintenance facility that accommodates daily maintenance, a facility would also be needed to accommodate heavy maintenance that involves extensive, long-duration work on locomotives and cars. Heavy maintenance work would be contracted to UPRR or to an outside vendor until such time as it becomes economical to do such work in the maintenance facility.

3.6.3 Potential Maintenance Facility Locations

The potential locations for a maintenance facility for the Yuma West Corridor include Campo Yard (located between 35th Avenue and 43rd Avenue), Buckeye, and Arlington. If the Grand Avenue and other potential System Study corridors are included in the commuter rail system, then potential locations would include BNSF Mobest Yard, UPRR Harrison Street Yard, or other such sites in the downtown Phoenix area provided that space is available.

3.7 Next Steps

The next step toward progressing the Yuma West Corridor Conceptual Development Plan is the refinement of the Operations Plan in coordination with UPRR. The infrastructure improvements outlined in Section 3.5 involve the upgrading of existing track and assume that passenger service would operate concurrently with commercial freight service on the same track. Agreements with UPRR regarding shared use of the track would need to be negotiated to identify the most feasible approach that would preserve commercial interests as well as meet passenger service demand. Further coordination with UPRR may change the proposed schedules for service or the list of specific infrastructure improvements.

A more detailed assessment of the cost and required implementation measures would be conducted to reflect any negotiated changes to service or infrastructure. Estimated costs are presented in the next chapter based on the service levels and improvements that are outlined in this chapter.

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4.0 ESTIMATED COSTS

4.1 Introduction

This chapter presents cost estimates for the implementation of commuter rail service in the Yuma West Corridor. Cost estimates are categorized by (1) the capital costs required to construct each phase of commuter rail service and (2) the annual operating and maintenance (O&M) costs required to run the service. The chapter is organized as follows:

- Section 4.2 summarizes the methodology used to estimate capital and O&M costs.
- Section 4.3 presents the estimated capital costs for each phase of commuter rail service and compares the estimated Yuma West Corridor capital costs to capital costs expended by commuter rail systems in other cities.
- Section 4.4 presents the estimated annual O&M costs associated with each phase of commuter rail service and potential farebox revenues that could offset a portion of these costs. This section also provides a comparison to O&M costs on other commuter rail systems.
- Section 4.5 summarizes the overall findings related to cost estimates.

4.2 Methodology

Cost estimates for the Yuma West Corridor were calculated based on a series of cost assumptions detailed in Appendix F and conceptual level drawings presented in Appendix D. The costs are based on recent peer system costs or estimates within commuter rail and freight rail industries. The costs are presented in 2009 US Dollars without an inflation factor and are summarized into Federal Transit Administration (FTA) standard categories using a typical FTA standard cost category summary sheet, as shown in Appendix F. Finally, the total corridor costs are inclusive of construction costs, soft costs (including design and environmental review), and project contingencies.

The implementation of commuter rail service in the Yuma West Corridor will require close coordination with the Union Pacific Railroad (UPRR). The UPRR may have plans for infrastructure upgrades along the corridor that would improve freight operations. Therefore, careful consideration should be given to the potential for partnering with UPRR for the mutual advancement of commuter rail and freight rail service.

Capital costs described in this chapter do not assume the implementation of freight rail infrastructure improvements by UPRR. Should a cost-sharing agreement be reached with UPRR to upgrade freight rail facilities for the mutual advancement of commuter and freight rail service, then capital costs associated with the implementation of commuter rail service may vary from those described herein. For example, UPRR could determine that there is some flexibility in operating freight trains on the line such that an operating easement could be granted to the commuter service to use the freight tracks during specific time periods. Freight service would be shifted to other hours in the day, allowing the commuter service to operate during peak periods. In this situation, fewer track improvements might be necessary in return for payments to obtain

the easement. Chapter 5 addresses the components of such agreements with the railroad and potential cost-sharing opportunities.

As described in detail in Chapter 3, three Yuma West Corridor service levels are proposed as operating phases (Phases A, B, and C). Each phase increases levels of service as ridership would grow. Table 4-1 lists the operational characteristics of the proposed phases used to estimate both capital and O&M costs.

Table 4-1: Yuma West Corridor Phases A through C Commuter Rail Service Level Assumptions

Service Level/ Facility Assumptions	Phase A	Phase B	Phase C
Corridor	Central Phoenix-Buckeye	Central Phoenix-Buckeye	Central Phoenix-Arlington
Route Miles	31	31	44
Stations	9	9	10
Fleet Size	5 locomotives 5 cab cars 5 coaches	5 locomotives 5 cab cars 5 coaches	7 locomotives 7 cab cars 7 coaches
Service Level	Peak:30-minute headways, one-way service	Peak:30-minute headways Off-Peak: 3 roundtrips	Peak: 30-minute Off-Peak: 60-minute
Service Days	Weekdays	Weekdays and Saturdays	Weekdays and Weekends

Source: URS Corp., 2009a.

The intermediate service level—Phase B service, which would terminate at Buckeye—is assumed for the purposes of comparing corridor performance and cost-effectiveness to peer city commuter rail systems in Sections 4.3.2 and 4.4.2.

4.3 Estimated Capital Costs

Each phase of commuter rail service is associated with a different level of infrastructure investment and capital cost requirement. A preliminary assessment of infrastructure improvements needed to implement commuter rail is summarized by phase in Chapter 3 (see Table 3-12). The cost estimate provided below is based on the assumption that these improvements will be needed. Capital costs reflect the investment in infrastructure needed to run passenger service at increased speeds as well as vehicle costs while preserving freight operations in the corridor. Generally, passenger rail operates at higher speeds than freight traffic and the Federal Railroad Administration (FRA) requires that track meet higher minimum standards to carry passenger rail.

FTA cost estimating standards are traditionally very conservative and require significant amounts for professional services and contingencies, especially at this early stage of project development (approximately one percent design level). The estimates in this chapter assume an allowance for professional services and program management based on a percentage of the overall construction costs. In addition, an allowance for additional project related costs, such as insurance, legal expenses, start-up/testing, and other soft costs, totaling approximately 29 percent for both categories was used.

Contingencies, which account for unforeseen items or variations in project cost components, were assumed to be 21 percent in developing cost estimates. Therefore, the total cost for professional services, project related costs, and contingencies was 50 percent of the construction cost total. The cost estimates assume that the locations of all improvements are within an existing freight railroad right-of-way, which has resulted in the concept design to be further along in this project than in similar planning studies. Ranges of capital costs are used that are slightly below the traditional conservative FTA amounts reserved for professional services, other related project costs, and contingencies. Therefore, for cost-effectiveness measurements for this and other MAG commuter rail projects, the Project Team is using a figure at 90 percent of the original capital cost estimate as the mid-point for cost estimating purposes. This mid-point still allows significant contingencies to be assumed while providing a more realistic picture of professional service expenses and current commodities prices for capital cost estimating.

Table 4-2 breaks down the estimated capital costs for the Yuma West Corridor by phase. Note that these phases are cumulative; the costs for Phase B and C assume that the previous phase(s) have already been implemented.

Table 4-2: Estimated Capital Costs by Phase

Cost Element	Phase A ($000)	Phase B ($000)	Phase C ($000)
Guideway and Track Elements	60888	2675	22553
Stations	56631	0	9,691
Vehicles	46,856	0	18,743
Support Facilities (Layover and Maintenance)	32,630	0	130
Sitework and Special Conditions			
Demolition, Earthwork, Utilities	9,750	0	0
Environmental Mitigation	19223	54	8512
Automobile access/roads/parking lots	20,150	0	5200
Other (retaining walls, pedestrian access)	4598	54	1102
Systems (Train Control and Traffic Crossings)	35,230	0	10,140
Right-of-Way	42124	0	4,247
Professional Services and Contingency	74121	862	17772
Estimated Cost Increase over Previous Phase	402201	+3645	+98090
Estimated Cost Increase over Previous Phase (90% of FTA Standards)	361981	+3280	+88281
Total Estimated Cost (90% of FTA Standards)	361981	365261	453542
Average Cost per Route Mile for each Phase	11677	106	2006

Source: URS Corp. and Gannett Fleming, 2009.

The initial phase is the most costly due to the basic infrastructure requirements to allow higher speeds and accommodate passenger rail. This constitutes a major improvement, as it would allow trains to increase speeds from 20 miles per hour (mph) up to a maximum speed of 79 mph where possible. To increase service between Phases A and B would require a relatively small additional investment. When Phases A and B are combined, the average cost per mile increases to $11.8 million per mile.

The majority of the additional cost to implement Phase C is largely due to the infrastructure requirements west of Buckeye to Arlington. Overall, the implementation of all phases would

have an estimated total cost of $453.5 million, with an average cost per route mile of about $10.3 million.

4.3.1 Ridership Gains per Increment of Expenditure

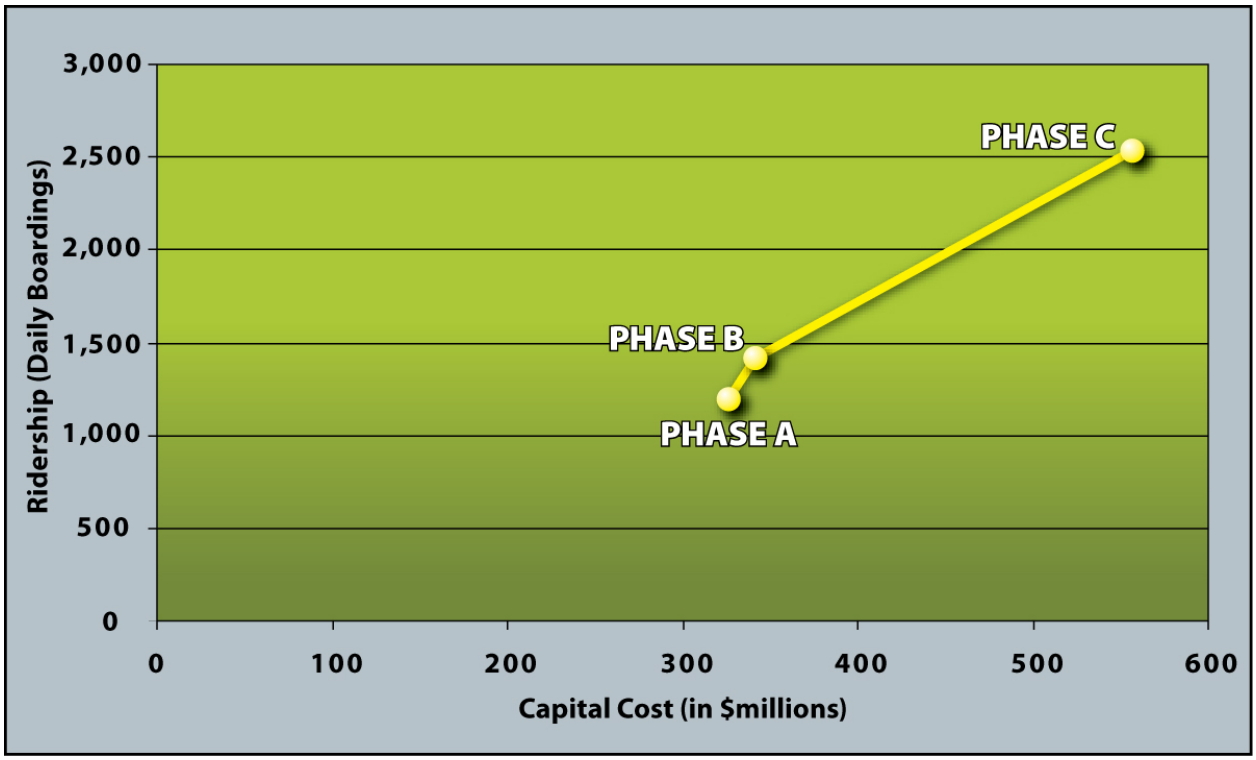
Figure 4-1 and Table 4-3 show the relationship between ridership growth and additional capital investment. As a stand-alone corridor, Yuma West gains appreciable ridership in Phase B (18 percent growth over Phase A) with the relatively modest additional capital investment. However, as described in Section 4.3, the increased operating costs required for Phase B must also be addressed by a longer-term funding solution.

Table 4-3: Relationship of Ridership Gains to Capital Cost Increases

Phase/Scenario	Ridership (Daily Boardings)	% Increase from Previous Phase	Capital Cost (in $million)	% Increase from Previous Phase
Phase A	1,200	-	362.0	-
Phase B	1,420	18%	365.2	1%
Phase C	2,540	79%	453.5	24%

Source: URS Corp. and Gannett Fleming, 2009.

Figure 4-1: Capital Cost for Ridership Gains



Source: URS Corp. and Gannett Fleming, 2009.

The MAG System Study evaluates alternative scenarios for combining the Yuma West Corridor with other potential commuter rail corridors in the region. The most productive interlined scenario interlines the Yuma West Corridor with the Southeast Corridor, which would provide service from downtown Phoenix to Queen Creek, together with the Grand Avenue Corridor interlined with the Tempe Corridor (see Section 3.4.2 for additional discussion of these

combinations). The interlined scenario would increase ridership along the Yuma West Corridor by approximately 10 percent. Capital costs for any interlined scenario would be higher due to the implementation of multiple corridors at the same time; however, cost savings would accrue due to greater economies of scale and the elimination of duplicative costs in the estimates for individual corridors (such as maintenance facilities and improvements in central Phoenix). The investment in a comprehensive regional system (about 105 miles) equates to a capital cost per route mile of about $12 to $14 million. See the MAG Commuter Rail System Study for a more detailed analysis of system alternatives.

4.3.2 Comparison to Other Commuter Rail Systems

Information on other commuter rail systems was gathered to compare and assess the reasonability of estimated costs for the Yuma West Corridor. As shown in Table 4-4, the length, ridership, and costs of other systems vary widely. The length of the Yuma West Corridor (about 31 miles) is closest to the FrontRunner (Utah) and Northstar (Minnesota). The range of capital costs per mile for those systems are $22 million and $7 million, respectively; in comparison, the Yuma West Corridor estimates range from $11.8 million per mile to implement Phases A and B, to $10.3 million per mile to implement all phases. These estimates for the Yuma West Corridor are below the average of the systems represented in Table 4-4 of $14.4 million per mile. For comparison to other types of rail transit, the METRO 20-mile light rail starter system cost about $70 million per mile to construct.

Table 4-4: Characteristics of other Commuter Rail Systems

System	Capital Cost	Route Miles	Capital Cost per Mile	Daily Ridership
Sounder (WA)	$1.4B	83	$17.2M	10,000
Westside Express (OR)	$166	14.7	$11.3M	1,200
FrontRunner (UT)	$954M	44	$21.7M	4,100
Northstar (MN)	$289.1M	40	$7.2M	TBD*
MAG Yuma West Corridor – Phase B	Est. $365.2M	31	Est. $11.8M	Est. 1,420

* This service opened in November 2009 and consistent ridership numbers are not yet available.
Source: National Transit Database, 2007.

When the Yuma West Corridor is interlined with other potential commuter rail corridors within the region, overall ridership is projected to increase. The capital cost range of $12 to $14 million per mile associated with the interlined combination noted in Section 4.3.1 is comparable to the peer city experiences shown in Table 4-4, but the projected ridership and length of a regional MAG system would exceed that of all of the examples shown in Table 4-4.

A primary variable influencing per-mile capital costs for commuter rail systems is the quality of existing track and infrastructure. These costs include the track itself, the need for additional tracks and passing sidings to accommodate both commuter rail and freight rail traffic, and other features such as bridges, culverts, and other major capital items. For example, the Northstar system in Minnesota has a relatively low capital cost per mile because that system is using an existing high-quality double-track alignment. The FrontRunner system in Utah has a relatively high cost per mile because it was required to install new track and purchase a considerable amount of right-of-way.

4.4 Estimated Operating and Maintenance (O&M) Costs

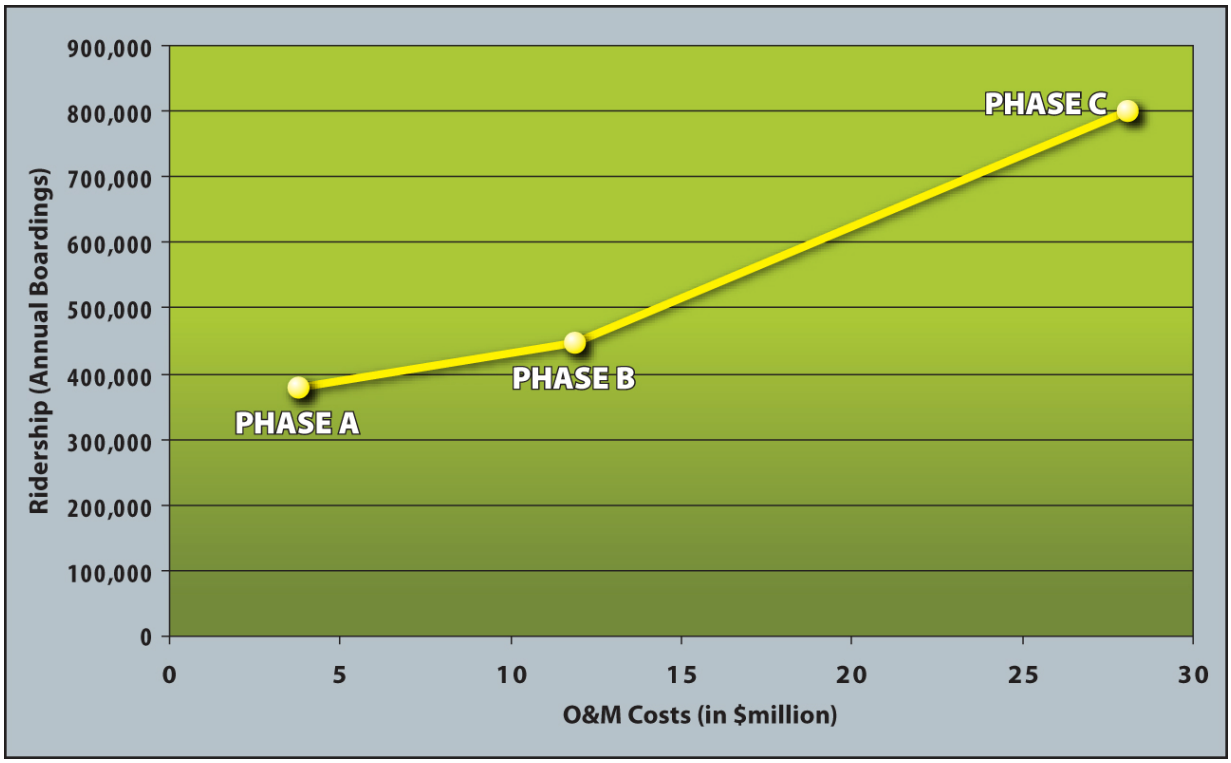
O&M costs include all expenditures required to operate commuter rail service, such as the operation and maintenance of vehicles, passenger stations and tracks, as well as other support services. Costs to operate the system would vary by phase, reflecting the increases in service with each phase. Table 4-5 shows the estimated operating costs by phase. Cost categories considered in estimating annual O&M costs include the total commuter rail track mileage, number of stations, vehicles, headways, and service days, all of which increase O&M costs as level of service increases by phase.

Table 4-5: Estimated Annual Operating Costs by Phase

Service Level/ Facility Assumptions	Phase A	Phase B	Phase C
Corridor	Phoenix-Buckeye	Phoenix-Buckeye	Phoenix-Arlington
Route Miles	31	31	44
Stations	9	9	10
Cars per Train	2	2	2
Service Level	4 trains, 1-way service during peaks at 30-minute headways	30-minute peak headway and 3 off-peak roundtrips	30-minute peak headway and 60-minute off-peak headway
Service Days	5	6	7
Estimated Annual O&M Cost ($million)	**3.8**	**11.9**	**28.1**

Source: URS Corp. and Gannett Fleming, 2009.

Figure 4-2: Annual O&M Costs Compared to Annual Boardings



Source: URS Corp. and Gannett Fleming, 2009.

The increase in O&M costs with each phase results from the steady increases in service levels with each successive phase. Table 4-6 shows the increases in the numbers of riders that would use the service during each phase, with the associated cost. The greatest jump in O&M costs occurs with the onset of Phase C, which entails all-day service along the Yuma West Corridor.

Table 4-6: Relationship of Ridership Gains to O&M Cost Increases

Phase/Scenario	Ridership (Daily Boardings)	% Increase from Previous Phase	O&M Cost (in $ million)
Phase A	1200	-	3.8
Phase B	1420	18%	11.9
Phase C	2540	79%	28.1

Source: URS Corp. and Gannett Fleming, 2009.

4.4.1 Potential Farebox Revenue

Riders are generally charged a higher amount per trip for commuter rail service compared to other types of public transportation, because the trips on commuter rail are typically longer and fewer. O&M costs paid for by passengers are calculated on a percent basis and known as "farebox recovery." In general, the higher the ridership is, the higher the farebox recovery on any public transit system. The majority of public transportation services in the U.S. do not pay for themselves. According to the National Transit Database, national average farebox recovery for commuter rail systems was about 37 percent in 2007. Applying an average farebox recovery of 37 percent to Yuma West commuter rail service would reduce the annual O&M cost estimates as shown in Table 4-7.

Table 4-7: O&M Cost Estimate Reduction through Farebox Recovery

Phase	Estimated Farebox Revenue (assuming 37% recovery)	O&M Cost without Farebox Revenue	O&M Cost with Farebox Revenue
A	$1.4 million	$3.8 million	$2.4 million
B	$4.4 million	$11.9 million	$7.5 million
C	$10.4 million	$28.1 million	$17.7million

Source: National Transit Database, 2007; URS Corp. and Gannett Fleming, 2009.

Based on the Phase B ridership projections, to obtain this level of farebox recovery would require recouping nearly $10 per trip[1]. Fare revenues are more likely to fall within the $6 to $7 range for this length of corridor. If it is assumed that fare revenues are $6.50 per trip, the Yuma West Corridor under Phase B would generate $2.9 million annually, which represents farebox recovery of about 24 percent. Farebox recovery would be expected to achieve the higher end of the range if ridership is greater than projected and/or the Yuma West Corridor is linked into a larger regional system.

4.4.2 Comparison to Other Commuter Rail Systems

The estimated cost to run commuter rail service on a per-rider basis in the Yuma West Corridor as compared to systems in other cities is shown in Table 4-8. The O&M estimate for the Yuma

[1] This is based on the assumption that the daily boardings figure would apply to each of 265 weekdays per year, with half the daily boardings figure on 100 weekend days. Under Phase B, this equates to 447,300 boardings annually.

West Corridor comprises a lower total than many existing systems, but due to lower projected ridership, annual O&M expenses per passenger trip are higher.

Table 4-8: Annual O&M Cost per Passenger Trip for other Commuter Rail Systems

Commuter Rail System	Operating Expenses	Annual Boardings	Annual Operating Expenses per Passenger Trip
MAG Yuma West Corridor – Phase B	Est. $11,900,000	Est. 447,300	Est. $26.60
Sounder – Seattle, WA	$24,631,997	2,156,652	$11.41
Sprinter – San Diego, CA	$17,783,628	1,560,729	$11.40
Metrolink – Los Angeles, CA	$123,833,293	12,018,859	$10.30
Caltrain Peninsula – San Francisco, CA	$74,757,500	10,264,225	$7.29
Altamont Commuter Express – Stockton, CA	$10,879,259	706,858	$15.42

Source: National Transit Database, Transit Profiles, 2007.

As discussed in the MAG System Study, interlining the Yuma West Corridor with other potential commuter rail corridors in the region has a positive impact on O&M costs per passenger trip. For example, interlining the Yuma West Corridor with the east valley Southeast Corridor creates a combination of high ridership with lower total costs, resulting in O&M costs of $20 per passenger trip. Interlining has the potential to reduce O&M costs per passenger trip somewhat by increasing the overall pool of riders and eliminating some duplicative expenditures when multiple corridors are built at the same time (for example, a maintenance facility may be shared among the corridors).

4.5 Overall Findings and Recommendations

According to initial cost estimates, the Yuma West Corridor could be built with capital expenditures that are below the average capital investment required for other commuter rail systems. The primary capital costs are due to the need to upgrade the existing track to allow for higher speeds, accommodate local freight operations, and provide the initial outlay for vehicles. Total operating costs for Yuma West Corridor service are estimated to be lower than average commuter rail systems, but equate to a higher O&M cost per passenger trip. Farebox recovery would be expected to offset some of the O&M costs.

Cost-sharing and coordination with UPRR and local jurisdictions may reduce the costs for implementation of commuter rail service. For example, UPRR may already be planning to implement positive train control which would duplicate the costs in this estimate. Local jurisdictions would have an interest in station development and related road/access improvements and may fund transit-supportive projects in advance of commuter rail. Possible opportunities for collaboration are discussed further in Chapter 5.

In addition, there may be options for reducing initial costs. For example, the cost estimate assumes that all stations will be built during the start-up phase. By reducing the number of start-up stations, initial costs for stations could be reduced by about $3 million per station. Postponed stations could be infilled during a later phase, as needed to respond to growth and development along the corridor.

The cost estimate also assumes that quiet zones will be implemented at all grade crossings, with raised medians or four-quad gates at high-traffic crossings. Quiet zones could be addressed prior to commuter rail service as part of a proactive effort to plan for more development in the area or to mitigate issues in areas that are already developed and negatively impacted by noise at crossings. Such improvements may be eligible for different funding sources. In addition, some improvements for quiet zones may be delayed for some low-traffic grade crossings along the corridor, such as between Goodyear and Buckeye.

As design of the commuter rail corridor progresses, cost estimates will continue to be refined and updated. Any changes in required infrastructure (as described in Chapter 3) will affect costs, and coordination with UPRR likely will affect these assumptions. Further coordination with UPRR would be expected to influence the costs for implementation of service.

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5.0 IMPLEMENTATION STRATEGY

5.1 Introduction

This chapter presents decisions to be made and steps to be taken to further the planning and preparation for implementation of commuter rail. The chapter includes the following sections:

- Section 5.2 summarizes the findings of Chapters 3 and 4 related to the performance and cost-effectiveness of a Yuma West commuter rail system relative to other commuter rail systems currently in operation throughout the U.S.
- Section 5.3 describes several models for operating commuter rail, including Sale or Capacity Rights agreements with the railroad.
- Section 5.4 discusses options for governance and evaluates the suitability of these options for this region.
- Section 5.5 provides options and strategies for funding.
- Section 5.6 delineates the near-term and subsequent steps towards implementing commuter rail in the region.

5.2 Summary of Performance and Cost-Effectiveness

The detailed analysis presented in Chapters 3 and 4 suggest that the cost-effectiveness of a commuter rail system in the Yuma West Corridor are comparable to commuter rail systems currently in operation elsewhere in the U.S. Although projected ridership per revenue mile is lower than the national average, capital costs are also lower than peer city commuter rail systems.

In order to gauge the relative ridership potential and cost-effectiveness of the Yuma West Corridor, comparisons are made to peer city commuter rail systems currently in operation. The peer cities used to compare boardings per revenue mile and annual O&M cost per passenger trip are different than those used to compare capital cost per mile. The reasons for these differences are described below.

The peer city commuter rail systems selected to compare daily boardings per revenue mile and annual O&M cost per passenger trip include the Sounder in Seattle, WA, the Coaster in San Diego, CA, the Metrolink in Los Angeles, CA, the Peninsula Corridor Joint Powers Board (PCJPB) Caltrain in the San Francisco Bay area, and the Altamont Commuter Express (ACE) between Stockton and San Jose, CA. These peer city systems were selected because they represent (1) commuter rail systems in the western United States and (2) their daily boardings per revenue mile and annual O&M cost per passenger trip have been recorded in the FTA's National Transit Database (NTD). The NTD is the national database of statistics for the transit industry.

The peer city commuter rail systems selected to compare capital cost per mile include the Sounder in Seattle, WA, the Front Runner in Salt Lake City, Utah, the Northstar in Minneapolis, MN and the Westside Express in Portland, OR. These four systems were selected because they represent a handful of commuter rail systems that have been constructed relatively recently and

therefore provide the closest approximation to what it would cost to build a new commuter rail system in the Phoenix region.

5.2.1 Peer City Comparison: Ridership

As a stand-alone corridor under Phase B, the Yuma West Corridor is forecast to have about 1,420 daily boardings. This equates to about 1.0 boarding per revenue mile; the comparable national average for this figure is 1.56. Yuma West boardings per mile would be somewhat comparable to the Los Angeles Metrolink and San Diego Coaster systems, which have 1.2 boardings per revenue mile. The projected ridership for the Yuma West Corridor may be on the low end of peer city experiences due to the longer time horizon for anticipated development to occur, and a less developed bus transit system in this part of the West Valley. Links to bus and other transit generally would promote greater efficiency and ridership for the overall system.

When interlined with East Valley corridors, projected ridership on the Yuma West Corridor increases by just under 10 percent. This information is presented in more detail in the *MAG Commuter Rail System Study*.

5.2.2 Peer City Comparison: Capital and Operating and Maintenance Costs

As discussed in Section 4.3.2 in Chapter 4, capital costs to implement the Yuma West Corridor are estimated to be $11.8 million per mile (Phase B), which is in the low-to-mid range of peer city costs (which ranged from $7.2 to 21.7 million). Due to the relatively low ridership projected for the Yuma West Corridor, the estimated O&M cost of $26.60 per passenger trip is relatively high compared to peer cities.

5.2.3 Findings and Recommendations

The relatively low capital costs associated with the Yuma West Corridor and higher development potential (due to more vacant land in the West Valley that may develop over time) are positive attributes of this corridor. As discussed in the *MAG Commuter Rail System Study*, the Yuma West Corridor is most cost-effective as part of a larger, interlined system that would spread the costs among more riders. The Yuma West Corridor is notable in that it has relatively low capital costs, but the projected boardings per revenue mile as modeled from currently available data are below the national average. The remainder of this chapter considers implementation strategies that would be applicable to the Yuma West Corridor as either a stand-alone corridor or as part of a regional system.

5.3 Operational Models

As envisioned, commuter rail service on the Yuma West Corridor would share right-of-way currently owned by the Union Pacific Railroad (UPRR), preferably utilizing the same track. To enable this, a rail access agreement of some type would be required. Railroad access agreements fall into two broad categories: Sale Agreements and Capacity Rights Agreements. A more detailed discussion of these types of agreements is provided in the Maricopa Association of Governments (MAG) Commuter Rail Strategic Plan (2008). These agreements are assessed in this section for suitability for implementing commuter rail service in the Yuma West Corridor. In addition, Section 5.1.3 identifies options for operating commuter rail service, which may be contracted with the railroad or another party.

5.3.1 Capacity Rights Agreements

Capacity Rights Agreements may be a real estate interest such as a lease or easement, or a contractual or license right. The purchaser is not acquiring the line, but rather is only acquiring the right to operate a specified number of trains. Unless conditions change, a Capacity Rights Agreement is expected to be the likely avenue for implementing commuter rail service along the Yuma West Corridor.

Two key elements of these agreements that need to be negotiated are (1) level of service and how passenger and freight service are timed to operate concurrently, and (2) capacity improvements. Chapter 3 provides a schedule for conceptual operations that may provide a starting point for these negotiations. Actual schedules will be influenced by both the projected ridership and the level and type of freight service on the corridor. With regard to capacity improvements, parties will need to show funding commitments and agree on the timing and nature of the improvements necessary to accommodate the level of service. Chapter 3 provides an initial list of infrastructure improvements by phase, but it is expected that this list may evolve as coordination with the railroad continues.

Because the railroad still owns the line, most capacity improvements would be designed and constructed by the railroad, or by contractors working for the railroad. In most instances, existing railroad labor agreements require that railroad employees actually construct the improvements that tie into an existing railroad facility. Normally the agreement with the railroad contains cost estimates for all the capacity improvements, with the commuter rail agency responsible for any increases over the estimate.

Under a Capacity Rights Agreement, the railroad will continue to maintain and dispatch the rail line. The standard of maintenance required for the speed and ride quality necessary for good passenger rail service is higher than that required for freight service. Accordingly, the agreement would detail the standard of maintenance required and set the cost paid for maintenance, or establish the method, or formula for allocating ongoing maintenance costs. Because the railroad use of the rail line may still be significant, these allocation formulas more evenly split maintenance costs than in sale agreements, where railroad use is less significant.

The agreement will also establish the process to be followed for identifying future capital projects. These future capital projects include capacity improvements requested by either party to the agreement, as well as capital maintenance projects such as major tie replacement and rail relay programs. The allocation formula or method of allocating these capital replacement costs is weighted to emphasize the more demanding operating requirements of passenger rail systems.

Under this scenario, dispatch of the line would remain with the railroad. Dispatch protocol (what train has priority) and compensation for dispatch services are negotiated between the agency and the railroad. All of these considerations for operations and maintenance may influence the preliminary cost estimates provided in Chapter 4.

5.3.2 Sale Agreements

Generally, a railroad would only enter into a Sale Agreement when the rail line involved is a light or moderate density (density refers to the number of trains operating on the corridor) branch line or a light density secondary main line that does not figure prominently in the railroad’s current or future operations.

UPRR has identified the Yuma West Corridor as part of a main line. Although the Yuma West Corridor currently does not appear to carry more than a moderate density of freight service, UPRR's future planning may assume that industrial development in the West Valley will result in additional freight customers. Alternatively, improvements along UPRR's Sunset corridor to the south of the Phoenix metropolitan area—which provides access across the state—may reduce the future significance of the Yuma West Corridor as a main line. For the Yuma West Corridor to be considered as a branch that could be eligible for a Sale Agreement, UPRR would likely have determined that (1) there are not major customers along the line; or (2) the line is not expected to increase dramatically in significance in the future.

Under a Sale Agreement the purchaser would assume greater upfront costs and liabilities, as sales costs may reach or exceed a million dollars per mile and the purchaser assumes responsibility for any environmental or other issues associated with the right-of-way. However, the owner would have greater control over timing and levels of service, dispatch, and the timing and nature of improvements.

A Sale Agreement generally will not transfer mineral or rail freight rights; the railroad will normally retain the right and obligation to serve rail freight customers on the corridor. The right and obligation to provide freight service is regulated by the Surface Transportation Board, formerly the Interstate Commerce Commission. This retained right is usually styled as a "common carrier easement," and gives the railroad a real estate, contractual, and regulatory right and obligation to continue providing rail freight service. This common carrier obligation could transfer to the new owner, but few, if any, public entities want to be burdened with the obligations and regulatory entanglements of freight rail responsibilities. The common carrier responsibilities may, however, be transferred at closing, or soon thereafter to a third party operator (such as a short line; see Section 5.1.3).

If the Yuma West Corridor is considered by UPRR to be a candidate for a Sale Agreement, the additional costs and liabilities may still make this an untenable option for a regional commuter rail agency. If a statewide rail authority is identified as the appropriate governance structure for commuter rail in the region, there may be more justification for assuming greater responsibilities associated with owning the line(s) if a larger vision for implementing and managing rail within the state is served, and the agency can provide the appropriate resources to manage the wider array of responsibilities attendant to owning such a resource. Potential governance options are discussed in more detail in Section 5.3.

5.3.3 Contracting Operations

It is expected that the operation of commuter rail service would be contracted out by the commuter rail agency. The owner railroad (UPRR) may operate passenger rail service under the terms of a Capacity Rights or other agreement.

Another option is to contract with a short line or other qualified operating entity to operate passenger service as a third party. A short line railroad is an independent company that operates shorter rail lines, typically under 100 miles. Short line and contract operators generally have lower labor, overhead, and regulatory costs than larger Class I railroads and can operate shorter lines profitably. A short line railroad or contract operating company may be contracted to operate passenger service under either a Sale or Capacity Rights Agreement.

5.3.4 Summary of Potential Agreements to Operate Commuter Rail

Further coordination with UPRR is critical to determining the appropriate approach to contractual relationships to operate commuter rail. There appears to be limited existing freight traffic along the Yuma West Corridor, which may make the negotiation of identifying windows of opportunity for commuter rail service reasonable and feasible. However, UPRR's projections of future freight activity along the corridor would need to be integrated into the overall agreement. Table 5-1 provides a summary of the pros and cons of each type of railroad agreement for operating commuter rail.

Table 5-1: Summary of Considerations for Passenger Rail Agency when Entering into Agreements to Operate Commuter Rail

Agreement	Potential Advantages	Potential Disadvantages
Sale Agreement	• More flexibility to operate service (although freight service likely would still continue) and schedule infrastructure improvements. • Greater capacity to exercise control along the corridor with dispatch and maintenance. • Freight common carrier service likely would remain with the railroad.	• Greater upfront costs to purchase. • Purchaser assumes environmental and other liabilities associated with the right-of-way. • Limited segments of the rail line would be considered eligible for sale by the railroad; most likely sales would not be considered where there is high freight traffic, or where existing customers or future development options might be compromised. • Need to identify additional agreements to dispatch the line and operate service, although these could be addressed in the Sale Agreement.
Capacity Rights Agreement	• Usually lower initial costs (compared to Sale Agreement). • May contract with the railroad to operate passenger service.	• Passenger rail agency has less control over the line, which makes increasing service or changing schedules more difficult. • Railroad would continue to maintain and dispatch the line, which limits control over train priority by passenger rail agency. • Need to identify additional agreements to dispatch the line for commuter rail. • Difficult and complex to negotiate compensation for capacity rights, infrastructure, maintenance. • Railroad has the ability to shut down negotiations.
Contract to Operate Passenger Rail to Third Party	• Operations would be run by qualified, experienced rail operator. • Short lines or qualified contract operators typically have reduced overhead and can operate shorter lines profitably. • Railroad may prefer third party operator agreements.	• Need to identify additional agreements to dispatch the line. • May require coordination between short line or other parties if different entities are operating passenger and freight on the line.

Source: URS Corp., 2009.

5.4 Governance Options

One of the most significant issues to be resolved for the implementation of commuter rail in the MAG region is the question of who will be the responsible party for managing, constructing and operating the system. A commuter rail system typically goes farther and cuts across more jurisdictional boundaries than most other types of transit service.

In the MAG region, this means that the commuter rail service area will expand beyond the political boundaries of existing local transit service areas and potentially beyond the boundaries of the MAG region itself into northern Pinal County. Implementation of a commuter rail system will likely require a governance structure that reflects the financial, political, and representational patterns of the areas served by commuter rail.

The following subsections describe potential governance models for consideration. It is important to note that additional legal analysis is necessary to determine the application of governance options in the State of Arizona.

5.4.1 Regional Transit Authority/District (Multi-Modal)

Regional transit authorities or districts are usually characterized by appointed boards, with representation closely aligned with area political subdivisions, and the authority to impose voter-approved taxes to balance financial resources with service demands. In many of the mature transit systems throughout the country, a regional transit authority will manage and operate several types of transit services, such as light rail, commuter rail, bus, streetcar, etc.

5.4.2 Regional Rail Authority/District (Single-Purpose)

A new regional transit authority or district could conceptually be a single provider of commuter rail service with its own board and planning, design, construction and operations functions. A new regional authority can be formed in one of two ways: (1) by a legislative statute at the state level that defines and grants authority to a district; or (2) by a direct popular vote of the electorate in which voters opt-in to form a regional transit district. Like a regional transit authority responsible for multi-modal services, a single-purpose regional rail authority is also usually characterized by an appointed board with representation closely aligned with area political subdivisions, and ideally has the authority to impose voter-approved taxes for balancing financial resources with service demands.

5.4.3 Joint Powers Authority

A Joint Powers Authority (JPA) is a common governance model for commuter rail transit operations. A JPA is an institution permitted under the laws of some states whereby two or more public authorities can operate collectively. A JPA is distinct from the member authorities and has separate operating boards of directors that can be given any of the powers inherent in all of the participating agencies. Unlike a new transit district, which would have its own source of funding as a taxing entity, a JPA relies on funding through its constituent members. A JPA can have legal standing at the state level or can be a partnership entered into between its constituent members via intergovernmental agreements at the local or regional level.

The rationale for forming JPAs to govern commuter rail systems varies. In some cases, a JPA is formed during the planning and design phases of commuter rail, while in other cases a JPA is formed to take over governance from another agency, such as a state Department of Transportation.

5.4.4 Division of State Department of Transportation

The provision of regional transportation services by state agencies is more common in small states with one dominant metropolitan area. Both Boston, Massachusetts and Baltimore, Maryland are examples of commuter rail systems that are planned and operated by a state Department of Transportation.

5.4.5 Division of Metropolitan Planning Organization

While Metropolitan Planning Organizations (MPOs) generally play a significant role in the planning for regional commuter rail service, they are usually not the entity responsible for the governance and administration of commuter rail service. One exception to this is New Mexico's recently opened Railrunner Express; the Mid-Region Council of Governments is the lead agency for implementation of this service. Within the MAG region and part of Pinal County, MAG has initiated the preliminary planning of commuter rail service.

5.4.6 Examples of Governance Models in Other Regions

Generally, the institutional arrangements for regional or commuter rail service throughout the country range from state-run regional rail operations to large single-purpose regional rail authorities that extend service into multiple political jurisdictions, to regional transit authorities that are responsible for multimodal services, to sub-regional agreements between cities to contribute to the management of a rail service in a common corridor.

There are several new commuter rail systems currently in operation or being considered across the country. From these networks there is a wealth of information and experience on which to draw for the analysis of possible governance structures.

The more mature systems are significantly larger in size than the newer ones, primarily because they have built ridership as the region has grown around them. Each has been a catalyst for successful service in corridors or in the region. Ridership has followed, growing steadily as the train became a preferred commuter option for local residents. In many of these locations, commuter rail was added after the regional urban form and transportation network had already been established. This has required close coordination among regional and local jurisdictions, the railroads, private businesses, and residents in order to be successful. Regional agencies such as the MPO or the transit agency have often taken the lead in initiating this coordination.

Table 5-2 illustrates the array of institutional arrangements that characterize typical commuter rail governance structures throughout the U.S.

Table 5-2: Existing Governance Models

Governance Structure	Governing Authority/District	Commuter Rail Service Description
Regional Transit Authority/District (Multi-Modal)	Sound Transit District, Washington	Sounder between Seattle and Everett and Seattle and Tacoma
	Tri-County Metropolitan District, Oregon	Westside Express Service (WES) between Wilsonville, Tualatin, Tigard and Beaverton
Regional Rail Authority/District (Single-Purpose)	Sonoma-Marin Area Rail Transit, California	Planned commuter rail between Cloverdale in Sonoma County and the San Francisco-bound ferry terminal in Larkspur, Marin County.
Joint Powers Authority	Peninsula Corridor Joint Powers Board, California	Caltrain between San Francisco, San Jose, and Gilroy
	South Florida Regional Transit Authority, Florida	Tri-Rail between Miami, Fort Lauderdale and West Palm Beach
	Virginia Railway Express, Virginia	Virginia Railway Express (VRE) between northern Virginia suburbs and Alexandria, Crystal City and downtown Washington, D.C.
Division of State Department of Transportation	Maryland Transit Administration, Maryland	Maryland Area Regional Commuter (MARC) between Maryland and Union Station in Washington, D. C., operating along three rail lines
Division of Metropolitan Planning Organization	New Mexico Mid-Region Council of Governments, New Mexico	Rail Runner Express between Albuquerque, Santa Fe, and Belen

Source: URS Corp., 2009.

5.4.7 Key Considerations for Governance Models

Based on a review of existing commuter rail system governance structures listed above, it is clear that the new systems have many different governance structures, as do the established systems. There is no one appropriate structure for governing a commuter rail system.

However, based on the decisions regarding governance made in the most recent commuter rail projects, two key factors are likely to determine the success of a new governance structure. These factors include the ability of the institutional arrangement to (1) balance local control with the need for regional system performance; and (2) provide stable funding opportunities. With these factors in mind, a set of typical responsibilities for the entity that manages the system has been developed as follows:

- Provide a seamless transportation service;
- Raise funds from a variety of sources including: fares, local/state/federal transit or rail programs, private developers, etc.;
- Coordinate with other transit providers regarding schedules, public information and integrated fare systems;
- Participate in priority-setting in RTP process;
- Facilitate growth of the network and provide transit options in off-peak periods;
- Develop long-range plans for system development;

- Coordinate with the private freight railways;
- Manage operations (often through contracts with private operators); and
- Build ridership by encouraging development at stations.

These responsibilities require the close working relationship among existing transit operators and the cities served by the network.

5.4.8 Potential Governance Structures in the MAG Region

The existing structure of transit service providers in the Phoenix metropolitan region is a complex mix of historical operations such as the City of Phoenix transit system, the Regional Public Transportation Authority (commonly known as Valley Metro) and Valley Metro Rail Inc. (METRO), a nonprofit, public corporation charged with the design, construction, and operation of the Valley's light rail system. Defining appropriate governance structures for a commuter rail system would depend upon opportunities that arise for cooperation and use of railroad right-of-way. This could be for one commuter rail project or a series of projects. Each agency would have to participate in the process to define the appropriate structure.

The options for an appropriate institutional structure for regional commuter rail, based on both the national experience and the local situation, are summarized below.

Regional Transit Authority/District (Multi-Modal): Should MAG consider this model in the implementation of commuter rail, it would likely entail a restructuring of RPTA, which was authorized in 1985 by the State Legislature.

Regional Rail Authority/District (Single-Purpose): A newly formed regional rail authority with the sole purpose of implementing commuter rail in the region would likely involve membership in Maricopa County, and potentially Pinal County or even Pima County if service is expanded. The more commuter rail lines that are developed and operated, the more this alternative makes sense. If only one or two lines develop, the efficiency of one authority is not as great. The clearest benefit of one single-purpose entity would be the focus and efficiency.

Joint Powers Authority: In the MAG region, a JPA would be formed by aggregating authorities from constituent districts. For example, METRO could enter into an agreement with the cities to be served by commuter rail to form a JPA responsible for the design, construction and operation of commuter rail service. The mission of METRO could be expanded, building upon the existing staff resources that are currently focused on light rail services. In this case, each of the constituent districts would be responsible for providing project funding, rather than funding coming from a single taxing authority, as is the case with a regional district. Depending on the structure of the JPA, individual jurisdictions may tax their constituents or rely on annual appropriations. Another option may be for those jurisdictions that would be served by commuter rail, but are not currently within the boundaries of RPTA or participants on the METRO Board to form one or more regional transit districts that could enter into a JPA with RPTA or METRO for the purposes of implementing commuter rail. This governance model is the most flexible, as it can be formed to fit whatever combined structure makes the most sense locally. However, a JPA would not generate any new taxing authority, may lack focus, and would likely need a strong leader to identify and further a common vision among the member entities.

Division of State Department of Transportation: While this model is primarily found in smaller states with a single metropolitan area (such as Maryland; see Table 5-2), it may have an application in the MAG region, particularly in conjunction with a state-sponsored intercity rail connection between Tucson and Phoenix and a statewide passenger rail system. Arizona Department of Transportation (ADOT) is currently finalizing a Statewide Rail Framework Study in which it is considering the establishment of a state rail organization that would be empowered to negotiate with railroads for a unified statewide passenger rail system. Further, determining the responsible agency for regional or statewide rail operation, governance, and oversight is a key implementation element of the ADOT study.

Division of Metropolitan Planning Organization: This governance model would require expanding the charter of MAG to include the operation of commuter rail. This expansion would likely require a change in state law and the creation of an operational division of MAG. Another consideration is that commuter rail service could extend to jurisdictions or regional governments in northern Pinal County, which is not part of the MAG region.

Table 5-3 summarizes the potential advantages and disadvantages of theses governance structures.

Table 5-3: Potential Governance Structures

Governance Structure Option	Potential Advantages	Potential Disadvantages
Regional Transit Authority/District (Multi-Modal)	• One transit service provider would create greater efficiencies and coordination between all transit modes to help ensure integrated regional system.	• May lack focus; if RPTA's role is expanded to include commuter rail, it has typically focused on bus and paratransit services. • May be cumbersome political process to expand taxing authority to outlying areas (could create an issue of taxing equity), particularly if services are expanded to Pinal County.
Regional Rail Authority/District (Single-Purpose)	• Single focus on commuter rail, rather than competition for resources being distributed among transit modes, may help ensure success. • With creation of new taxing district, all funding partners would be equally represented from the outset.	• Would require close coordination with METRO to ensure integrated regional transit system. • Adds another entity to the mix. • If formed by popular vote, would be unable to serve jurisdictions which do not vote to join, leaving gaps in representation/service. • Cost and start-up time to form new authority may be greater.
Joint Powers Authority	• Would provide maximum flexibility in the formation and responsibilities of a governing body. • Does not require legislative authority. • If METRO mission is expanded, JPA will benefit from similar rail expertise with LRT.	• May result in potential overlapping responsibilities among or within representative entities. • Each participating entity would be required to secure its own funding source through annual appropriations or voter-approved taxes, which may result in less-stable funding. • May start "turf war" between entities if a new JPA is formed.

Table 5-3: Potential Governance Structures

Governance Structure Option	Potential Advantages	Potential Disadvantages
		• LRT and commuter rail are "different animals," and serve different markets.
Division of State Department of Transportation	• A state agency could apply for funding from federal programs that a local entity may not be able to obtain. • Could empower single railroad negotiator and greater coordination for unified statewide passenger rail service.	• ADOT has not traditionally been an operator of systems, and there could be an institutional learning curve. • May rely primarily on state legislative appropriations. • May bring into question equity between regions of the state. • Increases state influence over local/regional decisions.
Division of Metropolitan Planning Organization	• MAG could continue its role as lead implementation agency and pass-through funding entity.	• Could require continued/greater collaboration and coordination among existing transit authorities. • Northern Pinal County is part of Central Arizona Association of Governments, or CAAG, (not within MAG region). Unless limited to commuter rail operations, Pinal County jurisdictions would be involved in other modal planning for the region. This may add confusion within the MAG and CAAG transportation planning processes. • Would require expansion of MAG charter. • MPOs typically do not engage in transit operations. Would require establishment of new operational division within MAG.

Source: URS Corp., 2009.

5.5 Funding Options

The initial step to develop a funding implementation strategy is to gauge possible or probable funding options from governments at the federal, state and local levels. The policy positions of the involved agencies and possible implementation responsibilities should be thoroughly considered, as should those of other local entities included in the project area. Ultimately, the critical financial issue at the local level is the annual requirement for local funds to meet capital, operating, and maintenance costs.

Table 5-4 lists the federal, state, local and private funding sources and their relative viability for use in the Yuma West Corridor. Each funding source is described in more detail Sections 5.5.1 through 5.5.4.

Table 5-4: Summary of Funding Options

FEDERAL FUNDING SOURCES		
Fund Source	**Capital and/or Operations**	**Viability**
Federal Transit Administration Section 5307	Supports transportation capital costs including preventative maintenance	Low. The MAG region's allocation is currently programmed to support a host of other transit projects; future funds could be allocated to commuter rail. This is an annual programming allocated by formula; if and when commuter rail is added to the region, its data would enter into the formula calculation.
Federal Transit Administration Section 5309 New Starts	Supports transportation capital	Moderate. The application of Section 5309 is feasible, but the New Starts alternatives analysis planning requirements will require a significant evaluation and time. However, New Starts regulations have been relaxed recently and additional funding will likely be provided nationwide in the next authorization bill.
Federal Railroad Administration Section 130	Supports transportation capital uses only, primarily for the use of improving grade crossings.	Low. The State's allocation of Section 130 funding is relatively small and may likely only support a portion of a safety improvement project.
Congestion Mitigation and Air Quality (CMAQ) Funds	Supports transportation capital uses only	Low. A commuter rail project application will contend with many other capital projects in the MAG region.
Surface Transportation Program (STP) Funds	Supports transportation capital uses only	Low. A commuter rail project application will contend with many other capital projects in the MAG region.
Federal Railroad Administration High Speed and Passenger Rail Program	Supports transportation capital uses only.	Low. May only address some intercity components of commuter rail or related rail projects.

STATE FUNDING OPTIONS		
Fund Source	**Capital and/or Operations**	**Viability**
Highway Users Revenue Fund (HURF)	Supports transportation capital uses only	Low. Funding is driven by fuel taxes and vehicle license taxes, which may not be sustainable sources in the future. In order to use HURF, State statute changes would be required.
Vehicle License Tax (VLT)	Supports transportation capital and/or operations	Low. The MAG region's allocation is currently programmed. The revenue generated from the tax may not be a sustainable source of funding in the future.
Statewide Transportation Acceleration Needs (STAN) Account	Supports transportation capital and/or operations	Low. Expected that this source will be eliminated to address budget issues.
New Dedicated Statewide Transportation Funding (e.g. statewide tax)	Supports transportation capital and/or operations	Low. Unclear if new tax would be considered viable in the future.

LOCAL OR REGIONAL FUNDING OPTIONS		
Fund Source	**Capital and/or Operations**	**Viability**
Maricopa County Transportation Excise Tax (Sales Tax)	Supports capital and/or operations	Moderate. Although the revenue generated from the current tax (Proposition 400) is programmed, future propositions are expected to occur.
Vehicle Miles Traveled (VMT) Tax	Supports capital and/or operations	Moderate. Typically used for roadway maintenance. Commonly unpopular with voters because of perceived invasion of privacy. Would be considered to be a more consistent funding alternative to a gas tax.
Payroll Tax	Potentially support capital and/or operations.	Low. Existing state, and potentially federal, tax codes must be modified to support these uses.
Motor Vehicle Sales Tax	Potentially support capital and/or operations.	Low. The MAG region's allocation programmed. The revenue generated from the tax may not be a sustainable source of funding in the future.
Vehicle Rental Tax	Supports capital and/or operations	Low. Special uses for the surcharges collected for this tax will require County, and possibly State, law modification for the purpose of commuter rail.
Local Gas Tax	Potentially supports capital and/or operations	Low. The MAG region's allocation is currently programmed. The revenue generated from the tax may not be a sustainable source of funding in the future. State tax codes will likely require modification to authorize uses.
Vehicle License Tax by District	Supports capital and/or operations	Moderate. The VLT by district concept would require significant political support since it has not been implemented. State and/or County tax codes will likely require modification to authorize districts and uses.

PRIVATE SOURCES		
Fund Source	**Capital and/or Operations**	**Viability**
Public Value Capture: Benefits Assessment Districts	Potentially support capital and/or operating uses.	Low. Setting up the finance mechanism for such a public investment will require State and County statute or code modification.
Public Value Capture: Tax Increment Financing	Potentially support capital and/or operating uses.	Low. The authorization of such a mechanism will require political support and State law modification.
Public-Private Partnerships	Potentially support capital and/or operating uses.	Moderate. ADOT is investigating new PPP opportunities. This approach is being used sparingly in other cities given uncertain nature of financial markets, but may be more viable in the future.

Source: URS Corp., 2009.

5.5.1 Federal Funds

While federal funds for commuter rail projects are fairly limited, there are several potential sources of funding for both capital and operating costs. The future spending levels for these federal programs are primarily subject to federal transportation legislation, or the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). The SAFETEA-LU authorizes federal surface transportation programs for highways, highway safety, and transit for a period of five years. This program expired in September 2009 and is in the process of being reauthorized by Congress at the time of this writing. Funding authorized by SAFETEA-LU includes both formula and grant monies to be used at the discretion of states and MPOs, and earmarked funds for particular projects.

It is anticipated that new legislation will be completed later in 2010. The current Administration has indicated that it will boost transit funding and ease restrictions on qualifying for federal funding for transit such as that embodied in the New Starts program. In addition, Congressional leaders in charge of the authorization effort have indicated support for additional transit funding. While it is unknown exactly the shape the new legislation will take, many in the transit industry are optimistic that additional federal resources will be available for new transit projects around the country as a means to promote job development and economic growth and to assist with mobility needs.

According to the MAG RTP, a total of $6.3 billion is anticipated from federal funding programs for the construction of transportation projects in the MAG region between FY 2008 and FY 2028. These forecasted funds have been committed to specific projects and do not include commuter rail projects. Since the passage of the Intermodal Surface Transportation Efficiency Act of 1991, the US Department of Transportation has permitted wide state discretion in assigning portions of "conventional" highway funds to the flexible funding pool, thus widening the funds potentially available for transit projects. The use of these funds for purposes of commuter rail would decrease funding for future light rail transit and bus projects, as well as street and highway projects. However, higher federal allocations than anticipated in the RTP may provide opportunities to utilize federal funds for commuter rail.

5.5.1.1 FTA Section 5307 Funds

The Federal Transit Administration (FTA) 5307 Urbanized Area Formula Program makes federal resources available to urbanized areas for transit capital and operating assistance in urbanized areas. This federal program can fund up to 80 percent of the net project cost of a new fixed guideway system, such as a commuter rail project. Funding is apportioned on the basis of legislative formulas. For areas with populations of 200,000 and more, like the MAG region, the formula would be based on a combination of fixed guideway revenue vehicle miles, and fixed guideway route miles as well as population and population density.

This funding source is expected to generate $1.9 billion for transit development in the MAG Region from FY 2008 through FY 2028.

5.5.1.2 FTA Section 5309 New Starts Funds

The FTA 5309 New Starts Program is the federal government’s primary financial resource for supporting locally planned, implemented, and operated major transit capital investments. Transit 5309 funds are available for the capital costs associated with New Starts commuter rail projects through discretionary grants from the FTA. New Starts funds are limited and the program is extremely competitive, with the national demand for funding far exceeding the supply of funds

available. While this federal program can fund up to 80 percent of the capital cost of a project, the average New Starts project receives about 50 percent of its funding from the New Starts program.

These funds are granted at the discretion of the FTA and projects applying for New Starts funds must follow a very stringent planning and project development process. New Starts project evaluations and ratings are based on a number of criteria including the local financial commitment, project mobility improvements, environmental benefits, cost effectiveness, and transit supportive land use patterns.

Over the planning horizon, it is estimated that $1.7 billion in 5309 funds for bus and rail transit projects will be made available to the MAG Region from the FTA, during FY 2008 through FY 2028. The total does not include the $587 million in 5309 funds for the 20-mile light rail starter segment, which has already been committed to the region.

5.5.1.3 Congestion Mitigation and Air Quality Funds

Congestion Mitigation and Air Quality (CMAQ) funds are available through the FHWA and FTA for projects that improve air quality in areas that do not meet clean air standards, otherwise known as nonattainment areas. Projects may include a wide variety of highway, transit and alternate mode projects that assist nonattainment areas in complying with the National Ambient Air Quality Standards. While these funds are allocated to the State, Arizona's funds have been dedicated entirely to the MAG region, due to the high congestion levels and major air quality issues in the Phoenix area.

MAG CMAQ funds are projected to generate $1.3 billion from FY 2008 through FY 2028. Approximately $465 million has been allocated to transit projects in the RTP. The balance of CMAQ funds is currently committed to other programs.

5.5.1.4 Surface Transportation Program Funds

The Surface Transportation Program (STP) provides flexible funding that may be used by States and localities for a broad range of surface transportation capital needs, including highway, transit or street projects. STP funds are the most flexible federal transportation funds and the federal share is generally 80 percent of the project cost. The MAG RTP currently allocates the region's share of these funds to primarily street and highway projects.

During the period from FY 2008 through FY 2028, it is estimated that $1.4 billion will be available from STP funds. This amount includes $34.1 million per year that has been allocated through FY 2015 to retire debt related to the completion of the Proposition 300 program, initiated in 1985.

5.5.1.5 Federal Railroad Administration Section 130 Funds

Federal Railroad Administration (FRA) funding may be available to improve at-grade railroad crossings to support safe automobile and commuter/freight rail travel within the corridor. The FRA 130 Program's intent is to eliminate hazards at public highway-railroad grade crossings. In fiscal year 2008, $220 million was allocated nationwide under SAFETEA-LU authorization. It is undetermined at this time the allocation Arizona can expect, however authorization of the federal transportation bill is expected to provide a similar amount to the states.

The FRA has designated ADOT to award funding for the Section 130 program. Grade crossing safety improvement projects are evaluated by ADOT on behalf of FRA. In the interest of public

safety, grade separations, safety equipment or other components may be eligible costs within an infrastructure improvement adjacent or intersecting the state highway system.

5.5.1.6 Federal Railroad Administration High-Speed Intercity Passenger Rail Funds

The High-Speed Intercity Passenger Rail (HSIPR) program is designed to invest federal funding via competitive grants in an efficient High-Speed/Intercity Passenger Rail network. Congress established the framework for this program through the passage of three key pieces of legislation: the FY 2008 and FY 2009 DOT Appropriations Acts, the Passenger Rail Investment and Improvement Act of 2008 (PRIIA) and the American Recovery and Reinvestment Act of 2009 (ARRA). The first round of grants is anticipated to be released in early-2010. The MAG region should continue to coordinate with state-wide rail planning efforts to pursue the opportunity for commuter rail service to be included as one component of a larger high-speed intercity rail program.

5.5.2 State Funds

State funding sources for commuter rail could come from a variety of potential sources as described below.

5.5.2.1 Arizona Highway Users Revenue Fund

ADOT is funded through two primary sources including the Highway Users Revenue Fund (HURF) and federal transportation funds. The HURF is an allocation and programming accounting framework funded with motor fuel excise taxes, truck fees, vehicle registration fees and taxes, and other miscellaneous charges and fees. These funds represent the primary source of revenues available to the ADOT for highway construction, operations, maintenance, improvements, and other expenses. HURF funds are allocated through a number of statewide, regional, and local programs. The MAG Region receives annual funding from ADOT in the form of ADOT 15 percent funds, which are allocated from the HURF. In addition, a 37 percent share of ADOT Discretionary Funds is targeted to the MAG Region.

According to the Arizona Constitution, HURF funds can only be used for highways and streets purposes. Therefore, in order to use HURF funds for commuter rail projects, the Arizona Constitution would need to be changed to allow use of these funds for transit projects. Gas taxes, which are included in the HURF fund in Arizona, are used to completely fund transit systems in other states such as Rhode Island, South Carolina, and Tennessee.

5.5.2.2 Statewide Transportation Acceleration Needs Account

In 2006 the State Legislature established the Statewide Transportation Acceleration Needs (STAN) account as a separate account within the State Highway Fund (SHF) to provide a new vehicle for directed and accelerated funding of key transportation improvements. The State Transportation Board uses funds in the STAN Account of the SHF to pay for certain costs for the construction or reconstruction of freeways, state highways, bridges, and interchanges that are in a RTP or the long-range statewide transportation plan. As of December 2008, the STAN Account had a balance of $253 million. Going forward, the STAN account may not be a reliable funding source.

The STAN account would not be considered as a source of revenue for future commuter rail except in conjunction with highway improvements that may be directly related to the project(s).

5.5.2.3 Potential New State Funding Sources

New state funding streams could include general fund appropriations for commuter rail as well as funding and/or acquisition of railroad right-of-way as part of a comprehensive state-wide rail program. ADOT also is expected to continue to play an important part in commuter rail implementation throughout, both because of its expertise and interest in innovative transit strategies and because of the possibility of state funding for both capital, and operations and maintenance.

The State of Arizona may appropriate funds for commuter rail service from its general fund. These funds may be made up of revenues from a number of sources including state sales taxes, property taxes and income taxes. In addition, the state could dedicate new funds to a comprehensive statewide rail system that unifies commuter rail and intercity rail. One component of the on-going Statewide Rail Framework Study is the construction of intercity rail in the Sun Corridor Megapolitan that would build on the MAG commuter rail systems. Like many other state DOTs around the nation, ADOT could also pursue the acquisition of lines from private railroad companies such as BSNF and UPRR as 'vital state intermodal corridors.'

5.5.3 Regional and Local Funds

Local transportation funding mechanisms can include any tax or fee presently authorized for local use (e.g., sales tax, property tax, service fees, fines and forfeitures, etc.). In practice, only the sales tax is currently employed as an exclusive transportation funding vehicle, such as the existing Maricopa County's half-cent sales tax program authorized by Proposition 400, described below.

5.5.3.1 Maricopa County Transportation Excise Tax

The major funding source for the RTP is the half-cent sales tax for transportation that was approved through Proposition 400. On November 2, 2004, the voters of Maricopa County passed Proposition 400, which authorized the continuation of the existing half-cent sales tax for transportation in the region (also known as the Maricopa County Transportation Excise Tax). This action provides a 20-year extension of the half-cent sales tax through calendar year 2025 to implement projects and programs identified in the MAG RTP. The results of the Proposition 400 vote in Maricopa County dedicated approximately one-third of the half-cent sales tax at the regional level to mass transit. The current MAG RTP reflects this significant increase in transportation funding, with expanded transit plans and programs. The use of transit funds must be separately accounted for based on allocations to: (1) light rail transit, (2) capital costs for other transit, and (3) operation and maintenance costs for other transit.

House Bill 2456 addresses the allocation of revenues from the collection of sales tax monies among the eligible transportation modes funded through Proposition 400. The legislation creates three "firewalls", which prohibit the transfer of half-cent funding allocations from one transportation mode to another. Therefore, this tax is unlikely to be available for commuter rail implementation, as the funds are committed to transit projects identified in the RTP.

5.5.3.2 Potential New Local/Regional Funding Sources

Most likely, commuter rail funding would be included in a future regional ballot proposition that is based on specific planned corridors that may emerge from this and other studies. Throughout the United States, sales taxes are the most common source of funding for local and regional transit services. In 2004, the State Legislature permitted Maricopa County to place a ballot initiative before the voters to authorize a special sales tax specifically for transportation

purposes. A potential sales tax program to specifically to fund commuter rail however, should consider the jurisdictional boundaries of the commuter rail system and the likely beneficiaries in the region. Therefore, an expedient approach to building commuter rail service in the Yuma West Corridor may be to establish a smaller sub-region among the municipalities along the corridor where there would likely be strong support for a tax measure.

Additional or alternative local taxes, with voter approval, could include one or a combination of the following revenue streams:

- **Payroll tax.** In Portland, Oregon, TriMet receives its operating revenue from payroll and self-employment taxes that are collected and administered by the State Department of Revenue. In 2003, the State Legislature provided TriMet with the authority to increase the tax rate over ten years to help pay for new transit service throughout the region. The rate increases annually by 1/100 of a percent.
- **Motor vehicles sales tax.** In Seattle, Washington, Sound Transit has imposed a voter-approved 0.3 percent motor vehicle excise tax, as well as a sales and use tax, to build and operate its regional mass transit system.
- **Vehicle rental tax.** In Pittsburgh, Pennsylvania, Allegheny County has enacted a $2 rental car fee to help support regional transit services provided by Port Authority Transit Services.
- **Local gas tax.** In South Florida, each county served by the South Florida Regional Transit Authority is required to dedicate $2.67 million to the authority annually. This funding may come from each county's share of the ninth-cent fuel tax, the local option fuel tax, or any other source of local gas taxes or other nonfederal funds available to the counties. A local gas tax is currently prohibited by the Arizona Constitution.
- **Vehicle registration fee**. In Seattle, Washington, the "car tab tax" is a motor vehicle excise tax collected by the Washington State Department of Licensing as part of vehicle license renewals in the Sound Transit District. Another example of a vehicle registration fee, the Florida State Legislature has authorized the levy of an annual $2 vehicle registration or renewal tax for the counties served by the South Florida Regional Transit Authority.
- **Vehicle Miles Traveled (VMT) tax.** A VMT tax would charge motorists a fee based on the number of miles driven rather than on fuel consumption, which is becoming a declining source of transportation revenues as vehicles become more fuel efficient. A VMT tax would require the installation of an onboard tracking device in vehicles to identify the locations where vehicles travel. While the idea of a VMT tax is increasingly being discussed among elected officials, it does not necessarily have widespread political support primarily due to privacy concerns.
- Other examples of local funding approaches include property taxes, resident impact fees, driver's license fees, and hotel occupancy taxes.

5.5.3.3 Alternative Funding Strategies

Early identification and assembly of potential project sponsors is a critical factor in evaluating dedicated funding options for commuter rail in the MAG region. Early discussion with key Congressional, state, and local legislators and officials would also be helpful to gain support for the project.

5.5.3.4 Public Value Capture

Current federal, state and local funds that have traditionally been used for transportation projects in Maricopa County have been dedicated to the implementation of the 20-year transit program identified in the RTP as defined through the Transportation Improvement Program. Due to the considerable cost involved in implementing a regional commuter rail system, the region will need to look at other funding mechanisms such as value capture.

Value capture mechanisms are used to indirectly capture some of the economic benefits derived by the private sector from the development and operation of a transit corridor. Building near a transit stop is not only good for the transit system; it is good for property owners and interested developers. Residential and commercial projects near transit typically appreciate in value more rapidly than other projects. As demand for scarce properties near transit stops increases, this trend will continue. As a result, development near transit stops increases tax revenues. As the value of property near transit appreciates, property taxes collected by local governments also increase.

Value capture techniques used throughout the United States include:

Benefits Assessment Districts – assessment charges imposed on property owners in a designated area, based on the specific benefits to those properties, as generated by the transit facilities. An example of this technique is Portland, Oregon's Transit Revitalization Investment District (TRID). The TRID model is able to calculate job creation, housing development and income results for each district. The revenues above a certain amount from property taxes, business license fees, system development charges and other revenues within the boundaries of a TRID district are used to pay for bonds that fund transit improvements, subsidize operating costs and other public benefits such as housing within the TRID district. The revenue sources and amounts from each can vary from TRID district to district. TRID has been used by Portland, Oregon to fund their streetcar system.

Tax Increment Financing – incremental property tax receipts (above a pre-determined base) which can be attributed to infrastructure improvements, such as transit facilities. These incremental receipts will typically be captured through a redevelopment agency (which could dedicate some of its own tax increment funds for transit facilities in a designated redevelopment area), or through the establishment of infrastructure financing districts. Arizona currently does not have a state law authorizing the use of Tax Increment Financing.

5.5.4 Public-Private Partnerships

Increasingly, transportation agencies are turning to the private sector to improve the efficiency of designing and building major transit projects and to help meet the financial demands of projects. Considered to be an innovative financing mechanism, a public-private partnership is described by FTA as a contract wherein a single private entity, typically a consortium of private companies, is responsible and financially liable for performing all or a significant number of functions in connection with a project. Advantages to forming a public-private partnership can include cost savings, cost predictability, additional expertise from the private sector with regard to finance, reduced project completion time, and greater private sector investment. Additionally, a public agency could potentially spread the cost of a project over a greater period of time. FTA has invested in several projects designed to promote private-sector investment in transit. Through the PPP Pilot Program (Penta-P), FTA is currently exploring how private sector funding could be integrated into the New Starts program.

Disadvantages of public private partnerships may include the disincentive for private companies to assume risk for design, construction, financing, and even operations and maintenance. Other challenges may include the establishment of long-term contracts, procurement that may be too long and costly, the use of more expensive private sector capital, and perceived loss of public sector control.

Types of Public-Private Partnerships may include:

- Design/Build – private sector designs and builds but public entity operates and maintains.
- Design/Build/Maintain – private sector designs, builds, and maintains system but public entity operates.
- Design/Build/Operate – private sector designs, builds, and operates over a specified period of time while public entity gets title to system.
- Design/Build/Operate/Maintain – private sector builds and operates over a specified period; at end of period, operations and maintenance revert to public entity.
- Design/Build/Operate/Maintain/Finance – private entity does it all under a long-term agreement; at end of agreement, operations and maintenance conducted by public entity.

An example of a successful Public-Private Partnership project is the New Jersey Riverline, a Design/Build/Operate/Maintain-type partnership, which is an LRT system operating 34 miles and serves 17 communities. The service was procured outside of the FTA process and financing was not required.

5.5.5 Summary of Funding Approaches in Other Cities

Peer cities and regions that have implemented commuter rail systems have used a variety of funding sources and mechanisms. Table 5-5 provides a summary of peer city approaches to funding. Recently developed commuter rail systems are built with a combination of federal funding, state budget commitments, and local tax monies. The Rail Runner in New Mexico is an anomaly, in that state and local sources funded the capital costs of commuter rail (exclusive of federal funding, although CMAQ funding contributes to operating costs), and thus the system was built more quickly than other recent commuter rail systems. Colorado's FasTracks and Minnesota's Northstar are continually evaluating public-private partnerships for future projects; this approach may also be a viable contributor to funding sources in Arizona.

Table 5-5: Comparison of Commuter Rail Facilities and Transit Funding

State/County	Operating Authority	Commuter Rail Facility	Key Funding Sources (inclusive of all transit services provided by operating authority)
Colorado: Denver	Regional Transportation District (RTD)	FasTracks	Dedicated Regional Sales Tax; Federal funding (Section 5309 New Starts program); Private Contributions
Utah: Weber, Davis, and Salt Lake	Utah Transit Authority	FrontRunner	Dedicated Local Sales Tax ; Federal funding (Section 5309 New Starts program)
Texas: Tarrant and Dallas	The Fort Worth Transportation Authority (The T)/Dallas Area Rapid Transit	Trinity Railway Express	Dedicated Local Sales Tax; Federal funding (CMAQ)
California: San Diego	San Diego Metropolitan Transit System	The San Diego Coast Express Rail (COASTER)	Dedicated Local Sales Tax
New Mexico: Valencia, Bernalillo, and Sandoval	Rio Metro	Rail Runner	Funded by the State of New Mexico; Federal funding (CMAQ), Dedicated Local Sales Tax.
Minnesota: Anoka, Benton, Hennepin, and Sherburne	Minnesota Department of Transportation (MnDOT) and the Northstar Corridor Development Authority	Northstar	Various dedicated funding for counties in Minnesota (only 17% of Northstar construction costs from local governments/transit agencies); State funding; Federal funding (Section 5309 New Starts program).

Source: MAG, 2008; URS Corp., 2009d.

5.6 Implementation Steps

5.6.1 Near-Term Implementation Steps (2010-2015)

This section outlines the near-term (within the next five years) implementation steps to advance this Corridor Development Plan. MAG's Commuter Rail Strategic Plan (2008) lays out key implementation steps. This section builds upon those concepts by applying them to the Yuma West Corridor based on the stakeholder input and more detailed operations planning that has occurred through this planning process.

Coordination with the Railroad. Further coordination with UPRR is critical to understanding the feasibility of sharing the corridor, and defining train schedules, operational constraints, and needed capacity improvements. To enable this coordination, several key efforts should be completed:

- **Establish state-level point of contact and communication protocols**. UPRR has indicated a preference to work through one point of contact on issues pertaining to its rail lines in Arizona. In addition to commuter rail, ADOT has been engaged in intercity rail planning between Tucson and the Phoenix metropolitan area and a Statewide Rail Framework Study, both of which have involved UPRR and BNSF. ADOT has been identified as a logical point of contact going forward through their participation in the

Project Management Team reviewing the commuter rail planning process. Communication protocols should be established to facilitate continuing stakeholder input and awareness of efforts to further rail planning efforts with UPRR.

- **Develop partnership to investigate options in accordance with an MOU**. A conceptual framework for a Memorandum of Understanding (MOU) with the railroad is attached as Appendix G. This MOU would address key points of negotiation such as determining compensation, capacity improvements, and level of service (see Appendix G as well as MAG Commuter Rail Strategic Plan). It is expected that resolution of these issues will require further modeling and investigation by the railroad based on the conceptual operating plan outlined in this Corridor Development Plan as well as ongoing discussions. For UPRR and other parties to commit the resources and efforts required to make substantive progress on these, it is likely that a funding commitment to furthering commuter rail must first be identified and be demonstrated.
- **Advance the design and operating concepts**. This Corridor Development Plan provides plan drawings which may be further developed in coordination with UPRR. UPRR likely will opt to conduct its own modeling and assessment of the infrastructure improvements that would be required. This information would be used to form the basis for any long-term agreement with the UPRR.

Identify Funding Commitments. To advance commuter rail it is critical to define new revenue streams that would be dedicated to development and ongoing operation of the commuter rail system. As discussed in Chapters 3 and 4 and Section 5.3 above, a phased approach and cost-sharing agreements may segment or defer expenditures.

A cost-sharing approach among the entities may facilitate the use of different funding sources for the capital costs of commuter rail implementation. An example of a cost-sharing approach is outlined in Table 5-6.

Table 5-6: Potential Cost-Sharing Approach to Commuter Rail Implementation

	Potential Cost-Sharing Partners			
	Commuter Rail Authority or JPA	**Local Jurisdictions**	**ADOT**	**UPRR**
Potential areas of responsibility	• Overall responsibility for the construction of the system. • Overall responsibility for coordination with UPRR on maintaining freight service during and after construction.	• Partner on development of station areas • Partner on improvements in at-grade crossings that increase public safety.	• Partner on improvements in at-grade crossings that increase public safety. • Partner on utility relocation or other efforts that may be coordinated with programmed road improvements.	• Implementation of positive train control may predate commuter rail (Although not necessarily cost-sharing, these independent efforts may reduce overall cost estimates.) • Partner on development of sidings, bridges, and improvements in at-grade crossings that also benefit freight service.

Source: URS Corp., 2009.

Develop and Implement Governance Plan. Options for governance of a commuter rail system are described in Section 5.3 above. The most likely approaches that are suitable for the region include:

- A new Commuter/Passenger Rail Authority.
- Designation of an existing agency as the Passenger Rail Authority (RPTA, METRO, MAG, ADOT).
- Establishment of a new Joint Powers Authority (JPA) with a provision for representation appropriate to the corridor or system to be implemented. One potential example of a regional Joint Powers Authority would be through the formation of a multi-county Megapolitan Planning Council.

Preserve Future Options. Planning studies may identify and preserve rights-of-way in developing and underdeveloped areas for multimodal transportation corridors to include roadway and rail transit. The Yuma West Corridor is assumed to occur within the existing railroad right-of-way and thus right-of-way acquisition requirements have not been identified for the implementation of the corridor. However, preliminary analysis of potential extensions of a commuter rail system was conducted as part of the MAG Commuter Rail System Study. Right-of-way preservation of future extensions may reduce the costs for growing a future regional system.

Passage of enabling legislation relative to liability and indemnification. Careful review of Arizona state law must be conducted to determine if legislation is required to facilitate passenger rail operations in freight rail corridors similar to legislation passed in Minnesota, Virginia, New Mexico, and Colorado. Progress on this issue may facilitate more effective coordination with the railroad, as this would be an important issue to UPRR.

Local Planning Efforts. A successful commuter rail project will require a collaboration of all participants – primarily the local governments as the development regulator and financial partner, the transit agency as the transit infrastructure builder, and the UPRR as the railroad right-of-way owner. Prior to securing project financing, local governments within the corridor can take steps to lay the foundation for commuter rail implementation. The following is a list of such actions:

- Partner with UPRR and ADOT to upgrade existing at-grade railroad crossings along the corridor.
- Pursue station area planning to identify suitable parcels and locations within each station target area.
- Control regulatory actions within station areas, including the planning, zoning, and development permitting process, to facilitate the development of commuter rail stations.
- Use other implementation tools such as infrastructure construction (for example, streets and utilities), land purchase and assembly, and creation of urban design guidelines to facilitate transit-supportive development.

Periodic Ridership Forecasting Updates. MAG continually updates socioeconomic data assumptions for the region. Therefore, it is recommended to re-run the MAG model approximately twice a year with the latest socioeconomic data to generate updated commuter rail boardings estimates. These estimates should be incorporated into the corridor prioritization and implementation process.

Table 5-7 summarizes the near-term implementation steps, including the step, potential responsible parties, and timeframe.

Table 5-7: Summary of Near-Term Implementation Steps

Item	Responsible Party	Partners	Timeframe
Periodic Ridership Forecasting Updates	MAG	Local jurisdictions	Ongoing
Coordinate with BNSF Railway Company - Maintain point of contact and communication protocols - Develop partnership to investigate options - Advance design and operating concepts	ADOT MAG UPRR	Local jurisdictions METRO RPTA	Ongoing
Address Enabling Legislation (Liability and Indemnification)	ADOT (as a statewide issue)	MAG UPRR	2010-2013
Identify Funding Commitments	MAG ADOT Legislature	Local jurisdictions	2010-2015
Develop and Implement Governance Plan	MAG ADOT	METRO RPTA Local jurisdictions	Following identification of local funding commitments
Preserve Future Options	Commuter Rail Authority or JPA	Local jurisdictions UPRR MAG CAAG ADOT	Ongoing
Local Planning Efforts	Local jurisdictions	MAG ADOT	Ongoing

Source: URS Corp., 2009.

5.6.2 Longer-Term Implementation Steps

The identification of funding commitments and determination of the appropriate governance structure for commuter rail, which are likely to influence each other, will set the stage for moving into the next level of investment in commuter rail within the MAG region. With progress on these key steps, the region will be in a position to move forward on other recommendations from the Strategic Plan, as described below.

Formalize partnership with the railroad. Following the development of a public/ private Memorandum of Understanding with UPRR, detailed agreements must be negotiated to define funding and the parameters to implement commuter rail facilities and services that will mutually benefit the public and private sector interests.

Initiate process for Federal funding. The process for FTA New Starts funding requires completion of Alternatives Analysis and NEPA compliance. Local match funding should be evaluated prior to initiating this process with FTA.

Design, construct, and operate initial commuter rail system. The implementation of the system would be contingent upon the realization of a partnership agreement with UPRR and funding commitments.

Further planning to develop seamless transportation system and meet regional sustainability goals. As the commuter rail system develops and expands, regional planning must occur to ensure efficient systems and intermodal connections.

6.0 REFERENCES

Arizona Department of Transportation (ADOT). 2007. *State of Arizona Railroad Inventory & Assessment 2007.* March 2007.

___. 2009a. *Interstate 10 (Papago Freeway) Inside Widening Construction Project Overview.* 2009. Available at http://www.dot.state.az.us/Highways/Valley_Freeways/I10/Papago/index.asp (accessed June 2009).

Avondale, City of. 2002. *City of Avondale General Plan.* June 2002. Available at http://www.ci.avondale.az.us/index.aspx?NID=1256 (accessed May 2009).

Buckeye, Town of. 2008. *Town of Buckeye General Plan Update 2007.* January 2008. Available at http://www.buckeyeaz.gov/index.aspx?NID=138 (accessed May 2009).

Federal Railroad Administration (FRA). 2009. *"Frequency of Crossing Collisions".* 2009. Available at http://safetydata.fra.dot.gov/officeofsafety/publicsite/Query/gxrtop50.aspx (accessed August 2009).

Goodyear, City of. 2003. *City of Goodyear General Plan.* May 2003. Available at http://www.ci.goodyear.az.us/index.aspx?NID=2173#_top (accessed May 2009).

Maricopa Association of Governments (MAG). 2002. *MAG Existing (Year 2000) Land Use (shapefile).* Phoenix, Arizona: Maricopa Association of Governments.

___. 2007a. *MAG Future Land Use* (*shapefile)*. Phoenix, Arizona: Maricopa Association of Governments.

___. 2007b. *MAG Socioeconomic Projections (shapefile).* Phoenix, Arizona: Maricopa Association of Governments.

___. 2007c. *Regional Transportation Plan 2007 Update.* July 2007. Available at http://www.mag.maricopa.gov/pdf/cms.resource/RTP_2007-Update_07July.pdf (accessed July 2009 and November 2009).

___. 2008. Commuter Rail Strategic Plan. Prepared by URS Corporation. March.

___. 2009a. *MAG 2007 Regional Travel Demand TransCAD Model (database).* Phoenix, Arizona: Maricopa Association of Governments.

___. 2009b. *MAG 2030 Regional Travel Demand TransCAD Model (database).* Phoenix, Arizona: Maricopa Association of Governments.

___. 2009c. *Regional Transit Framework Study.* 2009.

Maricopa County. 2002. *Maricopa County 2020 Eye to the Future Comprehensive Plan.* August 2002. Available at http://www.maricopa.gov/planning/Resources/Plans/ComprehensivePlan.aspx (accessed May 2009).

Phoenix, City of. 2001. *City of Phoenix General Plan*. December 2001. Available at http://phoenix.gov/PLANNING/gpindex.html (accessed May 2009).

Special Event Attendance Analysis. 2009a. Arizona Diamondbacks. Available at http://arizona.diamondbacks.mlb.com/ari/history/year_by_year_results.jsp (accessed November 2009).

___. 2009b. ASU Football. Available at

http://thesundevils.cstv.com/facilities/sun-devil-stadium.html (accessed November 2009)

___. 2009c. College Bowl Football Game. Available at http://thesundevils.cstv.com/facilities/sun-devil-stadium.html (accessed November 2009).

___. 2009d. First Friday's Artlink. Available at http://www.artlinkphoenix.com/about/ (accessed November 2009).

___. 2009e. Fourth of July, City of Tempe. Available at http://www.tempe.gov/business/brochure_files/overview/special_events.htm (accessed November 2009).

___. 2009f. New Year's Block Party. Available at http://www.tempecvb.com/events/2361/ (accessed November 2009).

___. 2009g. Phoenix Civic Center. Available at http://www.phoenix.gov/CITYGOV/stats.html (accessed November 2009).

___. 2009h. Phoenix Suns. *NBA Attendance Report-2009.* November 2009.

___. 2009i. Tempe Arts Festival. Available at http://www.tempefestivalofthearts.com/FestivalFacts.aspx (accessed November 2009).

___. 2009j. Tempe Music Festival. Available at http://www.tempemusicfestival.com/ (accessed November 2009).

Tolleson, City of. 2005. *2005 Tolleson General Plan.* December 2005. Available at http://www.tollesonaz.org/documentcenterii.aspx (accessed May 2009).

Transportation Research Board (TRB). 1997. *Quantifying Special Generator Ridership in Transit Analyses.* 1997. Available at http://ntl.bts.gov/lib/7000/7400/7496/789770.pdf (accessed November 2009).

URS Corporation (URS). 2009a. *Draft* MAG Yuma West Operations Plan. September.

___. 2009b. Technical Memorandum: Proposed Approach for the Final Round of System Study Model Runs. November.

___. 2009c. Technical Memorandum: Conceptual Station Planning. October.

___. 2009d. White Paper: Governance and Operating Structures. Prepared for the MAG Commuter Rail System Study. October.

___. 2009e. Technical Memorandum #1: Purpose and Need. October.

URS and Gannett Fleming. 2009. Cost Estimates.

Valley Metro. 2009a. *Annual Ridership Report FY2008-2009.* July 2009.

___. 2009b. *Dial-a-Ride.*2009. Available at http://www.valleymetro.org/valley_metro/dial_a_ride/ (accessed July 2009).

___. 2009c. *Existing Fixed Route Bus Service.* 2009. Available at http://www.valleymetro.org/bus_schedules/bus_routes/BusSchedules.html (accessed July 2009).

___. 2009d. *Park and Ride Locations.* 2009. Available at http://www.valleymetro.org/bus/park_and_rides/locations/ (accessed July 2009).

___. 2009e. *Transit Book* 2009. Available at http://www.valleymetro.org/images/uploads/2009_ValleyMetroTransitBook.pdf (accessed July 2009).

___. 2009f. *Transit Centers*. 2009. Available at http://www.valleymetro.org/bus/transit_centers/ (accessed July 2009).

Wisconsin Department of Transportation. 2001. *Commuter Rail Feasibility Study.* 1998. Available at http://www.countyofdane.com/rail/crfs/final/html/index.html (accessed November 2009).

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