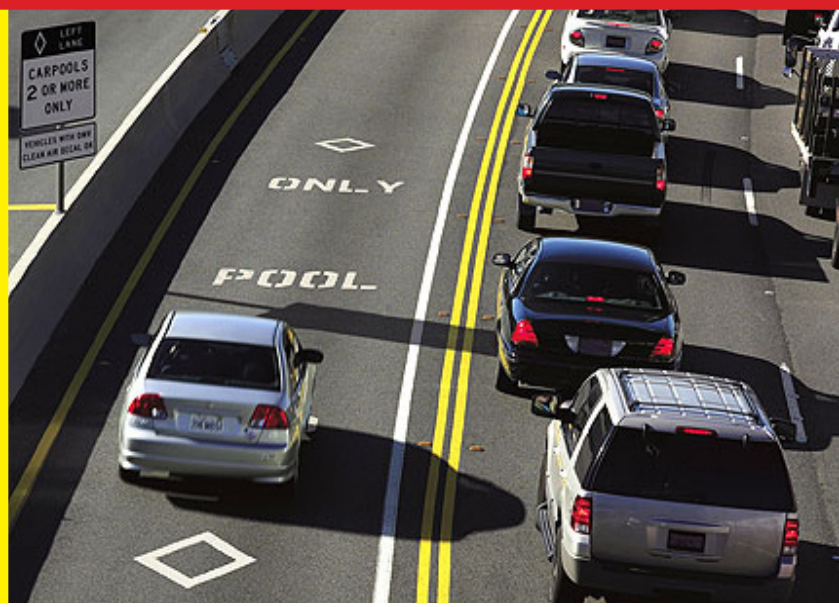

2010 Statewide Transportation Planning Framework

Arizona Department of Transportation

http://www.bqaz.gov

FINAL REPORT

March 2010

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Abbreviations

AA	Alternatives Analysis
AAC	Arizona Administrative Code
AASHTO	American Association of State Highway and Transportation Officials
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ASU	Arizona State University
AGFD	Arizona Game and Fish Department
AZTDM	Arizona Travel Demand Model
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BNSF	BNSF Railway
bqAZ	Building a Quality Arizona
CAA	Clean Air Act
CAAG	Central Arizona Association of Governments
CBP	Customs and Border Protection
CCP	Communication and Community Partnerships
CFR	Code of Federal Regulations
CREATE	Chicago Region Environmental and Transportation Efficiency Program
COG	Council of Governments
CSI	Container Security Initiative
CSS	Context Sensitive Solutions
C-TPAT	Customs-Trade Partnership Against Terrorism
CYMPO	Central Yavapai Metropolitan Planning Organization
DE	District Engineer
DOT	Department of Transportation
EC	Existing-plus-Committed
EIS	Environmental Impact Statement
EO	Environmental Overview
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FMC	Framework Management Committee
FMPO	Flagstaff Metropolitan Planning Organization
FPC	Framework Policy Committee
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GANS	Grant Anticipation Notes
GARVEES	Grant Anticipation Revenue Vehicles
GIS	Geographic Information Systems
GPS	Global Positioning Systems
HOT	High-Occupancy Toll
HOV	High-Occupancy Vehicle
HURF	Highway User Revenue Fund
IRR	Indian Reservation Roads
JPAC	Joint Planning Advisory Council
ITS	Intelligent Transportation Systems
LEED-ND	Leadership in Energy and Environmental Design for Neighborhood Development
LRTP	Long Range Transportation Plan
LTAF	Local Transportation Assistance Fund
MAG	Maricopa Association of Governments
MCDOT	Maricopa County Department of Transportation
MPD	Multimodal Planning Division
MPO	Metropolitan Planning Organization
MSAT	Mobile Source Air Toxics
NAAQS	National Ambient Air Quality Standards
NACOG	Northern Arizona Council of Governments
NAFTA	North American Free Trade Agreement
NCHRP	National Cooperative Highway Research Program
NHS	National Highway System
NRHP	National Register of Historic Places
O&M	Operations and Maintenance
PAG	Pima Association of Governments
POE	Port of Entry
PPP	Public-Private Partnerships
RAT	Regional Advisory Team
RNCA	Riparian National Conservation Area
RPTA	Regional Public Transportation Authority
RTAT	Regional Technical Advisory Team or Rail Technical Advisory Team
RTP	Regional Transportation Plan
SAFETEA-LU	Safe, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SBI	Secure Border Initiative
SEAGO	SouthEastern Arizona Governments Organization
SIP	State Implementation Plan
SRTS	Safe Routes to School
STAZ	State Traffic Analysis Zone
STIP	State Transportation Improvement Program
STP	Surface Transportation Program
SWAP	State Wildlife Action Plan
SWSPT	Southwest Sketch Planning Tool
TAZ	Traffic Analysis Zone
TDM	Travel Demand Management

Abbreviations

TI	Traffic Interchange
TIFIA	Transportation Infrastructure Finance and Innovation Act
TIP	Transportation Improvement Program
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TSM	Transportation Systems Management
ULI	Urban Land Institute
UP	Union Pacific Railroad
USC	United States Code
USDA	United States Department of Agriculture
USDOT	U.S. Department of Transportation
USFWS	U.S. Fish and Wildlife Service
VHT	Vehicle Hours of Travel
VLT	Vehicle License Tax
VMT	Vehicle Miles of Travel
WACOG	Western Arizona Council of Governments
YMPO	Yuma Metropolitan Planning Organization

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1.0 Background

In the fall of 2007, Arizona's Councils of Governments (COGs) and Metropolitan Planning Organizations (MPOs), in cooperation with the Arizona Department of Transportation (ADOT), launched a new phase in an ambitious, long-range statewide planning process known as *Building a Quality Arizona* or bqAZ. Working in collaboration with regional transportation planning entities, transit organizations, tribal governments, land management agencies, conservation groups, business and community leaders, and Governor Napolitano's Growth Cabinet, ADOT and local/regional leaders embarked on development of a Statewide Transportation Planning Framework that formulated and evaluated multimodal transportation improvements. ADOT's Multimodal Planning Division (ADOT-MPD) and Communication and Community Partnerships Division (ADOT-CCP) jointly led the Statewide Framework planning process.

In the Framework planning effort, Governor Napolitano directed ADOT and its partners to:

- Achieve multimodal balance (i.e., an appropriate balance among modes of transportation–such as private vehicles on roadways, public transportation, and passenger and freight rail service)
- Support Smart Growth and sustainable land use
- Involve the tribal communities
- Involve the economic development and business communities
- Involve the environmental and conservation community
- Collaborate statewide with COGs, MPOs, and tribal governments

The Statewide Framework was an ambitious and innovative endeavor that ADOT-MPD and ADOT-CCP could not have completed without both internal and external partnerships. The most important external partnerships were with the COGs and MPOs responsible for regional transportation planning and the state's federally recognized Indian tribes. Figure 1 illustrates the COG and MPO boundaries; Table 1 lists the area for which each has planning authority.

Table 1 Arizona COGs and MPOs

COG or MPO	Counties or other Area
Central Arizona Association of Governments (CAAG)	Gila, Pinal
Northern Arizona Council of Governments (NACOG)	Apache, Coconino, Navajo, Yavapai
SouthEastern Arizona Governments Organization (SEAGO)	Cochise, Graham, Greenlee, Santa Cruz
Western Arizona Council of Governments (WACOG)	La Paz, Mohave
Central Yavapai Metropolitan Planning Organization (CYMPO)	Prescott metropolitan area
Flagstaff Metropolitan Planning Organization (FMPO)	Flagstaff metropolitan area
Maricopa Association of Governments (MAG)	Maricopa
Pima Association of Governments (PAG)	Pima
Yuma Metropolitan Planning Organization (YMPO)	Yuma

Source: bqAZ Statewide Technical Team, September 2009.

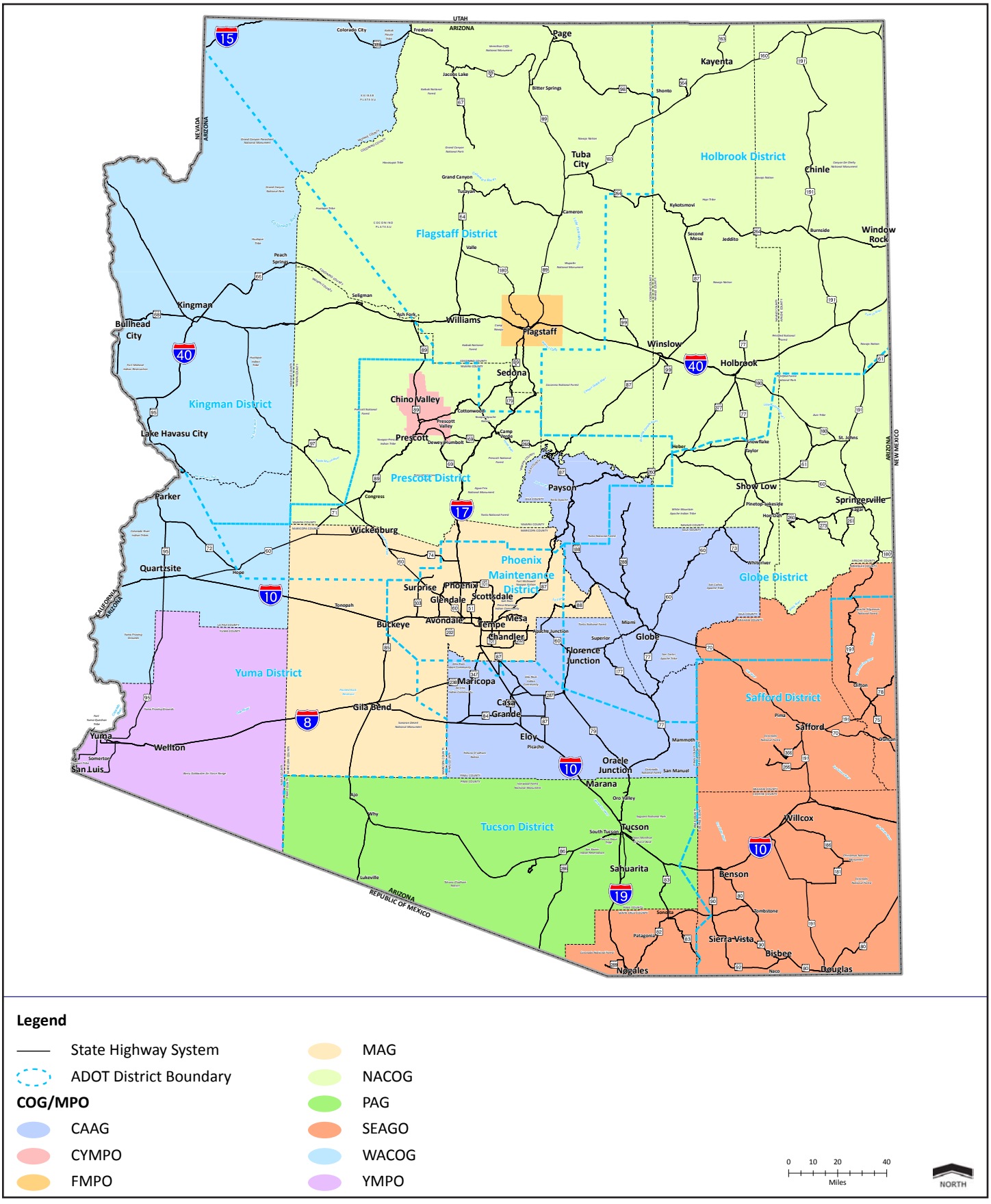
Internally, ADOT-MPD and ADOT-CCP worked closely with other units of ADOT, such as the Environmental Planning Group, Statewide Project Management, and the nine District Engineers (DEs). (Figure 1 shows the ADOT engineering districts, which do not necessarily coincide with county or COG/MPO boundaries.) ADOT staff assigned to this project also collaborated extensively with other state, federal, and local agencies, and with private stakeholders.

1.1 Overview of Process

The flow chart in Figure 2 illustrates the planning process for the Statewide Framework, which began early in 2008 concluded early in 2010. This report covers elements of the chart in the following sections:

- Vision Statement and Guiding Principles: Chapter 2
- Environmental Scan: Sections 5.4 and 6.2

Figure 1 COG/MPO and ADOT District Boundaries



Legend

- State Highway System
- ADOT District Boundary

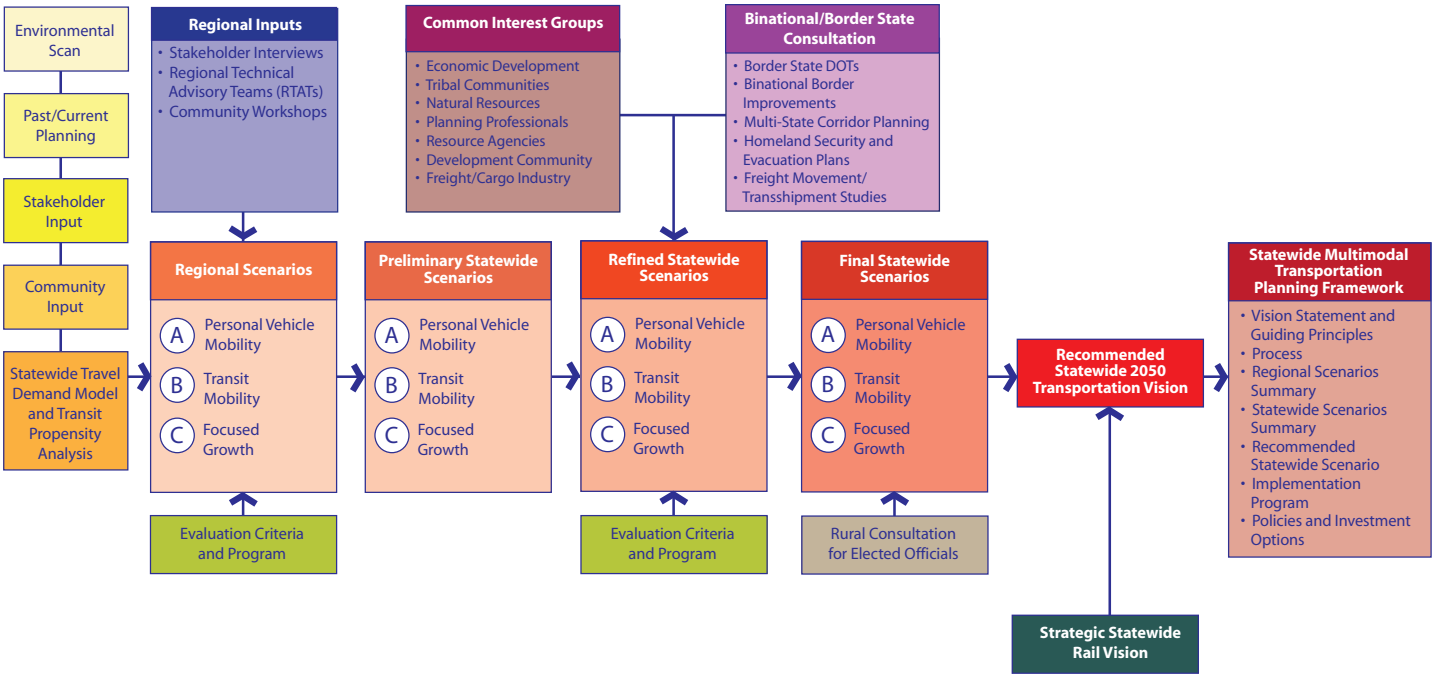
COG/MPO

- CAAG
- CYMPO
- FMPO
- MAG
- NACOG
- PAG
- SEAGO
- WACOG
- YMPO

0 10 20 40 Miles

NORTH

Figure 2 Overview of Planning Process



- Past and Current Planning: Sections 1.5, 6.2, and 6.9
- Stakeholder and Community Input: Sections 1.4, 4.2, 6.1, 6.2, 6.7
- Travel Demand Model and Transit Propensity Analysis: Sections 6.4, 6.8, and 7.2
- Regional Inputs: Section 6.2
- Scenarios: Sections 6.3, 6.5, 6.6, and 6.8
- Evaluation: Section 6.6
- Common Interest Groups (Workshops): Section 6.7
- Binational/Bordering State Consultation: Section 6.5
- Statewide Strategic Rail Vision: Chapter 8
- Recommended Statewide 2050 Transportation Vision (Scenario): Section 6.8
- Implementation and Policy Issues: Chapter 7

1.2 Supporting Sustainable Land Use and Smart Growth

One of the chief values of the Statewide Transportation Planning Framework is to support sustainable land use and Smart Growth. Sustainability has been defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs," or more loosely as "meeting the triple bottom line"–conducting processes for decision-making that considers social, environmental, and economic factors equally. A sustainable land use pattern fosters urban growth patterns with a strong jobs-to-housing balance, a hierarchy of mixed use activity centers, and a focus on creating livable, multimodal communities created from walkable neighborhoods that embody a sense of place. It contains fully connected transportation networks, and stimulates infill development to use vacant land or redevelopment sites that are efficiently served by existing infrastructure. Sustainable land use supports not only the built environment, but also the natural environment through reducing greenhouse gas emissions, improving air quality, and energy independence, and preserving natural habitats.

As an element of sustainability and a promoter of sustainable land use, Smart Growth is a compact, efficient, and environmentally sensitive pattern of development that provides people with additional travel, housing, and employment choices by focusing growth away from undeveloped areas and closer to existing and planned job centers and public facilities. Governor Napolitano's Growth Cabinet and the Arizona Department of Commerce promoted the concept of Smart Growth as an approach to achieving sustainability, and encouraged cities, towns, and counties to use this approach in their planning. As a result, Smart Growth was a fundamental consideration in developing a multimodal transportation network statewide.

According to *This Is Smart Growth*, published by the Smart Growth Network, the ten Smart Growth principles are:

- Mix land uses
- Take advantage of compact building design
- Create a range of housing opportunities and choices

- Create walkable neighborhoods
- Foster distinctive, attractive communities with a strong sense of place
- Preserve open space, farmland, natural beauty, and critical environmental areas
- Strengthen and direct development toward existing communities
- Provide a variety of transportation choices
- Make development decisions predictable, fair, and cost-effective
- Encourage community and stakeholder collaboration in development decisions

1.3 Other Innovations in the bqAZ Planning Process

In addition to sustainability, Smart Growth, and the other objectives and directions set by Governor Napolitano, this study breaks new ground for ADOT and ADOT-MPD in several ways:

- The Statewide Transportation Planning Framework and bqAZ represented the first effort by ADOT-MPD to establish a long-range (40-year, or 2050) vision for the transportation future of Arizona. Long-range transportation planning studies typically look ahead twenty years. In this case, ADOT developed a vision for 2050, with 2030 as an intermediate planning horizon.
- This study was not confined to highways and other transportation systems that are owned, operated, maintained or funded by the state of Arizona. All major surface transportation facilities and services were included, whether under the jurisdiction of state, local, federal or tribal government.
- ADOT emphasized coordination with Arizona's five neighboring states, including Sonora, Mexico, throughout the bqAZ process, in recognition of the need for seamless connections between Arizona and its neighbors. The bqAZ team, consisting of ADOT and its statewide consultants, visited each state and conferred with transportation officials during the study.
- This study focused not only on personal travel, but also on freight movement in general and international trade in particular.
- ADOT completed a separate but integrated State Rail Framework as part of the bqAZ process. Chapter 8 of this report summarizes the Rail Framework.

1.4 Tribal Outreach

The bqAZ Statewide Technical Team was committed to proactively engaging and receiving input throughout the study from all of the federally recognized Indian tribal communities. The Governor's Tribal Policy Advisor and the ADOT tribal liaison (who was an active member of the bqAZ team) worked to ensure that tribal interests were represented. They made presentations to communities and solicited feedback that was incorporated in the regional planning efforts. Additionally, two tribal representatives–Kenneth Poocha of the Arizona Commission of Indian Affairs and Delia Carlyle of the Ak-Chin Indian Community–served on the Framework Policy Committee. All tribes were encouraged to participate in the regional framework process described in Chapter 6.

Figure 3 ADOT Planning Process Evolution

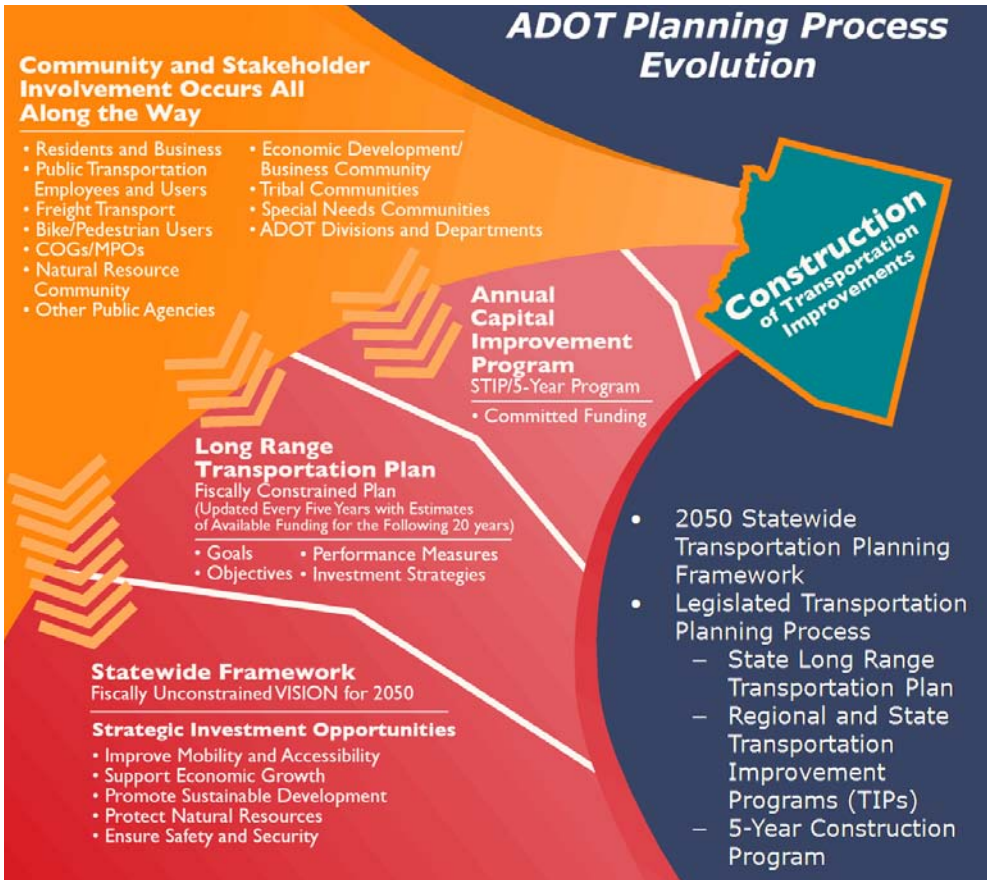


Table 2 Previous bqAZ Long-Range Visioning and Planning Studies

Name	Sponsors and Funding Partners	Study Area	Completion Date	Time Horizon(s)	Travel Demand Forecasting Tool	Focus of Outreach	Principal Outcome or Product
I-10 Hassayampa Valley Transportation Framework Study*	MAG, Buckeye, Goodyear, Surprise, Maricopa County, ADOT	Approx. 1,800 square miles west of SR 303 and north of Gila River	Fall 2007	Buildout and 2030	MAG model with new Buildout socioeconomic data	Property owners, developers, public agencies	Final report, technical reports, and illustrated poster with general locations of future freeways (including interchanges), parkways, arterials, and conceptual transit recommendations
I-8 and I-10 Hidden Valley Transportation Framework Study*	MAG, Buckeye, Goodyear, Maricopa (city), Maricopa County, Pinal County, ADOT	Over 2,000 square miles generally west of I-10, north of I-8 and south of Gila River	Fall 2009	Buildout and 2030	Same as Hassayampa, with additional data for Pinal County	Same as above, plus tribes and general public	Similar to Hassayampa, but with added emphasis on transit recommendations
Intrastate Mobility Reconnaissance Study	State of Arizona	State of Arizona	Spring 2008	2050	Statewide planning tool (precursor to statewide model)	COGs, MPOs, resource agencies	Booklet on long-range issues and recommendations: "The bqAZ Agenda"
MAG Regional Transit Framework Study	Maricopa County	Maricopa County	Fall 2009	2030, with some post-2030 visioning	MAG model	Transit user and non-user groups, peer cities, general public	Three long-range scenarios tied to funding levels: Basic Mobility, Enhanced Mobility and Transit Choice

*The MAG Regional Council has accepted both the Hassayampa Valley and Hidden Valley studies.
Source: bqAZ Statewide Technical Team, October 2009.

On May 14, 2008, the Statewide Transportation Planning Framework was discussed at the Tribal Transportation Forum and Safety Summit. Tribal entities statewide heard a detailed presentation about the process and critical transportation needs. In small breakout groups, the participants identified critical needs facing Arizona's Indian communities.

1.5 Related Planning Efforts

The bqAZ Framework process began in 2006 with MAG's groundbreaking planning framework studies looking ahead to buildout in two fast-growing areas: the Hassayampa Valley (mostly west of the White Tank Mountains), and the Hidden Valley (south and east of the Hassayampa Valley, and partly in northern Pinal County). The success of these studies drew the interest of the Arizona COG and MPO Association, which soon commissioned the *Statewide Intrastate Mobility Reconnaissance Study* under MAG's leadership. The Reconnaissance Study found that bqAZ needed to proceed with more detailed planning to identify and address the state's multimodal transportation needs through 2050. In short, that study served as the scoping effort for ADOT's subsequent Statewide Planning Framework.

Table 2 provides basic information on the previous long-range framework studies.

Results and recommendations of the previous studies are incorporated in the Statewide Transportation Planning Framework. Further information on all of the bqAZ planning efforts is available at the master website, www.bqaz.gov.

As the next step in the long-range transportation planning process, ADOT has begun the update of the *State Long Range Transportation Plan* (LRTP), a 20-year, fiscally constrained, multimodal plan to guide state transportation investments. The vision and results from the Recommended Statewide Scenario provided the springboard for the LRTP. Arizona state statutes require ADOT to update the plan every five years. Figure 3 shows how the Statewide Framework and LRTP fit into ADOT's comprehensive planning and programming process.

2.0 Statewide Vision and Guiding Principles

The Statewide Transportation Planning Framework presents a comprehensive transportation vision and strategic multimodal transportation opportunities. This vision sets in motion transportation planning that promotes place-sensitive and environmentally responsible mobility choices supporting economic prosperity for livable communities. The Framework focuses on the 2050 timeframe and advances the connection between land use and transportation planning to promote balanced and sustainable statewide growth.

2.1 Vision for Arizona Transportation in 2050

The 2050 vision for the Statewide Transportation Planning Framework Program is recited below, spoken in the future tense to visualize the future state of transportation in Arizona, as heard from stakeholders statewide.

"Arizona's integrated, multimodal transportation system provides residents and the traveling public with mobility choices (rail, transit, auto, air, pedestrian, and bicycle) that reflect the high value that Arizonans place on our unique Southwestern lifestyle, the extraordinary places we call home, and the natural resources that define us as a state. In recent decades, innovation and technology have changed the way we travel with the introduction of new modes to Arizona, as well as improved fuel efficiencies and expanded use of alternative fuels. Through coordinated land use decision-making and wise investments in state-of-the art infrastructure, Arizonans have broad transportation choices."

"We now move people and goods safely and efficiently in a way that promotes sustainable growth and preserves our natural environment, while continuing to position Arizona for economic opportunities and diversification based on our unique assets. Arizona's statewide transportation system connects communities, people and commerce to enhance our quality of life, while ensuring that future generations can enjoy an even better Arizona."

2.2 Guiding Principles

To help achieve the 2050 vision for transportation in Arizona, the bqAZ team established several principles to guide the planning process.

2.2.1 Improve Mobility and Accessibility

Develop a multimodal system, moving people and freight that offers transportation choices and connects all of Arizona, while linking the state nationally and globally. Reduce traffic delay to enhance economic activity and provide more time for our families and enjoying other pursuits.

- Preserve capacity on the transportation system through efficient operation and management of facilities, effective use of technology and information, and closer coordination between land use and transportation decision-making.
- Actively mitigate traffic congestion.
- Consider all modes of transportation in aviation, roadway, transit, and rail planning.
- Ensure that the transportation system is accessible to all users, including the young, elderly, disabled, and economically disadvantaged.
- Ensure that cost-benefit considerations and financial sustainability are included in transportation investment decision-making.

2.2.2 Support Economic Growth

Build a seamless transportation system that moves people and goods to ensure that Arizona's economy is competitive and thriving. Work toward a seamless system of roads, transit, passenger rail, non-motorized modes, aviation, and freight options to ensure Arizona's economic vitality.

- Link regional activity and employment centers through multimodal transportation options.
- Develop a transportation system that supports current and emerging statewide economic opportunities.
- Provide intermodal facilities that accommodate movement between air, rail, and highway vehicles.
- Improve high-priority freight corridors.

- Develop interstate and international transportation connections that foster enhanced economic activity.

2.2.3 Promote a Development Pattern that Links Land Use and Transportation

Develop a multimodal transportation system that recognizes and strengthens the relationship between land use and transportation, and connects activity and employment centers statewide. Population growth, community development, economic diversification, and transportation are related, and a comprehensive transportation system can be achieved by working with communities to provide suitable mode choices.

- Support infill development and revitalization through transportation investments that reinforce existing communities.
- Encourage mixed-use development to maximize trip purpose and foster use of alternative modes in daily travel.
- Use transportation infrastructure as a tool to direct growth.
- Work with local, county, and tribal governments to evaluate and plan for regional traffic impacts of major developments. Work collaboratively to minimize these impacts.
- Coordinate efforts to identify, preserve, and obtain required right-of-way to support future system growth and demand.
- Model and demonstrate Smart Growth practices that link land use and transportation in communities of all sizes.

2.2.4 Consider Arizona's Environment and Natural Resources

Being responsible to Arizona's citizens, provide access to transportation options that are sensitive to the environment and help reduce congestion. Ensure that the environment –including wildlife habitats, wildlife linkages, and natural resources–is an integral component of transportation planning and development.

- Promote and implement context-sensitive planning and design, oriented to achieving the principles of Smart Growth and long-term sustainability.
- Encourage development patterns and transportation solutions that reduce greenhouse gas emissions and improve air quality.
- Implement a green connectivity approach (connecting animals and ecosystems) to transportation planning and system development.
- Foster energy independence through broader mode choices, more efficient transportation infrastructure, and heavy emphasis on the use of renewable energy sources.

2.2.5 Ensure Safety and Security

Design, build, operate, and maintain a transportation system that promotes safety and security, reducing the risk of injury and property damage on or near transportation facilities.

- Maintain and enhance transportation safety, reducing crashes, injuries, and deaths.
- Address high-priority safety improvements in the statewide transportation system.
- Improve safety and reduce risks as more freight moves in and through the state.
- Include homeland security measures, as appropriate, as Arizona upgrades international border crossings, while maintaining efforts to promote cross-border economic opportunity and enhanced trade.

3.0 Long-Range Trends, Challenges, and Opportunities

The Statewide Framework planning process identified and analyzed existing and emerging trends for their impact on Arizona's future. The state's demographic characteristics, energy consumption, use of natural resources, and land development patterns will influence local, regional, and statewide demand for personal mobility and freight movement in ways that are important to understand. As transportation demand grows and evolves in Arizona, the state will face new challenges and opportunities. These trends and their implications are summarized on the following pages.

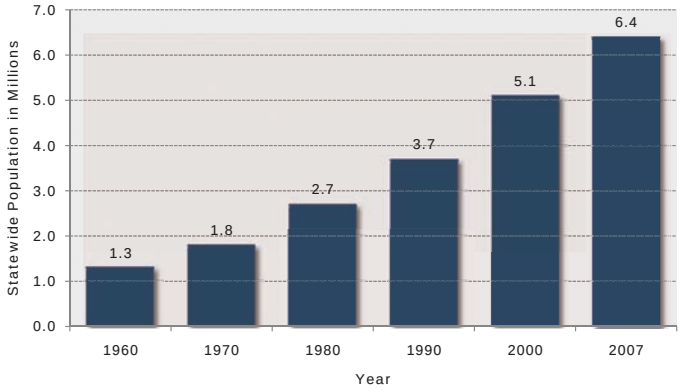
3.1 Population Growth and Vehicular Travel

Over the past half-century, Arizona has grown so quickly that transportation policy has been reactive, instead of proactively guiding future development. Arizona's urbanization occurred almost entirely in the period following the arrival of the automobile. Therefore, Arizona's cities and towns were built to accommodate motor vehicles, and most local and regional mobility in Arizona today relies on cars and other personal motor vehicles. The urban form that the cities implemented was designed to take advantage of motor vehicle travel by spreading growth out in low-density residential subdivisions, with commercial land uses generally located in strips along arterial streets. Figures 4 and 5 show how vehicle miles of travel (VMT) have grown even faster than population, with annual VMT per resident (calculated from the two charts) having risen from 6,400 in 1960 to 9,800 in 2007. During these forty-seven years, the population of Arizona nearly quintupled while VMT more than septupled, compounding traffic and congestion challenges.

Most of the growth in VMT per resident, and the resulting accelerated growth in total statewide VMT, occurred before 1990. From 1990 to 2007, the state's VMT grew 177 percent (roughly three and a half percent per year, compounded). In contrast, the annual VMT growth rate from 1970 to 1990 was approximately five and a half percent. Annual VMT per resident jumped from 6,700 in 1970 to 9,600 in 1990, but rose only slightly to 9,800 from 1990 to 2007. This moderation in the growth of VMT per resident is associated with the continuing urbanization of Arizona, a trend described in more detail below.

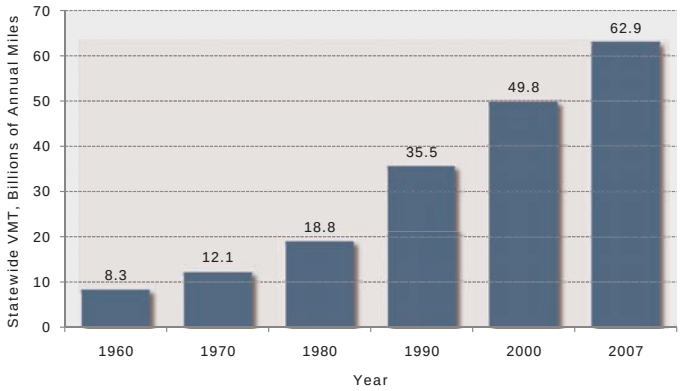
Although the recession that started in 2008 has slowed the rate of population growth in Arizona (primarily by greatly reducing in-migration), demographers and economic forecasters see this is as a short-term trend. Over the coming decades, Arizona will continue growing faster than the nation as a whole, with most (about four-fifths) of the expected growth attributable to in-migration from other states.

Figure 4 Arizona Population Growth: 1960-2007



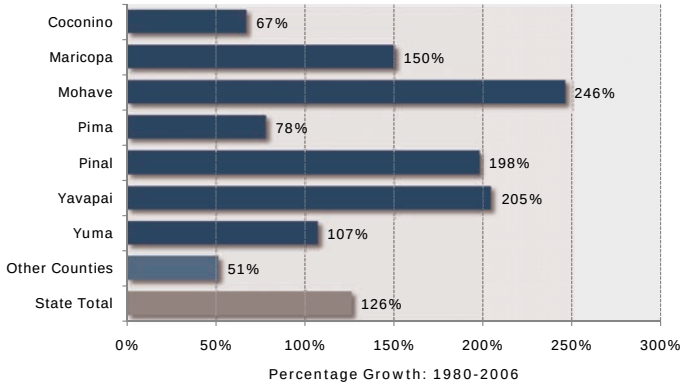
Source: U.S. Census Bureau, April 1, 2009 Estimates.

Figure 5 Arizona Vehicular Travel Growth: 1960-2007



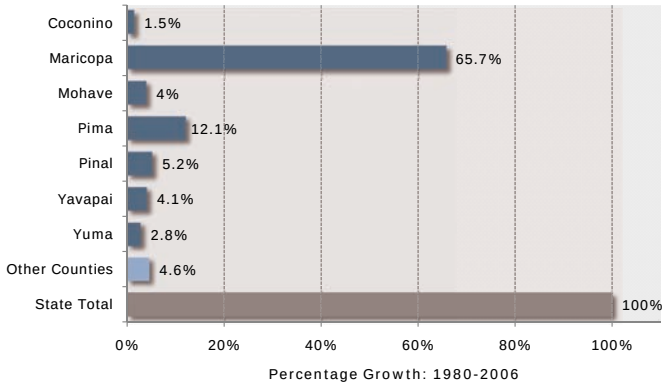
Source: Federal Highway Administration Annual Highway Statistics Report.

Figure 6 Population Growth Rate by County



Source: U.S. Census Bureau.

Figure 7 Distribution of Statewide Population Growth



Source: U.S. Census Bureau.

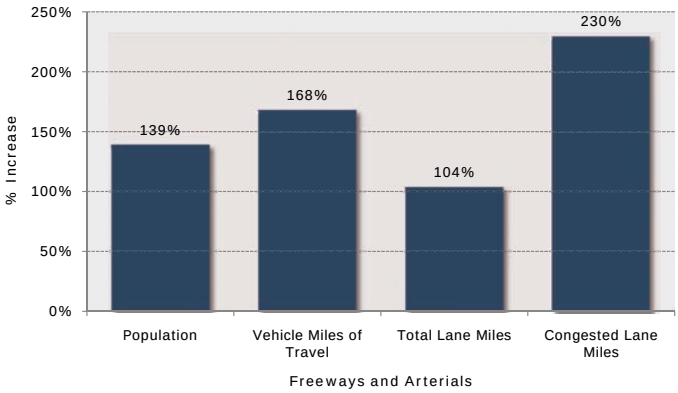
These forecasts translate into enormous future demand for housing, associated commercial and employment development, energy, services, and infrastructure, all of which represent significant economic opportunity. For example, the Urban Land Institute (ULI) states that half of the housing and commercial space that Arizona will need by 2050 is not yet built. More importantly for the Statewide Transportation Planning Framework, at least half of the future transportation systems that Arizona will need in 2050 are yet to be built, and these systems must change to enable the state to meet future mobility demands, and to thrive in the face of forecast growth.

Some of the fastest-growing places in Arizona have been the newer urbanizing areas in Mohave, Pinal, and Yavapai counties. These areas, along with Maricopa and Yuma counties, at least doubled in population from 1980 to 2006 (Figure 6). This pace of growth has created intense travel demand that has been impossible to meet with new transportation facilities. The limited arterial highway systems in these areas, a general lack of freeways and urban transit, and poorly connected street networks have resulted in rapidly increasing congestion on the principal streets and highways.

During the same 26 years, 83 percent of Arizona population growth occurred in three counties straddling the I-10 corridor: Maricopa, Pima, and Pinal (Figure 7). These counties, which comprise the heart of the Sun Corridor megapolitan region, absorbed an additional 2.8 million people, of whom 2.3 million were in Maricopa County alone.

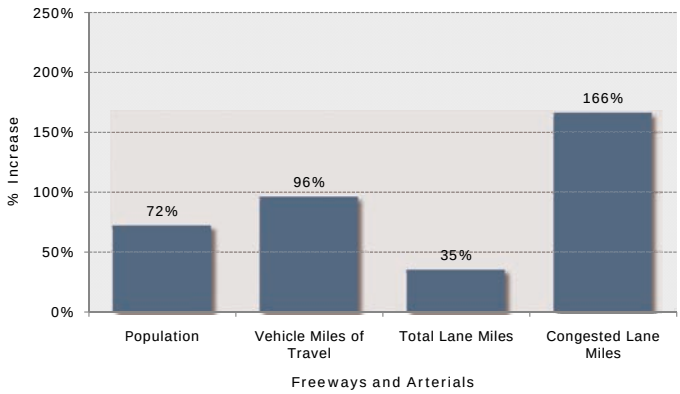
At the same time, ADOT, MAG, and local governments in Maricopa County pursued an aggressive and successful freeway expansion program. The investment in an urban freeway network has provided greater urban mobility, allowing cities in the state's largest metropolitan area to absorb population and employment in the existing urban context. Nevertheless, these agencies have not been able to build freeways and arterials fast enough to keep up with VMT growth. A similar set of trends has played out in Tucson

Figure 8 Changes in Phoenix Urban Area: 1982-2007



Source: Texas Transportation Institute Annual *Urban Mobility* Reports.

Figure 9 Changes in Tucson Urban Area: 1982-2007



Source: Texas Transportation Institute Annual *Urban Mobility* Reports.

and Pima County, although this smaller urban region has not embarked on an extensive freeway program. Figures 8 and 9 show that, in both major metropolitan areas, VMT grew faster than population from 1982 to 2007. In both cases, the number of roadway lane miles increased substantially, but congested lane miles grew faster.

Arizona will be challenged to offer the housing and transportation choices desired by its millions of new residents, who are expected to arrive with new needs and preferences. For example, the state's population will continue to age, with the number of Arizonans who are at least 65 years old increasing much faster than the total population between now and 2030. The number of people who do not drive will also increase. At the same time, a long-standing trend away from traditional households (with a married couple and one or more children) will continue. By 2040, 74 percent of all households in the U.S. will not include children.

These demographic trends will affect the market for housing and commercial space in significant ways. Increasingly, homeowners–especially first-time homebuyers and retirees–will opt for a different kind of housing than what was demanded in the years following World War II. Rather than choosing single-family homes in suburban subdivisions, many new and existing residents will choose homes on smaller lots closer to the cores of cities, or multi-family housing in mixed-use urban neighborhoods. Nationally, 25 percent of existing housing belongs to the "attached housing" category—townhomes, condominiums, and apartments. But about 38 percent of prospective homebuyers indicate that they will seek to buy attached housing, indicating an important new direction in housing demand.

Retirees also are expected to display different housing preferences than they have in the past. According to research conducted for the National Association of Realtors, only 49 percent of retirees will choose to live in suburban and rural settings, where 70 percent live today; a majority will prefer urban settings for their retirement.

The shifts in housing preferences also will be pronounced among "New Millennials"–the members of "Generation Y," born generally between 1982 and 2001–who will be needed if Arizona's economic growth is to match its population growth. The New Millennials are gravitating to mixed-use urban neighborhoods with local elementary schools, safe and pleasant walking environments, and access to regional transit services.

According to ULI, based on these trends, the existing supply of large-lot, single-family suburban homes in Arizona may be more than enough to satisfy expected market demand for some years. Meanwhile, an enormous market demand for smaller lot, single-family housing, and attached housing in mixed-use settings is almost entirely unmet in today's Arizona. This new and growing market represents an opportunity for developers; it also presents new challenges for transportation planners.

3.2 Land Development Trends and Transportation Demand

The primary forces driving increases in transportation demand, including motor vehicle traffic and resulting congestion, are:

- Population growth
- Economic activity
- Travel behavior
- Land development patterns

Population growth can be forecast but not managed by state policy. One of the objectives of good transportation planning is supporting and enhancing economic activity. Daily VMT tends to decline during recessions, but avoiding economic growth is not an acceptable strategy for reducing VMT. Fortunately, two other determinants of transportation demand can be addressed through public policy, including transportation investments.

Travel behavior is a term that includes all the characteristics of individual travel: mode share (percent of trips by mode), trip length, trip frequency, auto occupancy, route selection and others. Public investments in transportation facilities and services have a significant impact on travel behavior. With investment in freeways, daily VMT increases. With investment in effective public transit, daily ridership increases. When safe, comfortable walking environments are provided, pedestrian activity increases. Land development patterns also influence travel demand. For example, where most homes are located in residential subdivisions with no nearby jobs or commerce, driving per household is high.

On the other hand, where "complete neighborhoods" have schools, community retail and local services, driving trips are fewer and other modes of travel–especially walking and bicycling–increase. Research has shown that daily household VMT can drop by 25 percent or more in complete neighborhoods. Finally, where dense, mixed-use urban neighborhoods have direct transit connections to job

centers, driving per household is much lower, and walking, bicycling, and transit ridership all increase.

At the regional level, the spatial distribution of residences, offices, schools, and other land uses–and the associated distribution of trip generators and attractors–affect the amount of transportation activity. It is possible to forecast these relationships, and the traffic modeling used in the Statewide Framework reflects the regional impacts of development patterns.

Local urban form characteristics influence the following characteristics of individual and household travel behavior:

- Number of daily auto trips
- Mode share of non-auto trips
- Average lengths of all trips
- Vehicle occupancy rates of motorized trips

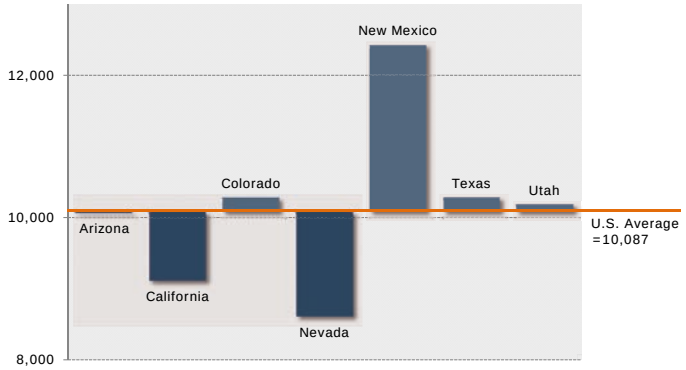
Both neighborhood and regional land development patterns influence travel demand. Therefore, both should be considered in planning for the travel characteristics of a specific location. The general term used to describe these local and regional factors is "location efficiency." Places with high location efficiency have lower daily VMT per household and per resident. They also produce higher levels of walking and biking. Where transit services are available, such places also generate increased transit patronage.

The concept of location efficiency recognizes that land use and urban form directly influence travel behavior by affecting neighborhood accessibility. The concept of neighborhood accessibility rests on the principle that neighborhood-scale characteristics–such as the local mix of land uses, street design and layout, and the density of different activities–can influence travel behavior, such as the propensity to walk. The connectivity of the local street network is especially important.

Many areas of Arizona have high levels of location efficiency, or at least display characteristics of location efficiency. For example, much of the greater Phoenix region was developed pursuant to sound traffic engineering guidance, so that a complete, well-connected street network was installed as the neighborhoods were built. This rectangular grid encourages walking and bicycling, and supports transit service, while shortening the average length of local auto trips. In many smaller cities around the state, such as Yuma, Prescott, and Flagstaff, there are also older, complete neighborhoods with schools, local retail, and services established on a regular grid street pattern.

This historical development pattern is beneficial and an important asset for Arizona communities, reducing VMT and the traffic volumes required to support household mobility and economic vitality. Arizona compares well with neighboring states in annual VMT per resident (Figure 10). Arizona's VMT per resident in 2005 was slightly below the national average, and less than four of six other Southwestern states (VMT per resident is a function not only of land use and the transportation network, but also of auto ownership and demographics).

Figure 10 Southwestern States Comparison: 2005 Annual VMT per Resident



Source: U.S. Bureau of Transportation Statistics, State Transportation Statistics 2006.

Over the past couple of decades, however, a different development pattern has become prevalent in suburban and rural Arizona. Large residential tract subdivisions with few or no schools, retail, or services have been developed far from core cities and job centers. These subdivisions often have poorly connected street systems that do not function as networks, but rather funnel traffic directly to arterial highways, concentrating local traffic on facilities intended for regional travel and unnecessarily amplifying peak period traffic congestion. Poor access management on many of these highways compounds the problem.

This has significant implications for Arizona's transportation system. Low levels of location efficiency can be virtually permanent, flooding roads with unnecessary traffic and burdening future generations of residents and workers with high levels of household driving. Where this type of development pattern predominates, VMT will grow faster than population and faster than the regional economy, making it difficult or impossible to fund new transportation facilities and services fast enough to keep up. Both VMT growth and lack of access management on arterials also make them less safe for users. The following sections explore some of the implications of the link between transportation service levels and land development patterns.

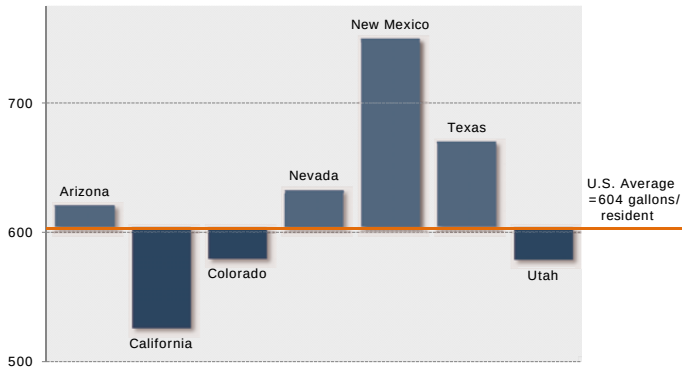
3.3 Energy Independence

The transportation sector accounts for 74 percent of the increase in petroleum consumption forecast by the U.S. Energy Information Agency for the next two decades. In some ways this trend seems inexorable. Until recently, many assumed that the U.S. would continue to have cheap, plentiful petroleum fuels indefinitely. As a result, this country has not aggressively pursued opportunities to improve transport energy efficiency or location efficiency. Instead, it has built a transportation system that is powered almost entirely by petroleum-based fuel, much of which is imported.

Both worldwide demand for oil and oil production costs will rise in the coming years, driven by economic growth in China and India and rapid modernization of less developed countries. Over the long term, much higher petroleum prices are almost a certainty. In the short term, oil prices are expected to remain unstable and fluctuate widely, as they have over the last two years.

This trend represents one of the most important policy issues facing Arizona and other states. A high dependence on imported oil for mobility and goods movement subjects the state's economy to periodic downturns driven by fuel prices. Families find it hard to budget when gas prices fluctuate, affecting both workers and their employers (including the homebuilding and construction sectors). Worse, these expenditures represent a substantial drain on the state's economy. The Arizona Department of Commerce estimates that Arizonans spent $9.9 billion on energy in 2006, of which 68 percent left the state. Figure 11 shows that in 2005, Arizona's motor fuel consumption per resident approximately equaled the national average and exceeded that of all but three Southwestern states.

Figure 11 Southwestern States Comparison: 2005 Annual Motor Fuel Use per Resident



Source: U.S. Bureau of Transportation Statistics, State Transportation Statistics 2006.

To some degree, the issue of dependence on imported oil is beyond policy remedy, at least in the short term. The U.S. and Arizona will continue to be reliant on foreign oil for years to come. Vehicle fuel economy is determined largely by market forces and by federal legislation. However, different places are dependent on imported oil to different degrees, and the differences–even at the margin–matter. One policy measure that many states are beginning to address is growth in VMT per resident. For example, the states of California and Washington have passed laws addressing VMT growth. Congress also is expected to make VMT growth a performance criterion in new surface transportation legislation.

The California legislation includes two bills [AB 32 (2006) and SB 375 (2008)] that primarily address climate change intervention. AB 32 sets statewide goals for greenhouse emissions and SB 375 requires state, local, and regional public agencies to develop plans that are consistent with these goals. In subsequent rulemaking, the state determined that meeting AB 32 goals will not be possible without reductions in VMT per resident, so implementation of SB 375 requires that the state DOT (Caltrans), along with local and regional agencies, develop plans to intervene in VMT growth trends. In contrast, the Washington legislation HB 2815 (2008), which is also aimed primarily at reducing greenhouse gases, sets specific statewide VMT goals in reducing VMT per resident below the 2005 level: 18 percent below by 2020, 30 percent by 2035, and 50 percent by 2050.

From a transportation perspective, it is now clear that energy will be more expensive in the future, and that Arizona would benefit by reducing its dependence on fossil fuels and on foreign oil in particular, especially for transportation. To some extent, state policymakers have already been addressing these issues. The state has encouraged the growth of ethanol/biofuel industry in a way that relies on crops appropriate for its arid climate. Other policy measures related to energy supply may be feasible.

However, Arizona's transportation investments should begin to take energy efficiency more explicitly into account. The state's dependence on carbon-based energy for transportation puts it at a disadvantage, subject to the whims of global politics and the economics of peak oil. Every state must face this challenge, but the amount of imported petroleum required to maintain economic vitality varies widely among cities and regions. Places where daily (per resident) VMT is high are at a disadvantage, as are places where commuters do not have options that allow them to reduce household driving when gas prices are high.

The good news is that Arizona is in a unique position to reduce its future dependence on oil relative to the size of its economy because half of the state's 2050 built environment remain to be built. This means that Arizona can shape its urban growth in a way that increases mobility while decreasing the amount of energy needed for travel. Such a strategy would be much more difficult for states like Michigan and Ohio, which are not growing. If Arizona can achieve a more compact, mixed-use land pattern and adopt a comprehensive, strategic approach to transportation choices and investments, it can reduce its dependence on oil compared with other states by shortening vehicle trips and providing an improved range of travel options.

3.4 Cost of Travel and Economic Growth

Arizonans are paying for transportation, not just through taxes, but also through travel delay, inconvenience, and reliance on the most expensive mode of travel–driving alone. Residents of the Phoenix and Tucson metropolitan areas have experienced a doubling of daily hours of travel delay over the last decade. The impact of the twin forces of congestion and oil prices has been to reduce mobility for many residents, workers, and businesses, with direct impacts to the state's economy, including especially the homebuilding and construction industries. There is no indication that this condition will moderate. Although the country has been in a recession, oil prices are decoupled from other economic trends. Even with the downturn, consumer gas prices have remained above two dollars a gallon. It is clear that as the economy recovers, the cost of travel will move even higher, although there may be periods of price volatility related to limited domestic oil production capacity, which has not increased since 1973.

While everyone is affected, the impacts of rising transportation costs are most severe for working families. According to the Center for Neighborhood Technology, families with annual incomes between $20,000 and $50,000 spend 29 percent of their income on transportation–often more than they spend on housing. As fuel costs increase, the budget available for items such as clothing, education, and recreation declines. Considering that over two-thirds of energy expenditures leave the state, the impact on the Arizona economy is substantial.

The disproportionate impact on working families has other implications. In recent decades, much of Arizona's supply of new workforce housing has been in suburban subdivisions, which impose high VMT on households because of poor location efficiency and long commutes to job centers. Families have chosen to "drive until they qualify," trading lower housing prices for higher transportation costs. Further increases in energy prices, coupled with the demographic trends described earlier, may significantly reduce the value of suburban housing, with resulting impacts to the homebuilding and construction industries.

The combined cost of housing and transportation is likely to make many Arizonans rethink critical decisions about where they live and how they travel. This will create new markets for urban housing, especially in locations with a good mix of neighborhood land uses and good access to regional transit. It will also increase demand for transit, and for safe and convenient walking and cycling environments. The state, metropolitan regions and local governments will be under pressure to respond to these needs and demands between now and 2050.

3.5 Climate Change

Arizona is among the states most affected by climate change. Its increase in average annual temperature is expected to be the highest of any state, and along with California and Nevada it will be heavily affected by reduced flows in the Colorado River Basin. No state has more at stake in the direct effects of climate change and the regulatory effects of federal legislation responding to the climate change threat.

Over the past ten years, the global scientific community has reached consensus that human activities are contributing significantly to an atmospheric build-up of greenhouse gases–principally carbon dioxide–that are warming the planet and introducing a wide range of climate changes. The American Southwest, including Arizona, has been affected already by an increase in annual ambient temperatures of more than two degrees Fahrenheit and by changes in seasonal precipitation to watersheds that supply the state with water for drinking, irrigation and industry. Arizona and other western states are experiencing a prolonged drought, decreased snowfall, increased and earlier snowmelt, and more severe and devastating forest and rangeland fires as a result of recent climate changes. The scientific evidence is that the West–and especially the Southwest–will continue to be particularly hard-hit by the effects of climate change.

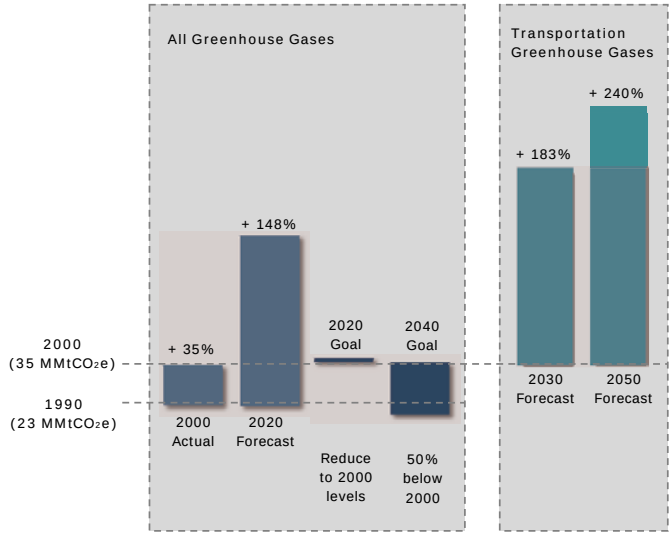
Congress is now considering climate change legislation that will directly affect Arizona's transportation choices. A climate change bill that may pass Congress in 2010 would increase the costs of "carbon" directly and indirectly, with unknown effects on the cost and availability of motor

fuels. It also appears likely that new surface transportation legislation will hold states accountable for decisions that affect how energy-intensive their transportation systems are. Carbon dioxide may become a criteria pollutant in the federal clean air regulatory system, and may become an additional "conformity" criterion in the approval process for federal cost participation in state and local transportation programs.

The transportation sector is the largest generator of greenhouse gases in Arizona, accounting for 39 percent of the total. Transportation is also the fastest growing category of greenhouse gas emissions. It will face state and federal policy scrutiny as a result.

The state completed an *Arizona Climate Change Action Plan* in August, 2006. The plan projected that greenhouse gases in Arizona would increase 148 percent from 1990 to 2020, due to growth in both population and travel. It set a goal that total greenhouse gas emissions should be reduced to 2000 levels by 2020, and to 50 percent below 2000 levels by 2040 (see Figure 12, "MMtCO2e" is million metric tons of carbon dioxide equivalent).

Figure 12 Arizona Greenhouse Gas Emission Forecasts and Goals



Sources: Arizona *Climate Change Action Plan*, 2006; Statewide Transportation Planning Framework Estimates, 2009.

These goals cannot be met in the transportation sector through technology alone. Implementing a clean car program could contribute about 30 percent of the emission reductions required to meet the 2040 goal of 50 percent below 2000 emissions. The *Arizona Climate Change Action Plan* recommends adoption of the State Clean Car Program to reduce greenhouse gas emissions from new light-duty passenger vehicles, beginning with model year 2011. Eleven states had already adopted Clean Car Program standards by 2006.

In the absence of changes in land use, greenhouse gas emissions will continue to increase because of growth in VMT. In addition to technological strategies, a statewide transportation system that expands mobility options and encourages location-efficient land development patterns will be necessary to achieve the targeted reductions in greenhouse gas emissions from transportation.

Some states are considering an approach that curbs growth in VMT per resident by integrating mobility with design of the built environment in a manner that improves transportation efficiency. For example, California's three-pronged approach to climate change mitigation includes: (1) increasing the fuel efficiency of vehicles, (2) improving vehicle technology, and (3) reducing vehicle miles traveled. Arizona's state transportation program must begin to respond to these issues, and the response must include addressing VMT growth per resident.

3.6 Air Quality

Arizona has made progress in its air quality condition, with continuing improvements in reducing motor vehicle emissions of pollutants at the tailpipe. Transit service has also improved in many of the state's metropolitan areas. But in 2008, Maricopa County exceeded National Ambient Air Quality Standards (NAAQS) for ozone, as did several other counties, including Pima, Pinal, and Yuma. Federal air quality standards are becoming stricter and the state's metropolitan areas are having difficulty meeting new benchmarks, especially for ozone and particulates. Urban haze monitoring is being developed in Arizona to help mitigate visibility issues in urban areas and national parks, especially the Grand Canyon.

The problem in Arizona, as in many other states, is that the rate of growth in daily motor vehicle travel is outpacing reductions in tailpipe emission rates. The key pollutants that cause ozone concentrations are unavoidable byproducts of internal combustion engines. Burning petroleum fuels yields carbon gases, including greenhouse gases like carbon dioxide and methane as well as the ozone precursors. During the coming decades, improvements in fuel economy and cleaner fuels should further reduce motor vehicle emission rates for carbon compounds. If these are outweighed by VMT growth, however, the state will have to find other ways to reduce air pollution. Because

the underlying causes of mobile source air pollutants and greenhouse gases are identical, the state's air quality and climate change programs should be managed through a single coordinated effort.

3.7 Natural Resources

Arizona is blessed with an abundance of unique and precious natural resources, including wildlife, dramatic scenery, open space, and natural areas. A key part of developing the Statewide Transportation Framework has been collaboration with resource agencies such as the Arizona Game and Fish Department (AGFD), and with non-governmental entities like the Sonoran Institute and the Nature Conservancy, to determine how to use planning systems for these natural resources in the transportation planning process.

Arizona's natural resources represent a system of "natural infrastructure" that includes the lands and waters that provide wildlife habitat and open space. This system of natural infrastructure can be mapped, identifying public open space, sensitive biological areas, critical wildlife habitat, wildlife movement corridors, important scenic vistas, riparian areas, and other resources. This will allow transportation planners to anticipate potential transportation impacts on key natural resources early in project development. It will also provide a basis for public and private land acquisition programs that can protect lands before they come under development pressure. Such pressure causes demand for new transportation corridors that may degrade the state's natural infrastructure.

3.8 Federal Transportation Policy

Over the next few years, federal transportation policies are expected to undergo a major transformation. This year (2009) has already been remarkable, with passage early in the year of the American Recovery and Reinvestment Act, which signaled new directions in the federal surface transportation program, including the resurrection of an intercity passenger rail and high-speed rail program. The act also signaled a new awareness of the need for transportation infrastructure investment and its importance to the national economy.

Although a new federal surface transportation authorization bill may be delayed until 2011, it is clear from committee action in the House and Senate that new directions in federal transportation policy will be forthcoming. These may include new emphasis on state-of-good-repair ("fix it first"), complete streets, multimodal choice, local self-determination, context-sensitive planning and design, and transportation equity. Intercity passenger rail and high-speed rail will become significant programs for the first time. It also appears that new policies on location efficiency and vehicle miles of travel, coordinated investment in transportation and housing, funding for urban mixed-use nodes, support for urban infill and redevelopment, and sustainable stormwater management–all unprecedented–will guide federal investment and will reshape state and local transportation plans and programs. The new surface transportation authorization will also address regulation of greenhouse gases, including emissions from motor vehicles, greater vehicle fuel efficiency, and related air quality measures.

Although the federal government is newly focused on the economic importance of infrastructure spending, it is not clear whether this will result in increased surface transportation funding. The primary source of funding for the federal transportation program has been federal fuel taxes. Revenue to the highway trust fund has been declining, while unit costs for construction projects have (until recently) been increasing. Whether Congress will consider increases to the gas tax or other new revenue measures is unclear. The size of the federal transportation program may not increase significantly, which would leave the states to find other ways to meet growing transportation needs.

It is similarly unclear what effect a climate change law will have on transportation programs, but it is likely to raise the price of petroleum fuels. Such a law may also require transportation agencies to account for greenhouse gas emissions and the impacts of proposed federally-funded projects on such emissions from transportation.

3.9 Statewide Transportation Framework Outcomes Summary

This concluding section summarizes the policy implications of Arizona's long-range trends, challenges, and opportunities.

1] Arizona must plan a more diversified transportation network. To date, the principal focus of Arizona's transportation program has been expanding, improving and maintaining the state's highway system. Over the past three decades the development of the state highway system, including urban freeways in the MAG region, has been the cornerstone of the state's economic growth and prosperity. Now the state must broaden its mission to include a major role for transit and rail, including development of an

intercity passenger rail network and support for regional rail systems serving the metropolitan areas.

Reducing Arizona's dependence on carbon-based fuels is critical to the state's economic competitiveness and an essential part of an air quality improvement and climate change mitigation program. One of the strategies necessary to reduce petroleum dependence will be developing a multimodal state transportation program. This will require a collaborative planning commitment and a more diversified state transportation funding system.

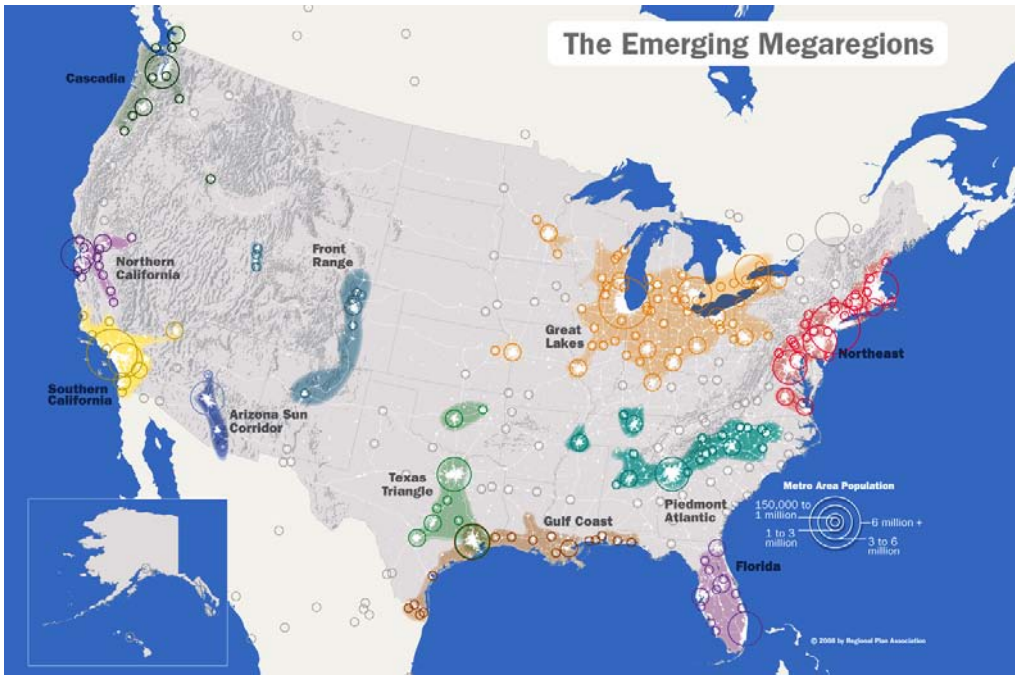
2] Arizona must work with local governments and regional agencies to improve location efficiency, which is essential to meeting Arizona's transportation needs. If VMT continues to grow faster than population, there will be no way to keep up with travel demand or to avoid losing mobility to endemic congestion. Historically, departments of transportation (DOT) in all states have been told they have no role in land use. Highway planning in particular has followed a "predict and provide" methodology that forecasts traffic and then attempts to build new capacity to support it. State transportation programs have thereby encouraged the spreading out of our cities and the development of high-VMT, low-efficiency development patterns, whether intended or not. Now the nation has learned that transportation systems and land development patterns are inextricable. State transportation departments must begin working with local governments and regional agencies to plan transportation and land use in a coordinated manner.

Arizona has a tremendous opportunity in this respect: half the population that will live here in 2050 has not yet arrived. Half of the homes, businesses, and civic buildings and half of the transportation infrastructure needed in 2050 have not yet been built. This state could, if it chose to, develop the nation's model program of integrating transportation policy horizontally with land use policy and vertically with local and metropolitan entities. The payoff in 2030 and 2050 would be a more robust economy, higher quality of life for residents, and a more competitive position with respect to climate change, air quality and petroleum dependence.

3] Arizona must adopt policies to reduce greenhouse gas emissions. Congress will likely mandate climate change responses through a climate change bill, expected by the end of 2010. Regardless of whether this takes the form of carbon taxation or cap-and-trade, greenhouse gas emissions will be regulated and proposed transportation investments tested against new greenhouse gas emission objectives. Mitigation of these emissions will require policy changes in many aspects of the state's transportation operations. The goal of these policy changes should be to improve mobility while reducing the greenhouse gas emissions associated therewith. Because energy use is at the root of a connected set of issues–economic growth, climate change, air quality, land use, and transportation demand–these issues should be approached in a coordinated, strategic manner.

4] Arizona must plan for its emerging megapolitan structure. Analyzing land ownership, resources, development trends and growth projections, demographers have identified eleven "megapolitan" regions throughout the country (Figure 13) where the majority of growth will occur in the future. The Arizona Sun Corridor, which stretches from south of Tucson to north of Prescott, is the fastest growing of these regions. The Sun Corridor will increasingly function as a mega-regional economy that draws strength from the interaction of its multiple cities. Intercity passenger rail will be needed to connect the urban centers and avoid limits to economic growth imposed by a congested freeway system. This kind of transportation

Figure 13 Emerging Megapolitan Regions of the U.S.



Source: Regional Plan Association, 2006.

planning represents a new challenge for Arizona. The California Blueprint Planning Process, which establishes a mega-regional planning framework and requires a scenario approach that addresses the relationship between land use and transportation, could serve as a model for Arizona to consider in the Sun Corridor.

5] Arizona must address its transportation funding needs. Arizona has reached a point where available transportation funding–federal, state, regional, and local –is only a small fraction of the amount needed. New federal surface transportation authorization legislation will eventually pass Congress, but it is highly unlikely that the federal transportation program will grow enough to close the gap. Arizona is currently dependent on fuel taxes (which may be spent only on roads) to fund a significant proportion of the state's transportation program. This will not be an appropriate funding mechanism in the future, as the state will increasingly be working to reduce, not increase, petroleum use. New public-private partnership techniques may help to manage project costs and in some cases to provide new funding sources for major projects–freeways, rail lines and bridges. But the potential for such strategies, while important, is limited.

If Arizona wishes to continue its past practice of using strategic transportation investments to bring economic growth and prosperity, it must pull together politically and establish funding sources appropriate to the tasks of the new millennium. The updated transportation funding system must be inherently multimodal, strengthen local and regional self-determination, reinforce efficient land development patterns, and establish an intergovernmental process for planning regional networks and identifying and prioritizing projects. The updated funding system must also avoid policy paradoxes, such as the current conflict between fuel taxes as the main source of transportation funding and petroleum dependence as one of the state's most urgent challenges.

4.0 Organizational Context

4.1 bqAZ Technical and Public Involvement Teams

ADOT-MPD and ADOT-CCP managed this study cooperatively. Each division hired a management consultant team to assist its staff. ADOT-MPD engaged a statewide technical consultant team led by AECOM (formerly DMJM Harris). ADOT-CCP selected a statewide public involvement consultant team led by KDA Creative. The two ADOT/consultant teams, which worked closely together throughout the study, are referred to herein as the bqAZ Statewide Technical Team and the bqAZ Statewide Public Involvement Team. Together they formed the bqAZ Statewide Team.

The bqAZ Statewide Technical Team was responsible for developing all technical planning products in the Statewide Framework. This team consisted of ADOT-MPD planners and employees of AECOM and its subconsultants. Similarly, the statewide public involvement team, led by the ADOT-CCP Deputy Director, contained ADOT-CCP staff based at various locations around the state, as well as staff of KDA Creative and its subconsultants. The Public Involvement Team was responsible for working with the Technical Team to organize, facilitate, and summarize all public involvement activities. This team was also responsible for communication and publicity on project-related events. ADOT-CCP and its management consultant maintained the portion of the website www.bqaz.gov devoted to the Statewide Framework.

4.2 Statewide Framework Steering and Oversight Committees

The Framework Policy Committee (FPC) provided guidance and information to the citizens, State Transportation Board, Governor, and Legislature on the long-term vision for transportation. The chair of the MAG Regional Council and a member of the State Transportation Board co-chaired this committee. The committee contained elected officials from the COG and MPO boards, business partners, representatives of Indian Communities, several state agency directors, Federal Highway Administration (FHWA) staff, and special interest groups (e.g., Arizona Transit Association and The Nature Conservancy). The FPC met every two to five months: four times in 2008 and four times in 2009.

The Framework Management Committee (FMC) monitored the progress and direction of the Statewide Framework through conversations with the bqAZ Statewide Technical Team and the Regional Advisory Team (see below). The ADOT Director and the MAG Executive Director co-chaired this committee, which contained executive directors of the COGs and MPOs, several business partners, and key ADOT staff. The committee met every two to four months: five times in 2008 and four times in 2009.

Several FMC meetings were held jointly with the Regional Advisory Team (RAT), which provided advice to the Technical Team at the staff level, emphasizing sound planning principles and consistency with local and regional plans. The RAT contained planners from the COGs and MPOs, FHWA, and the Arizona State Land Department (ASLD), among others. It met every one to four months: five times in 2008 and five times in 2009. These meetings were led by a facilitator rather than chaired.

The Acknowledgments page at the front of this document lists members of the FPC, FMC, and RAT.

5.0 Existing and Future Conditions

This chapter sets the stage for the rest of the report by summarizing existing land ownership, socioeconomics, transportation, and the environment in Arizona. It also discusses projected future conditions where appropriate.

5.1 Land Ownership and Use

Table 3 and Figure 14 show the distribution of land in Arizona by ownership or jurisdictional management–private, public, and tribal. Public lands are further classified by level of government and in some cases by agency. As Figure 15 illustrates, Indian tribal communities have jurisdiction over more than one-fourth of Arizona's land. Approximately one-sixth is in private hands, one-eighth is owned by state or local government, and the largest share (42 percent) is federally controlled. The vast majority of local government holdings are State Trust land, which are constitutionally earmarked for eventual sale or lease to support Arizona's public schools. By far the largest federal land managers, other than the Bureau of Indian Affairs (BIA), are the Bureau of Land Management (BLM, U.S. Department of the Interior), and the U.S. Department of Agriculture (USDA). These two agencies control nearly one-third of Arizona land. The other major federal landholding agencies are the Department of Defense, the National Park Service, and the U.S. Fish and Wildlife Service (USFWS).

Table 3 Arizona Land Area by Ownership/Management

Ownership Category	Ownership or Management	Land Area (Sq. Miles)	Percent of Total
Private	Private	20,010	17.6
Tribal	Tribal	31,418	27.6
State and Local	State Trust Land	14,526	12.7
	Local and State Parks	228	0.2
	Arizona Game and Fish Department	58	0.1
	Other Public Ownership	13	< 0.1
	Subtotal	*14,825*	*13.0*
Federal	Bureau of Land Management	19,135	16.8
	Wilderness Areas	2,293	2.0
	National Monuments and other protected areas*	2,996	2.6
	USDA Forest Service	17,435	15.3
	Wilderness Areas	2,266	2.0
	Military (Department of Defense)	4,303	3.8
	National Park Service**	4,009	3.5
	U.S. Fish & Wildlife Service	2,673	2.3
	Wilderness Areas	2,099	1.8
	Bureau of Reclamation	157	0.1
	Subtotal	*47,712*	*41.8*
Grand Total		**113,965**	**100.0**

*Excludes wilderness areas to avoid double counting.
**Includes wilderness areas in the Organ Pipe Cactus, Petrified Forest and Saguaro units.
Sources: bqAZ Statewide Technical Team; BLM website; www.sangres.com, October 2009.

Figure 14 Land Ownership and Management

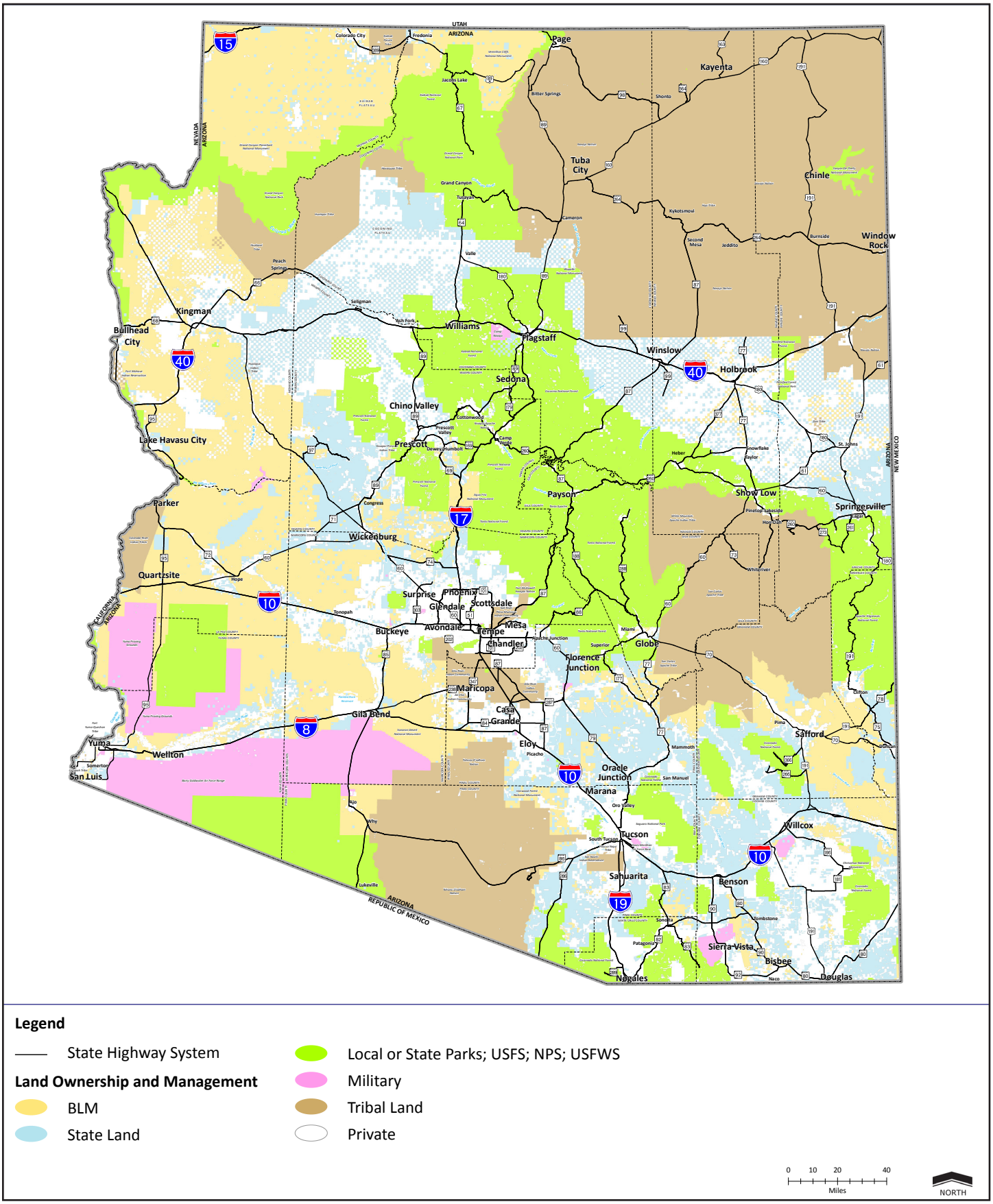
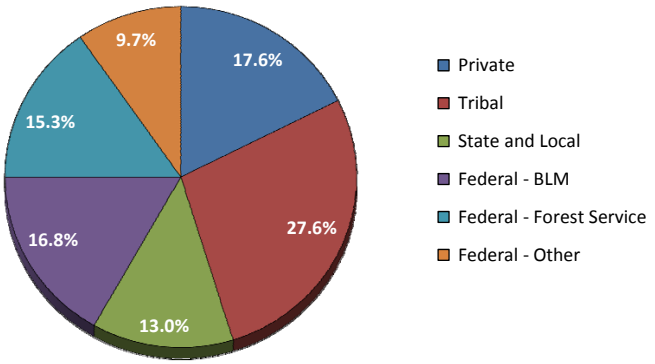


Figure 15 Arizona Land Ownership/Management (Percent)



Sources: bqAZ Statewide Technical Team; BLM website; www.sangres.com, October 2009.

Much of Arizona's federal land is protected by law from development, including National Park Service holdings, wilderness areas (which are managed by BLM, the Forest Service, USFWS, and the National Park Service), and certain other BLM lands such as designated conservation areas and five national monuments. These federally protected lands cover about 12 percent of the state–and this excludes state and local parks, military facilities, and national wildlife refuges (except the portions that are also wilderness areas). The tribal communities (another 28 percent) are considered sovereign nations, whose land is managed solely by the tribes and their members.

The mix of land ownership varies widely across the state. In Cochise, Navajo, and Santa Cruz counties, at least 30 percent of the land is held privately, according to the Arizona Department of Commerce. In Gila, Graham, Greenlee, and La Paz, on the other hand, 10 percent or less is privately owned. Statewide roughly 30 percent–the private land plus State Trust land–is known to be open to current or future private development. Approximately 42 percent of the four counties (Pima, Pinal, Maricopa, and Yavapai) comprising most of the Sun Corridor is privately held, with the rest largely in federal or tribal hands.

5.2 Population and Employment

Table 4 shows 2030 and 2050 population and employment projections developed for this study. The state's

Table 4 Population and Employment Estimates by County, 2005-2050

County	Population[1] (thousands)				Employment (thousands)			
	2005	2030	2050	% Growth, 2005-2050	2005	2030	2050	% Growth, 2005-2050
Apache	74	103	133	80	19	25	32	68
Cochise	133	245	358	169	48	83	151	215
Coconino	127	166	193	52	62	88	118	90
Gila	52	64	74	42	12	23	28	133
Graham	34	50	88	159	9	17	28	211
Greenlee	9	10	12	33	4	4	5	25
La Paz	21	27	32	52	4	25	40	900
Maricopa	3,672	6,123	7,623	108	1,748	3,379	4,206	141
Mohave	199	324	405	104	58	133	242	317
Navajo	104	252	289	178	30	79	90	200
Pima	918	1,514	1,990	117	400	706	838	110
Pinal	262	1,229	2,113	706	45	600	1,045	2,222
Santa Cruz	41	65	83	102	13	24	35	169
Yavapai	201	616	1,065	430	60	215	339	465
Yuma	173	337	398	130	60	116	187	212
Total	**6,021**	**11,123[2]**	**14,856[2]**	**147**	**2,570**	**5,517**	**7,384**	**187**

[1] Living in households
[2] Current U.S. Census Bureau projections are lower.
Source: HDR, Inc., working paper on Population and Employment Projections, September 2008.

population–approximately 6 million in 2005–is expected to exceed 11 million by 2030 and to approach 15 million by 2050. This high growth rate of 147 percent over 45 years will be exceeded by the 187 percent growth in statewide employment. While Arizona had an estimated one job per 2.3 residents in 2005, by 2050 the employment rate will rise to one job for every two state residents. In other words, the Arizona economy will remain robust over the long haul. The highest rates of population growth are projected to occur in Pinal and Yavapai counties, which lie partially in the Sun Corridor megapolitan region. The greatest population growth in absolute numbers will take place in the counties of Maricopa, Pima, Pinal, and Yavapai, which encompass the heart of the Sun Corridor.

Table 5 Arizona Roadway Miles and VMT, Year 2000

Roadway Type	Miles		VMT (thousands)	
	Number	% Total	Number	% Total
Interstate	1,167	2	34,651	26
Other arterials	4,884	9	67,126	49
Collectors	8,530	15	18,331	13
Locals	40,613	74	15,754	12
Total	**55,194**		**135,862**	

Source: ADOT Transportation Planning Division, 2002 Arizona Transportation Fact Book.

5.3 Transportation

5.3.1 Existing Roadway System

Facility Types

The roadways considered in the Statewide Framework belong to the following categories:

- **Multilane, with full access control:** The existing roads in this category are freeways; no toll roads currently exist in Arizona, although state law authorizes them. They are functionally classified as principal arterials. Nearly all Arizona freeways belong to the state highway system, and six (I-8, I-10, I-15, I-17, I-19, and I-40) are part of the Interstate Highway System. Existing freeways not on the Interstate system lie within the state's metropolitan areas. Freeways are fully grade-separated, provide for uninterrupted traffic flow on the mainline, and allow access and egress only at designated on- and off-ramps. Each has at least two through lanes per direction.
- **Multilane divided arterials, without full access control:** Arizona facilities of this type are generally classified as either rural or urban arterials. Access may be provided at signalized intersections, unsignalized intersections, and private driveways. These roads vary widely in their design speed and degree of access management. On-street parking may be permitted and curb/gutter/sidewalk may exist, especially in urban areas. This type of road may be divided by a physical barrier or by a painted median that often doubles as a left turn lane. With a physical barrier, left turns are usually permitted at median breaks.
- **Undivided arterials:** These arterials are most commonly found in rural areas, and include many low-volume state highways. They most often have two lanes, although some multilane facilities exist. Access management is often minimal.
- **The Arizona Parkway** is new to Arizona, although it has long existed elsewhere under other names, such as the Michigan Boulevard. The concept was introduced to Arizona because of the evident need for non-freeway facilities that restrict access and offer greater travel capacity than urban principal arterials. The Arizona Parkway can provide additional capacity at a much lower cost than a freeway, largely because full grade separation is not required. It is also safer than standard arterial designs, because the elimination of left turns at major intersections vastly reduces the number of conflict points between vehicle streams.

  The Arizona Parkway design provides simple two-phase traffic signal operations at intersections with arterials, by eliminating left turns there and accommodating them elsewhere. This is called the Michigan left-turn or indirect left-turn intersection design. These intersections accommodate left turns indirectly through strategically placed breaks in the median for U-turns. The U-turn breaks may be signalized in high-traffic areas. At some locations, a series of right turns can also substitute for the direct left. Although originally designed for urban and suburban applications, the concept may be adapted to more rural environments as well. The Maricopa County Department of Transportation (MCDOT) has published detailed guidance on the recommended design of Arizona Parkways. The Arizona Parkway design with indirect left turns has worked well in Michigan and elsewhere.
- **Collectors and local streets:** These roads perform important collection, distribution and local access function, but are not addressed in the long-range, broad-brush Statewide Framework vision.

Table 5 breaks down total Arizona roadway miles and VMT by facility type. Collector and local roads contain 90 percent of the centerline miles but carry only one-fourth of the traffic. At the other end of the scale, Interstate highways carry one-fourth of Arizona VMT on only two percent of its roadway miles.

Jurisdictional Responsibility

Table 6 reports Arizona's rural and urban roadway miles by jurisdictional responsibility. Cities, towns, and counties maintain the largest share of street and highway miles in both rural and urban areas. Roads and streets in urban areas account for only one-third of the total mileage, but for more than three-fifths of VMT. State highways form a much smaller proportion of the roadway network in urban areas than in rural Arizona. Federally maintained roads, primarily in tribal communities and national forests, are almost exclusively rural.

Table 6 Arizona Roadway Miles by Jurisdiction and Area Type, Year 2000

Jurisdiction	Rural Miles	%	Urban Miles	%	Total Miles	%
City and County	19,229	35	17,466	32	36,695	67
State	5,819	11	787	1	6,606	12
Federal	11,841	21	52	<1	11,893	22
Total	**36,889**	**67**	**18,305**	**33**	**55,194**	**100**

Source: ADOT Transportation Planning Division, 2002 Arizona Transportation Fact Book.

Specially Designated Roadways

The U.S. Department of Transportation (USDOT) established the National Highway System (NHS) in cooperation with the states, local officials, and MPOs. It consists of approximately 160,000 miles of roadway deemed important to the nation's economy, defense, and mobility. Its elements include the entire Interstate Highway System and selected principal arterials of high importance. Figure 16 illustrates the NHS in Arizona. In addition to the Interstates and portions of the MAG and PAG regional highway systems, it includes part or all of US 60, SR 64, SR 69, SR 77, SR 80, SR 85, SR 87, US 89, SR 90, US 93, SR/US 95, US 160, and SR 260.

The Strategic Highway Network, an element of the NHS, is a network of highways that provides continuity, access, and emergency transportation (of personnel and equipment) for the Department of Defense. In Arizona, the network includes US 60 from Phoenix to US 93 and US 93 from US 60 to the Nevada border, as well as the Interstate highways. Strategic Highway Network Connectors link military installations and ports around the country to the larger network. SR 90 from I-10 to Fort Huachuca is designated as a Strategic Highway Connector.

FHWA has designated NHS Intermodal Connectors. These highways provide access between major intermodal facilities and other elements of the NHS. The FHWA website lists connections to: airports at Phoenix, Tucson, and the Grand Canyon; intercity bus terminals in Flagstaff, Kingman, Nogales, Phoenix, and Tucson; transit centers in Phoenix and Tucson; truck/rail intermodal yards in Glendale and Phoenix; and the two Grand Canyon Railway stations.

Beginning with the Intermodal Surface Transportation Efficiency Act of 1991, Congress has designated certain corridors as NHS High Priority Corridors. These corridors may be intrastate or cross state lines; they may consist of existing highways, proposed future highways, or a combination. Various sections of SAFETEA-LU (Safe, Flexible, Efficient Transportation Equity Act: A Legacy for Users), the current federal transportation legislation, authorize funds for these corridors. Arizona's NHS High Priority Corridors are I-10, I-15, I-19, I-40, and US 93 from the Phoenix metropolitan area to the Nevada border. Portions of these routes belong to the CANAMEX Corridor (from Nogales to the Canadian border) or the Economic Lifeline Corridor.

USDOT created the Corridors of the Future program in response to concerns about freight flows on the Interstate Highway System. This 2007 initiative aims to reduce freight traffic congestion using a regional approach. The following six Interstate corridors, including two that cross Arizona, were selected for their potential to reduce congestion by constructing new roads, adding new lane miles, and building bypasses and truck-only lanes. An initial funding allocation was also made for a development plan in each corridor.

- I-5 in California, Oregon, and Washington: $15 million
- I-10, California to Florida: $8.6 million
- I-15 in California, Nevada, Arizona, and Utah: $15 million
- I-69, Texas to Michigan: $800,000
- I-70 in Missouri, Illinois, Indiana, and Ohio: $5 million
- I-95, Florida to Canadian border: $21.8 million

5.3.2 Arizona-Sonora Ports of Entry

The U.S.-Mexico border is the world's most frequently crossed international border, with about 250 million legal

Figure 16 Specially Designated Roadways

Legend

National Highway System

- NHS Route
- Future NHS Route
- State Highway System

Strategic Highway Network

- Strategic Highway Route
- Strategic Highway Connector

crossings annually. In addition to civilian border crossings, the ports of entry along the border process a large volume of freight traffic: an estimated 250,000 trucks and 75,000 railroad cars cross the border every year at Nogales. Arizona has seven border crossings open to motor vehicles, at Nogales (DeConcini and Mariposa), Douglas, Lukeville, Naco, Sasabe; San Luis I, and San Luis II (under construction).

San Luis II will serve as a commercial port upon completion in 2010. Planned private vehicle, bus, and recreational vehicle lane improvements to San Luis I, Mariposa, and Douglas will reduce crossing times as well. The Mexican federal government plans to upgrade San Luis II and Sonoyta (across from Lukeville) by constructing freight lanes, tourist lanes, bus lanes, red light inspection stations, and import/export lanes.

5.3.3 Existing Public Transportation

The largest metropolitan transit systems in Arizona are located in the Phoenix and Tucson areas. In Maricopa County, Valley Metro Rail (METRO) operates light rail, while the Regional Public Transportation Authority (RPTA or Valley Metro) coordinates planning of the regional bus and demand-responsive systems. In Tucson, Sun Tran is Pima County's largest provider of fixed-route bus service, while other agencies operate demand-responsive and rural transportation services. Among the smaller metropolitan areas, Flagstaff and Yuma have federally funded public transit systems.

A number of transit systems in smaller cities and rural areas receive funding from the Federal Transit Administration (FTA) Section 5311 program. These systems are required to serve the general public, but may offer fixed-route service, demand-responsive service, or both. Eleven of the state's fifteen counties have at least one Section 5311 provider or metropolitan transit system. Some 5311 programs operate within a community, but others provide intercity service in areas such as the Navajo and Hopi nations, Pima County and the Flagstaff/Verde Valley region.

Many private, not-for-profit agencies throughout the state offer transportation to the elderly, persons with disabilities, and others with special needs. The FTA Section 5310 program offers grants through ADOT to purchase vehicles for this type of service.

Greyhound Lines is the dominant provider of scheduled intercity bus service in the U.S. In Arizona Greyhound operates predominantly along I-10, I-17, I-40, and I-8, although its buses also use US 93/SR 68 (from Kingman to Bullhead City) and SR 85 (from I-10 to Gila Bend). It serves Phoenix, Tucson, Flagstaff, Yuma, Casa Grande, and other cities. Through service and connections are available to destinations nationwide. Greyhound offers connections and through ticketing with Mexican affiliates that serve Nogales, Agua Prieta, and points in the interior of Mexico. White Mountain Passenger Lines links Phoenix, Payson, Heber, and Show Low. Arizona also has a variety of airport shuttle services, intercity bus lines catering primarily to the Hispanic population, and private taxicab companies.

Except for three intrastate tourist services operated by short lines, the National Railroad Passenger Corporation (Amtrak) is the only provider of intercity rail passenger service in Arizona. The combined Sunset Limited/Texas Eagle operates three times a week per direction across southern Arizona, using the Union Pacific (UP) Sunset mainline. The Southwest Chief operates daily in each direction on the BNSF Railway (BNSF) Transcon mainline through northern Arizona. Each train stops in four Arizona communities.

5.3.4 Freight Modes and Flows

According to the *Arizona Multimodal Freight Analysis Study*, in 2005 approximately 557 million tons of freight, valued at $2.3 billion, moved into, out of, within or through Arizona. Approximately 76 percent (by weight) moved on the highway system in trucks and almost all the rest by rail. While rail accounted for 24 percent of total freight tonnage, it carried 37 percent of inbound tons, 30 percent of through tons, and much smaller proportions of outbound and internal flows. Railroads transported only 14 percent of Arizona commodities by value; 93 percent of the rail value consisted of through shipments, with only 7 percent having an Arizona origin or destination.

While Arizona is primarily a "bridge state" for rail freight, in which three-fourths of all traffic consists of through flows, the directional distribution of highway freight is more balanced, with 55 percent of total tonnage being through, 23 percent internal, 12 percent inbound, and 10 percent outbound. Although trucking is currently the dominant freight transportation mode, rail traffic is projected to grow faster than truck traffic from 2005 to 2030. While tonnage transported by truck is expected to increase by 69 percent over this period, representing an annual growth rate of 2.1 percent, rail freight is projected to increase by 105 percent, for an annual growth rate of 2.9 percent–a full percentage point higher than the national average. This bucks national trends that forecast faster growth in trucking volumes than in rail transportation.

Nevertheless, truck volumes on many major Arizona highways are already substantial and are expected to grow rapidly, along with general traffic and the state's population. Average annual daily truck volumes on some non-urban segments of I-10, I-17, and I-40 were approaching 10,000 in 2006. Commercial trucks comprise more than 35 percent of all vehicles on numerous segments of I-8, I-10, and I-40, reaching as high as 50 percent on I-10 and 51 percent on I-40.

5.3.5 Existing Railroad Network

Arizona is served by two Class I freight railroads and a number of short lines. The Class I carriers are the Union Pacific Railroad (UP) and the BNSF. The UP mainline, known as the Sunset Route, crosses southern Arizona through Yuma, Maricopa, Casa Grande, Tucson, Benson, and Willcox, roughly parallel to I-8 and I-10. Two major branches are active: one from Picacho to the Phoenix metropolitan area (which has its own branches in Chandler and Tempe), and the other from Tucson to Nogales.

The BNSF mainline, known as the Transcon, crosses northern Arizona generally parallel to I-40, passing through Kingman, Flagstaff, and Winslow. The BNSF also has two branches: from Williams Junction to Phoenix, and from Navajo south into Apache County. The BNSF and UP meet in Phoenix.

Fourteen short line railroads are currently active, of which seven are common carriers. The Arizona Central and Arizona Eastern railroads carry both freight and passengers, while the Grand Canyon Railway carries passengers only. Several other short lines are out of service. The S*tatewide Rail Framework Study*, summarized in Chapter 8, provides more details on existing and potential future rail services.

The DeConcini Port of Entry in Nogales is the only entry point for freight rail traffic between Sonora, Mexico and Arizona. Four trains, two in each direction, travel daily through the Nogales port. The existing Ferrocarril Mexicano north-south rail line extending north to Nogales, where it connects with the UP in Arizona, will not be adequate to accommodate the freight traffic expected to result from deepening the port at Guaymas to accommodate post-PANAMAX container ships. Additional freight traffic is a concern for Nogales on both sides of the border, as the existing rail line bisects the center of town, causing congestion and an unsafe environment.

5.3.6 Bicycle and Pedestrian Transportation

Many journeys, especially short trips, are made on foot or by bicycle. These non-motorized modes are non-polluting, energy-efficient, have a small carbon footprint, and benefit the health of participants. ADOT's 2003 *Statewide Bicycle and Pedestrian Plan*, available at www.azbikeped.org, provides extensive information on bicycle and pedestrian systems and programs. Bicycling is permitted on the entire state highway system except some freeways, and ADOT has issued a highway map showing pertinent characteristics such as shoulder widths, traffic volumes, and steep grades. Bikeway maps have been published for the Phoenix, Tucson, and Flagstaff metropolitan areas and for a number of cities around the state. Although most non-motorized travel occurs on the street and highway system, Flagstaff and other cities have developed or are planning off-road systems of urban, multi-use trails. Arizona also has many back-country trails designed for serious hikers, mountain bikers and equestrians.

5.3.7 Airports

The ADOT Aeronautics Division classifies airports in the following categories:

- Commercial Service: Primary
- Commercial Service: Other
- General Aviation: Public Use Airports
- Native American Airports
- Reliever Airports

The primary commercial service airports are at Phoenix (Sky Harbor), Tucson, Yuma, Flagstaff, Prescott, Lake Havasu City, Laughlin-Bullhead, Page, and Grand Canyon National Park. The last is the only Arizona airport under state ownership. Many private airfields and landing strips exist, in addition to facilities open to the public.

5.3.8 Programmed and Planned Roadway and Transit Improvements

The Central, Eastern, Northern, and Western Regional Framework studies–described in Chapter 6–identify roadway and transit improvements that ADOT and local jurisdictions have programmed or planned. Programmed improvements refer to projects for which funding has been identified and earmarked. Sources of programmed projects include the *State Transportation Improvement Program* for fiscal years 2007 through 2011, municipal and county capital improvement programs, and transportation improvement programs (TIPs) adopted by councils of governments. Planned improvements are currently unfunded, but appear in a formally adopted or approved state, regional or local transportation plan.

MAG and PAG adopt and frequently update both a regional TIP and a long-range *Regional Transportation Plan* (RTP). Both MAG and PAG have secured voter-approved sources of sales tax revenue to fund their RTP projects. Each TIP and RTP is available at the appropriate website (www.mag.maricopa.gov and www.pagnet.org).

5.4 Environmental Overview

5.4.1 Geology and Topography

Principal Landforms

The Southwest region of the U.S. encompasses several geologic provinces, including the Basin and Range Province, the Colorado Plateau, the Rocky Mountains, and the Interior Plains. Arizona contains portions of the Basin and Range and Colorado Plateau provinces. The area between the Colorado Plateau and the Basin and Range is sometimes considered a separate province called the Central Highlands or Transition Zone (Figure 17).

The Basin and Range Province is characterized by north-south trending low mountain ranges (1,000 to 3,000 feet high) that bound low-lying arid valleys or plains. The valleys are fertile and sustain agriculture if irrigated. The topography in this province is primarily characterized as gently sloping. Mountain soils in the Basin and Range Province are generally grouped either by soils formed on granitic and schistose rocks, or by soils formed on volcanic rocks. These soils are generally shallow, rocky, and gravelly.

The Colorado Plateau province extends through the northern portion of Arizona. It is a mainly broad, flat, and level landscape composed of colorful sedimentary rocks (e.g., sandstones, shale, and limestone) and punctuated by canyons and mountains. It ranges from roughly 4,000 to 9,000 feet above sea level. This province is characterized by tablelands of varying elevations. The Grand Canyon is one of the most notable features within the Colorado Plateau. Fluvial deposits along the Colorado River involve three intergrading components: tributary alluvial fan bouldery deposits, cobble and gravel bars, and fine-grained (sandy) terraces.

The Transition Zone, also referred to as the Central Highlands Province, is characterized by numerous mountain ranges separated by several basins. The topography includes tablelands of considerable relief, plains with low mountains, and high-relief mountains. The province contains exposed sedimentary, igneous, and metamorphic rocks.

Slope Analysis

Slope is an important consideration in planning infrastructure for several reasons. Steep slopes can increase the potential for physical hazards; raise susceptibility to rock falls, soil slippage and erosion; and make repairs and improvements difficult. Construction on steep slopes can create visual impacts and make slope re-vegetation difficult.

Erosion is directly affected by the steepness and length of slope; greater slopes increase the runoff velocity and the movement of sediment carried in runoff. Poor drainage may occur with some soils, which may increase velocity and erosion; therefore, specific soil characteristics should be taken into consideration.

Future infrastructure improvements and developments would generally be most feasible in areas with slope of 5 percent or less; or, in mountainous areas, collocated with infrastructure that currently exists. Steep slopes and ridgelines can also be environmentally sensitive. Property owners often desire steep slopes for residential construction because they can offer spectacular views, but these slopes may contain a wide range of vegetation types and provide valuable habitat for a variety of birds and other wildlife species. Steep slopes can often have unstable, highly erodible soils as well. See Figure 18 for a generalized summary of terrain steepness.

5.4.2 Hydrological Resources and Issues

Surface Water

Riparian and wetland areas are frequently habitats for sensitive biological resources, including federal and state special status species. Smaller washes are often centers of species diversity in arid regions. Wetland areas bordering surface water provide habitat and perform important hydrologic functions: discharging floodwaters, filtering stormwater runoff, and recharging groundwater.

Streams are categorized as perennial (constant flow), intermittent (flow only parts of the year) of ephemeral (flow only in response to precipitation). Many streams and watercourses in Arizona are intermittent or ephemeral.

Waters of the U.S.

Section 404 of the Clean Water Act establishes a program to regulate the discharge of dredged or fill material into waters of the U.S., including wetlands. Proposed activities must show that, to the extent practicable, steps have been taken to avoid impacts to Waters, minimize potential

Figure 17 Physiographic Provinces

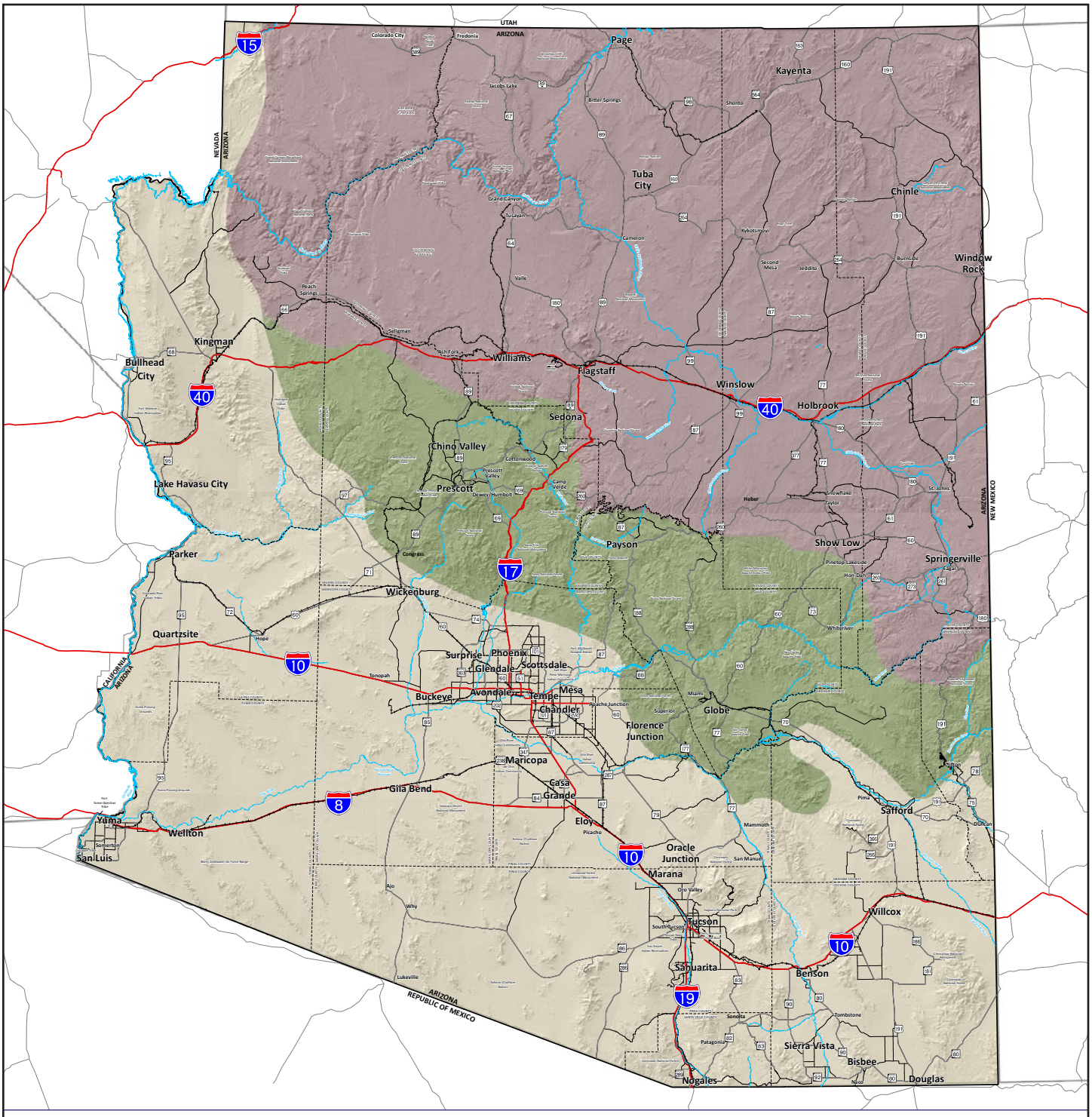
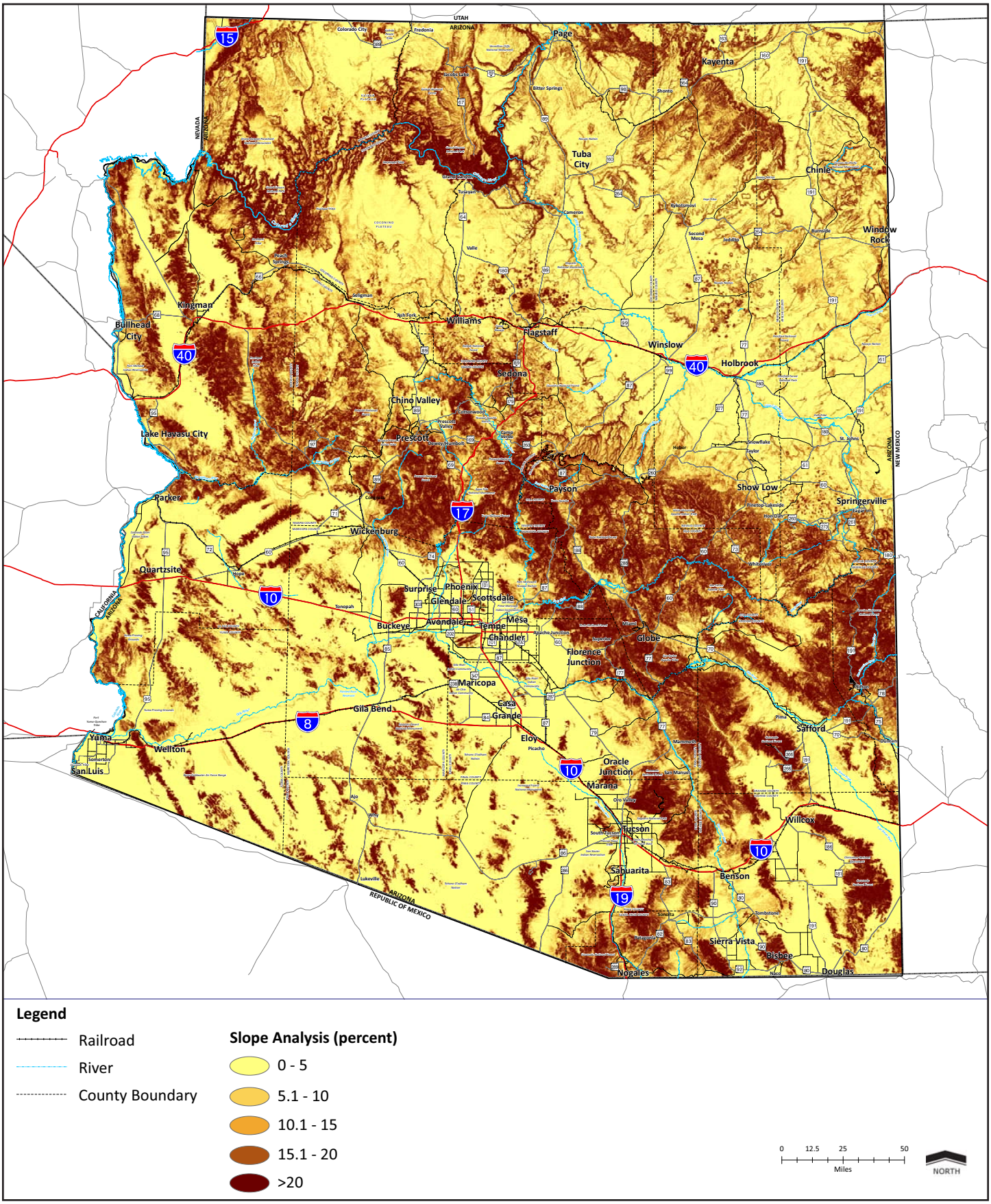


Figure 18 Slope Analysis



impacts thereto, and provide mitigation for any remaining unavoidable impacts.

Impaired Waters

Section 303(d) of the Clean Water Act requires each state to report a list of all of its surface waters that do not meet water quality standards. These standards, developed by the state and approved by the U.S. Environmental Protection Agency (EPA), vary depending on the designated beneficial "uses" assigned to each water body.

The Arizona Department of Environmental Quality (ADEQ) monitors whether standards are met and reports the assessment of surface water quality every two years in the Integrated 305(b) Assessment and 303(d) Listing Report. Water bodies that fail to support their designated uses because standards are not being met are designated as "impaired." The 303(d) list identifies these impaired waters and notes the pollutants causing their inclusion on the list. Once a surface water body is identified as "impaired," a Total Maximum Daily Load (TMDL) must be developed. A TMDL is the maximum amount of pollutant, such as sediment or metals, that a water body can receive and still meet water quality standards. Once a TMDL has been developed, the water body is removed from the 303(d) list and is classified as "non-attaining," meaning that it is not yet attaining the standards to support the designated uses. The 2006/2008 *Draft Integrated 305(b) Assessment and 303(d) Listing Report*, including the draft impaired waters and non-attaining waters lists, can be found on the ADEQ website for impaired and unique waters.

ADEQ may designate surface waters as "unique waters." Determination of a unique waterway is based on the criteria outlined in Arizona Administrative Code (AAC) Section R18-11-112. These criteria include a perennial water designation, free-flowing condition, water quality that meets or exceeds applicable standards, and exceptional recreational or ecological significance or importance for threatened and endangered species or critical habitat.

Unique waters are maintained and protected from degradation. New or additional discharge into a designated unique water or its tributaries is prohibited if the discharge will result in degradation of existing water quality.

Wild and Scenic Rivers

The Wild and Scenic Rivers Act of 1968 protects and preserves selected free-flowing rivers that provide outstanding scenic landscapes, recreational activities, geologic formations, fish and wildlife resources, and historic and cultural values. Designated Wild or Scenic Rivers are protected for the "benefit and enjoyment of future generations"

Sole Source Aquifers

The EPA established the Sole Source Aquifer Program under Section 1424(e) of the Safe Drinking Water Act. The program has been used to prevent contamination of groundwater from federally-funded projects and to increase public awareness of the sensitivity and vulnerability of groundwater resources. To be considered a sole source, the aquifer must supply at least 50 percent of the drinking water consumed in the area overlying the aquifer. These areas have no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend upon the aquifer for drinking water.

The program allows for EPA environmental review of any project assisted by federal monies. Projects are evaluated to determine whether they have the potential to contaminate a sole source aquifer. If such potential exists, the project should be modified to reduce or eliminate the risk, or federal financial support may be withdrawn. Modifications have included redesign of bridges and highways to prevent spills of hazardous materials.

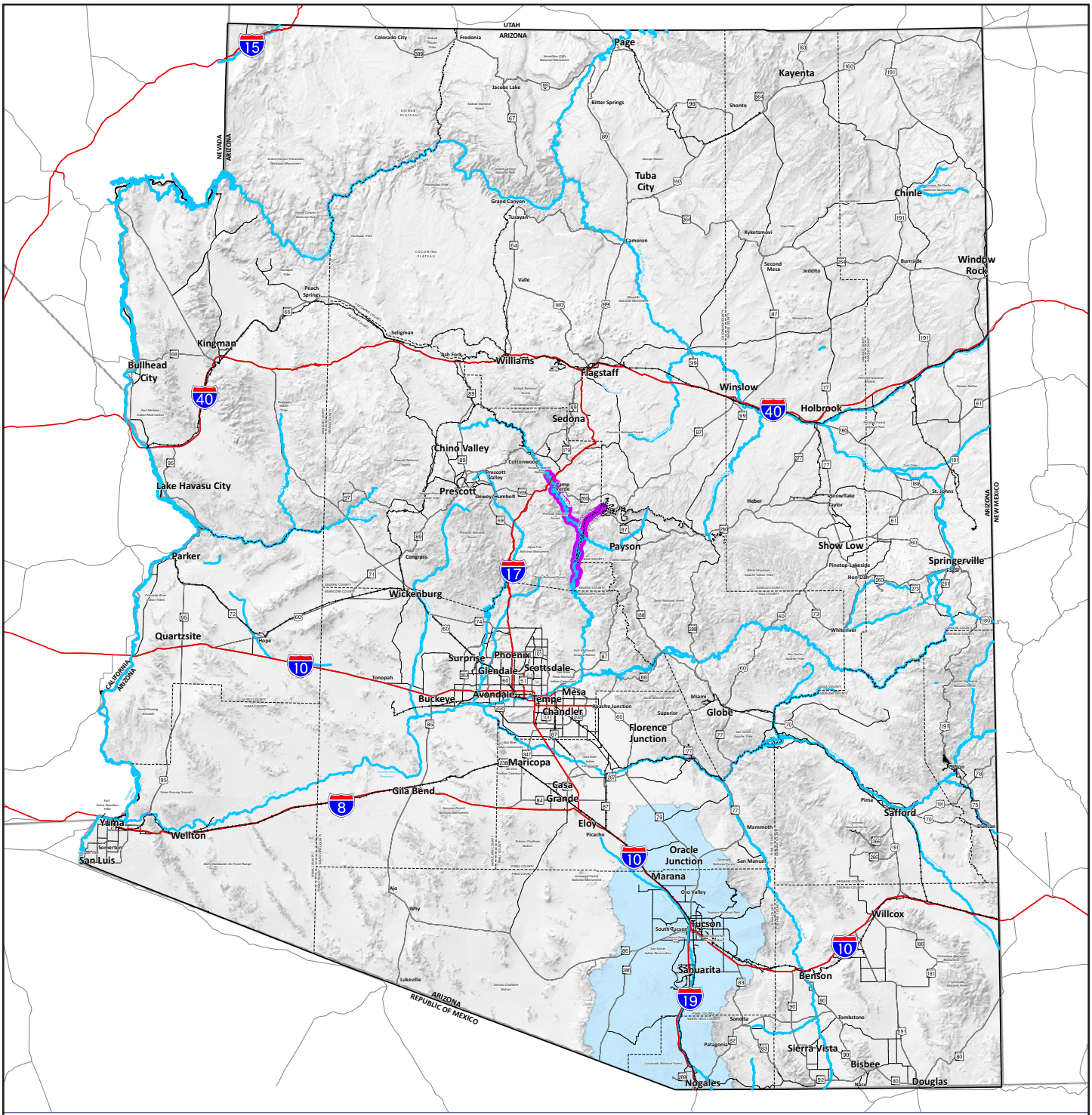
In Arizona the Upper Santa Cruz River and Avra Basin aquifers (49 Federal Register 2948) and the Bisbee-Naco Aquifer (53 38337) have been designated as sole source aquifers. Many aquifers in the state are by definition sole source aquifers, but have not been designated as such. Amendments to the Safe Drinking Water Act require the state to protect drinking water and its sources, including aquifers, rivers, lakes, reservoirs, springs, and ground water wells.

In Arizona, all aquifers are classified as drinking water aquifers. Figure 19 illustrates Arizona's water resources, including major watercourses and sole source aquifers.

Flood Hazards

The Federal Emergency Management Agency (FEMA) is responsible for developing Flood Insurance Rate Maps that identify areas subject to flooding. FEMA categorizes flood zones by the chance that the area will flood to a certain depth in a given period. For example, Zone A, the 100-year floodplain, is an area where a storm that would flood the area to a depth of one foot has a one percent chance of occurring each year. Any proposed development in a flood zone must be coordinated with the floodplain manager to ensure that proper measures are taken to avoid encroachment on known floodplains. As of 2008, all Arizona

Figure 19 Water Resources



counties are digitizing their published floodplain maps; this effort should be completed and approved by FEMA by 2013. As part of this digitization, some counties will add floodplain data from recent flood insurance studies, recent floodplain/floodway delineation, and other private drainage studies where new or revised floodplain delineation was required. Any future developments and roadway corridor studies will need to include the most recent data. Therefore, each county floodplain administrator must be consulted for the most recent floodplain data available.

5.4.3 Natural Infrastructure

Biotic Communities

The term biotic community refers to a group of interdependent organisms inhabiting the same region and interacting with each other. Climate and elevation are key factors that create the groups of species that coexist in biotic communities. Common biotic communities encountered in Arizona are listed in Table 7 and illustrated in Figure 20.

Special Status Species and Critical Habitats

Certain wildlife are deemed special status species by natural resource agencies. The USFWS identifies species according to the Endangered Species Act of 1973 as endangered, threatened, proposed, or candidate species. Candidate species are those being considered for addition to the threatened or endangered list. These species do not have legal protection under the act, but USFWS recommends their consideration in the planning process in the event that they become listed before completion of a project. The federal status listings are:

- LE Listed Endangered; imminent jeopardy of extinction
- LT Listed Threatened; imminent jeopardy of becoming endangered
- PDL Proposed for delisting
- PE Proposed Endangered
- PT Proposed Threatened
- C Candidate; species for which USFWS has sufficient information on biological vulnerability and threats to support proposals to list as Endangered or Threatened under the Endangered Species Act.

In addition to the federal listings, AGFD lists species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats of population decline, as wildlife of special concern.

The Arizona Department of Agriculture Arizona Native Plant Law listing categories are:

- HS Highly Safeguarded: no collection allowed
- SR Salvage Restricted: collection only with permit
- SA Salvage Assessed: permits required to remove
- HR Harvest Restricted: permits required to remove plant by-products

Critical habitat is defined in Section 3(5)(A) of the Endangered Species Act and includes:

- Areas within the current (at time of listing) range of a listed species that contain the physical or biological features that are essential to its conservation or that for some reason require special management; and
- Areas outside the current range that the Secretary of the Interior determines to be essential to its conservation.

Wildlife Linkages

The Arizona Wildlife Linkages Workgroup is a collaborative effort of nine public and private organizations to address habitat fragmentation throughout the state. Its members are ADOT, AGFD, BLM, FHWA, Northern Arizona University, the Sky Island Alliance, the USDA Forest Service, USFWS, and the Wildlands Project. The workgroup has identified habitat blocks, or areas of important wildlife habitat that can reasonably be expected to remain wild for at least 50 years, and potential wildlife linkage zones. The linkage zones identify opportunities both to prevent loss of wildlife connectivity and to create accommodations to re-establish connectivity between intact habitat blocks.

Coordination between ADOT and AGFD is important to identify critical habitat and wildlife linkages or connections. AGFD is evaluating areas that would be the most sensitive to, and incompatible with, expanded transportation infrastructure. AGFD is also evaluating where and to what degree transportation facilities would be suitable with appropriate mitigation. Figure 21 presents the current statewide wildlife linkages map provided by ADOT.

Conservation Areas

Wildlife preserves and conservation areas protect only a small fraction of the state. The major public lands include BLM and USDA Forest Service land, which provide general protection to plant and wildlife populations.

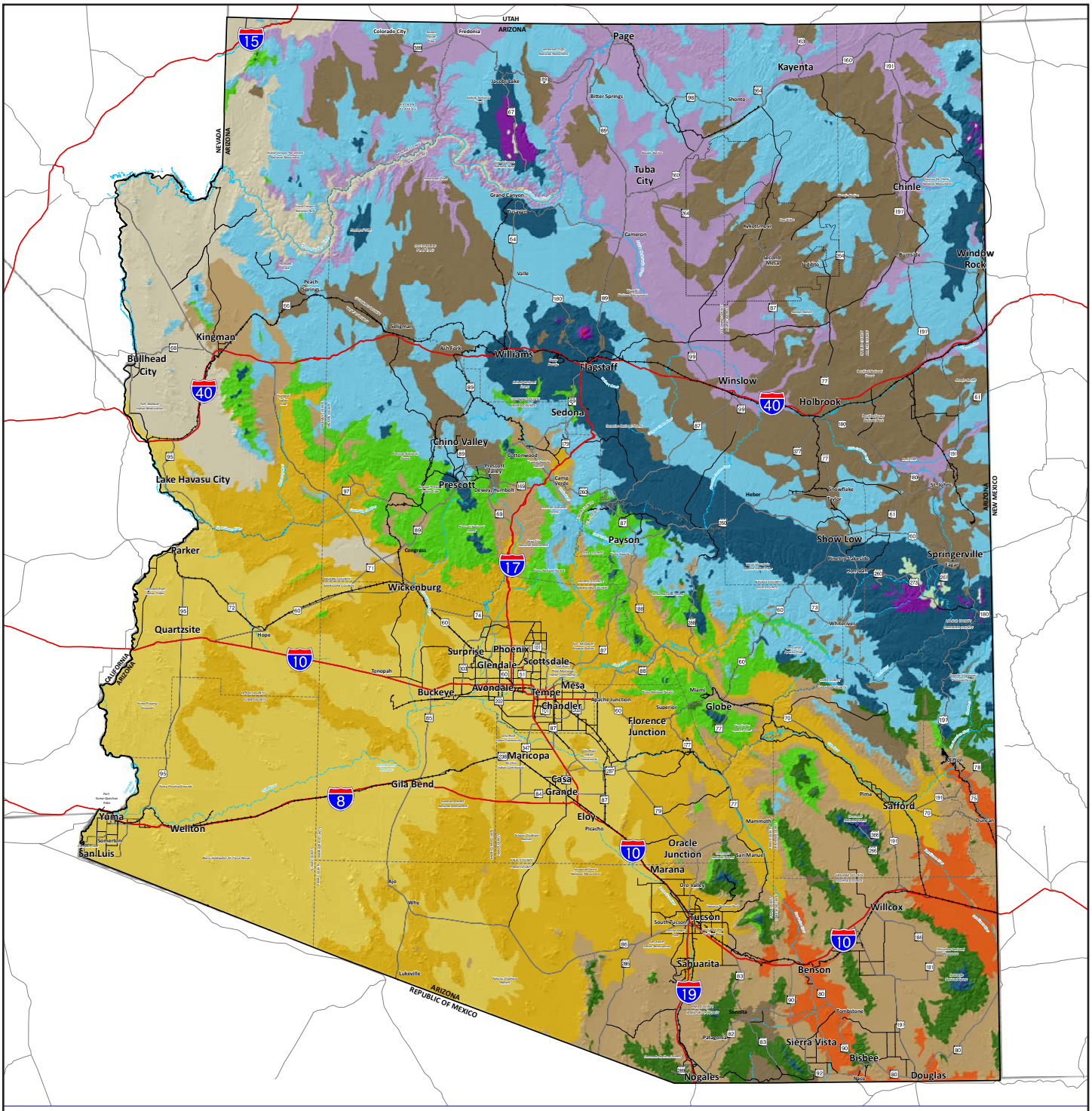
Wilderness and special designation areas of the Forest Service and BLM provide the largest contiguous conservation areas that protect plant and wildlife populations and habitat.

Table 7 Biotic Communities

Biotic Community	Brief Description
Alpine Tundra	Located only on Humphreys Peak, the highest point in the state. Treeless landscape above timberline, where incessant winds scour the landscape, mean annual temperatures are low, harsh subfreezing winters reign, and little moisture is available. Vegetation consists of low-growing, woody shrubs, diverse herbaceous plants, lichens and mosses; all are adapted to a brief and often interrupted growing season and are subjected to severe subfreezing temperatures annually.
Arizona Upland Sonoran Desertscrub	Characterized by leguminous trees; cacti such as the saguaro (Carnegiea gigantea) and chollas (Cylindropuntia species). Annual precipitation generally ranges between 12 and 17 inches, with summer rainfall accounting for 30 to 60 percent of the annual total. Elevations range from approximately 1,000 to above 3,300 feet.
Chihuahuan Desert Scrub	Dominant vegetation is characterized by large woody shrubs such as creosotebush (Larrea tridentata) and mixed succulent-scrub communities. Annual precipitation ranges from 8 to 14 inches, with usually more than 65 percent falling as summer rain. Elevations range from 1,300 to 5,000 feet and the climate is temperate, with freezing nighttime temperatures typically expected between October and March.
Great Basin Conifer Woodland	Evergreen woodland characterized by openly spaced junipers (Juniperus species) and Piñon pine (Pinus species). Elevations range from 4,900 to 7,000 feet, and annual precipitation ranges from 10 to 20 inches. Winter minimum temperatures are below freezing for more than 150 days a year.
Great Basin Desertscrub	Low-diversity scrublands characterized by sagebrush (Artemisia tridentata) and shadscale (Atriplex confertifolia), with few cacti or perennial grasses. Elevations range from 3,900 to 7,200 feet. Annual precipitation ranges from 6 inches to nearly 12 inches at the higher elevations.
Interior Chaparral	Occupies middle elevations (3,000 to 5,600 feet) in central sub-Mogollon regions and in drier mountain ranges of southeastern Arizona. Vegetation is characterized by 60 to 70 percent cover of shrubs such as scrub oaks (Quercus turbinella and many other species), and manzanita (Arctostaphylos species). Annual precipitation varies from 15 to 25 inches and falls in a distinctly bimodal pattern, characterized by spring drought between April and June, which is the driest time of the year.
Sonoran Desertscrub	From Sonora, Mexico into central Arizona at elevations below 3,500 feet. Warm desert with average annual precipitation from 7 to 10 inches that falls in two seasons–winter and summer monsoon. Vegetation is not cold tolerant; ranges from mainly cacti, including saguaro (Carnegiea gigantea) and creosote bush (Larrea tridentata), in lowest elevations to diverse low shrubland of legume trees, mainly palo verde (Parkinsonia species) in upland areas.
Mohave Desertscrub	Located only in the northwest corner of Arizona. Intervenes between the Sonoran and Great Basin desertscrubs, thus difficult to distinguish. It occupies middle elevations on slopes, hillsides, and washes with alluvial soils at elevations of about 4,000 to 5,000 feet. The vegetation is dominated by creosote bush (Larrea tridentata) and a diverse mixture of other shrubs, cacti, and Joshua trees (Yucca brevifolia).
Petran Montane Conifer Forest	Elevation ranges from 5,600 to over 8,000 feet on mountains, mesas, and plateaus. These open forests are characterized by large evergreen conifers and winter deciduous trees with openings dominated by grasses and forbs. The dominant tree at lower elevations is ponderosa pine (Pinus ponderosa). At higher elevations and in canyons and on north slopes, a cooler, mixed-conifer forest occurs with Douglas fir (Pseudotsuga menziesii), white fir (Abies concolor), and quaking aspen (Populus tremuloides). Annual precipitation varies from 18 to almost 28 inches, with over half during the summer.
Plains & Great Basin Grassland	Occurs on generally open and exposed plains north of the Mogollon region in Navajo and Apache counties, from 4,200 feet to 6,200 feet. Composition of dominant grasses and forbs in these communities varies considerably depending on available soil moisture, which is influenced by average temperature, precipitation, and soil texture. Annual precipitation ranges between 12 and 18 inches.
Semidesert Grassland	Characterized by vegetation dominated by perennial grasses and woody shrubs, positioned on the landscape between Chihuahuan Desert Scrub below, and either Interior Chaparral or Evergreen Woodland above. Elevations range from 3,100 to 5,400 feet. Winters are mild with generally less than 100 days per year with freezing temperatures. Precipitation averages 10 to 16 inches per year, 35 to 65 percent of which falls between April and August.
Subalpine Grassland	In Arizona, these grasslands occur between 7,000 and 9,800 feet in the White Mountains in Apache County. Dominant vegetation is herbaceous, consisting almost entirely of perennial bunch grasses (e.g., Festuca, Poa, Stipa) and forbs (Trifolium, Erigeron). Precipitation averages 22 to 24 inches per year, of which a significant amount is received as snowfall.

Source: Brown, David E. 1994. Biotic Communities: Southwestern U.S. and Northwestern Mexico.

Figure 20 Biotic Communities



Legend

- Railroad
- River
- County Boundary

Biotic Community

- Alpine Tundra
- Arizona Upland Sonoran Desertscrub
- Chihuahuan Desertscrub
- Great Basin Conifer Woodland
- Great Basin Desertscrub
- Interior Chaparral
- Lower Colorado River Sonoran Desertscrub
- Madrean Evergreen Woodland
- Mohave Desertscrub
- Petran Montane Conifer Forest
- Petran Subalpine Conifer Forest
- Plains & Great Basin Grassland
- Semidesert Grassland
- Subalpine Grassland

0 12.5 25 50
Miles

NORTH

USFWS national wildlife refuges, state wildlife areas, and Nature Conservancy preserves are typically small areas that protect particularly rare or imperiled habitats.

The Wilderness Act of 1964 established the National Wilderness Preservation System of all U.S. wilderness areas to "secure for the American people of present and future generations the benefits of an enduring resource of wilderness." In Arizona, BLM, Forest Service, USFWS, and National Park Service administer ninety wilderness areas.

BLM administers two Riparian National Conservation Areas (RNCA) covering 80,000 acres, and a third National Conservation Area in the state. The San Pedro RNCA (57,000 acres) was designated with the purpose "to protect and enhance the desert riparian ecosystem, a rare remnant of what was once an extensive network of similar riparian systems throughout the American Southwest." The Gila Box RNCA (23,000 acres) has four perennial waters, the Gila and San Francisco rivers and Bonita and Eagle creeks. The Las Cienegas National Conservation Area (45,000 acres) is grasslands and woodlands in Pima and Santa Cruz counties, where Cienega Creek supports a diverse plant and animal community.

BLM also administers areas of critical environmental concern in Arizona. Each such area is given special management prescriptions to protect resources, including plant and wildlife species and habitats.

The National Wildlife Refuges are a system of lands dedicated to preserving the nation's wildlife heritage. In the Southwest, national wildlife refuges protect some of the most varied wildlife and spectacular landscapes found anywhere in the world. Arizona has eight wildlife refuges.

AGFD owns or manages approximately 37,000 acres of land statewide, including wildlife areas, fish hatcheries, and shooting ranges. State wildlife areas have individual management objectives, but in general are managed to provide habitat for wildlife as well as recreational opportunities, such as camping, fishing, hiking, and hunting. The private Nature Conservancy manages twelve Arizona preserves, including one cooperative management area.

5.4.4 Cultural Resources

Arizona is renowned for its exceptional array of archaeological, historic, and traditional Native American cultural resources. Identification, preservation, and management of cultural resources are integral aspects of transportation and land use planning, as these resources define our history and heritage at the local, state, and national levels.

Prehistory and History

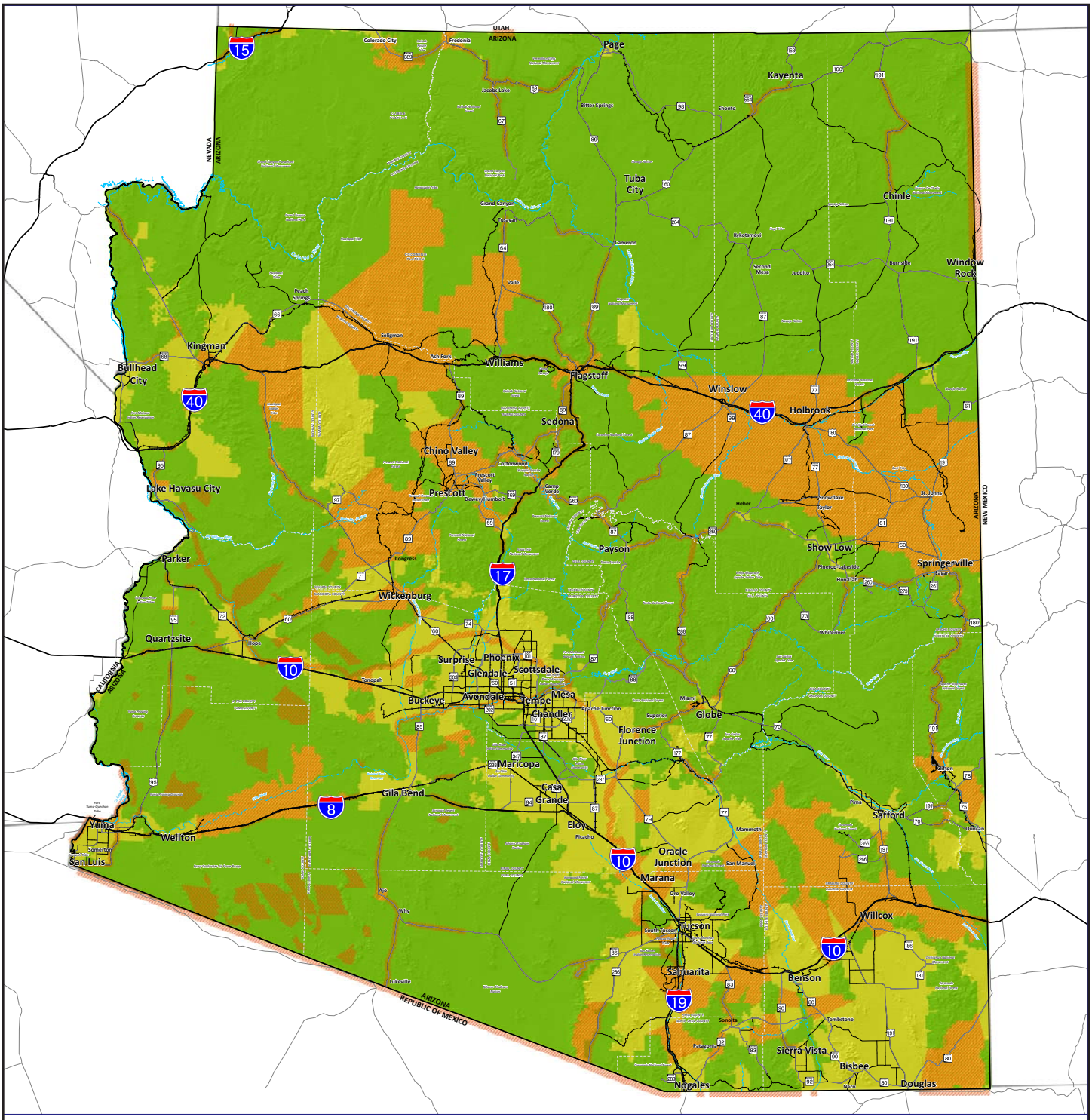
The Paleo-Indian Clovis people, the earliest known settlers of Arizona, arrived at least 12,000 years ago near the end of the Pleistocene period (Ice Age). The climate was cooler and wetter than today. By 6,000 B.C., warmer and drier climatic conditions contributed to the extinction of the Pleistocene megafauna, and the people changed their way of life. From this point forward they are known as the Archaic people.

Approximately 2,000 years ago, many people had settled into villages and relied on stored food during the winter. During this Formative period, they began to make and use pottery and to develop different techniques of agriculture such as canal irrigation. Gradually, larger villages were built and different groups of people began to emerge. The Hohokam, who inhabited the deserts of southern Arizona, constructed large networks of irrigation canals along the rivers. The Mogollon people lived in the mountains and valleys of eastern Arizona, and ancestral Puebloan peoples lived in the Colorado Plateau and Arizona Strip regions. The Patayan inhabited the Colorado River and desert areas of western Arizona. Each of these cultures had distinctive pottery and architectural styles, but throughout Arizona there were variations within each of these groups, as populations adapted to local environmental conditions and social networks. People in all parts of Arizona participated in trade networks and maintained contact with their neighbors in Mexico. Trade items included shells from the Gulf of California and the Pacific Ocean, turquoise from the Southwest, and copper bells and parrots from Mexico.

Around A.D. 1100, many groups began to construct structures such as multi-room pueblos, more substantial than the pithouses and brush shelters used up to that time. Some societies, notably among the Hohokam and ancestral Puebloans, achieved greater degrees of social and political complexity, possibly based on individual differences in wealth, social status and political influence. These groups constructed towns that housed hundreds or even thousands of people.

By the late thirteenth century, these prehistoric peoples appear to have moved on. Other cultures immigrated to the region, including the Paiute, Cerbat (Hualapai), Mohave, Chemehuevi, Hopi, and Navajo. Arizona is part of the traditional rangeland of numerous other Native American communities who claim cultural affinity to the region. Natural features such as the San Francisco Peaks

Figure 21 Arizona Wildlife Linkages



and the Grand Canyon are places of cultural importance to Native American communities, with religious, spiritual, and ceremonial significance. These locations, along with archaeological sites and other places of cultural heritage, are known as traditional cultural properties (or places) and protected under federal and state preservation laws.

Spanish expeditions arrived in the 16th and 17th centuries. The Spaniards established missions and introduced European livestock and crops to the Indian rancherias. In the mid-1820s, Anglo-American fur trappers, known as "mountain men," entered Arizona and began trapping along the Gila River. The U.S. acquired what is now Arizona through war with Mexico in 1848 and the Gadsden Purchase in 1854. An array of American explorers and surveyors entered the Arizona Territory, established in 1863. Approximately three dozen military camps and forts were established and used in Arizona between 1865 and 1920.

Arizona attracted miners after the California gold rush. Its population doubled between 1860 and 1864, and doubled again by 1870 because of mining. By 1880, one of five male workers in the territory was a miner. Silver initially dominated production, but was overtaken by copper by the late 1800s. With mining came the settlement of Arizona's towns. Arizona achieved statehood on February 14, 1912.

Historic Properties

The benchmark used to identify historic properties for management purposes is typically their eligibility for listing in the National Register of Historic Places (NRHP), according to guidelines issued by the Secretary of the Interior and the National Park Service. "Historic properties" include prehistoric and historic districts, sites, buildings, structures, and objects included in or eligible for inclusion in the NRHP. Historic properties may be eligible for nomination to the NRHP if they possess integrity of location, design, setting, materials, workmanship, feeling, and association, and meet at least one of the following criteria:

- **Criterion A:** Be associated with events that have made a significant contribution to the broad patterns of our history
- **Criterion B:** Be associated with the lives of persons significant in our past
- **Criterion C:** Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction
- **Criterion D:** Have yielded, or may be likely to yield, information important in prehistory or history

Properties may be of local, state, or national importance. Typically, historic properties are at least 50 years old, but younger properties may be considered for NRHP listing if they are of exceptional importance.

The National Park Service website lists 1,299 NRHP properties in Arizona as of September 2009. As each year passes, additional cultural resources will reach the 50-year threshold and will require evaluation for historical significance. Detailed investigation is required to identify the NRHP criterion that each property meets.

Proposed projects that use federal funding are required to adhere to the regulatory requirements and stipulations of the U.S. Department of Transportation Act of 1966, Section 4(f) (Title 23 Code of Federal Regulations (CFR), Part 771). In addition to protecting publicly owned parks, recreation areas, and wildlife and waterfowl refuges, Section 4(f) safeguards public and private historical sites from transportation project impacts.

5.4.5 Air Quality

The Clean Air Act (CAA) of 1970 and its Amendments of 1990 protect public health and the environment from increased air pollution. Under the CAA Amendments, the EPA has set NAAQS and classifies the severity of existing ambient air pollution as to whether air quality attains or fails to attain the standards described below. The classification of severity initiates a set of control requirements designed to achieve attainment by a specified date. An area considered to have air quality that meets or exceeds the NAAQS for a designated pollutant is referred to as in attainment for that pollutant. A non-attainment area is a geographic region that has not met NAAQS for designated pollutants. An area may be an attainment area for one pollutant and a non-attainment area for others. A maintenance area is a geographic region that has been previously designated a non-attainment area, but is currently meeting the NAAQS and has been redesignated as an attainment area with a maintenance plan. An area that fails to attain NAAQS for any of the criteria pollutants is required to submit a *State Implementation Plan* (SIP), which outlines actions that will be taken to attain compliance. The purpose of the SIP is to eliminate or reduce the severity and frequency of NAAQS violations. Section 176c of the CAA requires federal agencies and MPOs to ensure that all transportation projects conform to the approved SIP.

As required by the CAA, NAAQS have been established for carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), particulate matter smaller than 10 microns (PM10), particulate matter smaller than 2.5 microns (PM2.5), sulfur dioxide (SO2), and lead (Pb).

- Carbon monoxide is a colorless, odorless gas that affects the cardiovascular system. Vehicular emissions are a major source of carbon monoxide.
- Ozone is created through a complex reaction of hydrocarbons and oxides of nitrogen, with sunlight as a catalyst. Ozone affects the respiratory system. Major sources are vehicle emissions, power plants, and service stations.
- Nitrogen dioxide is a gas that impairs the respiratory system, with a yellowish orange to reddish brown appearance. Major sources of nitrogen dioxide are power plants and vehicle emissions.
- Particulate matter refers to small aerosols that may cause irritation and damage to the respiratory system. Vehicle emissions and the re-suspension of road dust by vehicular activity are common sources.
- Sulfur dioxide is a colorless gas frequently derived from the combustion of sulfur-containing fuels. It primarily affects the respiratory system; major sources are coal- and oil-fired power plants.
- Lead and its compounds damage the cardiovascular, renal, and nervous systems. Before the adverse health effects of lead were known, it was commonly used as an additive in gasoline. The primary source of airborne lead is vehicular emissions associated with the use of leaded gasoline. The CAA banned the sale of leaded fuel for use in on-road vehicles in 1996, but allowed leaded fuel to be sold for off-road uses until 2008.

Table 8 identifies non-attainment and maintenance areas for sulfur dioxide, ozone (eight-hour), carbon monoxide, and PM10 in Arizona.

Federally funded transportation projects that fall within a non-attainment or maintenance area must conform to the applicable SIP. The conformity process, which is governed by a regulation issued by the EPA (40 CFR Part 93), ensures that transportation activities will not cause new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS. Conformity requirements apply to metropolitan transportation plans, transportation improvement plans (TIPs), and individual projects. There are no conformity requirements on a statewide plan or Statewide Transportation Improvement Program. Regional transportation plans and TIPs must demonstrate that emissions from implementing the plan are consistent with the SIP. Proposed transportation projects within non-attainment and maintenance areas must be included in a conforming TIP for at least one year, and no more than three years, before construction.

Table 8 Air Quality Non-Attainment and Maintenance Areas

Area	County	Pollutant	Category/ Classification
Ajo	Pima	PM10	Non-Attainment (Moderate)
Douglas	Cochise	PM10	Non-Attainment (Moderate)
Hayden/Miami	Gila/Pinal	PM10	Non-Attainment (Moderate)
Hayden	Pinal	SO2	Non-Attainment (Primary)
Nogales	Santa Cruz	PM10	Non-Attainment (Moderate)
Phoenix-Mesa	Maricopa/ Pinal	8-hour Ozone	Non-Attainment (Subpart 1)
Phoenix-Mesa	Maricopa/ Pinal	PM10	Non-Attainment (Serious)
Phoenix-Mesa	Maricopa/ Pinal	CO	Maintenance (Serious)
Mohave	Mohave	PM10	Maintenance (Moderate)
Payson	Gila	PM10	Maintenance (Moderate)
Rillito	Pima	PM10	Non-Attainment (Moderate)
Tucson	Pima	CO	Maintenance (Not Classified)
Yuma	Yuma	PM10	Non-Attainment (Moderate)

Source: EPA Greenbook, www.epa.gov/air/oaqps/greenbk/index.html.

There are twenty-one hazardous air pollutants, referred to as Mobile Source Air Toxics (MSAT), generated in large part by transportation sources. There is no EPA- or FHWA-approved methodology for quantifying potential impacts to future ambient concentration levels of MSAT from vehicular emissions. Reliable methods do not currently exist to accurately and quantitatively assess MSAT emissions at the project level, but a qualitative MSAT assessment should be conducted for transportation projects. Federally funded rail projects must comply with EPA regulations for locomotives and other non-road engine emissions.

Construction-related disturbance of the soil by heavy

equipment would increase fugitive dust and, if uncontrolled, would affect local air quality. In addition, construction-related traffic delays, combined with exhaust emissions from constructed equipment, may elevate levels of pollutants. Such impacts are temporary and can be eliminated once construction is complete. Proposed construction activity must adhere to ADEQ air quality rules and regulations, and to any local ordinances.

5.4.6 Hazardous Materials

Hazardous materials are any items or chemicals that can cause harm to people, plants, or animals when released by spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing into the environment. Congress established the Comprehensive Environmental Response, Compensation, and Liability Act, commonly known as Superfund, and the Superfund Amendments and Reauthorization Act. Superfund is a program to identify, investigate, and clean up uncontrolled or abandoned hazardous waste sites throughout the U.S.

In Arizona, ADEQ administers the Superfund program. Information on the approximately 50 Superfund sites in Arizona is available on the ADEQ website at www.azdeq.gov/environ/waste/sps/index.html.

6.0 Framework Planning Process and Results

This chapter describes the statewide framework planning process and its results. The study opened with a self-assessment by COGs, MPOs, ADOT DEs, and tribal governments of critical transportation needs to the year 2030. The long-range planning process began with four separate Regional Framework studies covering the entire state, except for the portions within the MAG and PAG long-range planning areas. With guidance from the bqAZ Statewide Technical Team and extensive input from the community, each regional consulting team prepared three alternative 2050 scenarios. The Technical Team used the regional scenarios, along with input from MAG and PAG, to develop three corresponding statewide scenarios. After these scenarios were tested through an evaluation process, a Recommended Statewide Scenario emerged from elements of the three scenarios. Input from stakeholders, the public, and elected officials played a critical role in development and refinement of the Recommended Statewide Scenario.

6.1 Preliminary Critical Needs Definition

Governor Napolitano's Executive Order #2008-02 directed ADOT "to produce: a) by early spring 2008, a draft list of critical transportation needs and representative projects to bring about sustainable development patterns through the year 2030; and b) by late spring 2008, a consensus-based final list of needs and representative projects…"

The purpose of the Preliminary Critical Needs Definition, completed in the spring of 2008, was to identify the immediate and year 2030 needs of transportation systems throughout the state, to help ADOT and the Governor's Office better understand the magnitude of transportation needs that cannot be met with currently available or expected funding. This effort was given a high priority for rapid completion when the Statewide Framework began in late 2007. The process involved:

1. Submittal of a Preliminary Critical Needs List from each COG, each MPO, and their respective ADOT DEs. In conducting this effort, it became apparent that the various COGs, MPOs, DEs, and tribal governments interpreted critical needs differently; as a result, they actually submitted an identification of 2030 transportation improvement needs: 2030 Identified Improvement Needs Delineation.
2. Identification by the COGs, MPOs, DEs, and tribal governments of Representative Projects and Programs that best illustrate their critical transportation needs.

6.1.1 Delineation of Identified 2030 Improvement Needs

The project lists sorted by COG and MPO were divided into three categories: high-capacity roadways (Interstate highways, other freeways, and other state highways), public transit/rail, and principal arterials. The first two categories are self-explanatory. The third captures the most important roads that are not part of the State Highway System, and the local roadways that were modeled for the study.

Data collection began with a letter from ADOT-MPD to the DEs, asking them to identify critically needed improvements to the state highway system. They were asked to provide a brief description of each project, along with the location, the estimated cost, and whether the project is on an existing or new facility. Each DE was given a blank spreadsheet and asked to share it with staff of COGs and MPOs in the district. COGs and MPOs added projects on principal arterials outside the state system. Tribal governments added projects on Indian community lands.

Each recipient was asked to return the spreadsheet to ADOT in January 2008. Spreadsheets were returned separately by the COGs, MPOs, DEs, and tribal governments. Several COGs and MPOs also sent projects submitted to them by their member cities, towns, and counties. At this stage the spreadsheets contained "laundry lists" of projects, ranging from street maintenance to bridge replacement to passing lanes to new routes. These lists also varied dramatically from region to region.

After consulting with ADOT, MAG decided to use a slightly different procedure from the other COGs and MPOs (including PAG). Working in consultation with ADOT's Valley Freeway Management Consultant, MAG identified a set of

critical transportation needs for the Interstate highways, state highways, and other freeways in its region. MAG did not submit a complete list of local critical needs, but worked with the bqAZ Statewide Technical Team to identify representative projects and to apply a "rule of thumb" criteria to estimate the total cost of the needs in Maricopa County.

Identification of Transit/Rail Programs and Projects

In January 2007, Governor Napolitano issued Executive Order #2007-02, *Expanding Arizona's Transportation Options*. At that time she directed ADOT "to provide, within the next 90 days, a detailed list of options for mass transit, commuter rail and/or light rail to serve and connect as efficiently as possible those Arizona communities for which such options would be cost-effective. The report should include preliminary estimates of the cost of each option; an assessment of whether and how the private sector could be encouraged to offer or assist with each option, and, to the extent public money is required, recommendations regarding how to finance each option."

The ADOT-Public Transportation Division (later merged with ADOT-MPD) reviewed existing reports and formed an Executive Order Working Group, with representatives of COGs, MPOs, and transit agencies/providers. An outreach effort included stakeholder meetings, interviews, and a tribal forum, eight public meetings, and an online rural transit needs survey.

ADOT then prepared "control sheets" describing proposed programs and projects, with capital and operating cost estimates. The documented needs included many types of transit services and facilities. This thorough and up-to-date information became the foundation for identifying critical transit and rail needs, although each COG and MPO was given an opportunity to provide updated information or additional transit priorities.

Identification of Proposed Tribal Improvements

The ADOT-MPD Tribal Coordinator led this effort, after the ADOT Director initiated the process with a letter to the chief executive officer of each tribe requesting assistance. Identification of proposed tribal improvements was based partially on three Governor's Tribal Summits held from 2004 through 2007. In December 2007, ADOT submitted to Governor Napolitano a *Report on Tribal Transportation Issues and Needs*, based on input received at the summits. ADOT subsequently obtained information from the six tribes that did not attend.

Another source of tribal improvements was the Indian Reservation Roads-Transportation Improvement Programs (IRR-TIP) developed by tribal governments that have roads operated by the BIA. Most of these projects were programmed for fiscal years 2008 and 2009; not all tribes submitted an IRR-TIP to ADOT. A third source of improvements was the ADOT DEs, who identified state highway needs on tribal lands.

6.1.2 Summary of Identified 2030 Improvement Needs and Cost

Upon completion of the field visits and receipt of supplemental information from COGs, MPOs, DEs, and tribal governments through March 2008, the bqAZ Statewide Technical Team totaled the 2030 Identified Improvement Needs Delineation project costs to estimate total cost by COG/MPO and by category. The total cost of the transportation improvements proposed as part of the *2030 Identified Improvement Needs Delineation* (in 2008 dollars) is approximately $162.3 billion: $108.5 billion (67 percent) for high-capacity roadways, including state highways; $24.7 billion (15 percent) for transit and rail; and $29.1 billion (18 percent) for principal arterials.

Costs for high-capacity roadways and public transit/rail include a development cost (20 percent) to cover planning and design, environmental analysis and compliance documents, right-of-way acquisition, and utility relocations. In addition, high-capacity roadways include costs for general maintenance (five percent) and pavement preservation after year 15 (1.25 percent per year). The public transit/rail category includes estimated cost for operations and general maintenance. Costs of principal arterials are not as well defined, as there were varying degrees of response from local jurisdictions across the state.

Representative Projects and Programs

After reviewing the 2030 Identified Improvement Needs Delineation submittals, the bqAZ Statewide Technical Team scheduled field visits with the COGs, MPOs, DEs, and tribal governments to (a) confirm the list of identified pre-2030 improvements and (b) identify representative projects in each category that best illustrate the critical transportation needs of the region. Each COG or MPO was asked to select at least one such project in each category. The COG, MPO, and ADOT district representatives made the final decision on which improvements to include.

These representative projects (Table 9) were developed to illustrate what types of transportation and transit needs

Table 9 Representative Projects and Programs from Critical Needs

COG/ MPO	High-Capacity Roadways (Interstate Highways, other freeways and state highways)	Transit/Rail	Principal Arterials
CAAG	• North-South Freeway • US 60 Corridor widening to 4 lanes, TI changes, bridges and passing lanes • SR 347 widening and reconstruction, including Maricopa Bypass • US 70 widening to 4 lanes, US 60 to Safford • SR 77 widening and passing lanes • SR 79 widening • Montgomery Road construction as a high-capacity corridor • Val Vista Road construction as a high-capacity corridor	• Phoenix-Tucson intercity rail • Transit Connectors expansion	• Pinal County Regionally Significant Routes
CYMPO	• Great Western Extension • Chino Extension • SR 169 widening, I-17 to SR 69 • Fain Road Connector, SR 169 to SR 89 • Fain Road widening, new bridges	• Enhanced voucher program • Statewide vanpool program	• Sundog Connector • Santa Fe Loop • Outer Loop Road • Perkinsville Road
FMPO	• I-40 widening across northern Arizona • I-17 widening, Flagstaff to Phoenix • US 180 widening from MP 215 to 220 • B40 West Flagstaff reconstruction	• Statewide vanpool program • Mountain Line expansion • Northern Arizona rural-urban connector service	• Lone Tree Road extension and reconstruction • Milton Road reconstruction and BNSF railroad bridge replacement • JW Powell Boulevard/Fourth Street/Airport connection development
MAG	• I-10 collector-distributor roads • I-17 widening, I-10 to SR 101 • I-17 Durango Curve reconstruction • SR 801 construction, SR 303 to SR 85 • SR 85 reconstruction to freeway standards, I-10 to I-8 • Hassayampa Freeway construction, US 93 to SR 303 • SR 74 reconstruction to freeway standards, I-17 to Hassayampa Freeway • White Tank Freeway construction, US 60 to Hassayampa Freeway • Grand Avenue improvements • SR 101 HOV and general purpose lane project acceleration • SR 303 local access enhancements and acceleration • SR 802 acceleration • SR 303 construction, SR 801 to I-8	• Commuter rail system development • Phoenix-Tucson intercity rail • Double freeway express service	• Sonoran Parkway construction, Phoenix • Meridian Road widening, Mesa and Queen Creek • Turner Parkway construction, Buckeye • Jackrabbit Trail reconstruction and widening, Buckeye and Surprise • Old US 80 bridge at Agua Fria River • MCDOT ITS Smart Corridors • Agua Fria River crossings (West Valley communities) • UP and BNSF grade separations • Regional Parkway corridors in Hassayampa and Hidden valleys
NACOG	• I-17 widening, Flagstaff to Phoenix • I-40 widening across northern Arizona • US 89 widening, Flagstaff to Page • US 160 widening to Four Corners area • SR 260 widening, Heber to Show Low • SR 77 widening, Show Low to Holbrook • SR 64 widening	• Operating and capital state match for Section 5310 • Statewide vanpool expansion	• County 3144 reconstruction, Apache County • 24th West, St. Johns • Grand Canyon Boulevard extension, Williams • Lake Mary Road reconstruction • Southside Alternative Route, Holbrook • Obed Road bridge reconstruction, Holbrook to Joseph City

Table 9 Representative Projects and Programs from Critical Needs (continued)

COG/ MPO	High-Capacity Roadways (Interstate Highways, other freeways and state highways)	Transit/Rail	Principal Arterials
NACOG (cont.)	• US 191 drainage improvements, passing opportunities, and maintenance problem resolutions • SR 264 drainage improvements, passing opportunities, and maintenance problem resolutions	• Northern Arizona rural-urban connector service	• Broadway extension, Clarkdale • Willard Street Reconstruction, Cottonwood • Scott Ranch Road reconstruction, Show Low • Seventh Street Extension/new bridge, Snowflake • Sedona Alternative Access Route • New corridor, Northern Navajo Road to US 89 • Lone Pine Dam Road construction, Navajo County • Penrod Road reconstruction, Show Low to Pinetop • Alternatives to rail crossing, Winslow
PAG	• I-10 widening east of Tucson • I-19 widening south of Tucson • SR 210 extension of Barraza Parkway, new TI • SR 86 widening • SR 77 widening • SR 85 widening to 4 lanes, Lukeville to Ajo	• Commuter rail system development • Regional Bus Rapid Transit development • Phoenix-Tucson Intercity Rail	• Houghton Road reconstruction • Broadway Boulevard reconstruction • Airport area roadway improvements • Twin Peaks, Ajo Way widening • Sahuarita Road reconstruction
SEAGO	• I-10 widening to 6 lanes, Cochise County • SR 90 widening to 4 lanes, Benson to Sierra Vista • US 191 reconstruction to 4 lanes divided, I-10 to US 70 • US 70 widening to 4 lanes, Globe to Safford	• Transit Connector expansion • Graham/ Greenlee/Gila/ Pinal County rural bus service • Bisbee Bus expansion	• Local streets operations and maintenance • Grand Avenue railroad viaduct, Nogales • Palo Pratco, Santa Cruz River bridge • Extend SR 90 to airport, Benson • Kings Highway construction, new port of entry, Douglas • Paving of International Border Road, Douglas • Incorporate Naco Road in state system • Improvements to border, Bisbee • Buffalo Soldier Trail construction, Sierra Vista • First Street reconstruction, 20th Avenue to First Avenue, Safford • First Street extension, 20th Avenue to Reay Lane, Thatcher • Repave Duquesne Avenue, Patagonia
WACOG	• I-10 widening throughout Yuma District • I-40 widening to 6 lanes, MP 44 to MP 74 • US 93, Wickenburg to I-40 and • System interchange reconstruction, US 93/I-40 • SR 72 reconstruction to 40 feet, MP 13 to MP 22 • SR 95 Western Passage of CANAMEX Corridor widening to serve potential Mexican deep-water port, I-40 to I-8 • SR 66 widening, I-40 to Valle Vista • SR 95 realignment, I-40 to SR 68	• Tri-City Connectors expansion • Statewide vanpool expansion	• Diamond Bar Road construction to Grand Canyon Skywalk, Hualapai Tribe • Buck & Doe Road construction to Grand Canyon Skywalk • Colorado River crossing at Pearce Ferry • Grace Neal, Airport and suburb access, Kingman • Second bridge construction in Bullhead City • Vanderslice Road, parallel route construction to SR 95 • Kingman Crossing TI construction, Kingman • Rattlesnake Wash TI construction, Kingman • London Bridge Road reconstruction, Lake Havasu City

Table 9 Representative Projects and Programs from Critical Needs (continued)

COG/ MPO	High-Capacity Roadways (Interstate Highways, other freeways and state highways)	Transit/Rail	Principal Arterials
YMPO	• US 95 Western Passage CANAMEX Corridor reconstruction • I-8 improvements, state line to Telegraph Pass • SR 195 (Area Service Highway), I-8 to US 95	• Foothills Yuma County Area Transit (YCAT) service initiation • San Luis YCAT service initiation	• Controlled access loop/Yuma Expressway construction with TIs at I-8 and SR 195 • Expressway construction south from County 14/Avenue D to San Luis port of entry #2 • County 19th Street construction

HOV = High-Occupancy Vehicle Lane ITS = Intelligent Transportation Systems TI = Traffic Interchange
Source: bqAZ Statewide Technical Team, April 2008.

might be included in the three categories of improvements by 2030.

6.2 Regional Framework Studies

Governor Napolitano's Executive Order #2008-02 directed ADOT to produce "by the end of 2008, final Regional Transportation Framework Plans that will include the short- and long-range transportation projects necessary to further sustainable development patterns through the year 2050." Recommendations from the four Regional Frameworks, along with 2050 visions from MAG and PAG, formed the basis for development of a recommended Statewide Transportation Framework for 2050.

6.2.1 Four Regional Frameworks

Because of the great size and diversity of Arizona, the bulk of the state was divided into four framework regions. The technical work in each region was awarded to an experienced transportation planning consultant with detailed knowledge thereof, under the direction of liaisons from ADOT-MPD and the statewide management consultant. These regions can be described roughly as follows:

- **Central:** Pinal County and a portion of western Gila County, including Globe, Miami, Hayden, and Winkelman. Northwestern Pinal County–including the area north of I-8 and west of I-10–was studied separately by MAG in the *Interstate 8 and Interstate 10 Hidden Valley Transportation Framework Study.*
- **Eastern:** Cochise, Graham, Greenlee, and Santa Cruz counties, as well as the southern portions of Apache, Coconino, and Navajo counties, and the part of Gila County outside the Central region.
- **Northern:** Yavapai County and the portions of Apache, Coconino and Navajo counties outside the Eastern region–including the entirety of these counties north of I-40, and the entire Navajo Nation in Arizona.
- **Western:** La Paz, Mohave, and Yuma counties. For logistical reasons, the Northern team handled a portion of northernmost Mohave County, including Colorado City.

The boundaries of these regions do not necessarily coincide with COG and MPO boundaries. Table 10 matches Arizona's COGs and MPOs with the corresponding Framework regions. The four regions included the entire state except Maricopa and Pima counties, and the portion of Pinal County–generally northwest of the I-8/I-10 junction–covered by the MAG *Interstate 8 and Interstate 10 Hidden Valley Transportation Framework Study*.

Table 10 COG/MPOs and Transportation Framework Regions

COG or MPO	Framework Region(s)
CAAG	Central, Eastern, MAG Hidden Valley study area
NACOG	Eastern, Northern
SEAGO	Eastern
WACOG	Western
CYMPO	Northern
FMPO)	Northern
MAG	Not included in the four Framework regions
PAG	Not included in the four Framework regions
YMPO	Western

Source: bqAZ Statewide Technical Team, September 2009.

6.2.2 Focus Areas

Because of their large area, the Eastern, Northern and Western regions were divided into two or more focus areas. The purpose of these focus areas was (a) to enable stakeholders and interested citizens to focus more easily on

the communities or facilities of concern to them, and (b) to facilitate mapping at a legible scale. The Eastern region was divided roughly in thirds, from south to north: Cochise-Santa Cruz (consisting of those two counties), Copper Country, and Mogollon Rim. In the northern region, the New River focus area contained a slice of southern Yavapai County whose population and economic growth are closely linked to the growth of Maricopa County. The rest of the region was divided into Coconino-Yavapai and (in Apache and Navajo counties) Navajo-Hopi. The western region had two focus areas: Yuma Valley (Yuma County), and Mohave-La Paz. Figure 22 shows the focus area boundaries along with those of the four regions.

6.2.3 Organization of Regional Framework Study Teams

To ensure timely completion of the four Regional Framework Studies, ADOT contracted with two consultant teams for each region: a technical consultant responsible for transportation planning and the major written products, and a public involvement consultant responsible for community and stakeholder outreach. Each regional technical team reported to ADOT-MPD and its statewide technical consultant. Each regional public involvement team reported to ADOT-CCP and the statewide public involvement consultant.

Because recommendations from the four Regional Framework Studies were later to be melded into the Statewide Framework, maintaining methodological consistency among the regional technical teams was important. Therefore, both ADOT-MPD and its statewide technical consultant assigned an experienced planner to work with each of regional technical teams. Each of these eight regional liaisons (four from ADOT-MPD and four from the technical management consultant) attended all pertinent meetings and community events in her/his assigned region, provided advice throughout the process, and conducted the first review of submittals from the regional consultant.

6.2.4 Community and Stakeholder Involvement Opportunities

Regional Technical Advisory Teams

One or more Regional Technical Advisory Teams (RTAT) was formed in each of the four regions (Central, Eastern, Northern, and Western) to:

- Identify regional needs
- Discuss regional issues
- Craft the regional vision
- Provide technical input to interim working papers
- Review and comment on the *Regional Framework Study* recommendations

The organizations that participated in the RTATs are listed below. (In some regions, others were invited but failed to participate.) Collectively the RTATs represented all of Arizona's COGs and MPOs, 62 cities and towns, 14 counties, and 12 tribal communities. Each RTAT met from two to four times during the study, as Table 11 shows.

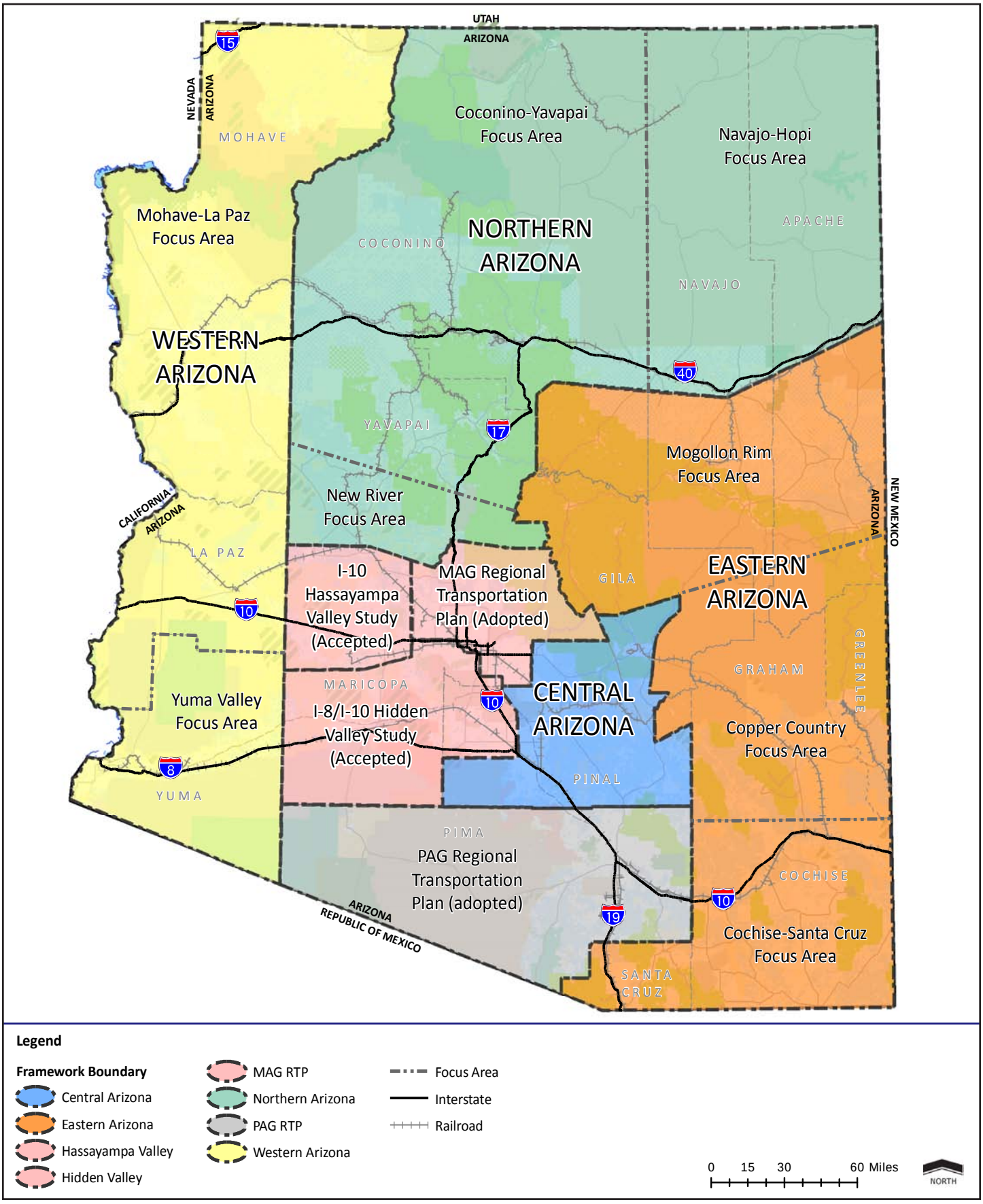
Central Region RTAT

- CAAG
- MAG
- PAG
- City of Apache Junction
- City of Casa Grande
- City of Coolidge
- City of Eloy
- Town of Florence
- City of Globe
- Town of Hayden
- Town of Kearny
- Town of Mammoth
- Town of Marana
- City of Maricopa
- Town of Miami
- Town of Oro Valley
- Town of Queen Creek
- Town of Superior
- Town of Winkelman
- Gila County
- Pima County
- Pinal County
- Gila River Indian Community
- Tohono O'odham Nation
- ADOT Environmental Planning
- ADOT Globe and Tucson Districts
- ADOT Predesign
- ASLD
- FHWA

Eastern Region RTATs

- SEAGO
- City of Benson
- City of Bisbee
- Town of Clifton
- City of Douglas
- Town of Duncan
- Town of Eagar
- Town of Huachuca City
- City of Nogales

Figure 22 Framework Regions and Focus Areas



- Town of Patagonia
- City of Payson
- Town of Pima
- Town of Pinetop-Lakeside
- City of Safford
- City of St. Johns
- City of Show Low
- City of Sierra Vista
- Town of Snowflake
- Town of Springerville
- Town of Star Valley
- Town of Thatcher
- City of Tombstone
- City of Willcox
- Apache County
- Cochise County
- Gila County
- Graham County
- Greenlee County
- Navajo County
- Santa Cruz County
- San Carlos Apache Tribe
- White Mountain Apache Tribe
- ADOT Safford District
- AGFD
- Apache-Sitgreaves National Forest
- BIA
- BIA Fort Apache Agency
- FHWA
- USDA Forest Service
- Freeport-McMoRan, Inc.
- Nogales Santa Cruz Port Authority

Northern Region RTATs

- CYMPO
- FMPO
- NACOG
- Town of Camp Verde
- Town of Chino Valley
- Town of Clarkdale
- Town of Colorado City
- City of Cottonwood
- Town of Dewey-Humboldt
- City of Flagstaff
- Town of Fredonia
- City of Holbrook
- Town of Jerome
- City of Page
- City of Prescott
- Town of Prescott Valley
- City of Sedona
- Town of Wickenburg
- City of Williams
- City of Winslow
- Apache County
- Coconino County
- Mohave County
- Navajo County
- Yavapai County
- Havasupai Tribe
- Hopi Tribe
- Hualapai Tribe
- Navajo Nation
- Yavapai-Apache Nation
- Yavapai-Prescott Tribe
- ADOT Flagstaff and Prescott Districts
- ADOT Regional Traffic Engineer
- FHWA
- USDA Forest Service
- Western Region RTATs
- WACOG
- YMPO
- City of Bullhead City
- City of Kingman
- City of Lake Havasu City
- Town of Parker
- Town of Quartszite
- City of San Luis
- City of Somerton
- Town of Wellton
- City of Yuma
- La Paz County
- Mohave County

Table 11 Regional RTAT Meetings

Region	# of RTATs	# of Meetings	Meeting Dates	Locations
Central	1	4	February, June, December 2008; April 2009	Florence
Eastern	3	3 x 4 = 12	May, July, October 2008; March-April 2009	Bisbee, Safford, Show Low, Sierra Vista, by Webinar
Northern	2	7	April, July-August, October 2008; April 2009	Flagstaff, Prescott, by Webinar
Western	2	2 x 2 = 4	October 2008; April 2009	Parker, Yuma

Source: bqAZ Statewide Technical Team, October 2009.

- Yuma County
- Cocopah Indian Tribe
- Colorado River Indian Community

Regional Public Outreach–Round 1

In March and April 2008, a series of stakeholder interviews, focus groups, and community events was held in each of the four regions. The purpose of the first round of community outreach was to understand critical issues, opportunities, and challenges that will affect the state's multimodal transportation system between now and 2050.

Nearly 600 people statewide participated in the first round of outreach efforts. The stakeholder interviews began in February 2008 and the last community events were held in late March of that year. Each of the events followed a standard planning template and the moderators in all regions used similar guidelines to ensure consistency.

Stakeholder Interviews: Building on past planning efforts, the purpose of interviewing key stakeholders was to understand issues, development trends and opinions about the future. Approximately 120 stakeholder interviews were conducted across the four regions.

Focus Groups: Three focus groups were conducted in each region. The purpose was to obtain expert input on topics of special importance throughout the state. The groups included representatives of the following interests:

- Commercial/Multimodal (e.g., railroads, trucking companies, shippers)
- Business and Development
- Environmental

Each group brought together experts to discuss opportunities and constraints affecting long-range transportation planning. Approximately 240 people participated in the focus groups. To maximize opportunities for participation, they were held at multiple locations: Florence and Globe (Central region); Safford, Show Low, and Sierra Vista (Eastern region); Flagstaff, Prescott, and Window Rock (Northern region); and Kingman, Parker, and Yuma (Western region).

Community Workshops: From two to four community workshops were held in each region. Their objectives were to inform the public and stakeholders, discuss issues, obtain input on impacts of alternatives and proposed projects, and solicit additional ideas. Interested stakeholders, developers, landowners, agencies, and citizens were invited to participate. Approximately 220 people participated in the community events.

This round of community outreach was preceded by vigorous publicity to encourage participation and stress the importance of shaping the future of transportation in Arizona. Publicity included newspaper, radio, and online advertisements, attendance at community events, flier distribution, television interviews, earned media (i.e., free media coverage provided because the project is newsworthy), and presentations from ADOT staff at local events.

Regional Public Outreach–Round 2

A second series of community workshops was held in November 2008. ADOT and its local and regional partners hosted these workshops across the state to present the three long-range transportation scenarios (described in the next section) to communities for feedback. Participants

Table 12 Round 1 and Round 2 Regional Community Workshops

Region	Round 1 Community Workshops		Round 2 Community Workshops	
	Locations	Attendance	Locations	Attendance
Central	Florence, Globe	60	Coolidge, Globe	53
Eastern	Nogales, Safford, Show Low, Sierra Vista	57	Nogales, Safford, Show Low, Sierra Vista	155
Northern	Flagstaff, Prescott, Window Rock	65	Flagstaff, Holbrook, Prescott, Window Rock	168
Western	Kingman, Quartzsite, Yuma	36	Bullhead City, Lake Havasu City, Yuma	108
	Total Attendance	**217**		**484**

Source: bqAZ Statewide Public Involvement Team, October 2009.

reviewed and provided input on the scenarios, which were developed with input from the spring 2008 workshops. Attendance reached nearly 500 participants statewide at the 13 community workshops. Table 12 shows the Round 1 and Round 2 workshop locations and attendance.

The objective of Round 2 public involvement was to involve elected officials, businesses and other interest groups in the process; to enhance the visibility of bqAZ in each region; and to reach a broad audience, including those not already engaged. Participants were encouraged to inspect and mark up detailed maps of the three transportation scenarios in their region.

The second round of community workshops, like the first, was preceded by an extensive publicity campaign to engage communities in shaping the future of transportation in Arizona. Outreach included newspaper, radio, and online advertisements, attendance at community events, flier distribution, television interviews, earned media, a video featuring the director of ADOT, and presentations from ADOT staff at local events.

Also during this round of public involvement, the bqAZ Statewide Public Involvement Team created an online survey instrument to present the alternative scenarios and solicit feedback on each. The online survey was widely publicized and provided an opportunity for input on any or all of the regional scenarios. Forty-nine people from all four regions responded to the survey from December 2008 through March 2009.

6.2.5 Regional Framework Reports

Each regional technical consultant team prepared three working papers and submitted them to the bqAZ Statewide Technical Team. After review, comment and revision, these working papers were published on the www.bqaz.gov website. The first working paper was a project management plan, including the public participation plan. The following outline (Table 13), which was common to all regions, shows the information provided to the Statewide Technical Team in *Working Paper 2, Existing and Future Conditions*, and *Working Paper 3, Scenarios and Evaluation Development*.

6.3 Long-Range Planning Scenarios

6.3.1 Common Elements

In the fall of 2008, the bqAZ Statewide Technical Team formulated three scenarios for the long-term evolution of Arizona and its transportation system. The scenarios were further developed after the thirteen community workshops held in November 2008 as part of the four regional framework studies described in the preceding section. Each scenario reflects a different transportation future for Arizona. The following characteristics apply to all three scenarios:

- All look ahead to 2050.
- All assume that the future of transportation will be substantially different from present conditions.
- All are multimodal, incorporating both roadways and public transportation.
- They include the principal locally controlled transportation facilities and services, as well as those for which ADOT is responsible.
- Each has its own set of proposed improvement projects and programs within each region.
- Each regional technical team identified the improvements for all scenarios within its region.
- Each regional team made extensive use of community input–especially from the stakeholder interviews and the two sets of public workshops held in 2008–to select the proposed improvements.
- In each region, some projects are common to two or more scenarios, while others are unique to one scenario.
- All scenarios involve phased implementation of the transportation improvements over several decades.
- To show a seamless transportation system, the bqAZ Statewide Technical Team and the four regional technical consultants coordinated the elements of each scenario across regional boundaries.

6.3.2 Three Distinct Long-Range Transportation Scenarios

The three scenarios differ in their assumptions about the transportation future of Arizona and the U.S. Scenario A is based on a "technological fix" that will keep the cost of driving affordable to 2050 and beyond, thereby allowing drivers to rely on their personal vehicles just as they do today. Scenario B posits that escalating fuel prices will impel travelers to switch to public transit for many of their regular trips currently made by private auto (e.g., employment, education). Scenario C, like B, involves a substantial shift to public transit, but in this case the shift reflects widespread changes in urban land use planning to reflect new housing and lifestyle preferences, as suggested in Chapter 3 of this report. Changes in travel demand (Scenarios B and C) and urban land use characteristics (Scenario C) would likely occur gradually over the next forty years and beyond.

Table 13 Standard Outline of Working Papers 2 and 3

Topic	Sub-Topic
Working Paper 2	
Environmental Context	Geology and Topography
	Hydrological Resources and Issues
	Natural Infrastructure
	Cultural Infrastructure
	Air Quality
	Hazardous Materials
	Environmental References
Land Use	Existing Land Use
	Future Land Use
	Generalized Land Ownership
	Public Land Management Studies
	Large Planned and Proposed Development Projects
Existing Roadway System	State Highway System
	Other Principal Arterial Roadways by Focus Area*
	Study Area Roadway Functional Classification Systems
	Existing Traffic Volumes and Percent Trucks
	Existing and Proposed Major Bridges and Structures
	Railroad Grade Crossings
Existing Public Transportation	Local and Regional Transportation Systems
	Special Needs Transportation Services
	Intercity Bus and Rail Transportation
Aviation Facilities	Primary Airports
	Secondary Airports
	Heliports
Rail Freight Infrastructure and Services	Class 1 Railroads
	Short Line Railroads
	Industrial Railroads
	Tourist Railroads
Bicycle and Pedestrian Transportation Systems	
Programmed (Funded) Short-Term Transportation Improvements	
Planned (Unfunded) Short- and Long-Range Improvements	Highways
	Public Transit
	Rail
	Pedestrian/Bicycle
Summary of Related Studies and Reports	Completed Studies
	Studies Currently Underway
	Funded Future Studies

Topic	Sub-Topic
Working Paper 3	
Modeled Regional Roadway Network	Year 2005 Network
	Year 2030 Base (Existing plus Committed) Network
Population and Employment Data and Projections by County	
2005 Congested Roadway Segments	
Non-Capacity-Related Roadway Needs (2008 to 2030)	Critical Needs Definition
	Small Area Transportation Studies and Corridor Definition Studies
	Other Studies and Plans
	Input from Stakeholders and Community Workshops
Transit and Passenger Rail Needs	Year 2030 Base (Existing and Committed) Transit System
	Rural Transit Needs Study and Responses to Executive Order #2007-02
	Recent Small Area Studies and Local or Regional Transit Studies
	Transit Propensity Analysis
	Input from Stakeholders and Community Workshops
Conceptual Overview of Long-Range Scenarios (2050)	Background and Approach
	Scenario A (Personal Vehicle Mobility)
	Scenario B (Transit Mobility Emphasis)
	Scenario C (Focused Growth)
Elements of Regional Transportation Scenarios	Definition of Improvement Categories
	Scenario A Improvements
	Scenario B Improvements
	Scenario C Improvements
	Summary
	Quantities for Cost Estimation by Scenario
Evaluation of Scenarios	Planning Factors, Goals, Criteria and How Measured
	Evaluation Matrix and Results
	Conclusion
General Policies and Issues**	Intelligent Transportation Systems
Transportation Systems Management	
Travel Demand Management	
Pedestrians and Bicycles	
Freight Transportation	

*Focus areas were not used in the Central region because of its size.
**Not every regional team addressed every topic.
Sources: HDR, Inc., Kimley-Horn and Associates, PB, URS Corporation

Scenario A: Personal Vehicle Mobility

This scenario is the closest to the status quo, insofar as it assumes that personal vehicles will continue to be used for most trips in 2050 and beyond. It assumes that cleaner and more efficient automotive vehicle technologies (i.e., fuels and engines other than traditional gasoline and diesel) will be further developed, and will gradually become pervasive in the fleet. This technological progress will enable people to continue driving their own vehicles affordably, with minimal harm to the environment and without excessive emission of greenhouse gases. However, recognizing that existing public transportation is inadequate, especially in rural areas, the scenario calls for moderate transit investment beyond existing-plus-committed levels. Such investment will increase in metropolitan areas and medium-sized cities, as well as between communities. Scenario A also assumes that long-range land use and development patterns will be consistent with currently adopted local plans, such as municipal general plans and county comprehensive plans.

Scenario B: Transit Mobility Emphasis

In contrast with Scenario A, this scenario assumes that automobiles and trucks will continue to rely on fuels whose prices continue to increase in the long run, making personal vehicle use less affordable for many. While some technological progress will occur, it will not counterbalance the rising cost of vehicle use and ownership. Scenario B also assumes that pollutant emissions and greenhouse gases will continue to rise and remain a major concern to society. As a result of the increasing costs and environmental concerns, demand for public transportation will increase dramatically, so this scenario emphasizes extensive local, regional, and intercity transit improvements. Like Scenario A, Scenario B assumes future consistency with existing local and community plans. Unlike Scenario A, Scenario B envisions a notable reduction in VMT. Under any scenario, however, private vehicles will remain the predominant form of transportation, especially in rural and small urban areas.

Scenario C: Focused Growth

Like Scenario B, this third scenario assumes a mix of increased public transit use and technological progress. Scenario C differs from Scenarios A and B in assuming that, where appropriate, existing long-range plans will be modified to encourage and support more intense land use in urban areas, with more compact development patterns and greater emphasis on mixing compatible land uses. Many cities, towns, and counties will embrace Smart Growth principles over time in their general and comprehensive plans. This will eventually result in reduced VMT, shorter trips, more multi-purpose trips, and more trips achieved through alternative modes (walking, bicycling, transit). Current land use plans may not change in many smaller, more rural communities, however. In general, Scenario C has a balanced emphasis on roadway and transit investments, although with less emphasis on transit than found in Scenario B.

Under Scenario C, the necessary changes in land use policy will need to occur at the local level, although state government may be able to provide technical assistance and support, as well as incentives. Many communities may gravitate toward Smart Growth principles as a result of the socioeconomic trends discussed in Chapter 3, and could be encouraged by state policies that link community development and infrastructure funding with a community's progress in implementing Smart Growth. In addition, these changes will occur gradually over several decades, especially because many land development entitlements are already in place around the state.

Regional Application across Arizona

The bqAZ Statewide Technical Team then explained the concepts governing the three 2050 scenarios to the four regional consultant teams. The regional teams were responsible for creating a multimodal list of projects and programs that could be used to implement the scenarios in the regions. With input from the community and a wide range of stakeholders, each regional consultant developed a separate list of roadway and transit projects for Scenarios A, B, and C.

6.3.3 Sources of Projects for Long-Range Regional Scenarios

The most important part of the work done for Working Paper 3 in each region, as outlined in the preceding section, was the development of transportation projects for Scenarios A, B, and C. Ideas for roadway, transit, and rail needs came from many sources, including the following:

- Results of the statewide travel demand modeling process described in 6.4 below, which forecast year 2050 deficiencies on major roadways throughout the state and each of the four regions. Application of the model was the main source of capacity-driven needs in each region. Depending on local conditions and the scenario, a transit or rail project rather than a highway capacity increase may have been the best solution for a future deficiency.
- The critical needs assessment performed by the

bqAZ Statewide Technical Team to estimate 2030 transportation needs (see 6.1 above).

- Input received directly from the RTATs, COGs, MPOs, local elected and appointed officials, other stakeholders, and the public at large, as described above. Comments from all of these sources also helped the regional consultant teams to select projects gleaned from other sources, and in some cases to modify them so they would better meet local needs.
- Results of the November 2007 *Arizona Rural Transit Needs Study*, available on the ADOT website.
- Proposed projects and programs to address "critical needs," submitted in response to Executive Order #2007-02, as described in 6.1 above.
- The transit propensity analysis was conducted by the bqAZ Statewide Technical Team. This analysis used recently developed techniques to estimate the propensity of residents to use public transit services between Arizona communities.
- More than 140 transportation studies, plans, and other relevant documents reviewed by the regional technical consultants.

6.3.4 Regional Scenarios A, B, and C

Working Paper 3 from each regional team illustrates and lists the roadway and transit (including rail) elements in Scenarios A, B, and C for that team's assigned region. Table 14 shows the types of transportation project or improvement proposed in each regional scenario, before those scenarios were adjusted by the bqAZ Statewide Technical Team. While details vary from one region to another, the types of improvements included in each scenario are similar across regions. (The Central region is unique because of its extensive urbanization expected as the Sun Corridor Megapolitan grows.) Although Scenario A emphasizes roadway improvements and the other scenarios focus more on transit, all scenarios in every region contain highway projects, and all contain transit projects except Scenario A in the Eastern region. With the exception of rail, public transit operates on roads and requires adequate roadway capacity to function efficiently.

6.3.5 Areas Outside the Regional Frameworks: Maricopa and Pima Counties, and MAG Hidden Valley Study Area

During preparation of the Statewide Planning Framework, MAG and PAG were updating their long-range regional transportation plans as part of their regular planning process. Therefore, ADOT relied exclusively on MAG for a long-range transportation vision in Maricopa County and on PAG for a similar vision in Pima County. Maricopa County includes the entire area of the *I-10 Hassayampa Valley Transportation Framework Study* and a portion of the *I-8 and I-10 Hidden Valley Transportation Framework Study* area. The Statewide Framework Program treated the entire Hidden Valley area, which contains portion of both the MAG and CAAG regions, as a unit for which MAG assumed long-range planning responsibility.

6.4 Statewide Travel Demand Modeling

To support the long-range visioning process of the Statewide Transportation Planning Framework Program, ADOT developed a quick-response statewide travel demand model, the Arizona Travel Demand Model (AZTDM), to evaluate long-range scenarios. The purpose of the model is to evaluate and compare the systemwide performance of the scenarios. The AZTDM had its origins in the *Statewide Mobility Reconnaissance Study*.

The bqAZ Statewide Technical Team relied on collaboration with the regional teams. Each of the latter–Central, Eastern, Northern, and Western–collected data needed for model development from its study area. The Statewide Technical Team compiled data from each regional technical team and from the MPOs and COGs; it then developed the travel demand model from data on population, employment, and roadway characteristics.

Development and validation of the statewide travel demand model is detailed in the May 2009 *Statewide Travel Demand Model Development and Validation Report*. It includes discussion covering:

- Socioeconomic data attributes
- Trip generation
- Trip distribution and highway assignment
- Highway assignment validation

6.4.1 Population and Employment Projections

In September 2008, the bqAZ Statewide Technical Team detailed the population and employment estimates compiled for the AZTDM. The *Statewide Travel Demand Model Population and Employment Projections* paper described the development of:

- State traffic analysis zone (STAZ) geography
- 2005 socioeconomic data
- 2030 and 2050 socioeconomic projections
- Southwest Sketch Planning Tool socioeconomic data

Table 14 Proposed Transportation Improvement Types by Region and Scenario

Type of Improvement	Scenario A				Scenario B				Scenario C			
	C	E	N	W	C	E	N	W	C	E	N	W
Widen Interstate highway	√	√	√	√	√	√	√	√	√	√	√	√
Widen other state highway	√	√	√	√	√	√	√	√	√	√	√	√
Widen other principal arterial[1]	√	√	√	√	√		√		√	√	√	√
Improve[2] Interstate highway			√				√				√	
Improve[2] non-Interstate highway	√	√	√	√	√	√	√		√	√	√	√
Improve[2] other principal arterial	√	√	√		√	√	√		√	√	√	
Construct new 8-lane freeway			√								√	
Construct new expressway				√				√				√
Construct new 6-lane freeway	√				√				√			
Construct new high-occupancy vehicle (HOV) lanes	√				√				√			
Construct new 6-lane Arizona Parkway	√				√				√			
Construct new 2-lane principal arterial	√		√		√				√		√	
Construct new 4-lane principal arterial	√	√	√	√	√		√	√	√		√	√
Construct new 6-lane principal arterial	√		√		√		√		√		√	
Construct new principal arterial (width indeterminate)				√								√
Construct or reconstruct local service traffic interchange on existing Interstate highway[3]			√	√			√	√			√	√
Reconstruct existing local service interchange to system interchange			√	√				√				√
Establish new express bus service	√				√				√			
Establish new intercity bus service	√		√	√	√	√	√	√	√	√	√	√
Develop new transit center (passenger transfer facility, with or without parking)	√		√	√	√		√	√	√		√	√
Provide new or enhanced local transit service in communities (e.g., fixed route, community circulator, dial-a-ride)	√		√	√	√	√	√	√	√	√	√	√
Establish new passenger rail service (regional or intercity)					√	√	√	√	√		√	√
Improve existing passenger rail service							√				√	
Establish enhanced freight rail service						√						
Bicycle and pedestrian improvements						√				√		
Provide commuter transit (unspecified)										√		

C = Central E = Eastern N = Northern W = Western

[1] Includes widening some roads to Arizona Parkways in Central region.
[2] "Improve" refers to improvements other than increased capacity (construction of additional through traffic lanes). These include shoulder widening, climbing lanes, passing lanes, drainage, pavement, and other projects that enhance safety and driveability.
[3] New freeways proposed in the Central and Northern regions would require local service interchanges, as well as system interchanges at junctions with existing Interstate highways.

Sources: HDR, Inc., Kimley-Horn and Associates, PB, URS Corporation; Regional Transportation Framework Studies, Working Paper 3, June 2009.

Figure 23 illustrates projected Arizona population and employment density in 2030 and 2050.

6.4.2 External Traffic Growth

Estimates of traffic entering and exiting the AZTDM model area are an important component of the forecasts. The bqAZ Statewide Technical Team developed the Southwest Sketch Planning Tool (SWSPT) to use in developing 2030 and 2050 traffic volumes at external stations (points where traffic enters and exits the model area) on the perimeter of the AZTDM. In addition to using the SWSPT, the team looked at previous planning studies and overall population growth trends to develop external traffic volume estimates.

Southwest Sketch Planning Tool

The SWSPT road network is a high-level network that includes Interstates and key state and county routes. Existing traffic count data on these facilities were used with a matrix estimation algorithm to develop year 2005 vehicle trip interaction. This sketch planning technique uses 2005 travel patterns to establish 2030 and 2050 passenger vehicle forecasts based on population growth rates.

The SWSPT traffic analysis zone (TAZ) geography and socioeconomic estimates are described in the working paper *Statewide Travel Demand Model Population and Employment Projections*, September, 2008. The model development and validation process are described in the May 2009 *Statewide Travel Demand Model Development and Validation Report*.

Existing-plus-Committed Road Network

The SWSPT existing-plus-committed roadway network incorporated capacity improvements programmed within Arizona and bordering Southwestern states. A capacity improvement is defined as a new roadway or new general purpose travel lanes in each direction. The existing-plus-committed network was based on funded, programmed improvements compiled from the Departments of Transportation of Arizona, California, Nevada, New Mexico, and Utah. (The roadway network in northern Mexico was assumed to remain the same in the future.)

The existing-plus-committed scenario is a no-action or no-build alternative. In this scenario, no transportation infrastructure would be added to the Arizona roadway system, except improvements already programmed for implementation. This includes existing 2005 roads along with committed (funded) road improvements identified by ADOT, COGs, MPOs, tribal communities, counties, municipalities, and DOTs of neighboring states.

Only major routes that may affect regional travel were incorporated as committed roads in the existing-plus-committed road network. Figure 24 shows the number of lanes by route that the travel demand model used for this network, while Figure 25 shows the functional classification of each route in the network.

Forecast Preparation

Table 15 shows 2005 population estimates and the regional population growth projections for 2030 and 2050. Figures 26 and 27 show projected 2030 and 2050 population density in the Southwest region. The bqAZ Statewide Technical Team prepared TAZ-level growth factors based on the regional population growth estimates. These factors were applied to 2005 trip interactions by TAZ to estimate 2030 and 2050 trips. Traffic forecasts were developed for

Table 15 SWSPT Population Growth Projections

State (or portion thereof)*	Population		
	2005	2030	2050
Arizona[1]	6,021,000	11,123,000	14,856,000
California (Southern)[2]	22,142,000	29,530,000	34,574,000
Utah (Southern)[3]	243,000	625,000	1,007,000
Nevada (Clark County)[4]	1,711,000	2,861,000	3,149,000
Colorado (Southwest)[5]	354,000	594,000	785,000
New Mexico (Western)[6]	1,557,000	2,260,000	2,822,000
Sonora, Mexico[7]	2,413,000	2,841,000	3,215,000
Baja California, Mexico[7]	2,823,000	5,075,000	6,875,000
Chihuahua, Mexico[7]	1,954,000	2,303,000	2,669,000
Total	**39,218,000**	**57,212,000**	**69,952,000**

*Population estimates are for the SWSPT area only

Sources:
[1] bqAZ Statewide Technical Team, August 2008.
[2] California Department of Finance, June 2001; Population Division U.S. Census Bureau, March 2006.
[3] Utah Office of Planning Budget, January 2008; Population Division U.S. Census Bureau, March 2006.
[4] Clark County Department of Comprehensive Planning.
[5] Colorado Department of Local Affairs, August 2004; Population Division U.S. Census Bureau, March 2006.
[6] Bureau of Economic Research, University of New Mexico, April 1997.
[7] Projections of the Population in Mexico 2005-2030, Municipalities, National Population Council, Ministry of the Interior, January 2008.

Figure 23 Arizona Population and Employment Density

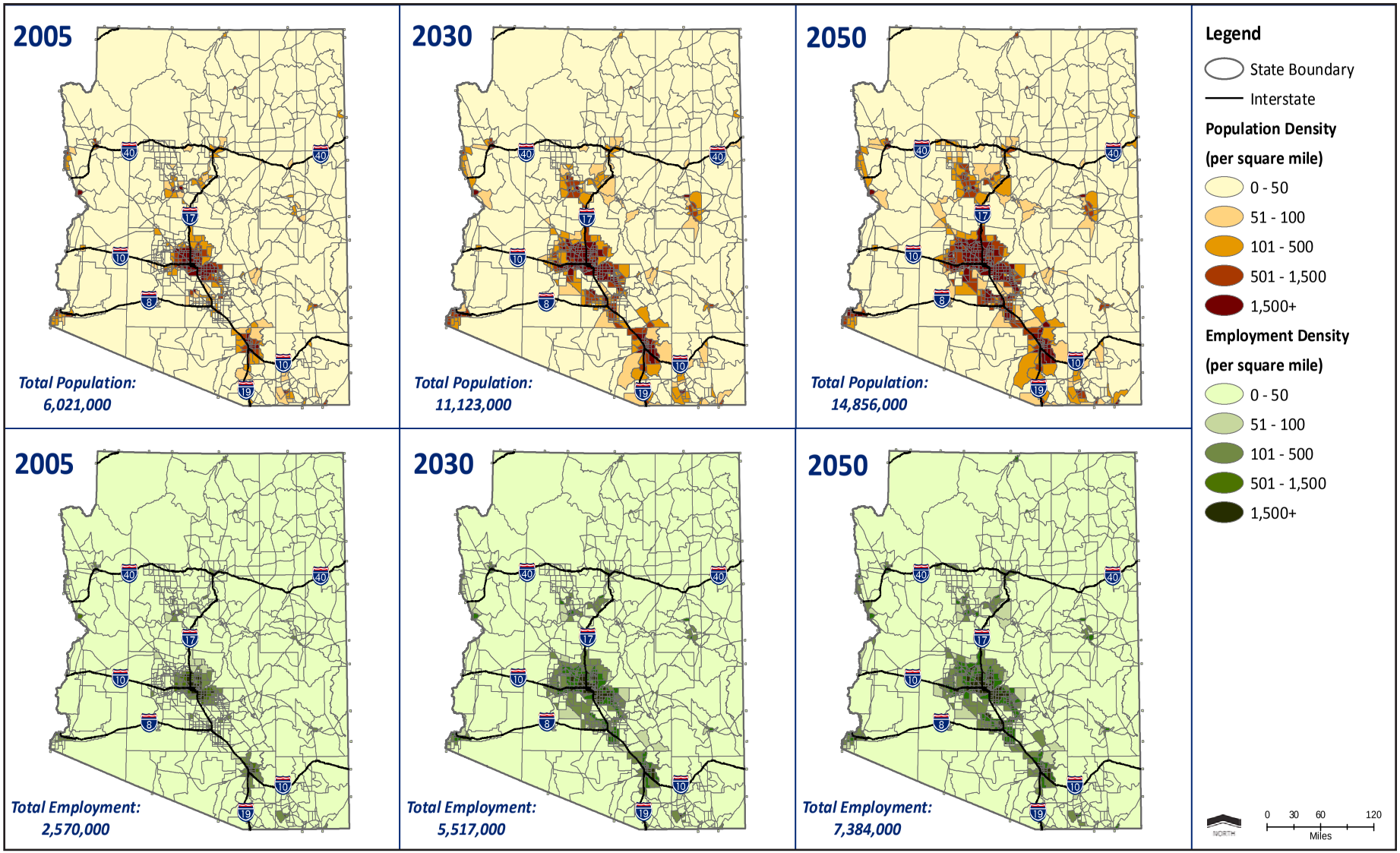


Figure 24 Existing-plus-Committed Roadway Network Lanes

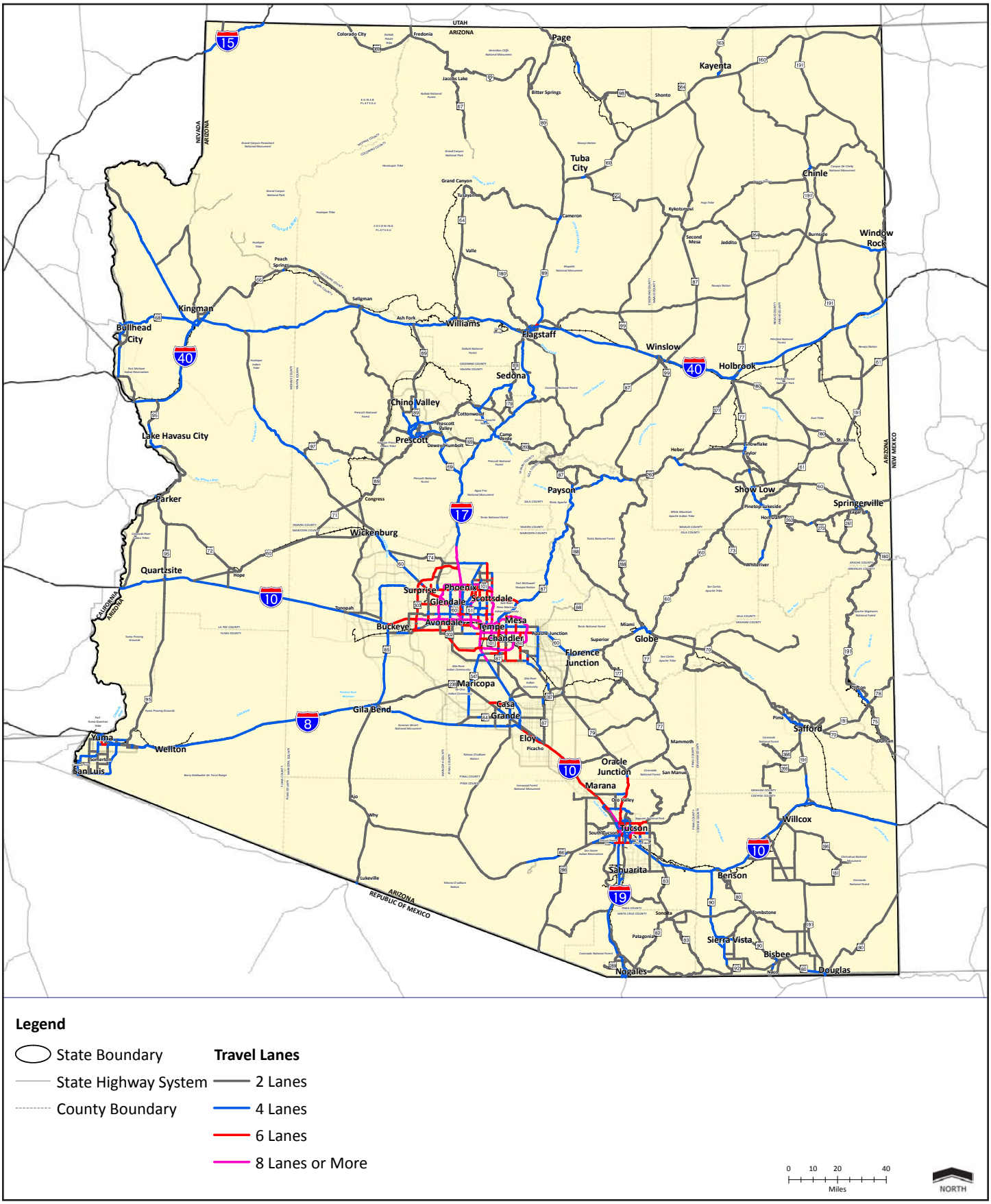


Figure 25 Existing-plus-Committed Roadway Functional Classification

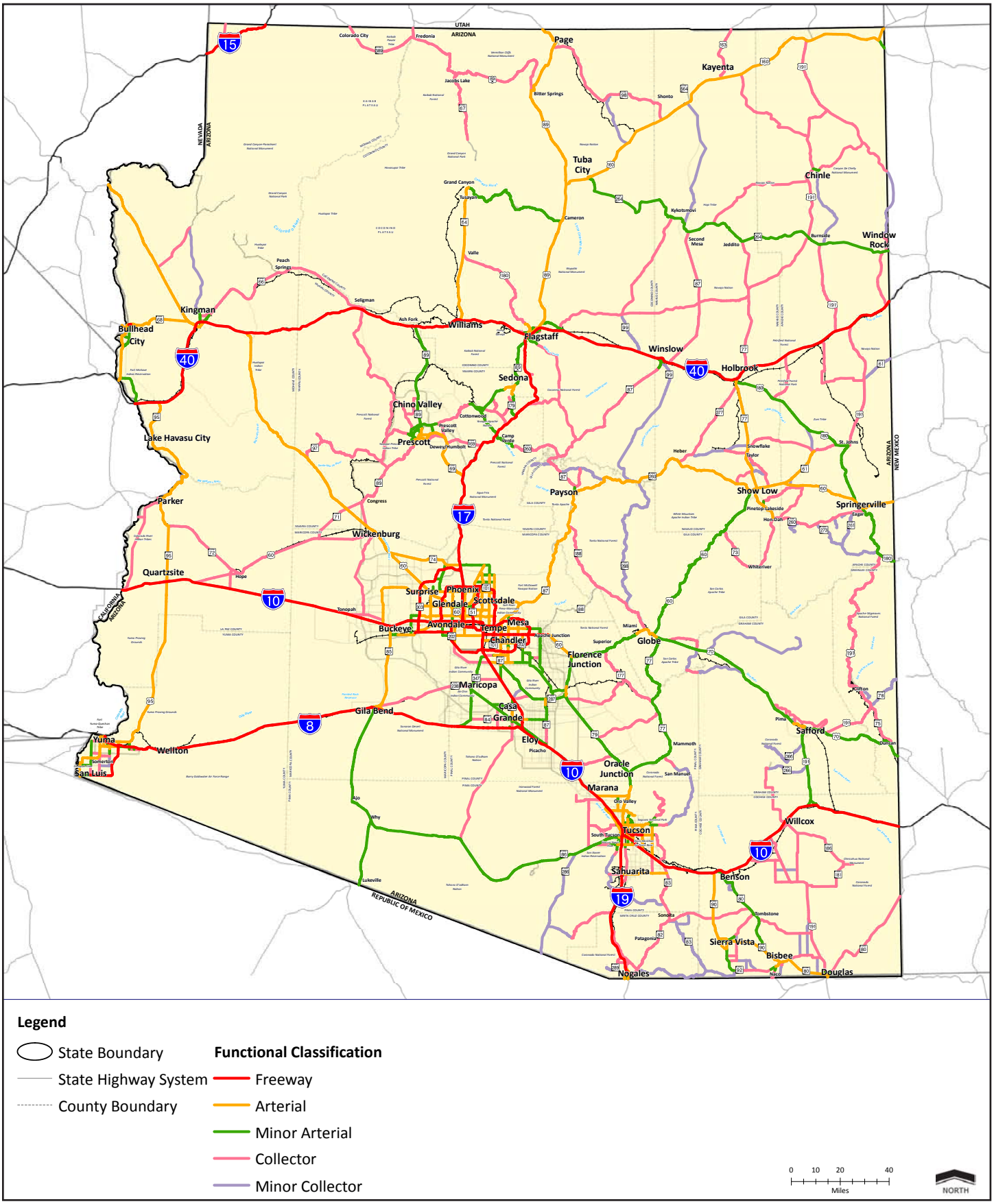


Figure 26 2030 Southwest Region Population Density

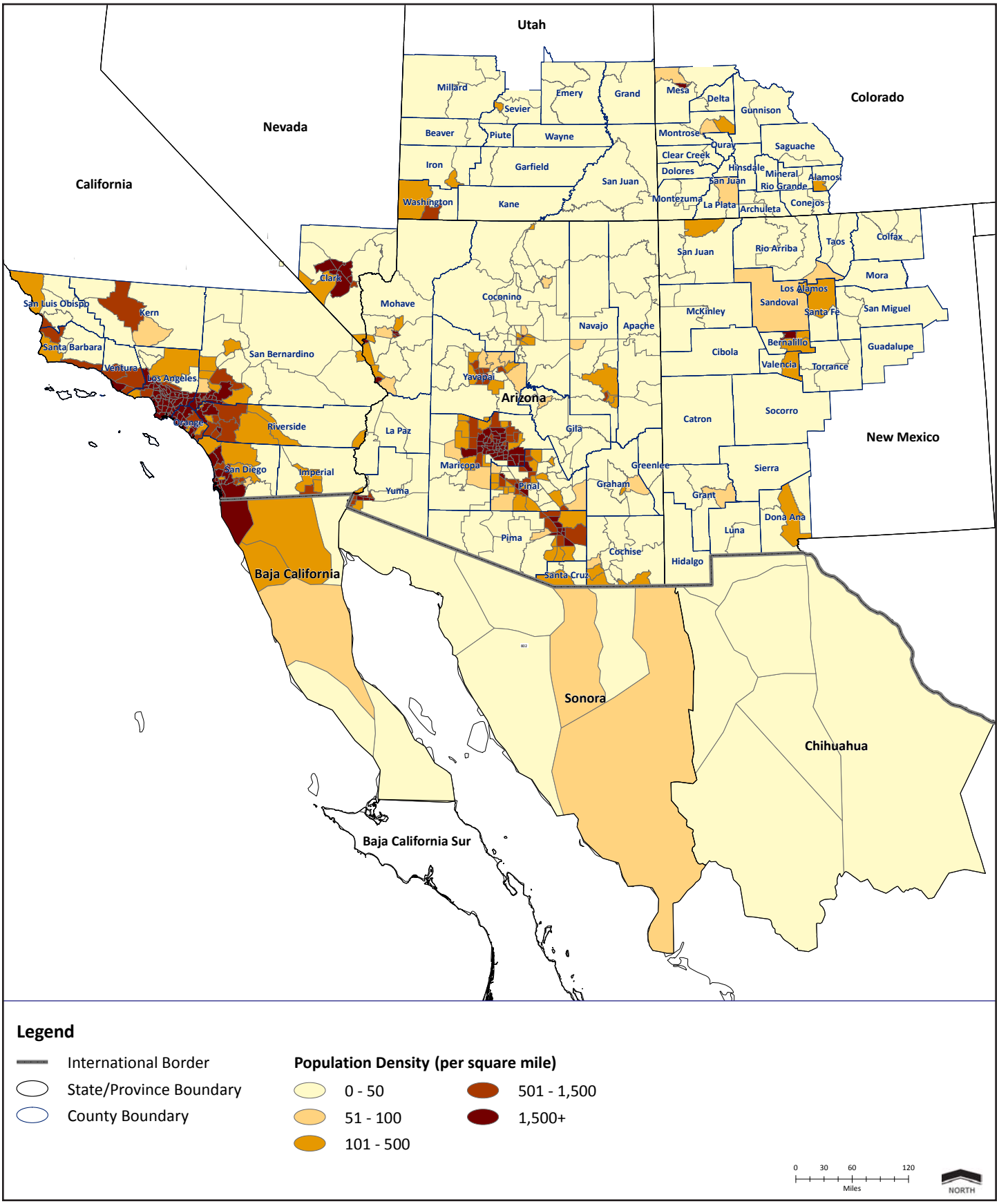
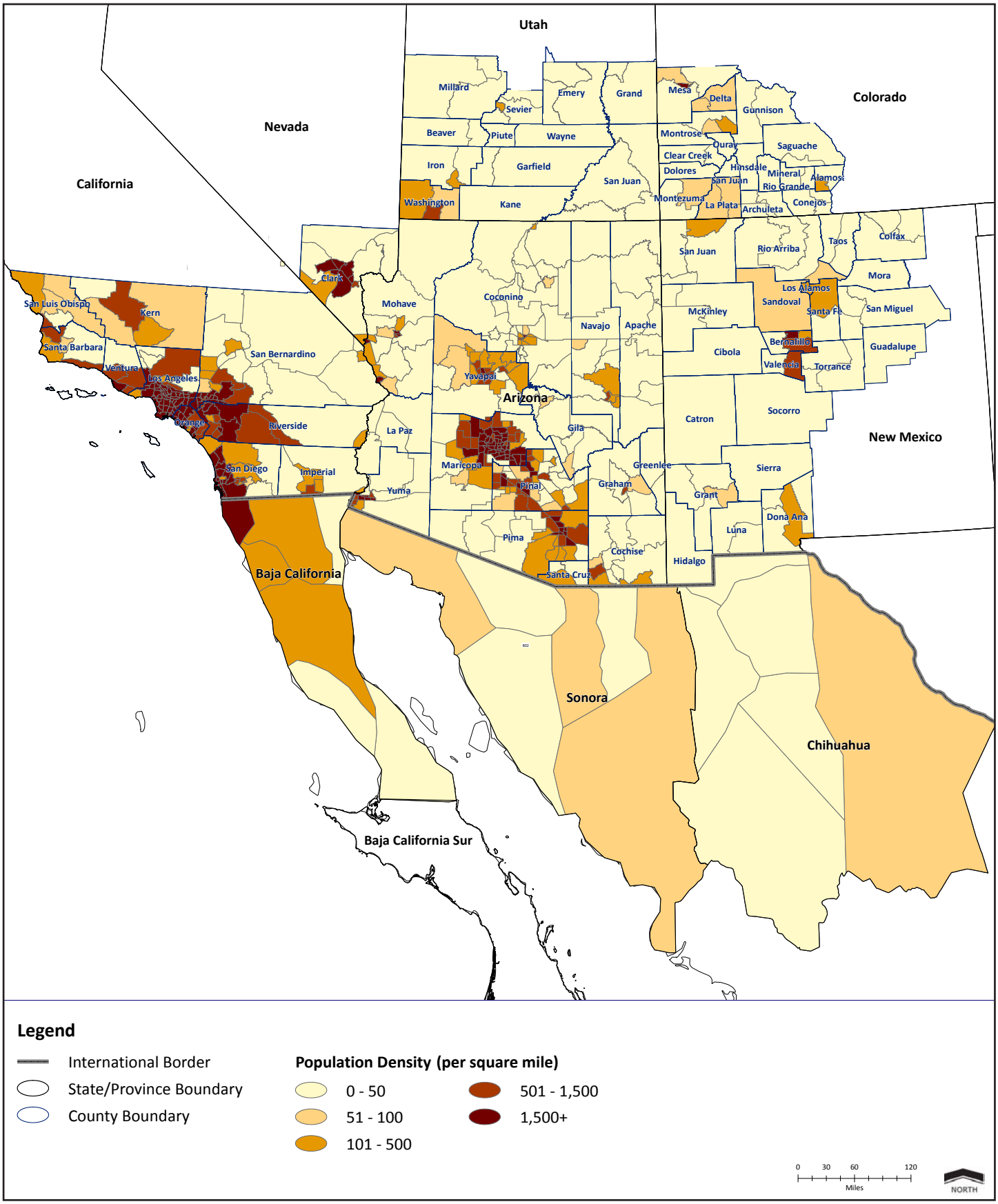


Figure 27 2050 Southwest Region Population Density



2030 and 2050 using the existing-plus-committed future roadway network and resultant trips between origins and destinations.

6.4.3 External Station Growth Estimates

Using output from the 2030 and 2050 SWSPT, the bqAZ Statewide Technical Team estimated annual traffic growth rates at external stations (on key roads along the Arizona perimeter). The SWSPT growth rates were used to make an initial estimate of external station traffic volumes for 2030 and 2050.

Next, the bqAZ Statewide Technical Team compared the initial 2030 and 2050 external station traffic volume estimates with estimates from other studies. This included comparing the rate of traffic growth from the SWSPT to Arizona's overall population growth rate for 2030 and 2050. For US 93, the Team also considered the additional automobile and commercial truck traffic that will come with the completion of the new Colorado River bridge near Hoover Dam. From this reasonableness check, the bqAZ Statewide Technical Team made adjustments to growth rates that seemed either too high or low. Table 16 shows the 2005 traffic counts, and the 2030 and 2050 traffic volume estimates, at each external station. This table also shows the annual traffic growth rate at each external station.

To support the Statewide Framework and other planning efforts, ADOT purchased a TRANSEARCH commodity flow database from Global Insight for 2005 and 2030. The TRANSEARCH database shows commodity flows that move to, from, or through Arizona by truck, rail or air.

The 2005 commodity flow database was used to establish origin-destination patterns for single-unit and multiple-unit commercial vehicles moving through the state. The 2030 commodity flow database was used to establish 2030 commercial vehicle origin-destination patterns. For 2050, the bqAZ Statewide Technical Team extrapolated commodity flow patterns from 2030 based on traffic growth forecasts at the external stations.

6.4.4 Highway Assignment

Assignment is a travel demand modeling step that loads vehicle trips onto the modeled road network. This section discusses the highway assignments developed for the four scenarios (existing-plus-committed, A, B, and C) using the AZTDM. The discussion includes the trip reduction method used to account for anticipated increases in non-auto trips in Scenarios B and C.

Trip Reduction Method–Central, Eastern, Northern, and Western Regions

Both Scenario B and Scenario C assume a shift in daily trip making from personal motor vehicles to public transit, walking, and bicycling. Additional investment in transit and more compact land use patterns would result in fewer vehicle trips on regional roads. Steps were implemented in the AZTDM for Scenarios B and C to simulate trip reduction related to this shift to non-auto modes in the Central, Eastern, Northern, and Western regions.

This approach to automotive vehicle trip reduction is that walk/bike and transit mode shares are related to place size and place type. Non-auto mode shares will increase because of improved facilities and services, growth in cities and towns, and household efforts to avoid auto-related costs such as fuel. More compact, mixed-use urban form will also increase non-auto mode shares in Scenario C. Most mode shifts will occur in urban places, primarily cities and towns. Very limited shifts are expected in rural areas.

Table 17 shows the non-auto mode shares by place type that were applied to AZTDM trip generation for Scenarios B and C to simulate reduction in vehicle trips. The bqAZ Statewide Technical Team estimated 2030 and 2050 non-auto trip mode shares for cities and towns outside the MAG and PAG regions (Table 18), using projected population and the national travel behavior research cited in Table 17.

The AZTDM traffic forecasts do not reflect continued public transit investment in Maricopa County or Pima County. The MAG and PAG models are the appropriate tools for adjusting future traffic volumes for estimated transit use in these urban areas.

6.4.5 Existing-plus-Committed Highway Assignment

The bqAZ Statewide Technical Team prepared highway assignments using the existing-plus-committed road network (which is identical in 2030 and 2050) using different approaches. Neither the 2030 nor the 2050 existing-plus-committed model is able to finish naturally and produce a highway assignment. There is insufficient capacity in the network to handle the travel demand from projected growth. The existing-plus-committed network "crashes" (i.e., fails to produce meaningful results) under 2030 and 2050 conditions.

The AZTDM uses an iterative multiple feedback loop that optimizes trip distribution based on road congestion.

Table 16 AZTDM External Station Traffic Volume Estimates

External Station ID	External Station	2005 Traffic Count	2030 Traffic Volume Estimate	Growth Rate per year (%) 2005-2030	2050 Traffic Volume Estimate	Growth Rate per year (%) 2030-2050
1099	Ehrenberg-Parker Highway	123	210	2.8%	330	2.9%
1100	US 95 South	26,919	49,570	3.4%	72,130	2.3%
1101	SR 8B	18,850	35,150	3.5%	51,020	2.3%
1102	I-8 West	36,633	67,760	3.4%	98,340	2.3%
1103	SR 286 South	1,282	2,100	2.6%	3,120	2.4%
1104	SR 85 South	1,151	1,880	2.5%	2,790	2.4%
1105	SR 189 South	12,474	20,610	2.6%	30,940	2.5%
1106	I-19 South	23,923	39,630	2.6%	59,470	2.5%
1107	US 191 South	12,165	19,900	2.5%	29,400	2.4%
1108	Naco Highway	3,701	6,080	2.6%	8,970	2.4%
1109	SR 80 East	393	640	2.5%	940	2.3%
1110	I-10 East	14,129	23,230	2.6%	34,720	2.5%
1111	US 70 East	1,752	2,910	2.6%	4,380	2.5%
1112	SR 78 East	360	590	2.6%	870	2.4%
1113	I-10 West	24,847	40,680	2.5%	60,550	2.4%
1114	SR 95 West	8,320	15,590	3.5%	24,970	3.0%
1115	SR 95 West	12,199	21,350	3.0%	30,070	2.0%
1116	I-40 West	12,769	20,900	2.5%	31,080	2.4%
1117	SR 95 West	35,139	59,910	2.8%	85,600	2.1%
1118	SR 95 West	731	1,220	2.7%	1,880	2.7%
1119	US 93 West	2,484	23,430	33.7%	37,470	3.0%
1120	I-15 North	22,930	36,570	2.4%	55,950	2.6%
1121	Hwy 91 North	1,308	2,050	2.3%	2,980	2.3%
1122	I-15 North	22,968	36,640	2.4%	56,040	2.6%
1123	SR 389 North	4,054	12,060	7.9%	17,890	2.4%
1124	US 89A North	5,133	22,510	13.5%	33,760	2.5%
1125	US 89 North	4,455	7,190	2.5%	10,850	2.5%
1126	US 163 North	2,861	4,600	2.4%	6,770	2.4%
1127	SR 264 East	16,274	26,660	2.6%	40,160	2.5%
1128	US 180 East	1,004	1,640	2.5%	2,430	2.4%
1129	US 60 East	301	1,250	12.6%	1,860	2.4%
1130	SR 61 East	247	410	2.6%	610	2.4%
1131	I-40 East	17,370	28,410	2.5%	42,230	2.4%
1132	US 64 East	2,889	4,660	2.5%	6,920	2.4%
1133	US 160 North	2,155	3,520	2.5%	5,320	2.6%

Source: bqAZ Statewide Technical Team, June 2009.

Table 17 AZTDM Non-Auto Trip Mode Shares by Place Type, 2030 and 2050

Mode	Rural	Towns (5K - 10K)	Cities (10K - 25%)	Cities (25K - 50K)	Cities (50K - 100K)	MPOs (100K+)	MAG/PAG
2030 Non-Auto Mode Share							
Walk/Bike	1%	2%	4%	5%	6%	6%	0%
Transit	0%	0%	0%	1%	2%	2%	0%
Total Non-Auto	**1%**	**2%**	**4%**	**6%**	**8%**	**8%**	**0%**
2050 Non-Auto Mode Share							
Walk/Bike	1%	3%	7%	8%	12%	12%	0%
Transit	1%	1%	1%	2%	4%	4%	0%
Total Non-Auto	**2%**	**4%**	**8%**	**10%**	**16%**	**16%**	**0%**

Sources: National Household Travel Survey 1995; U.S. Census Journey to Work.

Table 18 AZTDM Non-Auto Trip Mode Shares by Location

Place	Framework Region	2030		2050	
		Population Range (000)	Non-Auto Mode Share	Population Range (000)	Non-Auto Mode Share
All communities	Central	>100	8%	>100	16%
Benson	Eastern	5-10	2%	10-25	8%
Bisbee	Eastern	10-25	4%	10-25	8%
Douglas	Eastern	25-50	6%	25-50	10%
Nogales	Eastern	25-50	6%	25-50	10%
Payson	Eastern	10-25	4%	25-50	10%
Safford	Eastern	10-25	4%	10-25	8%
Show Low	Eastern	10-25	4%	25-50	10%
Sierra Vista	Eastern	50-100	8%	50-100	16%
Camp Verde	Northern	10-25	4%	10-25	8%
Chinle	Northern	5-10	2%	10-25	8%
Cottonwood	Northern	10-25	4%	25-50	10%
CYMPO (Prescott area)	Northern	>100	8%	>100	16%
FMPO (Flagstaff area)	Northern	>100	8%	>100	16%
Holbrook	Northern	5-10	2%	5-10	4%
Page	Northern	10-25	4%	10-25	8%
Sedona	Northern	10-25	4%	25-50	10%
Tuba City	Northern	10-25	4%	10-25	8%
Winslow	Northern	10-25	4%	10-25	8%
Bullhead City	Western	50-100	8%	50-100	16%
Kingman	Western	25-50	6%	50-100	16%
Lake Havasu City	Western	50-100	8%	50-100	16%
YMPO (Yuma County)	Western	>100	8%	>100	16%
All Communities	MAG	>100	0%	>100	0%
All Communities	PAG	>100	0%	>100	0%
All Communities	I-8 and I-10 Hidden Valley	>100	0%	>100	0%

Source: bqAZ Statewide Technical Team, November 2008; Flagstaff mode shares based on Flagstaff travel diary and related work done for FMPO.

The model iterates through the trip distribution and assignment steps until changes in overall travel times and trip distribution stabilize and convergence is reached. The feedback loop uses the method of successive averages to reach an equilibrium solution. Using this method, output volumes from trip assignment from previous iterations are weighted together to produce the current iteration's link volumes. Adjusted congested times are then calculated based on the normal volume-delay relationship. This adjusted congested time is then fed back to the process of determining the shortest path between any two zones, known as "skimming."

Under both 2030 and 2050 conditions, important highway corridors have insufficient capacity in the existing-plus-committed scenario for the multiple feedback loop to execute successfully. Excessive traffic volumes cause the model's volume-delay function to lower speeds on some congested segments to near zero. When speeds approach zero on multiple road segments, the gravity model is unable to resolve and the entire trip distribution-highway assignment process crashes. (A gravity model is a common algorithm used to assist in forecasting future trip patterns. It includes variables such as distance traveled and total travel activity to estimate the interaction between any two traffic analysis zones. The gravity model was originally generated from an analogy to Newton's gravitational law.)

The bqAZ Statewide Technical Team used "workarounds" (expedients) to prepare 2030 and 2050 existing-plus-committed highway assignments. For 2030, the Team applied a growth factor to roadway capacities to simulate additional roadway infrastructure. The vehicle trip table derived from this model run was applied to the 2030 existing-plus-committed network with normal capacities to obtain a highway assignment. For 2050, the highway assignment was prepared by applying the final trip table from the 2050 Scenario A model run to the existing-plus-committed network with normal capacities.

Scenario A Assignment

This highway assignment was prepared with no modifications to AZTDM trip generation or road network parameters. Adequate road capacity is available in the Scenario A network for the AZTDM to successfully execute an assignment. No changes to the network or trip tables were needed for the model to complete all necessary iterations of the multiple feedback loop.

Scenario B Assignment

This assignment was prepared using the non-auto mode share trip reduction discussed earlier. Several corridors in the Scenario B network did not have sufficient highway capacity for the AZTDM process to finish naturally. As in the existing-plus-committed case, excessive traffic volumes cause the model's volume-delay function to lower speeds on some segments to near zero. The gravity model is unable to resolve and the entire trip distribution-highway assignment process crashes.

In this situation, the bqAZ Statewide Technical Team identified the segments with speeds near zero and added one additional roadway lane in each direction to add capacity. Capacity was added to 318 road segments representing 242 centerline miles in the Sun Corridor (Maricopa, Pima, and Pinal counties). With this additional capacity on highly congested segments, the AZTDM was able to successfully complete all necessary iterations of the multiple feedback loop.

The high levels of congestion in the Scenario B network indicate that this network is inadequate to accommodate projected 2050 demand. Either additional non-auto trip reduction or additional highway capacity will be necessary to bring demand into better balance with the network in heavily traveled corridors.

Scenario C Assignment

This assignment was prepared using the non-auto mode share trip reduction discussed earlier. Adequate road capacity is available in the Scenario C network for the AZTDM to successfully execute a highway assignment. No changes to the network or trip tables were needed for the model to complete all necessary iterations of the multiple feedback loop.

6.4.6 Analysis of Performance

Analysis of scenarios performance is deferred to Section 6.8, to allow comparison of Scenarios A, B, C, and existing-plus-committed with the Recommended Statewide Scenario.

6.5 Amalgamation of Regional Scenarios into Statewide Scenarios

6.5.1 Amalgamation of Regional Scenarios A, B, and C

The three Statewide Scenarios were created by assembling the three scenarios for each region (Central, Eastern, Northern, and Western), along with the MAG *I-10 Hassayampa Valley Transportation Framework Study*

(2007) and *I-8 and I-10 Hidden Valley Transportation Framework Study* (2009) recommendations, the MAG (adopted 2007) and PAG (underway 2009) *Regional Transportation Plan* updates, the PAG *High Capacity Transit System Study* recommendations (September 2009), and the MAG *Regional Transit Framework Study* findings (fall 2009). Since each Regional Framework focused on roadway and transit within its region, adjustments were required to remove the inconsistencies along corridors crossing from one region to another. Connectivity between the regions was examined to ensure that highway improvements were consistent across regional boundaries, and that intercity bus and passenger rail connections were shown between destinations in neighboring regions.

After integrating each family of regional scenarios into a unified statewide scenario (A, B, or C), each statewide scenario was examined for adherence to its underlying philosophy and the project's vision and guiding principles, where then appropriate adjustments made. Although the three scenarios assign different emphases to roadway and transit improvements, each relies on a strong roadway network to support growth through 2050. An effective transit system requires a robust roadway network on which to operate.

The scenario refinement process also addressed capacity issues identified through travel demand modeling, and included selected improvements that were not part of the regional scenarios, but were deemed of statewide or interregional importance. Further refinements to the statewide scenarios were based on input received from several sources, including common interest group workshops with statewide perspective, stakeholder meetings, and consultations with COGs, MPOs, and elected officials.

6.5.2 MAG Long-Range Roadway and Transit System

The MAG *Regional Transit Framework Study* identified three "transit mobility" scenarios for 2030: Basic Mobility, Enhanced Mobility, and Transit Choice. These three scenarios are not related to Statewide Framework Scenarios A, B, and C. The Basic Mobility scenario is a low-cost expansion plan that includes a limited number of new routes, services, and capital investments. This scenario also includes a few extensions to existing regional routes and enhanced service on routes with high demand. This scenario keeps additional operating and capital costs to a minimum, because it assumes no additional funding other than continuation of the existing half-cent transportation sales tax from 2026 to 2030.

The Enhanced Mobility scenario builds on the Basic Mobility scenario, but focuses on adding options for faster and more frequent regional transit service in the highest-demand corridors. It would offer several types of new or improved service, including "Supergrid" (local bus service on important regional routes); arterial bus rapid transit; express bus; all-day, high-capacity service (light rail or busway); and peak-period, high-capacity service (commuter rail or bus rapid transit). New facilities to serve riders and vehicles would be constructed. This scenario assumes an approximate doubling of transit expenditures per resident in the MAG region, to approximate the level of spending in the Denver region today.

The Transit Choice scenario includes the transit investments from the Basic Mobility and Enhanced Mobility scenarios. In addition, more areas with high transit demand would be served with new or expanded regional transit service options, providing a more comprehensive regional transit system. High-capacity services would be introduced in additional corridors. This scenario assumes an approximate quadrupling of transit expenditures per resident, to approximate the level of spending in metropolitan Seattle today. MAG selected the Transit Choice scenario for use in all three statewide scenarios.

On the highway side, MAG is currently updating its RTP, originally adopted in November 2003 and served as the basis for the successful ballot Proposition 400 in November 2004, which extended the half-cent Maricopa County sales tax to fund regional transportation improvements for 20 years. From the expected roadway improvements in the RTP update, MAG provided one standard roadway network scenario for 2050 to the bqAZ Statewide Technical Team. This 2050 roadway network was combined with the recommendations of the Hassayampa and Hidden Valley Framework studies into a regional network. Members of the team met with senior MAG transportation staff to discuss details of the roadway network for inclusion in the three statewide scenarios. The conceptual MAG 2050 roadway network, like the rail and bus system in the Transit Choice scenario, builds on the programmed 2026 regional transportation system being developed with funding from the current countywide half-cent sales tax.

6.5.3 PAG Long-Range Roadway and Transit System

In early 2009, PAG began working with the bqAZ Statewide Technical Team to identify projects and programs in Pima

County for the Statewide Framework. PAG is also updating its long-range RTP, *2040 Mobility Matters*. The 2040 RTP envisions an energy-efficient and environmentally responsible regional transportation system that is interconnected, multimodal, technologically advanced, and integrated with sustainable land use policies. It includes bus (local and rapid transit), commuter rail, light rail transit and modern streetcars, as well as a regional freight planning component. Long-term goals for the Pima County transportation system are:

- **Multimodal expansion:** A balanced network of expanding mobility choices to meet rail, highway, transit, roadway, bicycle, and pedestrian needs.
- **Integrated transportation choices:** A user-friendly transportation network that integrates modes, connects to facilities outside the region, and optimizes mobility for people and goods.
- **Sustainable land use:** Vibrant, sustainable communities that link transportation and land use.
- **Economic sustainability:** A healthy, growing economy well-served by the transportation network.
- **Safety:** Safety and security for all transportation users across the region.
- **Environmental stewardship:** Natural resource protection, and energy efficiency in transportation planning, design, construction, and management.
- **Accessibility:** Transportation options and access for all users, including youth, elderly, low-income, and persons with disabilities.
- **System performance:** Unobstructed mobility through efficient system operations.

The RTP recommendations will be complete in spring 2010. Numerous stakeholders–such as governments, Sun Tran, environmental and business communities, non-profit organizations, and the general public–are helping PAG staff develop the plan.

The RTP task force created a subcommittee to develop a preferred alternative for the Statewide Framework. The subcommittee developed Scenario A, Scenario B, Scenario C, and a recommended scenario ("Scenario Pima") for Pima County. The main difference between Scenario Pima and the others is that Scenario Pima omits an I-10 bypass of the Tucson area and an extension of La Cholla Boulevard north through Oro Valley as an alternative to Oracle Road (SR 77). However, the subcommittee recognized that a need exists for more routes and connectivity between Pima and Pinal counties, and that the roadway and transit improvements in Scenario Pima are insufficient over the long-term to solve projected traffic congestion in the Sun Corridor. Members addressed this issue through policy recommendations that stress the need to plan across regional boundaries in the coming decades.

6.5.4 Consultation with Neighboring States

Long-range transportation planners must recognize that Arizona has connections with the transportation network in adjacent U.S. and Mexican states. To ensure that recommendations of the Statewide Framework fit in the regional context, the bqAZ Statewide Technical Team reviewed the plans and programs of adjacent states, and introduced their Department of Transportation or equivalent agency to bqAZ. Meetings were held from November 2008 through February 2009 with the DOT (or equivalent) of each neighboring state: California, Nevada, New Mexico, Utah, and Sonora, Mexico.

The following paragraphs summarize the primary transportation issues of each state related to Arizona. The Statewide Framework addressed these issues where appropriate.

- **California:** State transportation planning in California emphasizes improved north-south connections in the state. Potential improvements to I-40 and I-10 include truck-only lanes associated with Intelligent Transportation Systems (ITS) technology, which might extend into Arizona. Currently, no improvements are programmed to the east-west Interstates in eastern California. High-speed rail priorities established through the successful statewide funding referendum in November 2008 involve the recently approved north-south initiative, extending from Sacramento and the Bay Area to Los Angeles, and eventually south to San Diego. A Los Angeles-Las Vegas-Salt Lake City high-speed rail connection is a secondary concern, and a link to Phoenix could be included. The *California-Baja California Border Master Plan,* funded by FHWA, may serve as a template for other border states, including Arizona, regarding the planning, programming, and prioritization of border and port of entry transportation-related improvements for the next 20 years, within 60 miles (100 kilometers) north and south of the binational border.

- **Nevada:** The major focus in Nevada is the Las Vegas to Los Angeles connection, which may take the form of high-speed rail and spawn a Las Vegas to Phoenix route. The expansion of US 93 to freeway (or Interstate highway) standards and improved bridges for access between Laughlin, Nevada and Bullhead City are more localized border concerns that affect Arizona.

- **New Mexico:** New Mexico emphasizes improving the safety and reliability of I-40 and I-10, with a focus on investments to support incident management, particularly in inclement weather such as snowstorms in the north, and dust storms in the south. The state also wants to improve local mobility between communities near the Arizona-New Mexico border, to provide enhanced access for goods and services.

- **Utah:** Utah has no planned or programmed improvement projects that affect the Arizona border area. The state would like to see improvements to US 89, widening it to four lanes from Flagstaff to I-15 near St. George. An improved north-south roadway on the eastern edge of the state would improve access for recreational travel. A high-speed rail connection between Salt Lake City and Phoenix, via Las Vegas, could supplement a passenger rail link from Salt Lake City to Los Angeles.

- **Sonora, Mexico:** Improvements to the Mexico/Arizona border crossings are a priority for the Mexican state of Sonora. The state supports a new inland port and proposed improvements that would make Guaymas a deep-water port for container ships from around the Pacific Rim. Implementation of these projects would require significant improvements to the Ferromex rail line from Guaymas north to Nogales. Sonora plans to upgrade the principal north-south highway, MEX15, to a freeway, and build a new coastal highway from San Luis to Puerto Penasco and eventually to Guaymas. The road just south of and parallel to the Arizona/Sonora border, extending west to San Luis, is also programmed for improvements. While not located in Sonora, the Mexican federal government is also moving forward on the development of a new deep-water port at Punta Colonet, on the west coast of Baja California. If successful, one logical transportation connection proposed to connect the port to the U.S. is through Yuma, requiring construction of a new railroad corridor, as well as a higher-capacity roadway connection. Planned improvements on both sides of the border for each Mexico/Arizona border crossing are illustrated in Figure 28.

6.5.5 Final Statewide Scenarios

Figures 29, 30, and 31 illustrate the final statewide scenarios. As in the four regions, each scenario consists of a different mix of roadway and transit improvements (including rail in Scenarios B and C).

6.6 Evaluation of Scenarios

The following evaluation was intended to test the ability of each scenario to help the state fulfill the vision and guiding principles in Chapter 2. Each scenario has its advantages and drawbacks, but all can offer a far better transportation future than the gridlock forecast for much of the state if nothing is done. This is especially clear when one compares Scenarios A, B, and C to the 2050 Base (i.e., the existing-plus-committed network), using the quantitative criteria under Principle I, Improve Mobility and Accessibility, or IVA, Promote and Increase Energy Security.

An evaluation template provided a structure to evaluate multimodal transportation scenarios in each of the four regions, in the larger context of Smart Growth, sustainable development, and sound transportation planning. The template was subsequently refined for use in an aggregate statewide evaluation of the same scenarios. The statewide evaluation did not include the MAG region, the PAG region, or the Pinal County portion of the MAG Hidden Valley study area.

Table 19 shows the guiding principles, goals, criteria, and measurement procedures that the bqAZ Statewide Technical Team used to evaluate the three scenarios. The first column lists the five guiding principles presented in Chapter 2. The second column states a goal associated with each principle. The third column lists one or more evaluation criteria used to specify objectives that can help meet each goal. The last column indicates how the performance of each scenario was measured with respect to the criteria. Some criteria are quantitatively measurable, while others are non-quantitative. The numerical data used for criteria IA, IC, ID, IVA, and IVB comes from output of the statewide travel demand model.

On all criteria, whether numerically based or not, each scenario was given a rating of ■ (best rating), ◩ (intermediate), or □ (worst rating). The ratings are relative; i.e., they reflect how the three scenarios fare against one another, so (for example) a rating of □ (worst) does not necessarily mean that a scenario performs badly on some absolute scale.

Table 20 shows the results of the statewide evaluation for the year 2050. Like Table 19, it includes the guiding principles, evaluation criteria, and one or more measures for each criterion. It also includes a rating scale for each criterion, whether quantitative or non-quantitative. The right-hand portion of the matrix contains the results–either numerical or non-quantitative–for each scenario, along with ratings

Figure 28 International Border Improvements

U.S. Border Improvements

San Luis I

Northbound
- 14 personal vehicle lanes
- 6 pedestrian lanes
- 1 bus/RV lane
- 1 private farm bus lane
- 1 bike lane
- Automated lanes

Southbound
- Secured deportation path
- Dedicated pedestrian path
- Expanded vehicular lanes

Project Cost
- Approximately $75 million
- $7 mill. for design: FY 08
- Approx. $68 million: FY 12
- ADOT working with San Luis on Small Area Transportation Study

San Luis II

Northbound
- 2 cargo lanes plus one oversize lane
- 25 cargo inspection docks
- Expandable to include non-commercial operations

Southbound
- 2 cargo southbound lanes
- 6 cargo inspection docks

Project Cost
- Approx. $42 million: FY 07; completed March 2010
- ADOT in process of building an expressway to I-8; approximately $90

Lukeville

Northbound
- 5 personal vehicle lanes
- 1 designated RV lane
- 1 cargo lane

Southbound
- 2 lanes with no inspection facilities
- ADOT and FHWA working on conducting long-term master plan

Project Cost
- Approximately $2.5 million; to be complete May 2010

Sasabe

Customs and Border Patrol does not anticipate significant expansions.

Additional technologies may be installed as they become available; for example, in 2006 radiation monitoring portals were installed to inspect all inbound traffic.

Project Cost
- N/A

Mariposa

Northbound
- 12 personal vehicle lanes
- 8 commercial lanes
- 56 docks for cargo inspection, expandable by 44 docks
- Dedicated pedestrian path and 1 bus/RV lane

Southbound
- 1 pedestrian lane
- 1 repatriation lane (restricted access)
- 2 personal vehicle/cargo lanes

Project Cost
- $13.7 million for design
- Approx. $200 million for construction; to be complete late 2013

DeConcini

Customs and Border Patrol does not anticipate any significant expansions.

Additional technologies may be installed as they become available; for example, in 2006 radiation monitoring portals were installed to inspect all inbound traffic.

Project Cost
- N/A

Naco

Customs and Border Patrol does not anticipate any significant expansions.

Additional technologies may be installed as they become available; for example, in 2006 radiation monitoring portals were installed to inspect all inbound traffic.

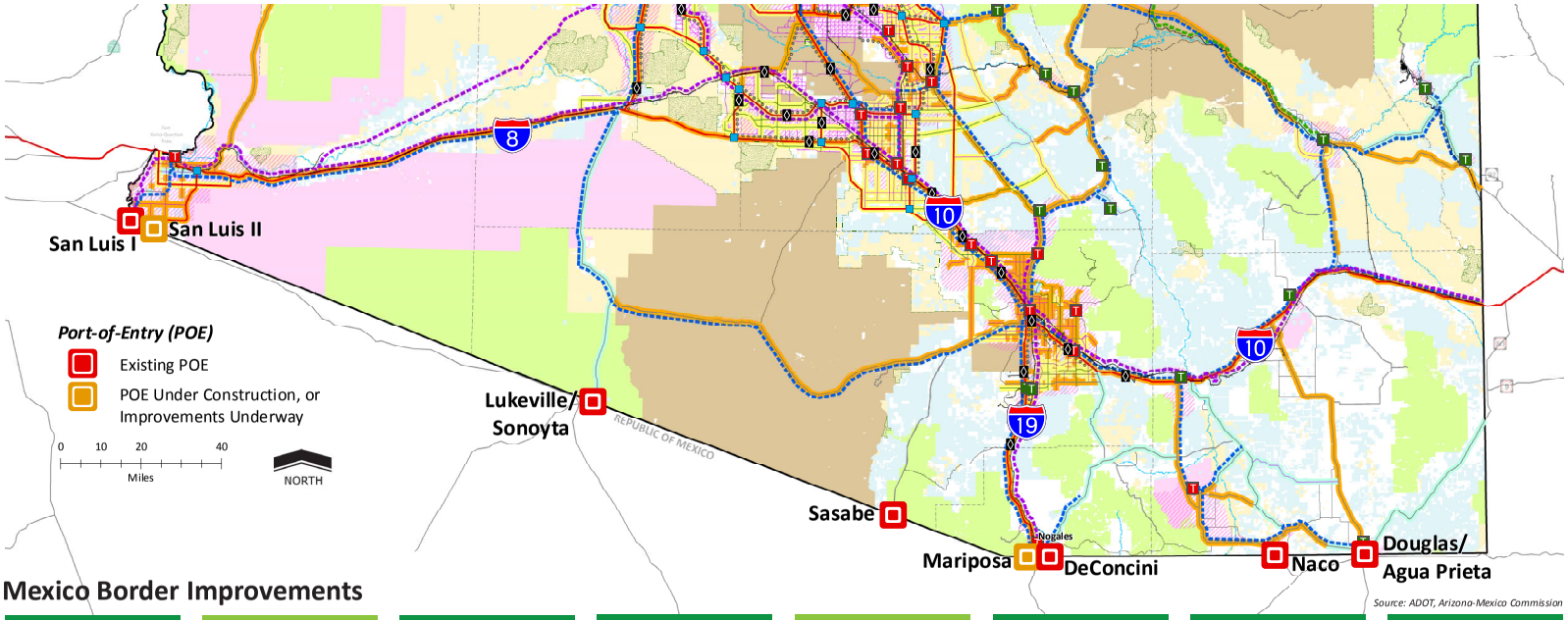
Project Cost
- N/A

Douglas

Northbound
- 3 cargo lanes
- 20 cargo inspection docks
- Dedicated pedestrian path
- 8 personal vehicle lanes
- 16 secondary personal vehicle lanes
- 1 bus lane

Southbound
- 1 cargo primary lane
- 2 cargo inspection docks
- 2 personal vehicle lanes
- 1 pedestrian lane

Project Cost
- Approximately $7 million; to be complete 2016



Source: ADOT, Arizona-Mexico Commission

Mexico Border Improvements

San Luis I

No planned improvements. ADOT to conduct bi-national study on inbound and outbound traffic, to commence summer 2010, to identify needed improvements on both sides of the border.

San Luis II

- 4 lanes to USA
- 2 lanes for tourists
- 1 lane, buses, imports
- 5 red light inspection stations
- 2 lanes, exports

Project Cost
- Approximately $11.1 mil.; to be complete Mar 2010
- Awaiting approval from Mexican Federal Govt.

Sonoyta

- 4 lanes to USA
- 2 lanes for tourists
- 1 lane, buses, imports
- 5 red light inspection stations
- 2 lanes, exports

Project Cost
- Approximately $2.6 mil.
- Awaiting approval from Mexican Federal Govt.

Sasabe

No planned improvements.

Mariposa

Northbound
- 3 personal vehicle lanes
- 4 commercial lanes
- Dedicated pedestrian path

Southbound
- 2 personal vehicle lanes
- 2 commercial lanes
- Dedicated pedestrian path
- 1 pedestrian lane
- 1 repatriation lane

DeConcini

No planned improvements.

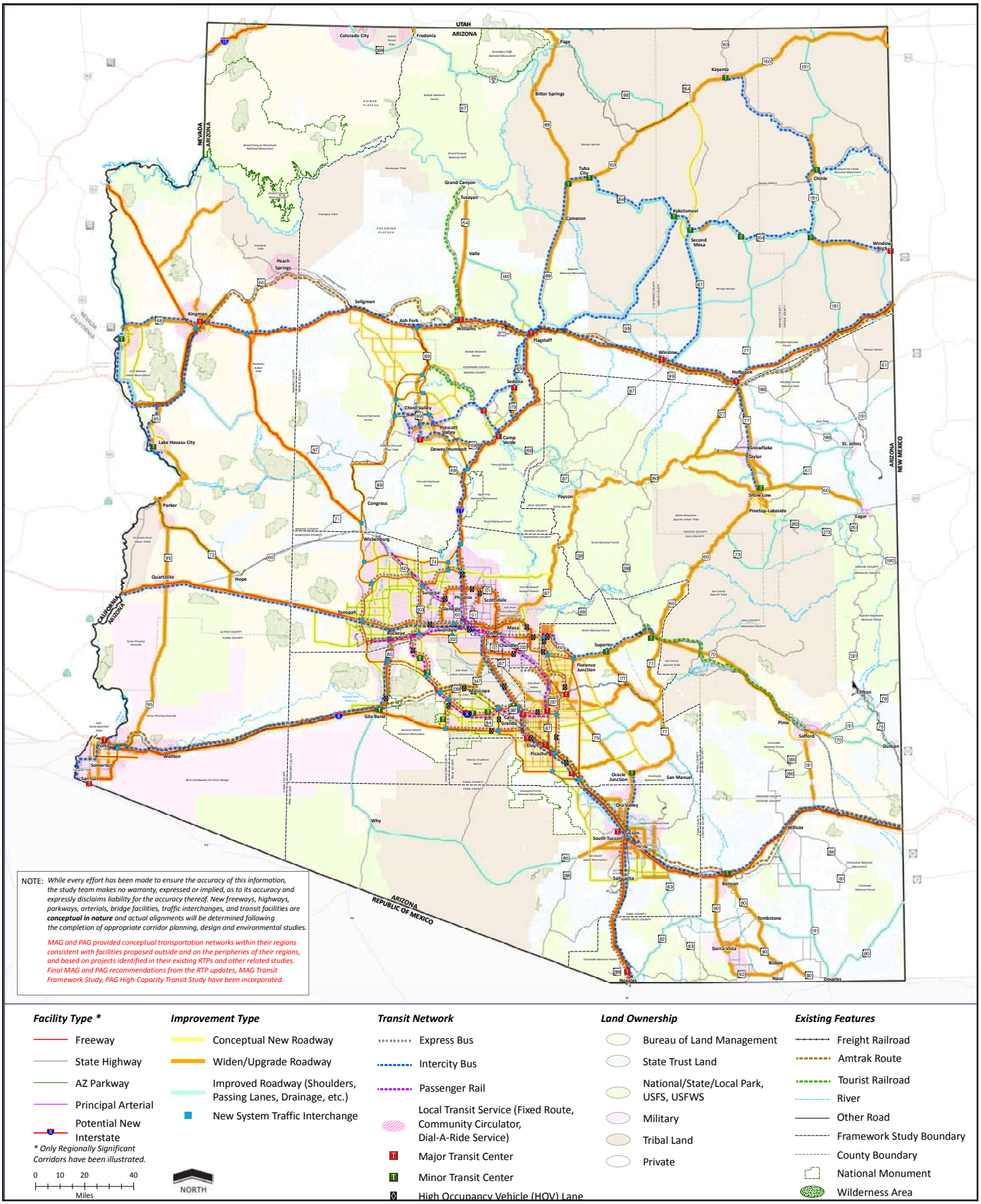
Naco

No planned improvements.

Agua Prieta

No planned improvements. Agua Prieta to choose preferred site for POE expansion by April 2010.

Figure 29 Statewide Scenario A: Personal Vehicle Mobility



NOTE: *While every effort has been made to ensure the accuracy of this information, the study team makes no warranty, expressed or implied, as to its accuracy and expressly disclaims liability for the accuracy thereof. New freeways, highways, parkways, arterials, bridge facilities, traffic interchanges, and transit facilities are* ***conceptual in nature*** *and actual alignments will be determined following the completion of appropriate corridor planning, design and environmental studies.*

MAG and PAG provided conceptual transportation networks within their regions consistent with facilities proposed outside and on the peripheries of their regions, and based on projects identified in their existing RTPs and other related studies. Final MAG and PAG recommendations from the RTP updates, MAG Transit Framework Study, PAG High-Capacity Transit Study have been incorporated.

Facility Type *
- Freeway
- State Highway
- AZ Parkway
- Principal Arterial
- Potential New Interstate

** Only Regionally Significant Corridors have been illustrated.*

0 10 20 40
Miles

NORTH

Improvement Type
- Conceptual New Roadway
- Widen/Upgrade Roadway
- Improved Roadway (Shoulders, Passing Lanes, Drainage, etc.)
- New System Traffic Interchange

Transit Network
- Express Bus
- Intercity Bus
- Passenger Rail
- Local Transit Service (Fixed Route, Community Circulator, Dial-A-Ride Service)
- Major Transit Center
- Minor Transit Center
- High Occupancy Vehicle (HOV) Lane

Land Ownership
- Bureau of Land Management
- State Trust Land
- National/State/Local Park, USFS, USFWS
- Military
- Tribal Land
- Private

Existing Features
- Freight Railroad
- Amtrak Route
- Tourist Railroad
- River
- Other Road
- Framework Study Boundary
- County Boundary
- National Monument
- Wilderness Area

Figure 30 Statewide Scenario B: Transit Mobility

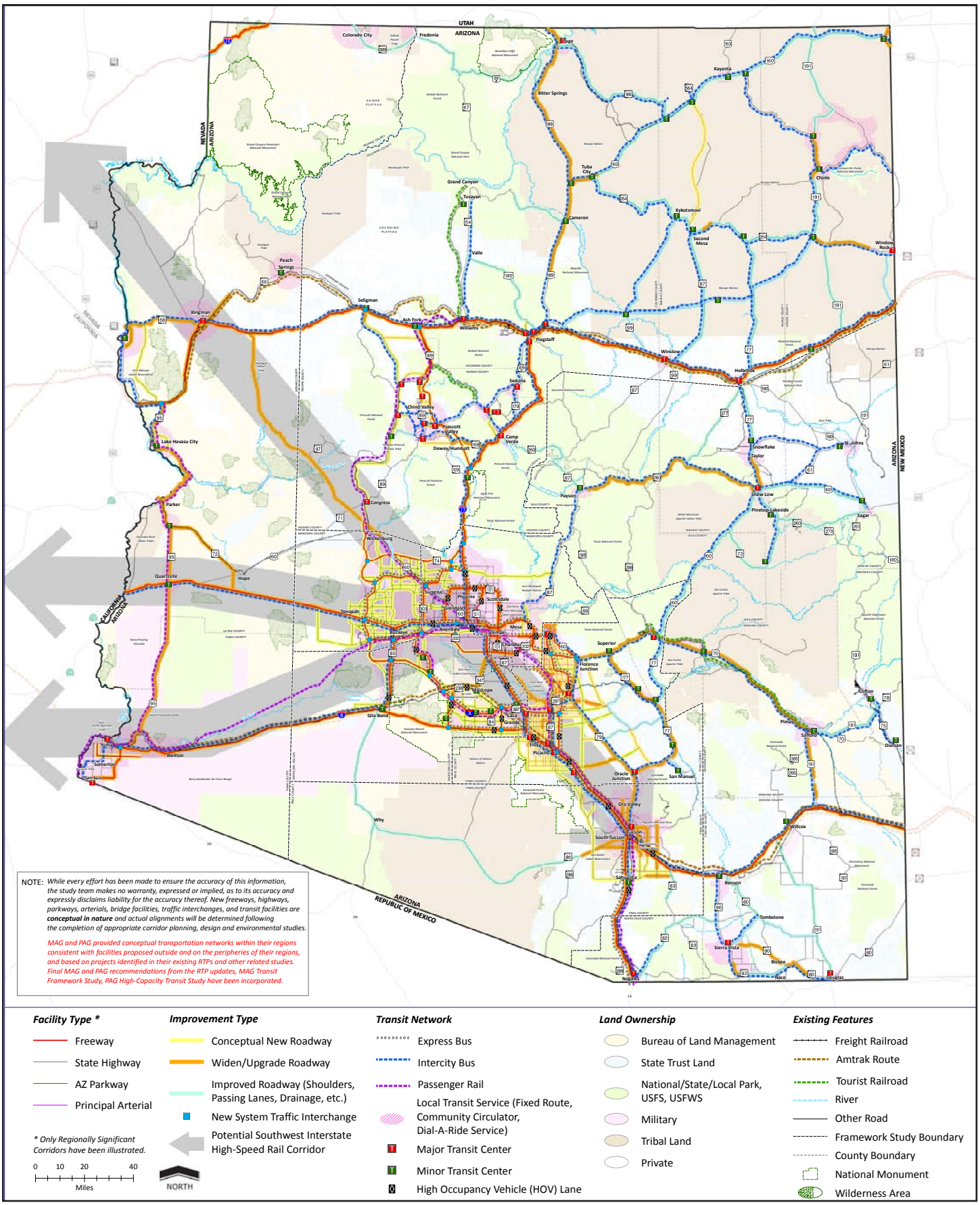


Figure 31 Statewide Scenario C: Focused Growth

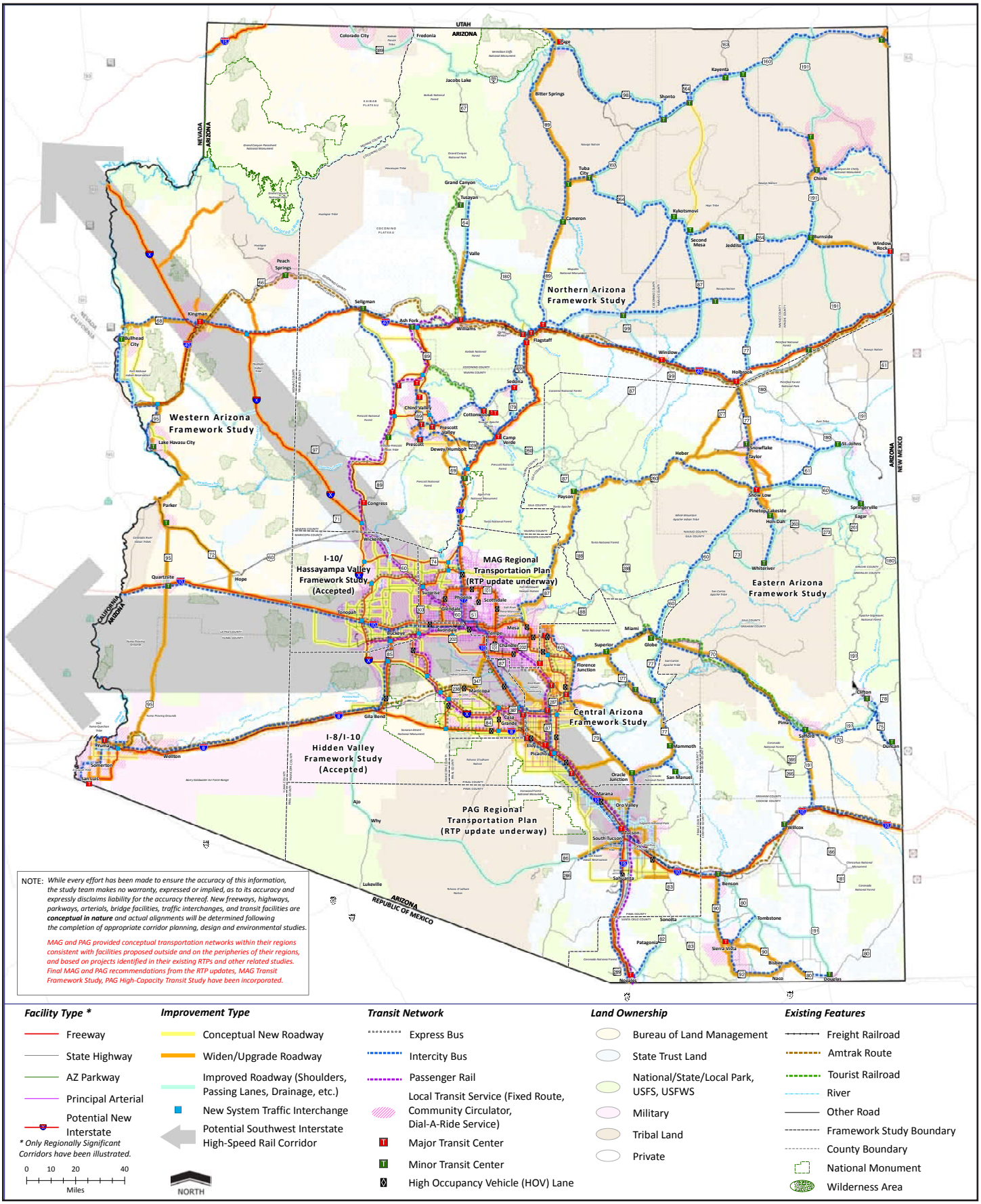


Table 19 Guiding Principles, Goals, Evaluation Criteria, and How Measured

Guiding Principles	Goals	Evaluation Criteria	Measures
I. Improve mobility and accessibility.	Develop functional, flexible mobility for Arizona.	A. Improve multimodal network connectivity.	1. Number of passenger terminals served by two or more modes (including air carrier) other than private vehicle access
			2. Number of additional free-flow junctions (e.g., system or directional TIs) compared with the 2050 Base condition
		B. Increase modal choice and improve mobility options.	Amount of transit and rail passenger service compared with the 2050 Base condition: ■ Many new services and extensive improvements compared with the 2050 Base condition ◩ Moderate improvements including some new services ☐ Incremental improvements
		C. Protect personal mobility from endemic (including seasonal) congestion.	Daily vehicle hours of delay (thousands)*
		D. Protect freight transport from endemic (including seasonal) roadway congestion.	Daily hours of commercial vehicle delay (thousands)*
II. Support economic growth.	Increase economic opportunities in Arizona.	A. Support regional and local (including tribal) economic development plans, priorities, goals and objectives.	■ Includes many projects that strongly support economic development priorities throughout the region ◩ Contains projects that support development priorities in some locations ☐ The proposed improvements offer little or no support at the state or local level
		B. Support industries considered vital to the region or its communities (e.g., tourism, mining, agriculture, timber).	■ Numerous new or improved facilities and services directly serving key industries or destinations ◩ Some such improvements ☐ Few or no such improvements
		C. Modernize and expand infrastructure that supports freight movement and delivery.	Number of infrastructure projects that directly support freight movement and delivery
III. Promote a development pattern that links land use and transportation.	Plan transportation facilities to promote land development patterns that maximize modal choice, minimize trip length and enable multi-purpose trips.	A. Be consistent with county comprehensive plans, city/town general plans, tribal plans, federal land management plans and other adopted land use plans, including development master plans.	■ Nearly all improvements are highly consistent with most pertinent plans ◩ Moderately consistent ☐ Least consistent
		B. Be consistent with adopted long-range transportation plans, including tribal plans.	■ Nearly all improvements are highly consistent with most pertinent plans ◩ Moderately consistent ☐ Least consistent
		C. Support existing and approved (in local plans) mixed-use development.	■ Transportation improvements provide strong support for mixed-use districts and activity centers ◩ Moderate support ☐ Weak support

Table 19 Guiding Principles, Goals, Evaluation Criteria, and How Measured (continued)

Guiding Principles	Goals	Evaluation Criteria	Measures
III. (cont.)		D. Support infill development in cities, towns and built-up unincorporated areas that are well served by existing infrastructure.	■ Transportation improvements provide strong support for infill development ◩ Moderate support ☐ Weak support
		E. Support designated redevelopment and revitalization areas.	■ Transportation improvements provide strong support for such areas ◩ Moderate support ☐ Weak support
IV. Consider Arizona's environment and natural resources.	Protect and enhance the natural and human environment.	A. Promote and increase energy security.	Daily vehicle hours of travel (thousands)*, as a proxy for fuel consumption
		B. Reduce vehicular greenhouse gas (CO_2e)~ emissions.	Reduction in daily metric tons of greenhouse gas emissions*^ compared with the 2050 Base
		C. Minimize impacts to federally designated natural resource areas.	■ Minimal impacts ◩ Moderate impacts ☐ Substantial impacts
		D. Minimize impacts to water resources.	■ Minimal impacts ◩ Moderate impacts ☐ Substantial impacts
		E. Minimize impacts to wildlife habitat blocks and wildlife linkage areas	■ Minimal impacts ◩ Moderate impacts ☐ Substantial impacts
		F. Minimize potential for Section 4(f) issues (parks, national recreation areas, wildlife and waterfowl refuges)	■ Minimal impacts ◩ Moderate impacts ☐ Substantial impacts
V. Ensure safety and security.	Maintain and enhance the safety of the transportation system for all users.	A. Strengthen and expand roadway access management.	Number of additional centerline miles* with a high level of access management (such as freeways and Arizona Parkways) compared with the 2050 Base condition
		B. Provide parallel or alternative transportation routes or services to facilitate emergency access, including evacuation.	■ Substantial alternative routing added (from the 2050 Base condition) ◩ Some alternative routing added ☐ Little or no alternative routing added

Ratings:
■ Highest rating
◩ Intermediate rating
☐ Lowest rating

*Refers to regionally significant roadways, including state highways.
^According to FHWA, "Quantifying greenhouse gas emissions from transportation plans is a new area and one fraught with uncertainty. There are limitations in the ability of existing models to estimate the emissions generated by current and forecast transportation systems. Existing models may not adequately capture the potential reductions in emissions from certain strategies. While many agencies recognize that they will eventually need to estimate emissions from plans and strategies, there are not standard tools or approaches yet." (See fhwa.dot.gov/HEP/climate change/chapter_five.htm)
~*CO_2e includes the six gases in the U.S. Greenhouse Gas Inventory: CO_2, CH_4, N_2O, HFC_s, PFC_s and SF_6.

Source: bqAZ Statewide Technical Team, May 2009.

of ■, ◩ or □ based on the results and the scale. Where appropriate, for quantitative criteria only, the result for the 2050 existing plus-committed network is also shown.

Using the informal point scoring system shown at the bottom of Table 20, each of the three scenarios receives a very similar total score, ranging from 26 points for Scenario A to 24 points for Scenario C. This suggests that the relative advantages and drawbacks of the scenarios tend to cancel each other out when one takes a broad view of potential impacts. Scenario A, however, performs slightly better than Scenarios B and C on mobility and accessibility, somewhat better than the others on support for economic growth, and much worse than the others with respect to the environment and natural resources. Since Scenario A focuses on building and improvement of roads, these results are not surprising. This scenario also earns the most points for promoting safety.

Figure 32 provides a more concise summary of how each scenario fares with respect to the five guiding principles introduced in Chapter 2. Scenario A receives the highest marks on the first, second, and fifth principles (mobility, accessibility, support for economic growth, safety and security), and the lowest on the fourth principle (environment and natural resources). Scenarios B and C slightly outperform Scenario A on promotion of sustainable links between transportation and land use. Scenarios B and C perform similarly to each other, with modest differences on the first two guiding principles.

The similar total scores of the three scenarios led the bqAZ Statewide Technical Team to recommend a hybrid based largely on input from stakeholders throughout Arizona, at both the regional and the state level. The statewide outreach process (as opposed to the regional outreach discussed earlier) is summarized in the next section, and followed by a presentation of the Recommended 2050 Statewide Transportation Framework Scenario.

6.7 Statewide Outreach

As the Regional Framework studies were completed in early 2009, the bqAZ Statewide Technical Team, working closely with the three Statewide Framework committees, began to meld the regional scenarios into three statewide scenarios. The preliminary draft scenarios were vetted through a series of outreach activities, in addition to the formal committee process.

6.7.1 Common Interest Workshops

In February and March 2009, eight common interest workshops were convened to review and critique the three

Figure 32 Statewide Refined Scenarios Evaluation Summary–Year 2050

Principles	Scenario A	Scenario B	Scenario C	Remarks
Principle I: Improve Mobility and Accessibility	High	Medium	Low	Scenarios A and B score highest because of their emphasis on facility quantities (roadway and transit) to enhance mobility and accessibility.
Principle II: Support Economic Growth	High	Low	Medium	The emphasis on economic growth is through improvements that directly support industries and freight -- which are primarily served by roadways.
Principle III: Promote Sustainable Transportation/ Land Use Links	Medium	High	High	The emphasis of this principle is on taking a multimodal approach to support the land use and transportation linkage -- Scenarios B and C both include a balanced mix of roadways and transit.
Principle IV: Consideration of the Environment and Natural Resources	Low	High	High	Scenarios B and C score high on this principle because of their lesser emphasis on major roadway improvements.
Principle V: Support Safety and Security	High	Low	Low	This principle is measured primarily by the number of facilities with high access management (e.g., freeways and parkways) and the extent of alternative routes.

Table 20 Statewide Framework Evaluation, Year 2050

Evaluation Criteria	Measures	Scale	Scenarios (four regions combined)			
			Year 2050 Base	A	B	C
Principle I: Improve Mobility and Accessibility						
A. Improve multimodal network connectivity.	1. Number of passenger terminals served by two or more modes (including air carrier) other than private vehicle access).	(Four regions) ■ 0-15 ◩ 16-30 ☐ 31+	N/A	◩ 24	■ 40	■ 42
	2. Number of additional free-flow junctions (e.g., system or directional TIs) compared with the 2050 Base condition.	(Four regions) ■ 0-15 ◩ 16-30 ☐ 31+	N/A	■ 14	◩ 7	◩ 7
B. Increase modal choice and improve mobility options.	Amount of transit and rail passenger service compared with the 2050 Base condition.	■ Many new services and extensive improvements compared with the 2050 Base ◩ Moderate improvements including some new services ☐ Incremental improvements	N/A	☐ Emphasizes use of personal vehicles.	■ Heavy focus on transit, including passenger rail.	■ Transit and rail similar to (B), with slightly less emphasis on intercity and more on regional transit.
C. Protect personal mobility from endemic (including seasonal) congestion.	Daily vehicle hours (000) of non-commercial vehicle delay on the regionally significant roadway system.	■ 0 - 2,000 ◩ 2,001 - 2,500 ☐ More than 2,500	1,800,532	■ 1,621	☐ 2,381	☐ 2,607
D. Protect freight transport from endemic (including seasonal) roadway congestion.	Daily hours of commercial vehicle delay (000) on the regionally significant roadway system.	■ 0 - 200 ◩ 201 - 250 ☐ More than 250	91,756	■ 144	◩ 213	☐ 258
Subtotal for Principle I			**N/A**	■ **(7 points)**	◩ **(6 points)**	☐ **(5 points)**
Principle II: Support Economic Growth						
A. Support regional and local (including tribal) economic development plans, priorities, goals and objectives.	Non-quantitative.	■ Includes many projects that strongly support economic development priorities throughout the region ◩ Contains projects that support development priorities in some locations ☐ The proposed improvements offer little or no support at the state or local level	N/A	■ Multimodal transportation improvements strongly support economic development priorities.	■ Multimodal transportation improvements strongly support economic development priorities.	■ Multimodal transportation improvements strongly support economic development priorities.

Table 20 Statewide Framework Evaluation, Year 2050 (continued)

Evaluation Criteria	Measures	Scale	Scenarios (four regions combined)			
			Year 2050 Base	A	B	C
B. Support industries considered vital to the region or its communities (e.g., tourism, mining, agriculture, timber).	Non-quantitative.	■ Numerous new or improved facilities and services directly serving key industries or destinations ◩ Some such improvements ☐ Few or no such improvements	N/A	■ Major road system improvements especially benefit freight service to industry.	◩ Less enhancement to highway freight service than (A)–but new passenger rail lines could indirectly benefit freight.	◩ Similar to (B).
C. Modernize and expand infrastructure that supports freight movement and delivery.	Number of infrastructure projects that directly support freight movement and delivery.	■ More than 65 ◩ 51 - 65 ☐ 50 or fewer	N/A	■ 73	☐ 50	◩ 58
Subtotal for Principle II			**N/A**	**■ (6 points)**	**☐ (3 points)**	**◩ (4 points)**
Principle III: Promote a Development Pattern that Links Land Use and Transportation						
A. Be consistent with county comprehensive plans, city/town general plans, tribal plans, federal land management plans and other adopted land use plans, including development master plans.	Non-quantitative.	■ Nearly all improvements are highly consistent with most pertinent plans ◩ Moderately consistent ☐ Least consistent	N/A	■ Highly consistent.	■ Highly consistent.	☐ Less consistent than other scenarios because of focused growth assumption.
B. Be consistent with adopted long-range transportation plans, including tribal plans.	Non-quantitative.	■ Nearly all improvements are highly consistent with most pertinent plans ◩ Moderately consistent ☐ Least consistent	N/A	■ Most projects are consistent, especially with roadway-oriented plans.	◩ Adds transit elements not necessarily consistent w/ long-range plans.	☐ Least consistent because of altered land use assumptions that will affect long-range local and regional transportation planning.
C. Support existing and approved (in local plans) mixed-use development.	Non-quantitative.	■ Transportation improvements provide strong support for mixed-use districts and activity centers ◩ Moderate support ☐ Weak support	N/A	☐ Least supportive owing to emphasis on extensive highway investments.	◩ Transit emphasis supports mixed use, and vice versa.	■ More concentrated growth in some areas accompanies mobility options that strongly favor mixed use.

Table 20 Statewide Framework Evaluation, Year 2050 (continued)

Evaluation Criteria	Measures	Scale	Scenarios (four regions combined)			
			Year 2050 Base	A	B	C
D. Support infill development in cities, towns and built-up unincorporated areas that are well served by existing infrastructure.	Non-quantitative.	■ Transportation improvements provide strong support for infill development ◪ Moderate support ☐ Weak support	N/A	☐ Roadway emphasis tends to support expansion of urban areas rather than infill.	◪ Transit investments may support some infill.	■ Focused growth in existing urban centers most strongly promotes infill.
E. Support designated redevelopment and revitalization areas.	Non-quantitative.	■ Transportation improvements provide strong support for such areas ◪ Moderate support ☐ Weak support	N/A	◪ Improved roadway network may enhance access to some redevelopment areas.	◪ Improved transit network may enhance access to some redevelopment and revitalization areas.	■ Focused growth emphasis is most likely to support redevelopment and revitalization in urbanized areas.
Subtotal for Principle III			**N/A**	**◪ (5 points)**	**■ (6 points)**	**■ (6 points)**
Principle IV: Consider Arizona's Environment and Natural Resources						
A. Promote and increase energy security.	Daily vehicle hours of travel (000) on regionally significant roads, as a surrogate for reduction in fuel consumption.	■ 5,000 or fewer ◪ 5,001 - 6,000 ☐ More than 6,000	1,896,613	■ 4,589	◪ 5,266	◪ 5,393
B. Reduce vehicular greenhouse gas (CO_2e)* emissions.	Reduction in daily metric tons of emissions (from vehicles on regionally significant roads) compared with the 2050 Base.	■ 18,000 or more ◪ 15,001 - 18,000 ☐ Fewer than 15,000	(total = 46,791)	◪ 16,052	■ 18,287	■ 18,792
C. Minimize impacts to federally designated natural resource areas (e.g., national forests, national parks, national monuments, wildlife and waterfowl refuges, wilderness areas, designated critical habitat, areas of critical environmental concern).	Non-quantitative, but incorporating some quantitative measures. Length of new roadway and length of expanded corridors within designated areas; location, nature, and sensitivity of biological resource areas.	■ Minimal impacts ◪ Moderate impacts ☐ Substantial impacts	N/A	☐ 119 miles–new roads 452 miles–widen/upgrade	◪ 55 miles–new roads 279 miles–widen/upgrade	◪ 57 miles–new roads 395 miles–widen/upgrade

Table 20 Statewide Framework Evaluation, Year 2050 (continued)

Evaluation Criteria	Measures	Scale	Scenarios (four regions combined)			
			Year 2050 Base	A	B	C
D. Minimize impacts to water resources.	Non-quantitative, but incorporating some quantitative measures. Number of new or expanded watercourse crossings; length of new and expanded roadway within 1,000 feet of a watercourse; location, nature, and sensitivity of the affected water resources.	■ Minimal impacts ◩ Moderate impacts ☐ Substantial impacts	N/A	☐ Substantial new or expanded watercourse crossings; more conflict with the San Pedro River, the Verde River and its tributaries, and the eastern reaches of the Gila River; and moderate conflict with the Santa Cruz. Within 1,000 ft: 33 miles of new roads, 92 miles widen/ upgrade. Within one-half mile: 91 miles of new roads, 314 miles widen/upgrade.	◩ Moderate amount of new or expanded watercourse crossings; more conflict with the Santa Cruz and Colorado rivers; and less conflict with the San Pedro, the Verde River and its tributaries, and the eastern Gila River. Within 1,000 ft: 31 miles of new roads, 69 miles widen/ upgrade. Within one-half mile: 84 miles of new roads, 270 miles widen/ upgrade.	◩ Moderate amount of new or expanded watercourse crossings; more conflict with the Santa Cruz, eastern Gila, and Colorado rivers; and less conflict with the San Pedro and the Verde River and its tributaries. Within 1,000 ft: 29 miles of new roads, 77 miles widen/upgrade. Within one-half mile: 84 miles of new roads, 289 miles widen/upgrade.
E. Minimize impacts to wildlife habitat blocks and wildlife linkage areas.	Non-quantitative, but incorporating some quantitative measures. Length of new roadway and length of expanded corridors within designated areas; location, nature, and sensitivity of wildlife habitat and linkage areas.	■ Minimal impacts ◩ Moderate impacts ☐ Substantial impacts	N/A	☐ Substantial conflict with linkage zones, habitat blocks and missing linkages near Kayenta, Holbrook-Snowflake area, Oro Valley area, Yuma, and Chino Valley; less conflict near Bullhead City. *AZ Missing Linkages* 97 miles–new roads 94 miles–widen/ upgrade *Potential Linkage Zone* 452 miles–new roads 1521 miles–widen/ upgrade *Habitat Blocks* 355 miles–new roads 127 miles–widen/ upgrade	◩ Moderate conflict with linkage zones, habitat blocks and missing linkages near Fredonia, Kayenta, Oro Valley and Chino Valley; and less conflict near Holbrook, Snowflake, Yuma, and Bullhead City. *AZ Missing Linkages* 59 miles–new roads 95 miles–widen/ upgrade *Potential Linkage Zone* 370 miles–new roads 1057 miles–widen/ upgrade *Habitat Blocks* 273 miles–new roads 59 miles–widen/ upgrade	◩ Moderate conflict with linkage zones, habitat blocks and missing linkages near Kayenta, Holbrook-Snowflake area, Oro Valley, Chino Valley, and Bullhead; more conflict near Yuma; and less conflict near Fredonia. *AZ Missing Linkages* 71 miles–new roads 91 miles–widen/ upgrade *Potential Linkage Zone* 330 miles–new roads 1340 miles–widen/ upgrade *Habitat Blocks* 28 miles–new roads 121 miles–widen/ upgrade

Table 20 Statewide Framework Evaluation, Year 2050 (continued)

Evaluation Criteria	Measures	Scale	Scenarios (four regions combined)			
			Year 2050 Base	A	B	C
F. Minimize potential for Section 4(f) issues (federal, state, and local parks; designated national recreation areas; wildlife refuges; waterfowl refuges).	Non-quantitative, but incorporating some quantitative measures. Length of new roadway and length of expanded corridors within designated areas; location, nature, and sensitivity of the area.	■ Minimal impacts ◩ Moderate impacts ☐ Substantial impacts	N/A	◩ <1 miles–new roads 47 miles–widen/upgrade	◩ <1 miles–new roads 24 miles–widen/upgrade Minimal impact from high-speed rail.	◩ <1 miles–new roads 38 miles–widen/upgrade Minimal impact from high-speed rail.
Subtotal for Principle IV			**N/A**	☐ **(4 points)**	■ **(7 points)**	■ **(7 points)**
Principle V: Ensure Safety and Security						
A. Strengthen and expand roadway access management.	Number of additional centerline miles with a high level of access management (such as freeways and Arizona Parkways) compared with the 2050 Base condition.	■ More than 800 ◩ 601 - 800 ☐ 600 or fewer	(total = 820)	■ 802	◩ 692	◩ 621
B. Provide parallel or alternative transportation routes or services to facilitate emergency access, including evacuation.	Non-quantitative.	■ Substantial alternative routing added (from the 2050 Base condition) ◩ Some alternative routing added ☐ Little or no alternative routing added	N/A	■ Substantial alternative roadway routing added.	◩ Fewer alternative road routes than (A), although there is new passenger rail.	◩ Fewer alternative road routes than (A), although there is new passenger rail.
Subtotal for Principle V			**N/A**	■ **(4 points)**	☐ **(2 points)**	☐ **(2 points)**
Grand Total			***N/A***	***26***	***25***	***24***

*CO_2e includes the six gases in the U.S. Greenhouse Gas Inventory: CO_2, CH_4, N_2O, HFC_s, PFC_s and SF_6.

Point scale: ■ 2 points ◩ 1 point ☐ 0 points

Source: bqAZ Statewide Technical Team, May 2009.

draft statewide scenarios. Representatives of each group were asked to provide a statewide perspective on their special interests. A total of 105 people participated in the workshops, which were held in Phoenix, and included:

- Tribal communities
- Natural resources (primarily representatives of environmental organizations and interest groups
- Real estate development community
- Planning professionals knowledgeable about sustainability
- Economic development
- Resource agencies (government agencies such as BLM and AGFD)
- Major freight users
- ADOT-CCP staff

6.7.2 Elected Official Consultations

ADOT, the COGs, and the MPOs collaboratively developed a process for consultation with local elected officials, to further engage these officials. The purpose of the consultations–consisting of one meeting in each COG and MPO–was to provide an update on the Statewide Framework process, and to solicit input on the transportation vision and the three draft scenarios. ADOT provided the following information at meetings held in late summer 2009:

- Trends affecting the future of Arizona
- Arizona responds–long-range transportation planning
- 2050 Vision and Guiding Principles for transportation in Arizona
- The three draft statewide scenarios and their implications
- Next steps in the bqAZ process

The consultation process with the COGs and MPOs also involved meetings in the MAG and PAG regions to brief their committees and leadership on the items enumerated above, as well as on how their RTP update work and completed framework study results were to be incorporated in the three draft scenarios. These meetings included:

- PAG *2040 Mobility Matters* Committee: August 20, 2009
- MAG Transportation Policy Committee: September 23, 2009
- MAG Management Committee: September 16, 2009
- MAG Regional Council: September 30, 2009

6.7.3 Miscellaneous Presentations

In addition to the formal committee process, special interest workshops, and elected official consultations, the bqAZ Statewide Technical Team made presentations throughout the study at various meetings and conferences.

- January 17, 2008: Rural Transportation Summit
- January 21, 2008: Tribal Summit
- February 6, 2008: PAG Transportation Planning Committee
- February 8, 2008: Arizona City/County Management Association
- March 19, 2008: Roads and Streets Conference (American Council of Engineering Companies, Arizona Division)
- April 23, 2008: MAG Regional Council
- April 24, 2008: NACOG Regional Council
- May 14, 2008: Tribal Transportation Forum
- June 13, 2008: Pinal Partnership Breakfast
- January 22, 2009: Rural Transportation Summit
- March 4, 2009: Institute of Transportation Engineers–Arizona Spring Conference
- October 15, 2009: Annual American Planning Association–Arizona Chapter Conference

6.8 Recommended Statewide Scenario

6.8.1 Description

The Recommended 2050 Statewide Scenario is a hybrid of Scenarios A and C. It takes the roadway system from Scenario A with minor changes, and improvements to other modes from Scenario C. It thereby:

- Maintains and improves the existing roadway system to help meet future travel demand
- Enhances roadway capacity in key corridors
- Provides alternative routes in key corridors
- Improves roads to establish a foundation for efficient bus transit services
- Links transportation to Smart Growth planning principles, as Scenario C envisions
- Provides transit options, including intercity rail between Phoenix and Tucson, commuter rail in the largest metropolitan areas, and local, intercity, and express bus service where appropriate.
- Addresses climate change through focused growth and travel demand reduction

The Recommended Statewide Scenario is intended to:

- Relieve congestion through increased capacity, including alternative routes in selected corridors
- Link activity centers using roadway, transit, and rail
- Maximize environmental sensitivity through primary use of existing corridors

- Promote economic diversification and coordination of land use with transportation
- Build a multimodal spine in the Sun Corridor
- Potentially incorporate the Western States High Speed Rail Initiative, which may someday connect Arizona with California, southern Nevada, Utah, and the Front Range megapolitan region (Albuquerque/Denver)

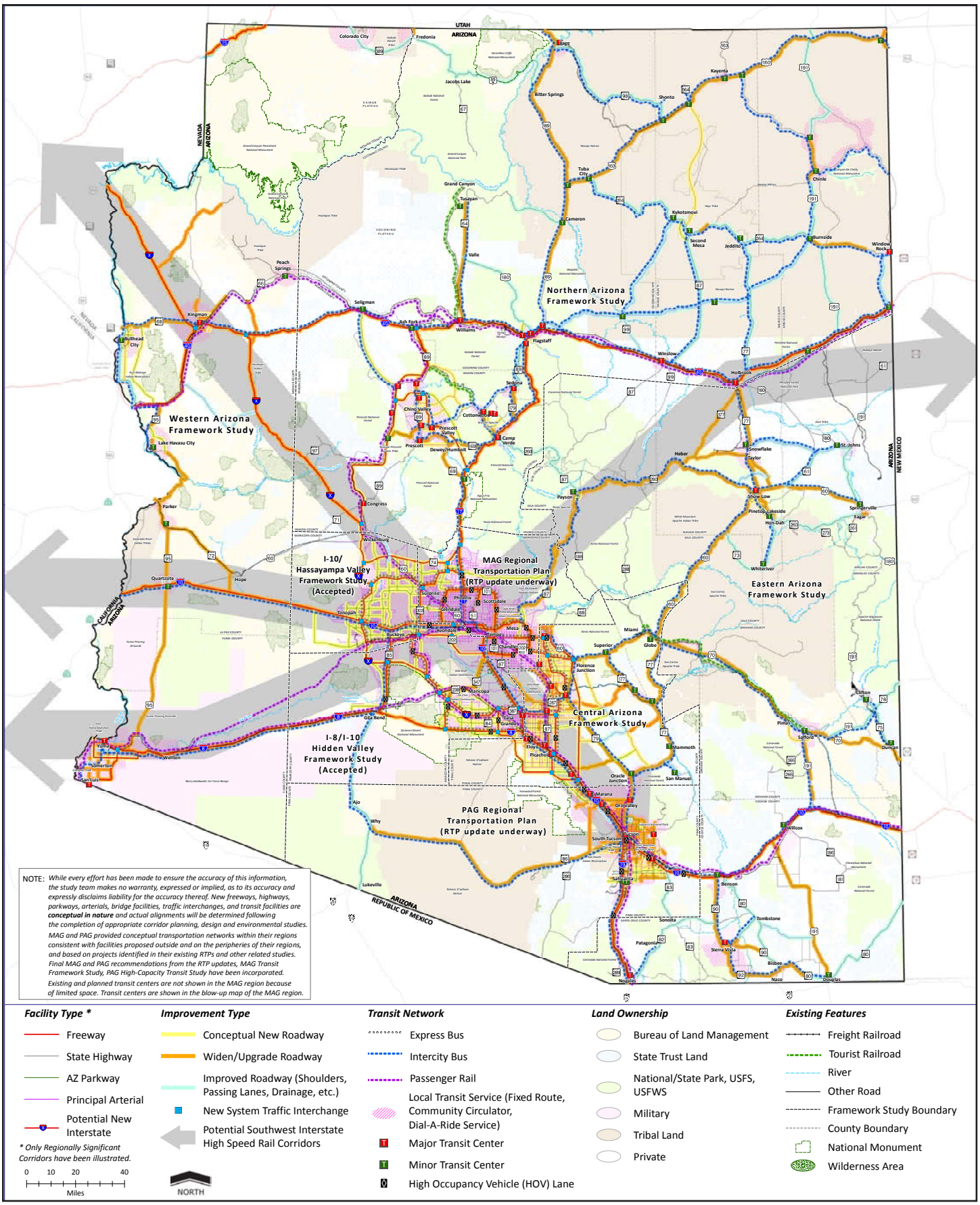
Figure 33 illustrates the Recommended Statewide Scenario, which includes enhanced local and intercity transit services in every region of the state. All Interstate highways would be widened to at least three lanes per direction. Table 21 shows highlights from each region.

Table 21 Highlights of Recommended Scenario by Region

Proposed Roadway Improvements	Region
New freeway connecting Maricopa and Pinal counties with Las Vegas–potentially replacing or supplementing US 93	Central, Hidden Valley, MAG, Northern, Western
New north-south freeway, Florence Jct. to I-10	Central
New north-south freeway, US 60 to Marana area	Central
New north-south freeway between I-40 and Wickenburg area, complementing I-17	Northern
New freeway, I-17 to SR 89 (Chino Valley area)	Northern
New Yuma east-west freeway	Western
New HOV lanes on freeways in Sun Corridor	Central, MAG, PAG
New Arizona Parkway system	Sun Corridor (Central, MAG, PAG)
New arterials in growth areas of Pinal and northern Yavapai counties	Central, Northern
New north-south arterial from SR 264 to US 160	Northern
New highway bypass around Payson	Eastern
New highway bypass around Bullhead City	Western
New parkway/bypass around Lake Havasu City	Western
Widen I-10 to ten lanes between Phoenix and Tucson	Sun Corridor
Widen I-40 to eight lanes between Kingman and US 93 (or new freeway)	Western
Widen all other Interstate Highways to six lanes in rural Arizona	Statewide
Widen SR 79, 87, 177, 287, 387	Central
Widen US 60, Florence Jct. to Springerville	Central, Eastern
Widen US 70	Central, Eastern
Widen SR 77, Holbrook to Tucson area	Central, Eastern
Widen SR 90	Eastern
Widen SR 377	Eastern
Widen two-lane portions of US 89	Northern
Widen US 160	Northern
Widen SR 72; improve connection to I-10	Western
Widen two-lane portions of SR 95	Western
Widen rural state highways and other key routes	Sun Corridor
Improve roadway connection between Yuma and San Luis	Western
Improve historic Route 66	Western
Improve state highways (shoulders, climbing lanes, etc.)	Statewide
Improve selected principal arterials	Statewide
Proposed Transit and Rail Improvements	**Region**
New express bus route system	Central
Intercity bus routes connecting communities	Statewide
Transit centers in strategic locations	Statewide
Develop or improve local transit systems in urban areas	Statewide
Phoenix-Tucson intercity rail, connecting to commuter rail in MAG and PAG areas	Sun Corridor
Passenger rail in BNSF Peavine corridor to Prescott and Flagstaff, connecting with Grand Canyon Railway	MAG, Northern
Reinstate freight and passenger rail service on UP Wellton Branch	MAG, Western
Possible passenger rail from Tucson to Nogales	Eastern, PAG
Study potential freight rail bypass of Nogales	Eastern
Study potential freight rail bypass of Flagstaff	Northern
Study potential freight rail bypass of Tucson	PAG
Plan for high-speed rail to California, Nevada and/or Front Range	Statewide

Source: bqAZ Statewide Technical Team, October 2009.

Figure 33 Recommended Statewide 2050 Transportation Framework Scenario



After consulting with elected officials and COGs/MPOs toward the end of the project, the bqAZ Statewide Technical Team made several refinements to the Recommended Statewide Scenario. Table 22 lists these mostly minor changes, which are reflected in Figure 33.

Table 22 Changes to Recommended Statewide Scenario Due to Elected Official Consultations

Description	Requesting Agency
La Cholla parkway extension in Pima County removed due to environmental impact	PAG/Town of Oro Valley
Reconfigured freeway alignment in Chino Valley area (to avoid headwaters of the Verde River)	Yavapai County/ CYMPO
Local transit service around Parker expanded	Town of Parker/ WACOG
US 191, Douglas to I-10, widened/ upgraded to four lanes instead of spot improvements	SEAGO
Yuma east-west freeway connected to I-8	YMPO/ADOT Yuma District Engineer
Incorporated Hassayampa and Hidden Valley Frameworks recommendations, and RTP update results	MAG
Incorporated the PAG final recommendations "Scenario Pima"	PAG

Source: bqAZ Statewide Technical Team, October 2009.

Figure 34 shows the roadway features of the Recommended Statewide Scenario in greater detail. The scenario is intended to:

- Maintain the current system and enhance safety for multimodal transportation (including transit vehicles operating on the highway system)
- Provide new alternative routes to major high-capacity corridors (e.g., I-17, I-10, a south and west bypass of the Phoenix metropolitan area)
- Provide a new freeway, designed to Interstate Highway standards, along or parallel to the US 93 corridor between Maricopa County and Nevada
- Preserve the environment through emphasis on use of existing corridors wherever possible
- Enhance connectivity between activity centers

Figure 35 highlights the public transit features, which:

- Emphasize multimodal transit
- Include focused transit growth in local service areas
- Provide new bus routes to serve regional needs
- Greatly expand and strengthen intercity bus service
- Introduce express bus service in selected corridors

Finally, the rail elements (Figure 36) emphasize:

- Intercity passenger rail between Phoenix and Tucson, with possible longer-term extensions both north and south to serve the Sun Corridor
- Reinstatement of freight and passenger rail on the UP Wellton Branch between Yuma and Phoenix, allowing direct freight service to the Phoenix metropolitan area from the west and allowing reinstatement of Amtrak service to the state's largestpopulation and employment center
- Commuter rail service in the Phoenix and Tucson metropolitan areas
- Potential high-speed rail corridors connecting the Sun Corridor Megapolitan with California, Las Vegas, Tucson, and Albuquerque/Denver.

6.8.2 Analysis of Modeling Results and Comparison with other Scenarios

Recommended Scenario–Highway Assignment

This assignment was prepared using the non-auto mode share trip reduction discussed earlier and tabulated in Tables 17 and 18. Adequate road capacity is available in the recommended model network for the AZTDM to successfully execute a highway assignment. No changes to the network or trip tables were needed for the model to complete all necessary iterations of the multiple feedback loop.

Performance of Scenarios

Table 23 shows the statewide centerline miles by roadway functional classification, for each of the five scenarios–existing-plus-committed, A, B, C, and Recommended–and for existing 2005 conditions.

Cut-Line Analysis

Cut-line analysis is a technique that allows a broad assessment of the relationship between modeled traffic volume estimates and observed counts. Cut-line locations were selected to represent key statewide travel corridors. For this analysis, a line was drawn across all the modeled roadway facilities in each corridor. The total cut-line crossing volume was calculated by summing the volumes on the individual routes that cross the cut-line. Figures 37

Figure 34 2050 Recommended Statewide Scenario–Roadway Features

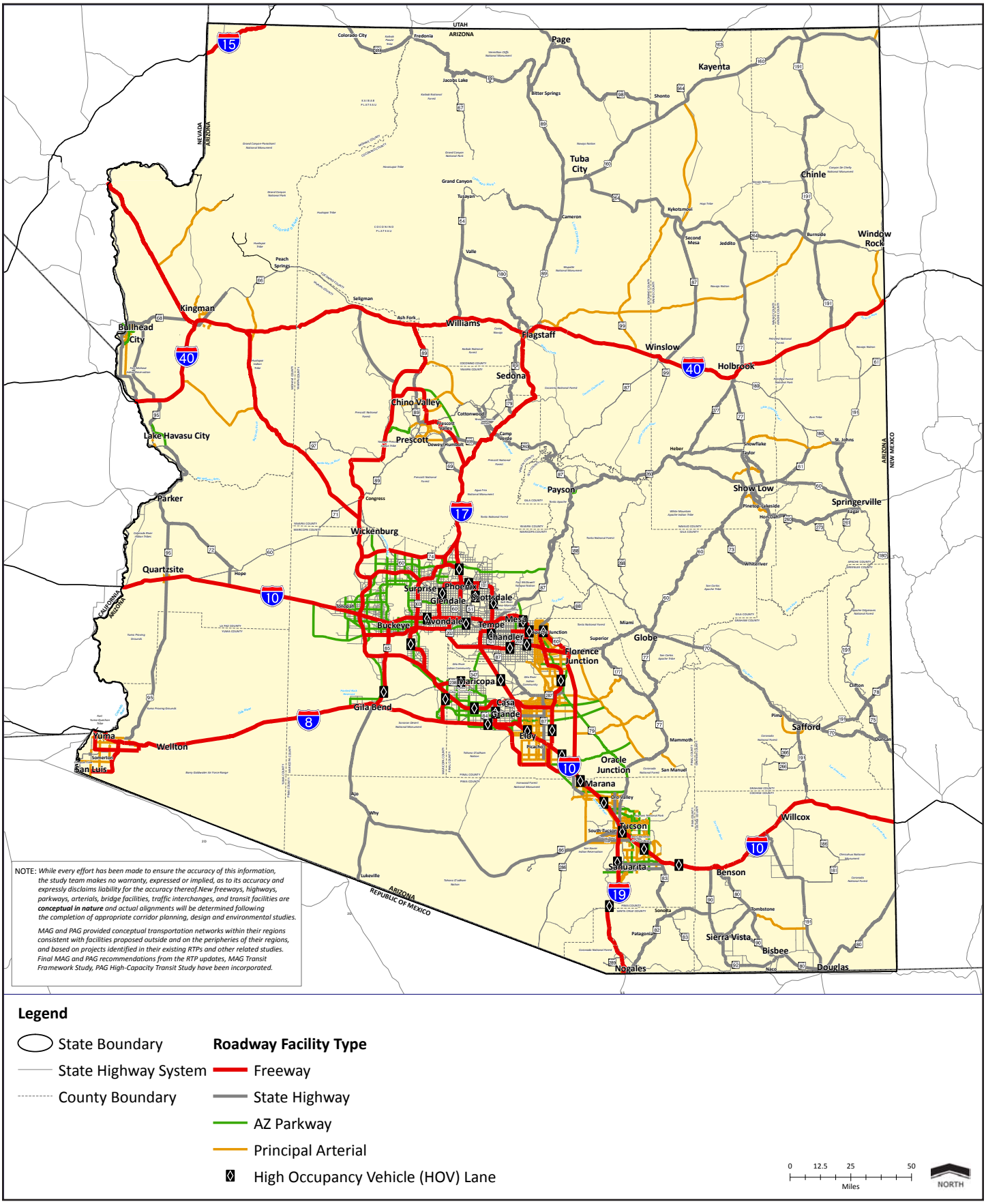


Figure 35 2050 Recommended Statewide Scenario–Transit Features

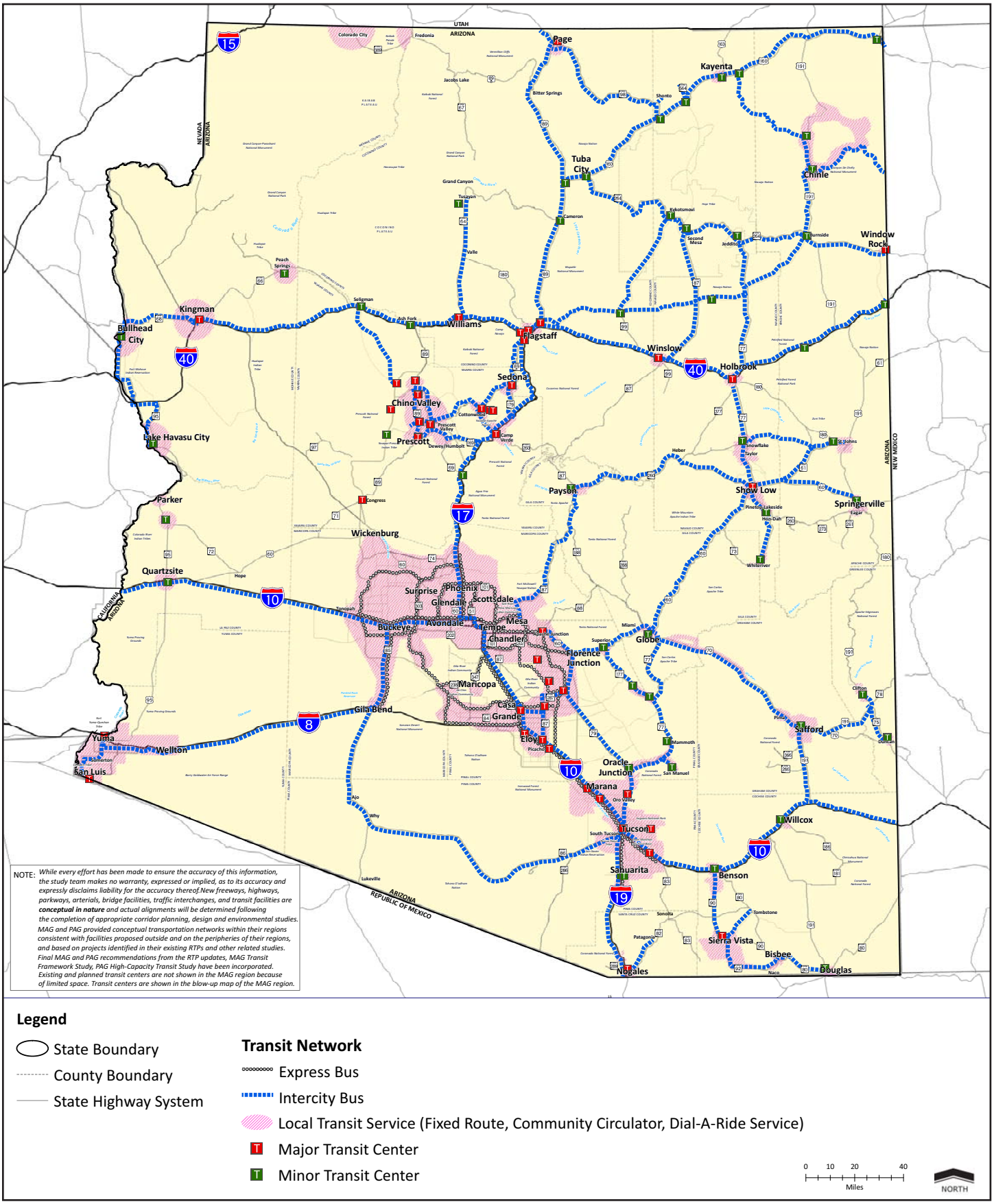
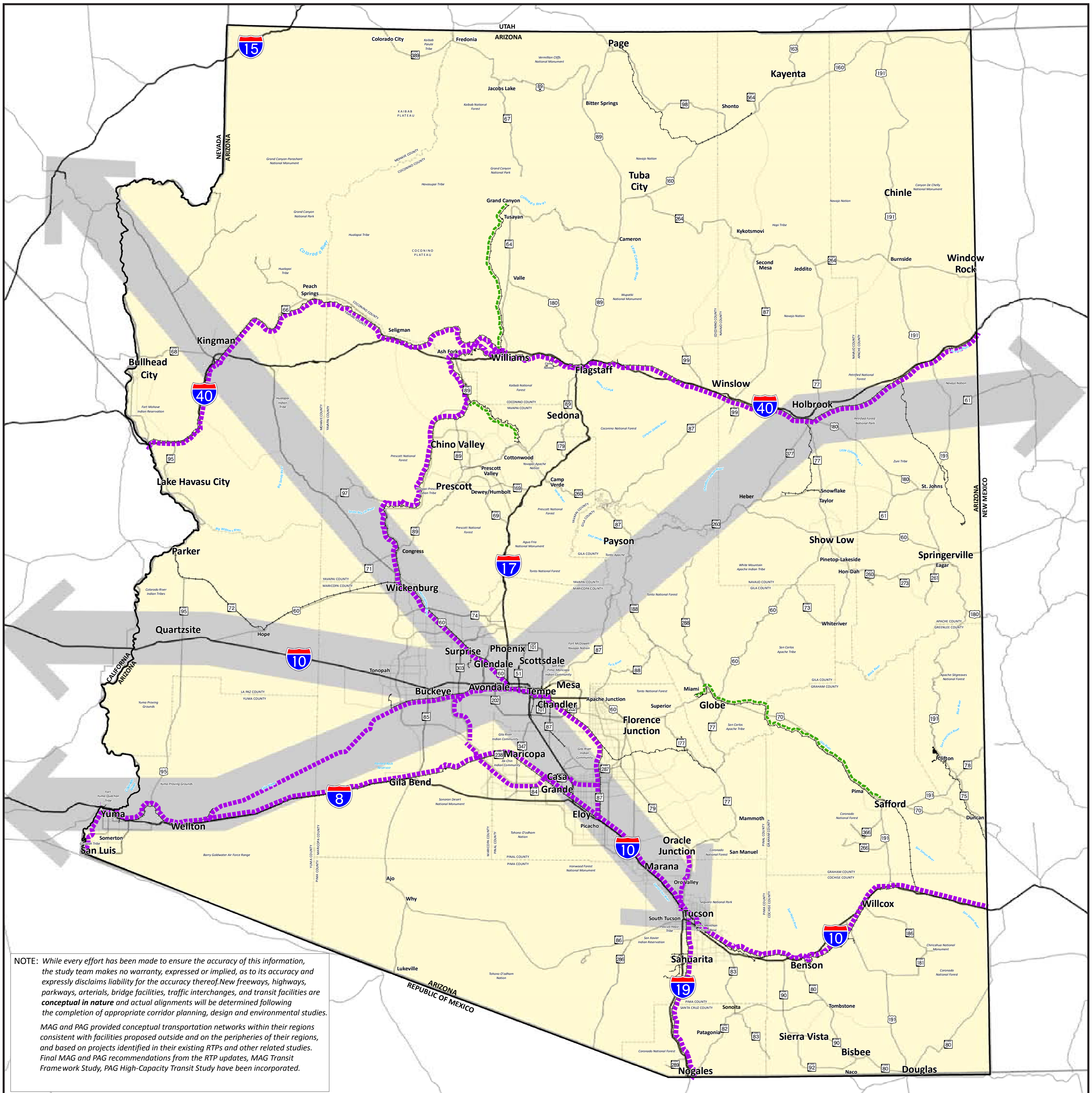


Figure 36 2050 Recommended Statewide Scenario–Rail Features



Legend

State Boundary
State Highway System
County Boundary

Passenger Rail Network

Passenger Rail
Tourist Railroad
Potential Southwest Interstate High-Speed Rail Corridor

0 10 20 40
Miles

NORTH

Table 23 Centerline Miles by Functional Classification

Scenario	Roadway Functional Classification		
	Freeway	Parkway	Principal Arterial
2005 Existing	1,310	2*	1,939
2030 Existing-plus-Committed	1,434	2*	1,981
2050 Scenario A**	2,362	862	2,872
2050 Scenario B**	2,174	911	2,827
2050 Scenario C**	2,168	856	2,779
2050 Recommended	2,279	931	2,776

*Prescott Lakes Parkway in Prescott
**Refers to statewide 2050 scenarios
Source: bqAZ Statewide Technical Team, November 2009.

through 42 show the cut-line locations for all scenarios: existing-plus-committed (2030 and 2050), Scenarios A, B, and C, and the Recommend Statewide Scenario (2050).

The capacities of roads crossing the cut-line were added together to arrive at a total corridor capacity. This value was then compared with the total traffic volume crossing the cut-line. This comparison yielded a single volume to capacity ratio. This ratio indicates the degree or severity of roadway congestion. A ratio of 1.0 shows that volume equals capacity. A ratio less than 1.0 means that enough capacity exists to accommodate the volume of travel demand across the cut-line.

Table 24 shows the forecast traffic volumes and capacities across nine cut-lines for the following scenarios:

- 2005 Existing Condition
- 2030 Existing-plus-Committed (EC)
- 2050 EC
- 2050 Scenario A
- 2050 Scenario B
- 2050 Scenario C
- 2050 Recommended Statewide Scenario (R)

Scenario A provides the best cut-line performance under forecast 2050 traffic conditions. Only one cut-line has a volume to capacity ratio of 1.0 or more (shown in bold) in this scenario. The Recommended Statewide Scenario ("R") also has only one such cut-line, but its volume to capacity ratio is slightly higher. The existing-plus-committed scenario–essentially a no-build alternative–has by far the worst performance in 2050.

Other measures used to evaluate scenario performance statewide include VMT, vehicle hours of travel (VHT), and hours of travel delay. Table 25 summarizes key performance measures by scenario.

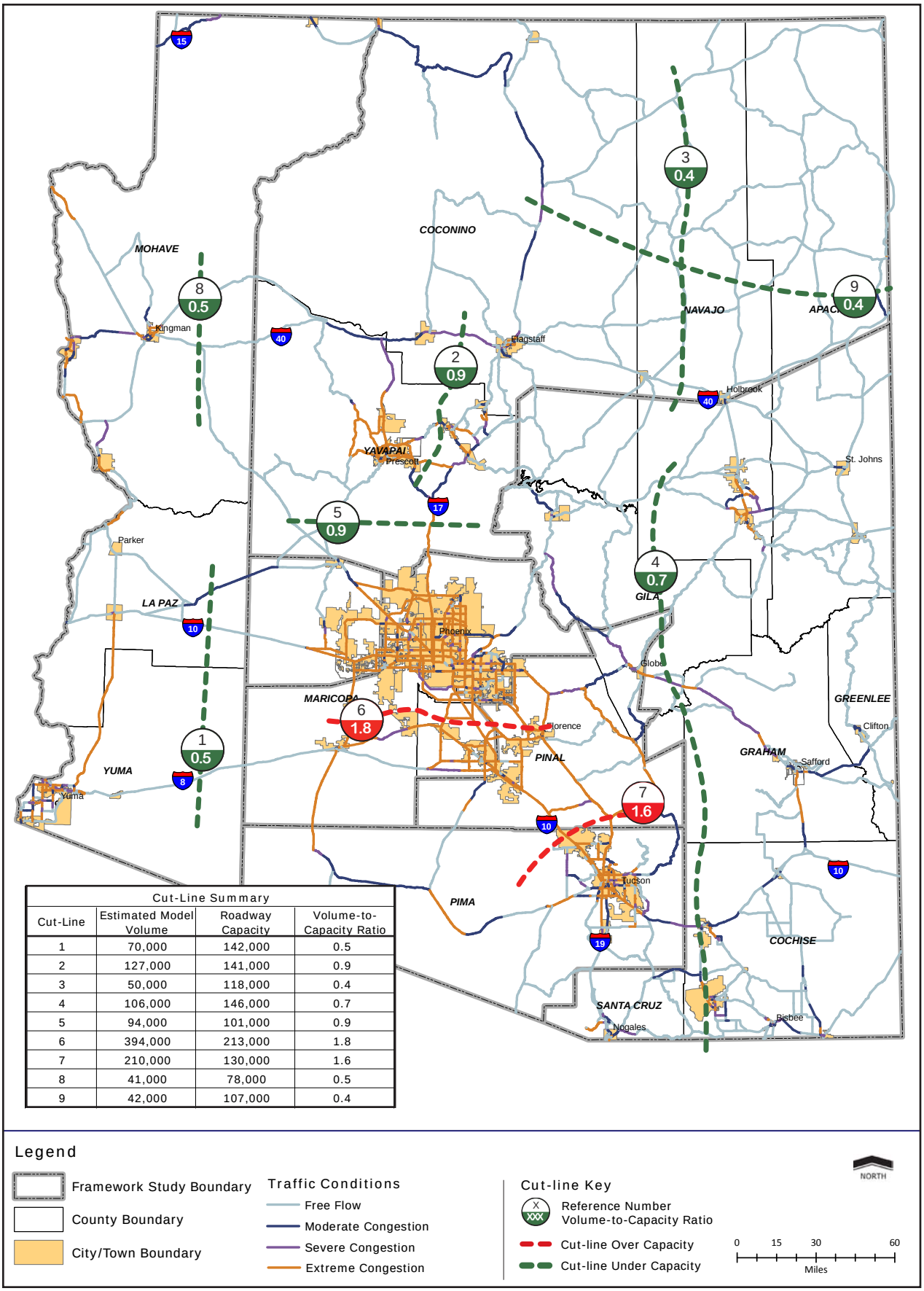
Table 24 Cut-Line Summary by Scenario

Cut-line	Volume/Capacity Ratio						
	2005	2030 EC	2050 EC	2050 A	2050 B	2050 C	2050 R
1	0.3	0.5	2.0	0.5	0.5	0.5	0.5
2	0.3	0.9	3.0	0.6	0.6	0.6	0.6
3	0.2	0.4	1.0	0.4	0.5	0.5	0.4
4	0.3	0.7	2.6	0.9	1.0	1.0	0.8
5	0.5	0.9	4.1	0.5	0.5	0.5	0.5
6	0.5	1.8	4.9	0.8	0.9	0.9	0.8
7	0.3	1.6	6.3	2.4	2.3	2.1	2.6
8	0.3	0.5	1.3	0.6	0.6	0.6	0.4
9	0.3	0.4	0.6	0.4	0.4	0.4	0.4
Average	**0.3**	**1.0**	**3.1**	**0.9**	**0.8**	**0.9**	**0.9**

Shaded columns represent 2050 conditions under five scenarios:
EC = Existing-plus-Committed (2050 no-build)
A = Personal Vehicle Mobility
B = Transit Mobility Emphasis
B = Transit Mobility Emphasis
C = Focused Growth
R = Recommended Statewide Scenario

Source: bqAZ Statewide Technical Team, November 2009.

Figure 37 2030 Existing-plus-committed Traffic Conditions



Cut-Line Summary			
Cut-Line	Estimated Model Volume	Roadway Capacity	Volume-to-Capacity Ratio
1	70,000	142,000	0.5
2	127,000	141,000	0.9
3	50,000	118,000	0.4
4	106,000	146,000	0.7
5	94,000	101,000	0.9
6	394,000	213,000	1.8
7	210,000	130,000	1.6
8	41,000	78,000	0.5
9	42,000	107,000	0.4

Legend

- Framework Study Boundary
- County Boundary
- City/Town Boundary

Traffic Conditions

- Free Flow
- Moderate Congestion
- Severe Congestion
- Extreme Congestion

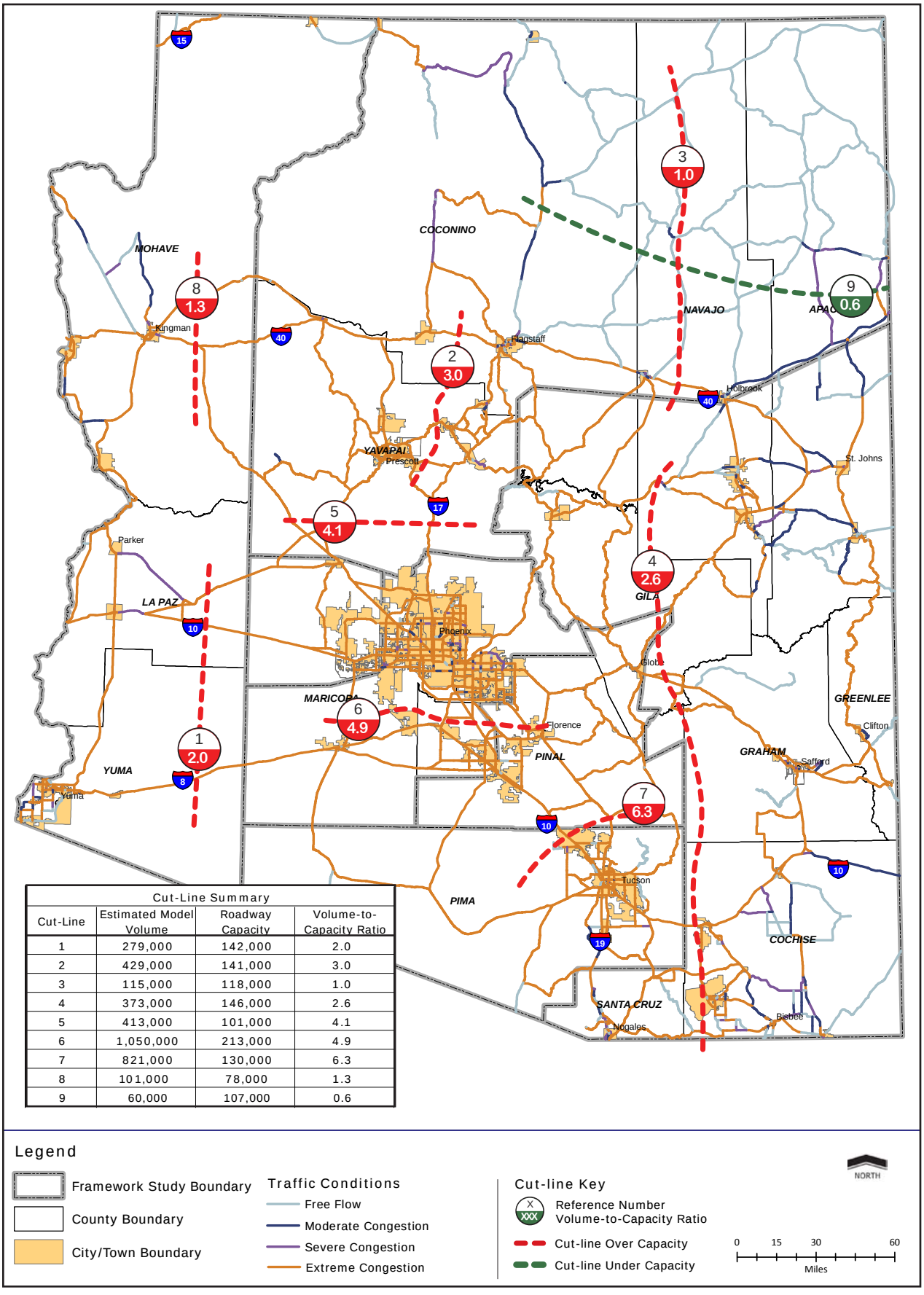
Cut-line Key

- Reference Number / Volume-to-Capacity Ratio
- Cut-line Over Capacity
- Cut-line Under Capacity

NORTH

0 15 30 60 Miles

Figure 38 2050 Existing-plus-committed Traffic Conditions



Cut-Line Summary

Cut-Line	Estimated Model Volume	Roadway Capacity	Volume-to-Capacity Ratio
1	279,000	142,000	2.0
2	429,000	141,000	3.0
3	115,000	118,000	1.0
4	373,000	146,000	2.6
5	413,000	101,000	4.1
6	1,050,000	213,000	4.9
7	821,000	130,000	6.3
8	101,000	78,000	1.3
9	60,000	107,000	0.6

Legend

- Framework Study Boundary
- County Boundary
- City/Town Boundary

Traffic Conditions

- Free Flow
- Moderate Congestion
- Severe Congestion
- Extreme Congestion

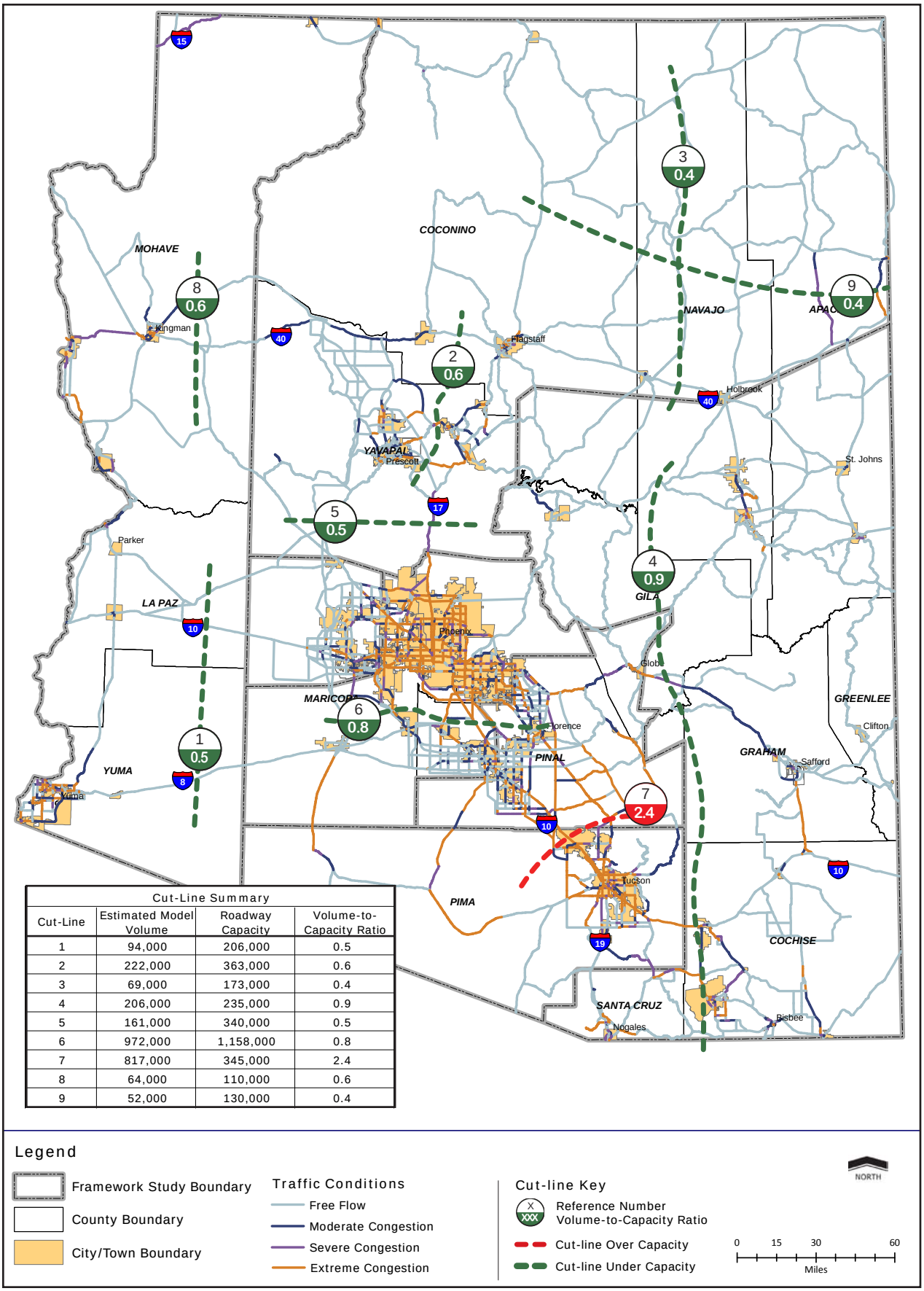
Cut-line Key

- Reference Number / Volume-to-Capacity Ratio
- Cut-line Over Capacity
- Cut-line Under Capacity

NORTH

0 15 30 60 Miles

Figure 39 2050 Scenario A Traffic Conditions



Cut-Line Summary			
Cut-Line	Estimated Model Volume	Roadway Capacity	Volume-to-Capacity Ratio
1	94,000	206,000	0.5
2	222,000	363,000	0.6
3	69,000	173,000	0.4
4	206,000	235,000	0.9
5	161,000	340,000	0.5
6	972,000	1,158,000	0.8
7	817,000	345,000	2.4
8	64,000	110,000	0.6
9	52,000	130,000	0.4

Legend

- Framework Study Boundary
- County Boundary
- City/Town Boundary

Traffic Conditions

- Free Flow
- Moderate Congestion
- Severe Congestion
- Extreme Congestion

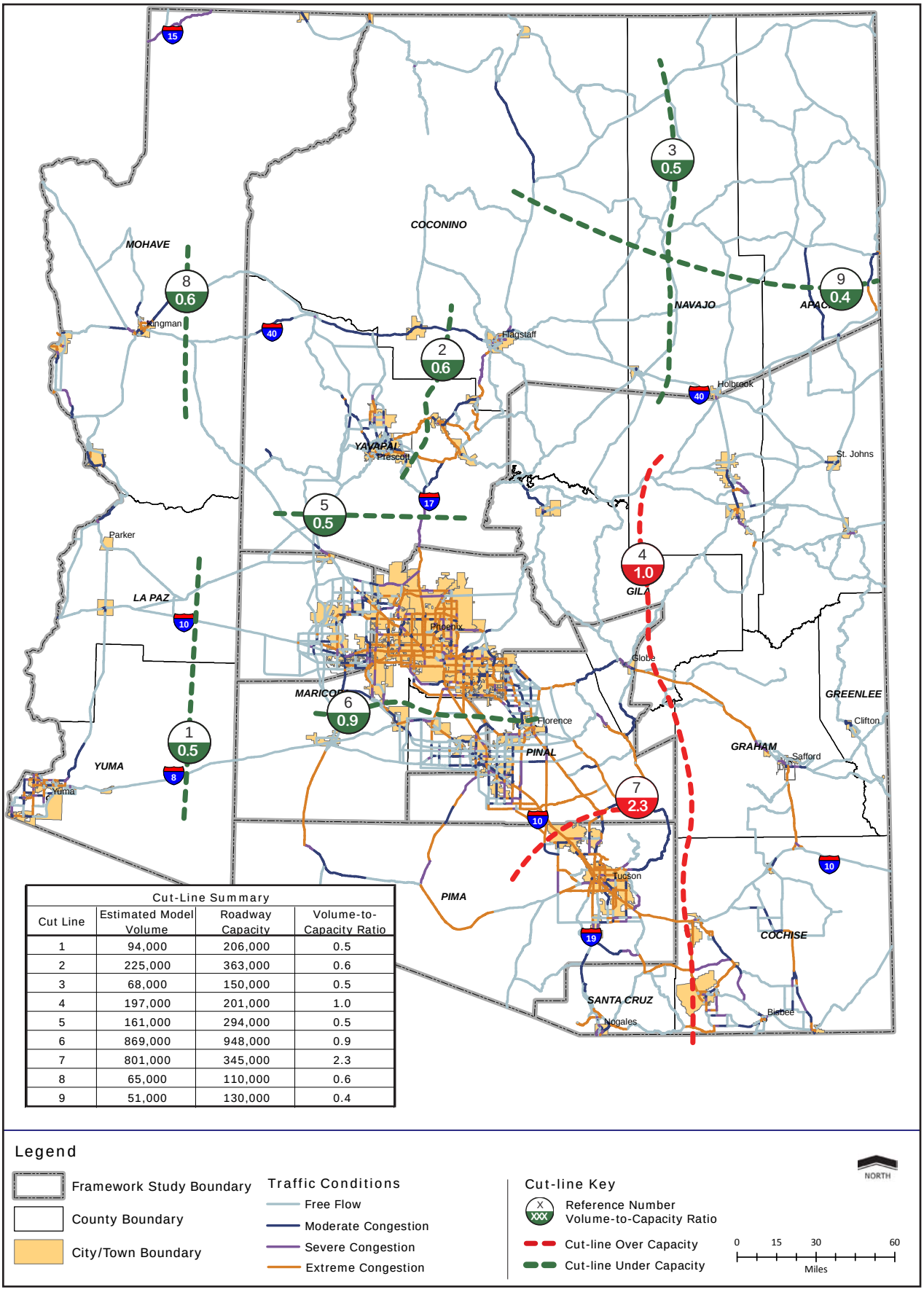
Cut-line Key

- Reference Number / Volume-to-Capacity Ratio
- Cut-line Over Capacity
- Cut-line Under Capacity

NORTH

0 15 30 60 Miles

Figure 40 2050 Scenario B Traffic Conditions



Cut-Line Summary

Cut Line	Estimated Model Volume	Roadway Capacity	Volume-to-Capacity Ratio
1	94,000	206,000	0.5
2	225,000	363,000	0.6
3	68,000	150,000	0.5
4	197,000	201,000	1.0
5	161,000	294,000	0.5
6	869,000	948,000	0.9
7	801,000	345,000	2.3
8	65,000	110,000	0.6
9	51,000	130,000	0.4

Legend

Framework Study Boundary
County Boundary
City/Town Boundary

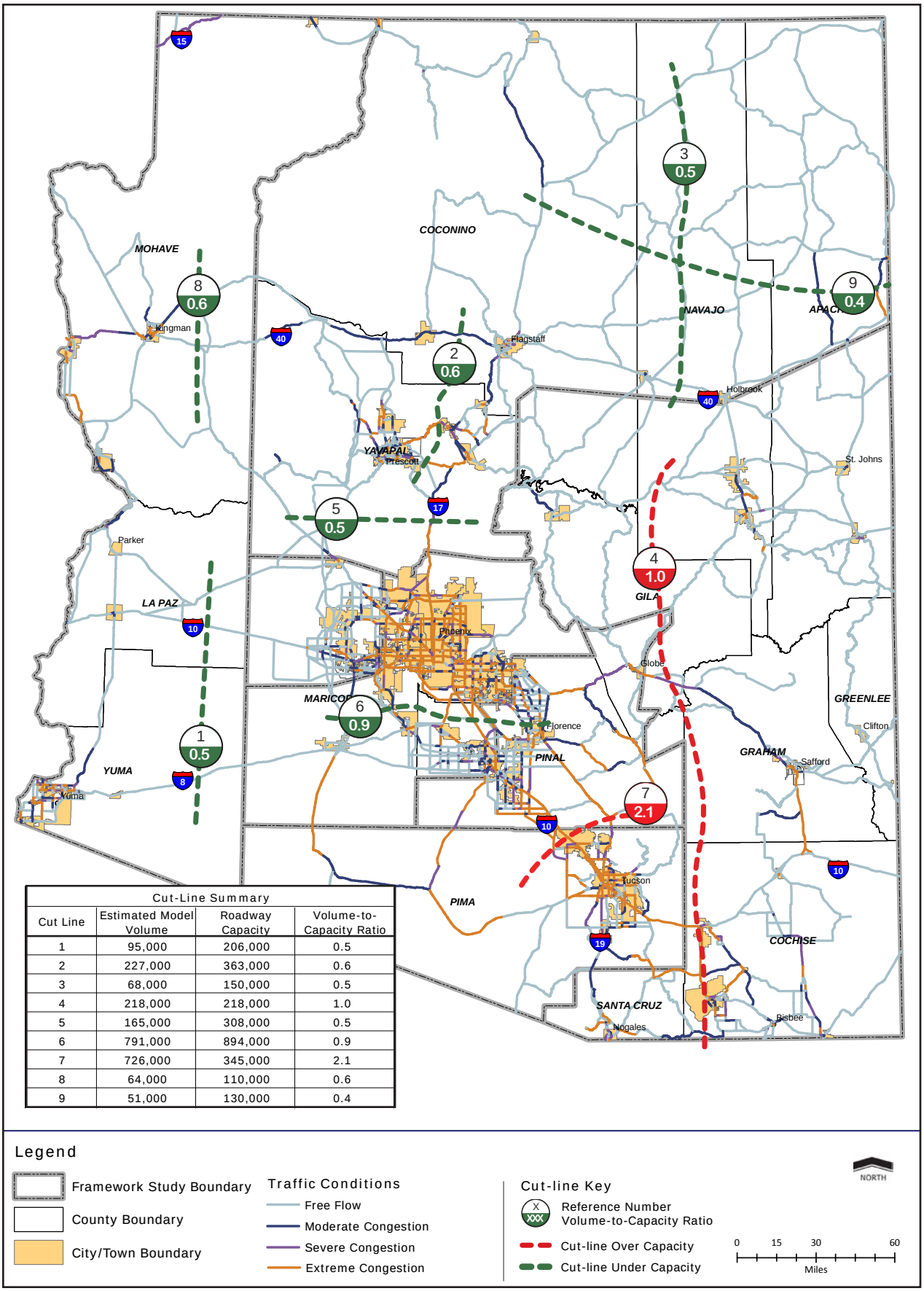
Traffic Conditions
Free Flow
Moderate Congestion
Severe Congestion
Extreme Congestion

Cut-line Key
XXX Reference Number
Volume-to-Capacity Ratio
Cut-line Over Capacity
Cut-line Under Capacity

NORTH

0 15 30 60
Miles

Figure 41 2050 Scenario C Traffic Conditions



Cut-Line Summary

Cut Line	Estimated Model Volume	Roadway Capacity	Volume-to-Capacity Ratio
1	95,000	206,000	0.5
2	227,000	363,000	0.6
3	68,000	150,000	0.5
4	218,000	218,000	1.0
5	165,000	308,000	0.5
6	791,000	894,000	0.9
7	726,000	345,000	2.1
8	64,000	110,000	0.6
9	51,000	130,000	0.4

Legend

- Framework Study Boundary
- County Boundary
- City/Town Boundary

Traffic Conditions

- Free Flow
- Moderate Congestion
- Severe Congestion
- Extreme Congestion

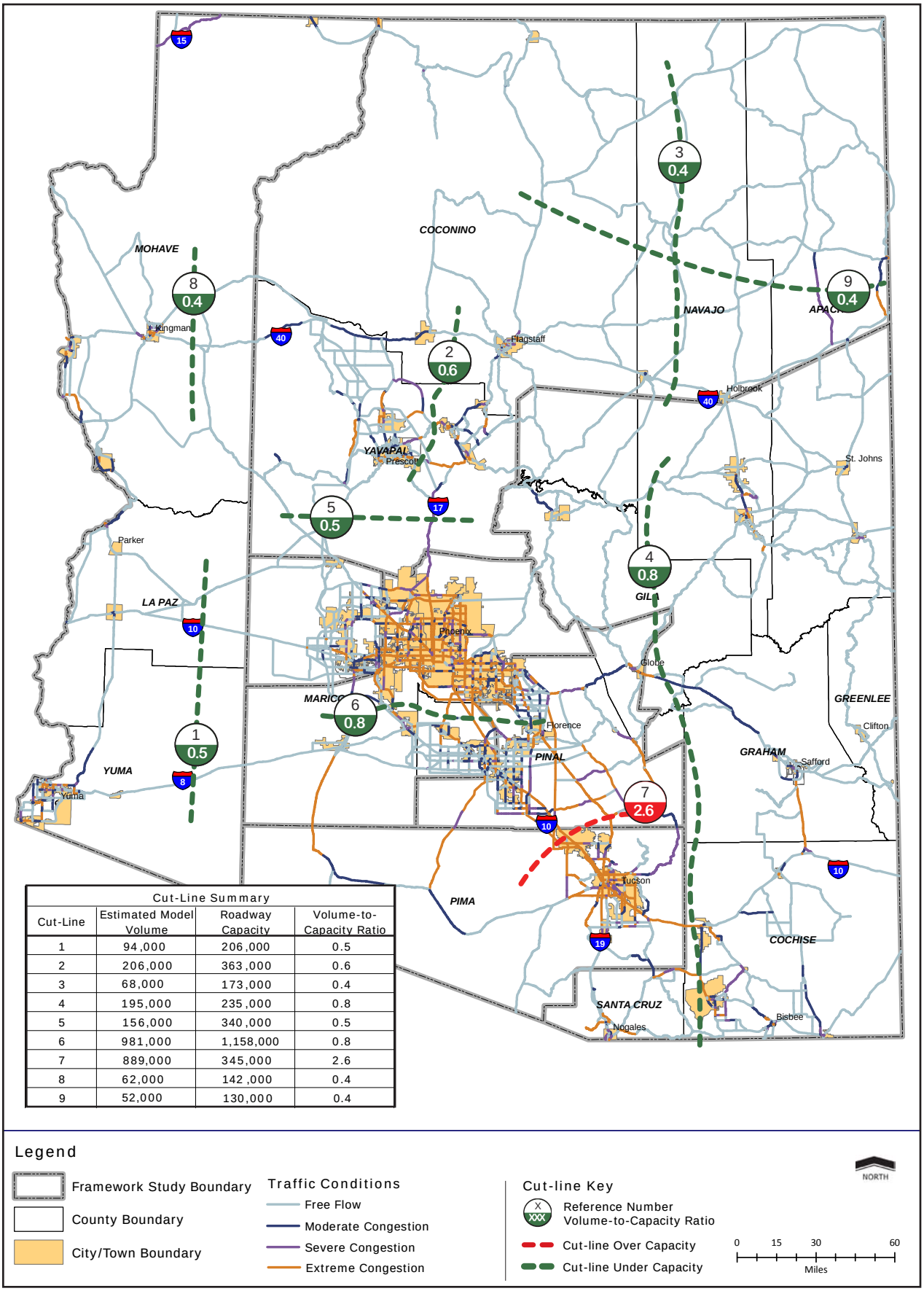
Cut-line Key

- Reference Number / Volume-to-Capacity Ratio
- Cut-line Over Capacity
- Cut-line Under Capacity

NORTH

0 15 30 60 Miles

Figure 42 2050 Recommended Statewide Scenario Traffic Conditions



Cut-Line Summary

Cut-Line	Estimated Model Volume	Roadway Capacity	Volume-to-Capacity Ratio
1	94,000	206,000	0.5
2	206,000	363,000	0.6
3	68,000	173,000	0.4
4	195,000	235,000	0.8
5	156,000	340,000	0.5
6	981,000	1,158,000	0.8
7	889,000	345,000	2.6
8	62,000	142,000	0.4
9	52,000	130,000	0.4

Legend

- Framework Study Boundary
- County Boundary
- City/Town Boundary

Traffic Conditions

- Free Flow
- Moderate Congestion
- Severe Congestion
- Extreme Congestion

Cut-line Key

- Reference Number / Volume-to-Capacity Ratio
- Cut-line Over Capacity
- Cut-line Under Capacity

NORTH

0 15 30 60 Miles

Table 25 Model Performance Measures by Scenario

Scenario	VMT (000)		VHT (000)		Delay in Hours (000)		
	Car	Truck	Car	Truck	Car	Truck	Total
Base 2005	87,205	18,424	2,511	413	945	115	1,060
2030 EC	182,539	39,857	12,427	1,875	9,173	1,228	10,401
2050 EC	452,586	70,259	3,430,688	212,761	3,422,752	211,594	3,634,346
2050 Scenario A	301,505	53,440	11,380	1,496	6,076	633	6,709
2050 Scenario B	290,932	53,239	11,263	1,499	6,058	634	6,692
2050 Scenario C	283,781	53,346	11,723	1,571	6,682	704	7,386
2050 R	297,980	53,252	10,936	1,455	5,703	595	6,298

Shaded rows represent 2050 conditions under five scenarios (see Table 23).
Source: bqAZ Statewide Technical Team, November 2009.

Both the cut-line analysis and the measures in Table 25 show that the existing-plus-committed network cannot accommodate projected traffic growth by 2050. From a statewide perspective, there is little difference between the performance of Scenarios A, B, and C–largely because many of the changes assumed in these scenarios do not affect Maricopa County or Pima County, where much of the travel in the state will continue to occur.

6.8.3 Conclusion

Outside the MAG and PAG regions, significant differences exist between the three alternative futures reflected in Scenarios A, B, and C. Each regional consultant's Working Paper 3 contrasts their performance at the regional level. At a statewide level, however, all three scenarios perform similarly. This happens largely because the MAG and PAG regions are not included in the trip reduction (Tables 17 and 18) assumed in Scenarios B and C. As a result, the similarities of the three scenarios in these two populous counties tend to swamp the differences in the Central, Eastern, Northern, and Western regions.

The Recommended Statewide Scenario combines the capacity improvements of Scenario A with the trip reduction assumed in Scenarios B and C. It therefore performs similarly to Scenarios A, B, and C on a statewide level.

It is clear that the existing-plus-committed highway network will be insufficient to support projected population growth. Although some reduction in car trips due to shifts to other modes may occur, substantial new roadway capacity will be necessary to maintain urban, regional, and intercity mobility in Arizona.

6.8.4 Issues for Further Consideration

Upon completion of the Recommended Statewide Scenario, several issues remained on the table for further consideration. ADOT and its local partners in Pima, Pinal and Yavapai counties will need to keep working to resolve these issues in future years.

Potential Travel Congestion between Pima and Pinal Counties

- Forecast travel demand for 2050 exceeds planned roadway capacity improvements between Pima and Pinal counties
- Alternative modes (transit and rail) and sustainable land use policy changes must be pursued, but these alone will not bridge the gap.
- The PAG Scenario Pima does not contain a La Cholla Corridor from Tucson to Oracle Junction, or a highway to connect with a possible I-10 bypass loop west of central Tucson. PAG believes that environmental impacts of the roadway projects must be comprehensively analyzed and publicly reviewed before recommending either roadway as part of the 2050 scenario.
- Further interagency planning between ADOT, PAG, CAAG, the two counties, municipalities, and other stakeholders will be necessary as growth continues.

PAG understands these issues and recommends coordinated planning efforts involving the three counties that link the Tucson and Phoenix metropolitan areas. Such planning should begin now. It should consider roadways, transit, freight and passenger rail, land use, and the effects of infrastructure expansion on environmentally sensitive lands. In addition, the PAG 2040 Task Force recommends

joining with MAG, CAAG, and ADOT to address projected congestion. PAG believes that planning for the Sun Corridor should explore a full range of congestion-relieving options. The CAAG, MAG, and PAG regional councils recently adopted a resolution stating their intent to "coordinate their…planning activities and…work together to foster a successful and economically viable Sun Corridor." The three organizations agreed to work with ADOT and the State Land Department to provide planning information to promote successful development of the corridor. The resolution also calls for a Joint Planning Advisory Council "to identify mutually agreed upon goals and interests, provide guidance on possible technical assistance and joint planning activities, and enhance communication and cooperation among policymakers in the three regions."

PAG also supports:

- Accommodating bicycles and pedestrians on new roadways, including ADOT facilities.
- High-capacity transit, with light rail and commuter rail in suitable corridors.
- Expanded freight and passenger rail capacity and services.
- Wildlife crossing structures for both large and small animals.

Yavapai County "Big Chino" Environmental Concerns

- This area contains irreplaceable habitat and movement corridors for Pronghorn and other wildlife.
- The area is also slated for substantial growth and development, which will require transportation improvements reflected in the Recommended Statewide Scenario.
- A context-sensitive approach to planning and design will be critical in projects to add roadway capacity.

Recognizing the environmental concerns of this sensitive area, ADOT decided not to show an extensive background network of principal arterials, which Yavapai County originally supported, in its recommended roadway scenario. ADOT and its local agency partners understand, however, that some sort of underlying roadway system will be necessary to accommodate long-term population growth in this area. A hypothetical network was coded into the statewide travel demand model for evaluation purposes, and to prevent the model from unrealistically overloading high-capacity corridors with local trips. Details of the network will be planned locally as development patterns in this part of Yavapai County become clearer.

Eastern Pinal County Environmental Concerns

- The natural environment in much of this area is sensitive, with challenging topography and important wildlife habitat.
- The recently adopted Pinal County Comprehensive Plan, which was a major source of the transportation Framework in the Central region, contains numerous regionally significant roads that will be needed to serve future growth.
- As in the Big Chino, a context-sensitive approach will be critical to projects adding roadway capacity.

6.9 Wildlife Corridors, Green Connectivity, and Avoiding Habitat Fragmentation

To help understand the environmental impact of transportation corridors included in the Recommended Statewide Scenario, the bqAZ Statewide Technical Team held a series of meetings with AGFD, The Nature Conservancy (TNC), and the Sonoran Institute. The Team presented the three statewide scenarios and asked for input. In response, AGFD and TNC provided their recommendations and tools for future planning efforts.

6.9.1 AGFD

AGFD developed the *Draft Species and Habitat Conservation Guide* to identify key habitats for potential wildlife conservation. This analysis is intended to guide project planners and developers at a statewide landscape level, as well as inform federal, state, county, municipal, and non-governmental partners. The geographic information systems (GIS)-based tool classifies areas by relative statewide potential (highest to lowest) for wildlife conservation, based on the following criteria:

Species of Economic and Recreational Importance: This category represents thirteen of Arizona's game species. The distribution of game species influences important aspects of wildlife-related recreation. When evaluating the effects of changes to this distribution, AGFD considers three aspects: demand for the game resource, revenue generated by the game resource for communities in Arizona, and revenue generated by the game resource for AGFD. Demand for the resource provides an indication of the importance of a particular piece of habitat to hunters for a given species, and is represented by the number of first choice applicants divided by the available number of permits for that species. Areas with higher demand are likely to be more important to hunters than areas with lower demand. Revenue generated

by the game resource for Arizona communities provides an indication of the economic importance of an area, and is represented by hunter days multiplied by the value of a hunter day in purchases of goods and commodities (e.g., gas, food, lodging). Areas with high value are used more frequently and provide a greater contribution to Arizona's economy than areas with lower value. Finally, the license and tag revenue generated by the game resource provides an indication of how critical an area is economically to AGFD. Together, the economic and recreational importance of game species to hunters, the community, and AGFD provide a realistic view of the importance of game habitat.

Species of Greatest Conservation Need: This category represents vulnerable species as defined in the *State Wildlife Action Plan* (SWAP). The criteria for Tier 1a, 1b, and 1c classifications are:

- Tier 1a: Vulnerable species that match at least one of the following:
  - Federally listed species (threatened or endangered)
  - Candidate species
  - Require monitoring following federal delisting
  - Protected under a signed conservation agreement
- Tier 1b: Vulnerable species that match at least one of the following:
  - Is petitioned for federal listing (threatened or endangered)
  - Is high priority in the Arizona Partners in Flight Bird Conservation Plan
  - Occurs on any of the following species of special concerns lists:
    - BLM Sensitive Species
    - USDA Forest Service Sensitive Species
    - National Park Service Sensitive Species
    - Pima County Priority Vulnerable Species
    - Trilateral Committee Species of Common Concern
    - Federal Species of Concern
    - Wildlife Species of Concern in Arizona
- Tier 1c: Vulnerable species that match none of the above criteria

Sportfish: Sport fishing is a significant contributor to Arizona's outdoor recreation and economy with close to 400,000 anglers creating $1.3 billion in economic value to the state annually.

Riparian: Riparian areas in the Southwest are crucial habitats for wildlife sustainability and often serve as wildlife movement corridors. Riparian communities and aquatic habitat make up less than two percent of the total land area in the arid western U.S., but are considered the most productive and ecologically diverse habitats in Arizona. The role of riparian areas is disproportionate to their size because of their many ecological functions, most important:

- Fish and wildlife habitat: 70 percent of all threatened and endangered vertebrate species in Arizona depend on riparian areas
- Increased water storage and recharge for aquifers
- Reduction of floodwater runoff
- Filtration and retention of upland sediment
- Reduction of chemical inputs from uplands by immobilizing, storing, and transforming
- Stabilization of stream banks and build up of new stream banks

Unfragmented Areas: This category analyzes large swaths of contiguous, unfragmented blocks of habitat. AGFD has identified maintaining unfragmented habitats as a critical component in the conservation of wildlife and its habitat, as well as in addressing existing and predicted global climate change (i.e., protecting blocks of habitat across an elevational and vegetation gradient). Determining contiguous habitat was based on GIS analyses using all major barriers (e.g., roads, railways, canals) to delineate areas.

Specific information on data sources, analysis, and weighting used to develop the *Draft Species and Habitat Conservation Guide* may be found on the AGFD website.

6.9.2 The Nature Conservancy

TNC evaluated potential effects on Arizona's natural resources as well as opportunities for resource enhancement associated with the 2050 transportation scenarios. The proposed transportation improvements and new transportation corridors were compared with a standardized dataset of twelve regional studies that identified important lands and waters, habitat for imperiled species, wildlife corridors, and open space. The combined datasets are referred to as the natural infrastructure.

TNC evaluated each proposed activity against the individual components of the natural infrastructure and characterized potential effects and recommended actions in the four categories listed in Table 26. (Time constraints precluded an analysis of proposed rail transit routes or a complete analysis of bus routes.)

Table 26 TNC Classification of Effects and Recommended Actions

Classification of Effects		Recommended Action
1	No issues identified	No further action needed beyond compliance with existing state and federal regulations
2	Intersects wildlife linkage(s) in which a wildlife corridor study has already been completed	Incorporate study recommendations for crossing designs and structures into project design and construction
3	Intersects wildlife linkage(s) and requires completion of a fine-scale linkage study of project design and construction	Complete corridor/linkage study and incorporate recommended designs and structures into project design and construction
4	Intersects core wildlife habitat with significant environmental concerns, including habitat for imperiled or declining species or large game, alternative habitat not available, or curtailment of land management options compromising federal and state resource agencies' ability to carry out their mission.	Roadway location inappropriate

Sources: Marshall et al 2009.

6.9.3 Implementation

The collaboration with AGFD, TNC, and Sonoran Institute prompted a three-tiered approach to maintaining wildlife corridors, green connectivity, and avoiding habitat fragmentation while formulating the multimodal transportation scenarios, including the Recommended Statewide Scenario. These tiers are:

3. **Maximize use of existing corridors:** Using existing right-of-way is the preferred method of clustering transportation routes, such as rail and roadway corridors, and of making full use of such right-of-way for capacity or safety enhancements, such as constructing additional lanes, passing lanes, wider shoulders, or bus pullouts.

4. **Wildlife mitigation:** Where maximizing use of existing transportation corridors is not sufficient, or where such corridors traverse sensitive wildlife corridors, mitigation measures will be required. Context sensitive solutions (CSS) consider the communities and lands that transportation corridors pass through, and are designed to accommodate adjacent communities and lands. The CSS process will need to be carried through a corridor's Alternatives Analysis (AA), environmental review, and final design. (See Chapter 7 for more on CSS.)

5. **Avoidance:** Where mitigation efforts are not feasible, avoidance–removing corridor recommendations altogether–should be considered. Several proposed highway corridors did not appear in the final version of the Recommended Statewide Scenario because of environmental concerns.

7.0 Statewide Framework Implementation

7.1 Transportation Funding

This chapter reviews existing and potential transportation funding options for the state of Arizona and its local jurisdictions. It identifies and quantifies transportation revenue sources currently used by jurisdictions in the state, including tribes. It also identifies (a) options that are statutorily available but not currently used, and (b) options that would require new legislation to be applied in Arizona. Additionally, it presents policy issues that jurisdictions will face regarding transportation revenue in the future, based on existing, statutorily available, and potential new funding options.

Because bqAZ considers all modes of surface transportation, this chapter includes a brief section on transit revenue. There are federal and state funding sources for transit service, as well as opportunities for local funding options. Transit funding typically comes from the fare box, from the federal government (mostly for purchasing capital equipment, but also for operations), and from general fund transfers to cover any shortfall. The Arizona constitution restricts the Highway User Revenue Fund (HURF) to highway purposes only.

Other states have applied several funding mechanisms to encourage and promote Smart Growth policies. This chapter includes a summary of several that Arizona might apply.

7.1.1 Basic Sources of Transportation Revenue

There are many sources and types of transportation revenue, each with its advantages and limitations. No single source meets all of the needs, so jurisdictions must rely on multiple revenue streams. Most major transportation sources are public revenue, levied, and collected as taxes by federal, state, and local governments. Public-private partnerships and direct private ownership, operation, and maintenance of transportation facilities do occur, however, and could become more prominent in the future.

Some transportation revenue comes from direct user taxes and fees, such as the (per gallon) tax on gasoline sales, the vehicle license tax, toll roads, and transit fares. These taxes and fees are assessed on the users of transportation systems, to offset the demands that users make for new capital investments as well as for operations and maintenance. In Arizona, the user fees and fuel taxes for a mid-size car amount to about two of the 57 cents per mile to own and operate the vehicle, according to data from the American Automobile Association. The amount differs in other states.

Other transportation revenue consists of indirect taxes and fees levied by governments that allocate the revenue to transportation purposes. Property taxes and sales taxes are the primary sources of indirect transportation revenue. They are considered indirect because they are imposed on the taxpaying public at large, rather than on transportation system users in particular.

Table 27 presents a simplified profile of transportation revenue, distinguishing between direct user taxes and fees, and indirect taxes and fees.

7.1.2 Direct User Taxes and Fees

Direct user taxes and fees include motor fuel taxes, vehicle license and registration taxes and fees, fees based on vehicle weight, tolls, fares, and other fees.

Sale of Motor Vehicle Fuel

This tax is typically levied in cents per gallon. Some states impose a sales tax on fuel sales instead of, or in addition to, the cents-per-gallon tax. Current taxes on the sale of gasoline are 18.3 cents per gallon (federal) and 18 cents per gallon (state). Arizona also collects another cent per gallon, which is used for remediating leaking underground storage tanks, and is not considered a transportation revenue source. The federal government and Arizona collect taxes on diesel fuels; the federal government collects taxes on the sales of alternative fuels (such as liquefied petroleum and natural gas, compressed natural gas, and E-85), but at lower rates. Motor fuel taxes are paid by the general motoring public (passenger cars) and owners of commercial vehicles. A few states index the tax rate to inflation, but

Table 27 Transportation Revenue Overview

Revenue Sources	How Paid	Who Collects	Who Pays
DIRECT USES TAX AND FEES	Taxes charged on fuel sales		
Gasoline Sales	Typically charged as cents-per-gallon and charged at the pump	Federal/state	Passenger/ commercial vehicles
Diesel Fuel Sales	Typically charged as cents-per-gallon and charged at the pump	Federal/state	Commercial vehicles
Alternative Fuels	Typically charged as cents-per-gallon and charged at the pump	Federal	Alternate fuel users
Vehicle License/Registration Fees	Fees for vehicle licensing and registration		
Vehicle License Fees	Fees based upon the value of the vehicle (ad valorem), assessed annually	State	All vehicle owners
Vehicle Registration/Title Fees	Typically one-time fees paid at the time of the initial vehicle registration	State	All vehicle owners
Vehicle Weight Taxes and Fees	Taxes and fees assessed against vehicles above specified weights		
Truck and trailer sales	Sales taxes on trucks and trailers above specified weight	Federal	Commercial vehicles
Tires	Cents per each 10 pounds over rated loads in excess of 3,500 pounds	Federal	Commercial vehicles
Heavy Vehicle Use	Annual taxes on trucks over a specified gross vehicle weight	Federal/state	Commercial vehicles
Tolls and Fares	Fees charged for use of facility		
Toll Roads	Tolls paid for use of roadways	State or interstate agencies/private entities	All vehicles using roadway
Transit Fares	Fares paid by transit riders	Local	Transit riders
Other Miscellaneous Fees	Various fees charged for operators licenses, specialized license plates, requests for special services, licenses and permits	State/local	Varies
INDIRECT TAXES AND FEES	Taxes/assessments on real property or for development thereof		
Primary Property Taxes	Taxes on assessed property valuations, collected annually, with some general fund revenue allocated to transportation	Local	All property owners
Secondary Property Taxes	Taxes on assessed property valuations, collected annually, for debt service on general obligation bond debt allocated to transportation capital improvements	Local	All property owners
Improvement and Community Facilities Districts	Assessments or property taxes against properties in specified geographic areas to pay for improvements benefiting the area	Local	All property owners in district
Development Impact Fees	One-time fees against new residential and non-residential property development, to offset the costs of transportation demand generated by the new development	Local	All new development
Private Contributions	Exactions/conditions of rezoning/dedications (e.g., right-of-way), construction and other "in lieu" payments	Local	Private developers

Table 27 Transportation Revenue Overview (continued)

Revenue Sources	How Paid	Who Collects	Who Pays
Sales Taxes	Taxes levied on retail sales or construction		
General Sales Tax	Taxes levied on sales of taxable items, with all or some of the proceeds provided for transportation	Local	All purchasers of taxable goods and services
Transportation Sales Tax	Taxes levied on sales of taxable items, with all proceeds dedicated to transportation	Local	All purchasers of taxable goods and services
Construction Sales Tax	A tax levied on all construction activity, in addition to general sales taxes, with all or a portion of the proceeds dedicated to transportation	Local	All purchasers of taxable goods and services

Source: Curtis Lueck & Associates, July 2009.

Arizona's fuel tax rate has not increased since 1991, and is not indexed. If adjusted for inflation since the last increase, the Arizona rate would be 39 cents today.

Rates in other states range from 8 cents per gallon in Alaska to 32.9 cents in Wisconsin. Revenue from fuel sales is relatively predictable because the volume of sales changes little in response to price fluctuations (i.e., consumer demand for gasoline is inelastic with respect to price). However, improvements in vehicle fuel economy reduce fuel sales, and hence revenue from the tax. At 20 miles per gallon, a person driving 15,000 miles per year pays about $135 in Arizona gasoline tax and $137 in federal gasoline tax.

Vehicle License Tax (VLT)

A second significant source of direct user revenue, the VLT is imposed by the state of Arizona and collected annually. It is a personal property tax on motor vehicles, based on statutorily defined formulas rather than direct market values. The tax is paid by all vehicle owners, at the time of initial licensing and on annual license renewal. In Arizona, the amount decreases as the vehicle depreciates. Therefore, VLT receipts are largely driven by new car sales. The VLT on a typical $25,000 new car is about $420 and drops about 16 percent per year. As discussed later, only a portion of the VLT is dedicated to transportation.

Vehicle Registration/Title Fees

Vehicle registration fees and certificate of title fees typically are minor charges. For motor vehicles, the certificate of title is a one-time charge of $4.00, while registration fees of $8.00 are collected annually. These fees are collected by the state and paid by all vehicle owners. (On the other hand, the sales tax on vehicle purchases is substantial, yet typically flows into the general fund and is not considered a transportation revenue source. In Arizona, the total sales tax on a new $25,000 vehicle can exceed $2,000.)

Vehicle Weight Charges

The federal government and states also assess fees based on vehicle weight. These charges are typically levied against large trucks and trailers, to recoup some of the extra wear and tear that heavy vehicles impose on roadways. The federal government assesses sales tax on trucks and trailers above a specified weight, and on large tires with rated loads in excess of 3,500 pounds. Both the federal government and states impose charges against "heavy-vehicle use" as well. Arizona imposes a commercial registration fee and a "gross weight fee" for designated vehicles that increases with the vehicle weight, from $7.50 for vehicles up to 8,000 pounds gross weight to $918 for vehicles with a gross weight of 75,001 to 80,000 pounds. These charges are paid by owners/operators of large commercial vehicles.

Toll Roads

Toll roads are operated by public toll road agencies or private entities. Tolls are usually based on miles traveled and paid by all users of the road. Toll charges typically range from five cents to fifteen cents per mile for passenger cars and twice that for commercial vehicles, and can vary by time of day and congestion level. Interest has grown both in selling existing public toll road systems to private investors, and in asking private investors to build, own (or lease long-term) and operate new toll roads. Arizona considered toll roads in the 1990s for the Phoenix metropolitan area, but the

interest was short-lived and none were constructed. Most toll roads have fully controlled access. In recent decades, vehicle transponder technology, and automatic billing have enabled many users to bypass traditional toll plazas. These users receive a monthly bill based on miles driven.

7.1.3 Indirect Taxes and Fees

Direct user taxes and fees typically do not generate enough revenue to meet all capital, operation, and maintenance costs of the transportation system. Many local governments enhance transportation revenue by levying indirect taxes and fees on the two principal sources of local revenue–real property and retail sales.

Real Property Taxes and Fees

Real property taxes and fees can be primary or secondary property taxes, taxes against improvement districts or community facilities districts, or development impact fees.

Primary Property Taxes

Primary property taxes are collected by local governments, based on assessed valuations (ad valorem), and collected annually. Primary property taxes are deposited in the local government's general fund, and some governments allocate a portion of this revenue to transportation.

Secondary Property Taxes

Secondary property taxes are also ad valorem, but they are levied to pay debt service on general obligation bonds approved by voters. General obligation bond debt has been used to fund transportation capital investments in Arizona and around the country.

Improvement Districts or Community Facilities Districts

Many local governments form improvement districts or community facilities districts, which are special taxing districts that can be formed to fund capital improvements, operations and maintenance, or both. The districts are funded through assessments placed on all benefiting properties within the district. The Arizona enabling legislation is slightly different for counties than for municipalities.

Development Impact Fees, Exactions, and "In Lieu" Fees

Development impact fees have become a common source of revenue for local governments, notably for transportation capital improvements. Impact fees are charged against new development, usually both residential and non-residential, to offset the costs of new travel demand generated by the development. These fees are paid by developers at the time of building permit issuance, and are typically passed along to the owners and tenants. The fees cannot be used to cure existing deficiencies or for non-capital expenditures. In Arizona, jurisdictions that impose impact fees must prepare annual reports that simplify tracking the revenue. Impact fees for roads range from a few hundred dollars to $10,000 per new house. The fees for non-residential uses also vary widely. Impact fees must be demonstrably proportionate to the actual cost of accommodating travel demand due to the development.

Property development may also generate transportation revenue in the form of private contributions, such as exactions and other conditions of rezoning, developer contributions (typically of right-of-way for public improvements), and direct developer construction of improvements or payments "in lieu" of construction. Contributions may be either in cash or in kind.

Local Sales Taxes

Sales taxes are a major source of transportation revenue in many states, including Arizona, where local sales taxes are levied in addition to the state rate of 5.6 percent, of which 0.6 percent is earmarked for public education and 5 percent goes to the state's general fund. Local sales taxes may be levied for general purposes or earmarked for specific uses such as transportation. Unlike cities and towns, Arizona counties lack the authority to charge a general sales tax.

Local general sales taxes are levied against all taxable sales, typically as a percent of the purchase price, and are usually deposited in the general fund. Some local governments allocate a portion of their general fund revenue to transportation. The total local sales tax rate is not prescribed by state law, but may be limited by municipal charter. Most cities charge a 1.5 percent to 2.0 percent sales tax. In communities with balanced land uses, sales taxes are large and relatively reliable revenue producers, typically generating at least $150 per resident annually for each percent of the tax rate.

Some local governments levy transportation sales taxes on all taxable sales, with all of the proceeds dedicated to transportation. This revenue is typically deposited in special accounts and tracked separately from other government accounts. In Arizona, governments have used both regional transportation sales taxes levied countywide, and local transportation sales taxes levied by cities and

towns. In many cases, voters are asked to approve a sales tax for specific projects, such as the roadway and transit improvements in the adopted MAG *RTP*.

In addition to general sales tax, some municipalities levy incremental sales taxes on certain construction-related activities. (Counties cannot impose this type of sales tax.) This revenue, which is statutorily based on 65 percent of the sale or contract price, is then earmarked for transportation. The tax is collected on new homes and other activities that involve a construction contract, such as installing a swimming pool, re-roofing, or recurring structural maintenance. Activities subject to the tax are defined by local policy or adopted ordinance. A two percent construction sales tax on a typical $300,000 new home generates about $3,900 ($300,000 x 2 percent x 0.65) in revenue. (The factor of 0.65 is imposed by state law.)

7.1.4 Some Basics on Federal and State Highway Revenue

This section provides basic information on federal and state of Arizona highway revenue. Both federal and state revenue are somewhat complex in their sources and allocation procedures.

Federal Highway Revenue

Federal transportation revenue and spending are governed by authorization bills enacted by Congress. The current authorizing legislation is SAFETEA–LU, signed into law on August 10, 2005. Federal transportation revenue is collected from motor fuel taxes and vehicle weight-related taxes, as shown in Table 28. Federal funding is deposited into either the highway account or the mass transit account of the Highway Trust Fund.

The federal government collects taxes on gasoline, diesel fuel, and five forms of alternative fuels. With the exception of compressed natural gas, these taxes are imposed on a cents-per-gallon basis, with the rate for gasoline being $0.183/gallon and for diesel $0.243/gallon. These tax rates have been in effect since the early 1990s. Gasohol is also taxed at $0.183/gallon, but the tax rates on other alternative fuels are lower.

The federal government also collects taxes on the sale of tires used for vehicles with a gross vehicle weight in excess of 3,500 pounds; on the sale of trucks and trailers in excess of 55,000 pounds and 26,000 pounds (respectively); and (annually) on trucks over 55,000 pounds.

Depending on the type of fuel, 80 percent to 88 percent of the motor fuel tax revenue is deposited in the highway account of the trust fund (with the remainder going to the mass transit account). All of the truck-related taxes are deposited into this account. Revenue in the highway account is allocated among a number of programs, as Table 29 shows. Four programs account for 55 percent of federal highway authorizations: Interstate Maintenance, National Highway System, Bridge, and Surface Transportation. These four, plus the Equity Bonus Program (provided to ensure a minimum rate of return to each state from its federal highway contributions), account for 76 percent of the authorizations.

State-shared Revenue

The state of Arizona shares transportation revenue with counties, cities, and towns through allocations from HURF, and through a small allocation of (non-HURF) VLT revenue to counties for transportation. The percentages of each allocation are fixed by statute. State shared revenue includes two subsets of the Local Transportation Assistance Fund (LTAF I and II), derived from state lottery revenue. Myriad

Table 28 Federal Highway User Taxes and Allocations

Type of Excise Tax	Tax Rates (cents/gallon)	Distribution of Tax	
		Highway Account	Mass Transit Account
Gasoline	18.3	84%	16%
Diesel	24.3	88%	12%
Gasohol	18.3	84%	16%
Liquefied petroleum gas	13.6	84%	16%
Liquefied natural gas	11.9	84%	16%
M85 (from natural gas)	9.15	84%	16%
Compressed natural gas	48.54/1,000 cu. ft.	80%	20%
Tires	9.45 cents/10 lbs	100%	0%
Truck and trailer sales	12% of sales price	100%	0%
Heavy-vehicle use	Weight-based-maximum $550	100%	0%

Source: U.S. Government Accountability Office, H*ighway Trust Fund: Overview of Highway Trust Fund Estimates*, Table 1, page 4, April 4, 2006.

Table 29 Federal Highway Account Program Categories

Authorization Category	5-Year Authorizations ($ million)	% of Total
Interstate Maintenance Program	$25,202	13%
National Highway System	$30,542	15%
Bridge Program	$21,607	11%
Surface Transportation Program	$32,550	16%
Equity Bonus Program	$40,896	21%
High Priority Projects Program	$14,832	7%
Congestion Mitigation/Air Quality Improvement Program	$8,609	4%
Highway Safety Improvement Program	$5,064	3%
Coordinated Border Infrastructure Program	$833	<1%
Safe Routes to School Program	$612	<1%
Other Programs	$18,744	9%
Total	**$199,491**	**100%**

Source: Federal Highway Administration, "Highway Authorizations: Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (Public Law 109-59)," April 6, 2006.

revenue sources are also shared with local jurisdictions for non-transportation purposes such as education.

HURF and VLT Revenue

Arizona collects an array of user-related taxes and fees, which are then deposited in the HURF account. HURF is a primary source of transportation funds for ADOT, municipalities, and counties.

The major transportation revenue sources that the state of Arizona collects are gasoline taxes, use fuel (diesel) taxes, vehicle license taxes, registration fees, and other fees. Over the last 20 years (from FY 1989 through 2008), gasoline taxes were the largest source of HURF revenue, providing 41 percent of the total ($7.56 billion). The next largest source of revenue was the transportation-dedicated portion of the VLT, which accounted for 21 percent (approximately $4 billion) of collections. Diesel fuel taxes accounted for 14 percent, followed by vehicle registration fees at 12 percent. Motor carrier (commercial vehicle) fees made up 8 percent of the total, with various other fees accounting for the remaining 4 percent. All of these taxes and fees are assessed at a fixed rate (not indexed or responsive to inflation) except the VLT, which reflects the changing price of new motor vehicles.

State statutes prescribe how HURF revenue is allocated to the State Highway Fund and to cities, towns, and counties (Table 30). Just over one-half of HURF (approximately 51 percent) is distributed to the State Highway Fund–including 8 percent to Maricopa and Pima counties for controlled-access highways, leaving 43 percent for ADOT discretionary programs involving state highway projects and maintenance throughout Arizona. Cities and towns receive approximately 28 percent of HURF revenue and counties 19 percent. These funds are disbursed among the jurisdictions based on population and origin of fuel sales. Phoenix, Tucson, and Mesa, the three largest cities, share the remaining 3 percent of HURF revenue (in addition to their portion of the 28 percent), allocated among the jurisdictions by population.

In FY 2008, approximately 45 percent of VLT collections were deposited into HURF. Another 5.83 percent of VLT revenue was separately distributed among the fifteen Arizona counties for highway purposes. The remaining 49 percent went to the general funds of the state, counties, cities and towns.

LTAF

There are two LTAF accounts, which are the only sources of state funding for local public transit. LTAF I is funded

Table 30 HURF Allocation Formulas

Distribution Breakdown	Distribution Formulas
50.5% to State Highway Fund	7.67% to Maricopa and Pima Counties for controlled access, with a 75%/25% split between them; 42.83% to "ADOT Discretionary"
27.5% to (all) cities and towns	One-half distributed by incorporated population, and one-half by county origin of gasoline sales and city or town population within each county
3% to cities over 300,000	Distributed to Phoenix, Tucson, and Mesa based on population
19% to counties	Distributed in part by gasoline distribution and diesel consumption (72%), and in part by unincorporated population (28%)

Source: FY 2008 Year End HURF Report.

from state lottery proceeds, up to $23 million per year (not indexed for inflation). The funds are distributed to cities and towns–but not counties–by population. The funds must be used for public transportation or for general transportation purposes, depending on the population. Municipalities larger than 300,000 must use the funds solely for public transit; smaller jurisdictions may use it for transit or roads.

The Legislature created LTAF II in 1998 to provide additional state transit and transportation funding to cities, towns, and counties. Statewide LTAF II revenue is capped at $18 million. In FY 2008, total LTAF II revenue was $10.1 million. Between FY 2002 and FY 2008, LTAF II revenue averaged $9.5 million. The LTAF II funding comes from the multistate Powerball lottery game and instant bingo game monies, along with a portion of the State Highway Fund's VLT money. ADOT administers LTAF II and funds are distributed to metropolitan planning organizations (or the regional public transportation authority [RPTA] in a county where one exists), and directly to cities, towns, and counties not represented by an RPTA or MPO. This program is administered by ADOT, and awards are based on an application process. Funds must be used for public transit unless a jurisdiction receives less than $2,500 in a calendar year. At the jurisdictional level, LTAF II is not deemed a reliable revenue source because the total annual allocation varies, and the distributions are made competitively.

7.1.5 Tribal Transportation Funding

Many Indian communities in Arizona rely on federal funds for maintaining IRR and other roads in the BIA system. The Federal Lands Highway Program is the primary resource for funding the development and upkeep of public roads that serve federal and Indian lands. The program is an adjunct to the Federal-Aid Highway Program.

IRR projects are selected by tribal governments and approved by BIA and FHWA. Each project must be listed in the Tribal Transportation Improvement Program, which is submitted by the BIA to FHWA for approval and then forwarded to the state for inclusion in the State Transportation Improvement Program. The Tribal Transportation Improvement Program planning and approval process involves the tribal chapters, agency roads committees, transportation and community development committees, BIA Regional Division of Transportation and FHWA. Approved IRR projects may be subject to metropolitan and statewide planning requirements and guidelines.

Tribes work with the ADOT district engineer and COG or MPO to identify project-specific funding. During its 1992 Functional Classification for Arizona, BIA classified the roads in the following Indian communities: Navajo, Hopi, San Carlos Apache, White Mountain Apache, Tohono O'ohdam, and Gila River. In other cases, the COG or MPO is responsible for classifying roads on the reservations.

The following are funding sources for IRR projects:

- **IRR (two percent) Tribal Transportation Planning Funds:** Available from BIA for transportation planning projects/activities.
- **IRR Construction Funds:** Available from BIA for the construction and improvement of roads, bridges, and transit facilities, and transportation planning projects/activities.
- **IRR Bridge Program Funds:** Available from BIA for the rehabilitation or reconstruction of deficient BIA bridges.
- **Federal Lands Highway-Discretionary Funds:** Available from the FHWA Federal Lands Highway Office through state DOTs, for road construction and transportation planning that promote or benefit tourism and recreational travel. Applications are submitted by the tribe to the state DOT.
- **Tribal Gas Tax Funds B:** Available through the tribal transportation department for use on local non-BIA roads and bridges.

IRR funding is used for the following:

1. Two percent planning (see item 1 above)
2. Preliminary engineering, including administration, planning, survey, design, archaeological/environmental clearances, and right-of-way acquisition.
3. New construction
4. Road and bridge maintenance
5. Construction engineering and inspection
6. Transit initiatives
7. Non-operations related
8. Emergency Relief Program for federal roads
9. Transportation enhancement and scenic byways
10. Most transportation-related activity, except road maintenance, which is funded with U.S. Department of the Interior appropriations.

ITS projects are also eligible for funding under IRR. Maintenance funding for BIA system roads is prioritized in the Interior Department budget. Maintenance funding for non-BIA roads must come from other sources.

Most roads on the reservations do not meet the criteria for Surface Transportation Program (STP) funding, but some BIA/tribal roads carry heavy traffic or are major routes for

school buses, and may qualify for STP funds. The application must then be submitted by the COG.

HURF is not distributed to the tribes in Arizona. The IRR Program does receive federal highway trust funds to address the transportation needs of the various Indian communities.

ADOT has prepared the *Tribal Traffic Safety Funding Guide*, a compilation of sources for tribal program funding. It includes not only funding sources for transportation-related program uses, but also agricultural, justice system, and health tribal programs.

7.1.6 Transit Funding

FTA typically provides about 80 percent of the cost to acquire transit vehicles, with the remaining 20 percent being local match. The service provider must fund most of the ongoing operation and maintenance costs. Farebox revenue typically recovers only about 20 percent of operating costs, or about 10 percent of the total costs for capital and operations. The two state LTAF funds were mentioned earlier.

Transit revenue can come from many other sources such as local transportation sales tax, general fund subsidies, grants, paid advertising on buses and at bus stops, and marketing of special services. Each service provider has different funding strategies and service goals. Federal funding programs available from the FTA are numerous and complex. A complete list is available at www.fta.dot.gov/funding/grants_financing_263.html.

7.1.7 Smart Growth Funding Opportunities

Several funding opportunities exist for communities wishing to implement or sustain manageable development based on Smart Growth concepts. Several of these are for

Table 31 Examples of Smart Growth Transportation Funding Programs

Smart Growth Funding Program	Description	Who Funds
Bicycle and Pedestrian Funding (General)	Bicycle and pedestrian projects are broadly eligible for funding from almost all the major Federal-aid highway, transit, safety, and other programs. Bicycle projects must be "principally for transportation, rather than recreation, purposes" and must be designed and located pursuant to the transportation plans required of states and MPOs.	Federal Aid Highway Program, Federal Transit Program, Highway Safety Programs, others
Federal Transit Administration Grant Programs	A major way FTA helps communities support public transportation is by issuing grants to eligible recipients for planning, vehicle purchases, facility construction, operations, and other purposes. FTA administers this financial assistance according to authorization, SAFETEA-LU, which was signed into law in August 2005. SAFETEA-LU authorizes specific dollar amounts for each program. Each year Congress provides an annual appropriation which funds the programs specified in SAFETEA-LU. Upon receiving this appropriation, FTA apportions and allocates these funds according to formulas and earmarks. These FTA apportionments are published annually in the Federal Register.	Federal Transit Administration
Helping Johnny Walk to School	To help localities site their schools in a way that not only achieves their educational objectives, but also anchors the local neighborhood, supports better public health, creates a cleaner environment, spurs economic development, and offers additional amenities to the community, the National Trust for Historic Preservation recently launched a new policy program, "Helping Johnny Walk to School," through a cooperative agreement with the EPA and with support from the Jessie Ball DuPont Fund. These grants are available to state agencies.	National Trust for Historic Preservation
Safe Routes to School	The program's purpose is to enable and encourage children, including those with disabilities, to walk and bicycle to school; to make walking and bicycling to school safe and more appealing; and to facilitate planning, development and implementation of projects that will improve safety and reduce traffic, fuel consumption, and air pollution near schools. Each year after deducting $3 million for administrative expenses, the funds are apportioned to states based on their shares of total enrollment in kindergarten through eighth grade, but no state receives less than $1 million.	FHWA

Source: www.smartgrowth.org

transportation enhancements that can improve pedestrian and bicycle access, encourage transit use and promote active living. Many of these are found on the smartgrowth.org website, an online clearinghouse providing guidance to policy makers on Smart Growth opportunities. Table 31 shows several existing transportation funding sources that can be used in Arizona.

7.1.8 Comparison of Arizona Transportation Revenue with National Data

The National Cooperative Highway Research Program (NCHRP) report, *Future Funding Options to Meet Highway and Transit Needs*, provides national data on funding that permits comparison with data on Arizona. The NCHRP report classifies funding sources as user fees, specialized taxes, and general taxes.

User Fees

The NCHRP report divides user fees into direct fees, such as tolls and transit fares, and indirect fees, such as motor fuel taxes, vehicle license tax, registration and sales taxes, and taxes on tires.

Specialized Taxes

These are non-user taxes and fees that are collected on non-transportation uses, but with the revenue dedicated to transportation. Examples of specialized taxes used in Arizona are transportation excise (sales) taxes, roadway development impact fees, and secondary property taxes used to retire transportation general obligation bond issues. Impact fees for public transit are used in some states (California, Florida), but are not allowed in Arizona.

General Taxes

These are taxes collected for broad purposes, but with some of the revenue used for transportation. Examples are income taxes, general sales taxes, and primary property .

Arizona Statewide Highway User Revenue Fund (HURF) Revenue

Table 32 shows the sources of FY 2008 HURF collections, the major source of statewide revenue. It excludes federal revenue available to ADOT. All HURF revenue is derived from what the NCHRP report characterized as user fees, compared to the nationwide 82 percent that NCHRP reports for the last 25 years.

The composition of HURF revenue shifted significantly from 1990 to 2008, as Figure 43 shows. The gasoline tax declined as a percent of HURF revenue from 43 percent in FY 1990 to 36 percent in FY 2008, while the VLT increased from 14 percent to 29 percent. This is a function of both (a) the erosion of fuel tax revenue by inflation and improving vehicle fuel economy, and (b) the increasing cost of new vehicles which produces more VLT.

Table 32 Sources of Arizona HURF (FY 2008)

Revenue Sources		FY 2008 Collections ($ million)	% of Total
Motor Fuel Taxes	Gasoline Tax	$493	36.6%
	Diesel Fuel Tax	$208	15.5%
Vehicle Related Taxes/ Fees	Vehicle License Tax	$385	28.6%
	Registration Fees	$163	12.1%
All Other Taxes/ Fees	Motor Carrier Fees	$40	3.0%
	Other Revenue	$56	4.2%
Total Revenue		**$1,345**	**100%**

Source: NCHRP, "Future Financing Options to Meet Highway and Transit Needs," Table 2.3.

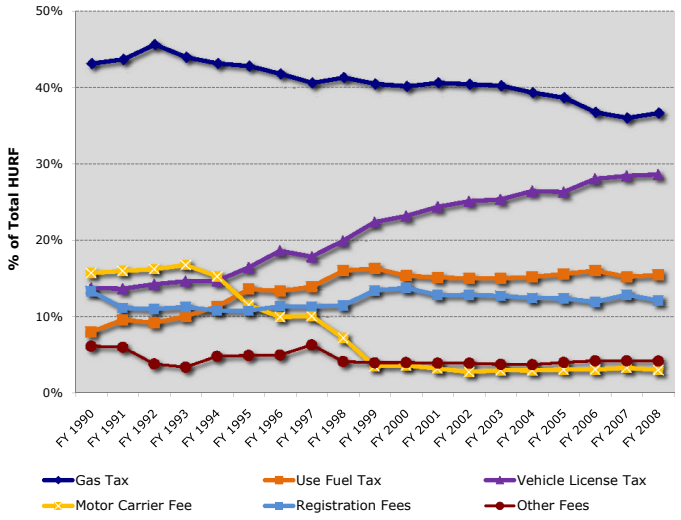
The American Petroleum Institute maintains a database on state motor fuel taxes. Arizona's gasoline tax of 18 cents per gallon ranks 32nd among the 51 states (including Washington, DC). Four other states are also at 18 cents per gallon, leaving 15 states with a lower gasoline tax. The average gasoline tax nationwide is 18.2 cents per gallon. The Arizona diesel tax is 26 cents per gallon–about three cents below the national average.

One other comparison of Arizona with other states is instructive: how is state transportation revenue allocated? The Brookings Institution report, *Fueling Transportation Finance: A Primer on the Gas Tax*, reports the disposition of state motor fuel tax receipts for 1998–2001 to four categories:

- State-administered highways
- Local roads and streets
- Mass transit purposes
- General fund and non-highway uses

Nationwide, the proportion allocated to state-administered highways was 62 percent. Arizona ranked 39th in this

Figure 43 Sources of HURF Collections, FY 1990 to 2008



Source: Curtis Lueck & Associates, July 2009.

respect, allocating 47 percent of its highway revenue to state-administered highways. On the other hand, Arizona allocated 52 percent to local roads and streets, the fifth highest–much higher than the 29 percent nationwide. The percent of urban and rural roadway miles in the state highway system varies substantially from one state to another.

Local Transportation Revenue

Local jurisdictions can collect only the revenue authorized by state statutes. In Arizona, no local jurisdiction is authorized to collect direct highway user taxes and fees, such as gasoline taxes or vehicle license taxes, although jurisdictions may impose transit fares. The revenue sources that are authorized for use by local jurisdictions are primarily indirect taxes and taxes on real property or sales.

7.1.9 Transportation Funding Source Options

This section identifies a menu of transportation funding options that are or could be available to the state. The NCHRP report presented a checklist of transportation revenue options, as shown in Table 33. From this list of options, some sources are either (a) currently available in Arizona, (b) used in other states but would require state legislative action for use in Arizona, or (c) considered innovative finance options.

The following two sections look at options from Table 33 that would require state enabling legislation or which are innovative financing options.

Revenue Options Requiring State Action

Table 34 identifies additional revenue options that would require authorization through changes in Arizona law. Legislative changes could either raise new revenue directly or permit a local option.

The state could increase fuel taxes, index these taxes to inflation, or do both. A citizen initiative from 1992 mandates that any tax increase requires a two-thirds ("supermajority") vote of the Legislature, however. Alternatively, the Legislature could authorize local governments to levy their own fuel taxes, and this is exempt from the supermajority requirement by Article 9, § 22(C)3 of the state constitution.

The state could levy a sales tax on vehicles or fuel, or a general sales tax with the revenue dedicated to transportation. Alternatively, the Legislature could allow local governments to levy vehicle-related taxes and fees. A sales tax–except on motor fuel–could be used for modes other than highways.

One of the most innovative concepts is the VMT fee, in which a vehicle's use of the highway network is tracked via global positioning systems (GPS). In Oregon's successful pilot programs, the fee was based on the amount of travel, route, and time of day.

Regarding pricing mechanisms, the state may be better equipped to use toll facilities, while local governments may benefit from either tolls or congestion pricing. Both the state and local governments could consider VMT fees. The Legislature could also consider fees to address development impacts on the state highway system.

Innovative Financing Options

Table 35 presents an overview of currently discussed innovative transportation financing options. This classification is derived from the USDOT "Innovative Finance for Surface Transportation" program.

USDOT defines "innovative finances" to include the following categories, with examples shown in Table 35:

- New or non-traditional sources of revenue
- New financing mechanisms designed to attract additional investment
- New funds management techniques
- New institutional arrangements

Table 33 NCHRP Transportation Revenue Options

Specific Revenue Tool	Modes				Scope		Yield	Locations Used
	Highway/ Bridge		Transit					
	Preservation, Maintenance	New Capacity	Operations, Maintenance	Capital	Program	Project	Potential Yield[a]	
Fuel Taxes								
Motor fuel excise (per gallon) tax	•	•		•	•		H	All states, Federal
Indexing of the motor fuel tax (can be indexed to inflation or to other factors)	•	•		•	•		H	FL, IA, KY, ME, NE, NC, PA, EV
Sales tax on motor fuel[d]	•	•		•	•		H	CA, GA, HI, IL, IN, MI, NY
Petroleum franchise or business taxes	•	•		•	•		H	NY, PA
Vehicle Registration and Related Fees								
Vehicle registration and license fees	•	•			•		H	All states
Vehicle personal property taxes	•	•			•		M	CA, KS, VA
Excise tax on vehicle sales dedicated to transportation	•	•			•		H	CT, IA, KS, MD, MI, MN, MO, NC, NE, OK, SD, VA; Federal for heavy trucks
Tolling, Pricing, and Other User Fees								
Tolling new roads and bridges		•	•	•		•	M	About half of states
Tolling existing roads	•	•	•	•		•	L	VA proposed, others considering
High-Occupancy Toll (HOT) lanes, express toll lanes, truck toll lanes		•	•	•		•	M	CA, CO, GA, MN, TX
VMT fees	•	•	•	•	•		H	OR testing; recommended by 15 state-pooled fund study
Transit fees (fares, park-n-ride fees, other)			•		•		H	All transit agencies
Container fees, customs duties, etc.		•			•	•	M	CA
Beneficiary Charges and Local Option								
Dedicated property taxes	•	•	•	•	•		H	Many local governments
Beneficiary charges/value capture (impact fees, tax increment financing, mortgage recording fees, lease fees, etc.)		•		•		•	L	Many states and localities (e.g., CA, FL, OR, NY)
Permitting local option taxes for highway improvements								
• Local option vehicle or registration fees	•	•			•	•	M	AK, CA, CT[b], CO, HI, ID, IN, MS[b], MO, NE, NV, NH, NY, OH, SC, SD, TN[b], TX, VA[b], WA, WI
• Local option sales taxes	•	•			•	•	H	AL, AZ, AR, CA, CO, FL, GA, IA, KS, LA, MN, MO, NE, NV, NM, NY[b], OH, OK, SC, TN, UT, WY
• Local option motor fuel taxes	•	•			•	•	M	AL, AK[b], FL, HI, IL, MS, NV, OR, VA, WA
Permitting local option taxes for transit								
• Local option sales taxes			•	•	•	•	H	AL, AZ, CA, CO, FL, GA, IL., LA, MO, NV, NM, NY, NC, OH, OK, TX, UT, WA

Table 33 NCHRP Transportation Revenue Options (continued)

Specific Revenue Tool	Modes				Scope		Yield	Locations Used
	Highway/ Bridge		Transit					
	Preservation, Maintenance	New Capacity	Operations, Maintenance	Capital	Program	Project	Potential Yield[a]	
• Local option income or payroll tax			•	•	•	•	M	IN, KY, OH, OR, WA
Other Dedicated Taxes								
Dedicate portion of state sales tax	•	•	•	•	•		H	AZ, CA, IN, KS, MA, MS, NY, PA, UT, VA
Miscellaneous transit taxes (lottery, cigarette, room tax, rental car fees, etc.)			•	•	•	•	L	Various states and localities
General Revenue Sources								
General Revenue[c]	•	•	•	•				Most states and localities

[a] Potential Yield; H = High, M = Medium, L = Low.
[b] Revenues go into General Fund but can be earmarked or used for transportation.
[c] For purposes of this report, the leveraging of tax subsidies through tax credit bonds and investment tax credits is treated effectively as producing revenue from general fund sources for transportation.
[d] In some states, revenues from sales taxes on motor fuel are not dedicated or only partially dedicated to fund transportation needs.

Source: NCHRP 20-24(49) - *Future Financing Options to Meet Highway and Transit Needs.*

Table 34 Transportation Revenue Options Requiring State Approval

Revenue Source Category		State Options	Local Government Options
User Fees	Fuel Taxes	Increase and/or index fuel taxes	Local option for motor fuel tax, with indexing permitted
		Levy a sales tax on sale of motor fuels	
	Vehicle-Related Taxes/ Fees	Vehicle excise tax dedicated to transportation	Local option for vehicle related taxes or fees
		Vehicle personal property tax	Local option for vehicle personal property tax
	Pricing Mechanisms	Tolling new roads and bridges	Congestion pricing
		HOT lanes	VMT fees
		VMT fees	
Specialized Taxes	Sales Taxes	Statewide general sales tax for transportation	Enable Maricopa and Pima counties to impose an additional transportation sales tax
	Impact Fees	Impact fee for state highways	Enable local jurisdictions to levy impact fees for state highways

Source: Curtis Lueck & Associates, 2009.

Each of the innovative financing options identified is already in use, either in Arizona or elsewhere.

The state of Arizona already uses Transportation Infrastructure Finance and Innovation Act (TIFIA) support, the state infrastructure bank, Grant Anticipation Revenue Vehicles (GARVEES), Grant Anticipation Notes (GANS) loans, revenue bonds (HURF and Regional Area Road Fund), and Board Funding Obligations. All of these strategies fund projects through new debt that is retired by committed federal and state funding. Accordingly, they are financing mechanisms that build today's roads with tomorrow's dollars. They are not funding sources per se. For a detailed discussion on these and other sources, the reader is referred to the FHWA Innovative Finance website at www.Innovativefinance.org.

7.1.10 Funding Policy Considerations and Strategies for Discussion

Recent research paints a grim picture for transportation funding today and in the future: costs of necessary capital improvements and operations/maintenance vastly exceed available and expected revenue. The shortfall will result in increased congestion, a stifled state economy, compromised traffic safety, and an unhappy traveling public unless steps are taken.

On a broad-brush level, there are four options for addressing this gap:

- Raise revenue to more fully cover costs
- Substitute lower-cost alternatives–such as Travel Demand Management (TDM), Transportation Systems Management (TSM), and Intelligent Transportation Systems (ITS)–for more costly capacity solutions
- Accept lower performance standards to bring revenue and needs into balance, and
- Some blend of these three options

It is apparent that no single option will close the gap between revenue and cost. The need exists to investigate an array of revenue sources, including both current sources and new or enhanced sources.

An effective transportation system is critical to Arizona's current and future economy. Additional action to expand the revenue base can be taken at the state, municipal, and county levels. Successful local revenue sources have included development impact fees, construction sales taxes, and special districts. The state could authorize regional impact fees, impact fees for transit, and impact fees for state highways; it could further empower local government with more local options to raise revenue.

Table 35 Transportation Innovative Financing Overview

Finance Programs	Finance Sources
Federal Loans and Credit Support	Transportation Infrastructure Finance and Innovation Act (TIFIA)
	Section 129 loans
State Credit Assistance	State infrastructure banks
Bonding and Debt Instruments	Municipal/public bond issues
	Revenue bonds
	General obligation bonds
	Limited and special tax bonds
	Hybrid bonds
	Private activity bonds
	Anticipation Notes
	Grant Anticipation Revenue Vehicles (GARVEES)
	Transit Grant Anticipation Notes (GANS)
	Private bond issues
	Certificates of participation
	Shadow tolls
Federal Matching Flexibility	Tapered match
	Third party donations
	Using federal funds as match
	Toll credits
	Program match

Source: Derived from U.S. Department of Transportation (USDOT) "Innovative Finance for Surface Transportation" website: www.innovativefinance.org, 2009.

The estimated cost of arterial roadway capacity consumed by each new home built in urban and suburban Arizona is approximately $15,000. The cost of local and collector roadway capacity is rolled into the construction of new development projects and passed on to the end user (the homeowner and motorist). The cost of freeways and Interstate highways, which can add another $5,000 to $10,000 per dwelling unit, is frequently funded by the state or federal government with local matching funds. Therefore, the total cost of required new freeway and arterial capacity is about $20,000 to $25,000 per new home. However, impact fees and other existing sources typically raise less than $5,000 per home, leaving a large shortfall and a funding conundrum. In addition, the cost of

long-term maintenance is roughly equal to the capital cost of initial construction, when the latter is amortized over the useful life of the roadway.

The following list offers some possible strategies for raising revenue to meet the needs of a growing population:

- Use improvement districts, revenue bonds, innovative financing, and construction sales taxes to help resolve as many as possible of today's capacity and maintenance deficiencies. No new legislation is needed.
- To accommodate new growth, establish a regional development impact fee program for the major corridors identified in the study, possibly including state routes. The program could be modeled after other jurisdictions (see for example California) using new legislation. No new legislation is needed if joint powers agreements (such as intergovernmental agreements) are used. New legislation would be needed, however, to enable the state to collect impact fees for improvements to the ADOT highway system.
- Consider the use of community facilities districts to fund offsite improvements for new development.
- Pursue toll roads and other innovative financing strategies along one or more new or existing corridors. Landmark public-private partnership (PPP) legislation was recently enacted in Arizona. The law is very flexible and allows innovative financing for many types of infrastructure, including roads, transit, and rail. It gives ADOT some flexibility in determining the best project delivery methods, which can blend design, build, finance, operate, maintain or lease options. The law also authorizes ADOT to issue traditional revenue bonds to build a public project such as a highway, bridge or tunnel.
- Implement a life cycle cost program, similar to MAG's Regional Area Road Fund, for specific areas, to address both capital and maintenance needs. No new legislation is required.
- Implement a concurrency program, in which new development cannot proceed into construction until needed roadways are funded, permitted, and fully programmed for implementation. No new legislation is needed, and it would likely not be restricted by Proposition 207 (Private Property Rights Protection Act) due to exceptions therein. This can be incorporated into each municipality's general plan and each county's comprehensive plan, pursuant to ARS Title 9 and 11.
- Seek legislative approval for local revenue options such as a local gasoline tax, a local sales tax on fuel, and local vehicle registration fees. This requires a simple majority vote at the Legislature followed by local adoption.
- Seek an increase in the state gasoline tax. A tax increase requires a supermajority vote of the Legislature to comply with the constitution, but changes to the HURF formula require a simple majority vote.
- Seek an increase in the federal gasoline tax. This requires action by Congress.
- Strive for a balanced transportation system, with due consideration of land use patterns, that incorporates transit and alternative modes of travel. This will require investigation of additional sources of funding for public transportation, such as a one-quarter to one-half percent sales tax, a property tax, or a new transit district with taxation authority. These options may require new legislation, but some may be achievable under current statutes.
- Recognize that fuel tax revenue will decline as vehicles become more efficient and manufacturers shift away from internal combustion engines. Prepare for new revenue strategies, such as vehicle mileage charges, as demonstrated successfully in Oregon and other locations.

7.1.11 Public-Private Partnerships in Arizona

PPPs create innovative ways to build and operate transportation facilities. Many states use this funding mechanism to build new capacity, and sometimes generate new funds by selling public assets to private investors who then operate them on a pay-for-use basis. Arizona had numerous toll facilities during territorial days, including roads and bridges, although their use ended long ago.

Until recently, Arizona law did not encourage the formation of PPP investments. The state Legislature recently reopened the door for viable PPP investments by adopting new enabling legislation. This landmark legislation codifies best practices from around the country into a single statute. The legislation is innovative and flexible, and can be used for public transit as well as roads. This flexibility will encourage planners and investors to consider all modes of travel–more so than in the past.

7.1.12 Highlights of HB 2396

In July 2009, Governor Brewer signed into law House Bill 2396 (Session Law Chapter 141). HB 2396 amended Title 28 (Transportation) and Chapter 22 (Transportation Project Privatization), substituting a new Chapter 22 (Public-Private Partnerships in Transportation). The new laws enable in Arizona the most up-to-date PPP strategies, as defined by FHWA: "contractual agreements between a public agency and a private entity that allow for greater private sector

participation in the delivery and funding of transportation projects."

Highlights of HB 2396 include:

1. ADOT is authorized to use a "variety of project delivery methods and forms of agreement" to develop PPP projects. HB 2396 also permits ADOT to approve requests by "another unit of government" to use these same methods and agreements. "Unit of government" is broadly defined to include a "city, county, district, commission, authority, entity, port or other public corporation organized and existing under statutory law or under a voter approved charter or initiative, and any intergovernmental entity."

2. "Eligible projects" are broadly defined as "any enhanced, upgraded or new facility" using "one or more modes," including highways, alternative modes (transit, bus systems, guided rapid transit), "intermodal or multimodal systems," other modes (ferries, boats, and vessels), and support facilities, equipment and property.

3. ADOT or another unit of government can solicit competitive bids for projects using a range of procurement methods, or can accept unsolicited bids that are determined to have "sufficient merit" if there is a "reasonable opportunity" for submission of competing bids.

4. The statute allows the "development or operation of eligible facilities using a variety of project delivery methods and forms of agreement" (lasting up to fifty years, with opportunities for extension) that may include "a wide range of possibilities." Further, it allows:

    - A variety of agreements in which responsibilities for design, build, finance, maintenance, and operation of eligible projects are assigned, such as design-build and design-build-finance-operate-maintain agreements.
    - Concessions to a private partner to "design, build, operate, maintain, manage or lease an eligible facility." A concession is defined as "any lease, ground lease, franchise, easement, permit or other binding agreement transferring rights to use or control, in whole or in part, of an eligible facility to a private partner."
    - Creating "predevelopment agreements leading to other implementing agreements."

5. The statute provides for a wide variety of revenues, financing and funding arrangements. Private partners are authorized to collect "use fees, tolls, fares or similar charges." Furthermore, "any lawful source of funding" can be used to develop an eligible project, including such examples as federal, state or local revenues; private activity bonds; toll revenue bonds; and grants and contributions.

6. The statute permits drivers who pay tolls on an eligible facility to apply for a refund or credit for motor vehicle fuel taxes, license taxes, use fuel taxes, and motor carrier fees "paid while operating the motor vehicle on the roadway project."

7.1.13 Opportunities and Limitations

FHWA is a leader in advocating for and researching PPPs for transportation. It maintains a website devoted exclusively to PPPs, at www.fhwa.dot.gov/PPP. The agency also published in 2007 its *User Guidebook on Implementing Public-Private Partnerships for Transportation Infrastructure Projects in the United States* that provides an important resource for understanding the applicability of PPPs to Arizona. Figures 44 and 45 reproduce exhibits from the guidebook that highlight opportunities and limitations that must be addressed in structuring PPPs.

Figure 44 shows the major types of public-private partnerships, sorting them according to the degree of responsibility and risk assumed by the private sector. HB 2396 contemplates the full range of options identified by FHWA, except that it does not contemplate an "asset sale," and does not explicitly refer to either "contract

Figure 44 Major Types of Public-Private Partnerships

Source: Curtis Lueck & Associates, July 2009.

maintenance" or fee-based contract services (options that are probably available under other statutes).

Figure 45 identifies potential benefits and risks to PPP partners. The partnerships will work only when agreements are written to maximize benefits and minimize risks to acceptable levels. At a minimum, properly balancing benefits and risks will require that:

1. ADOT establishes clear and comprehensive rules and guidelines for PPPs.
2. Both public and private partners possess a great deal of specific expertise.
3. Eligible projects are chosen that are well suited for the PPP format, address pressing needs that will yield material benefits, are well designed, and have strong public support.
4. Projects are initiated in an economic climate conducive to PPP financing arrangements and structured to withstand up and down cycles in the economy.

The following list provides examples of successful PPP projects, distinguishing between "New-Build Facilities" and "Existing Facilities." New facilities include toll roads, light rail, monorails, high occupancy/toll lanes, expressways/greenways, and corridor reconstructions. Existing facilities include operations and maintenance (O&M) concessions and long-term leases of existing toll facilities.

New-Build Facilities

Design/Build

- E-470 Tollway (Denver)
- Hiawatha Light Rail Transit (Minneapolis)
- I-15 Corridor Reconstruction Project (Salt Lake City)
- Texas State Highway 130

Design/Build/Operate/Maintain

- Hudson-Bergen Light Rail (Hoboken/Jersey City)
- Las Vegas Monorail
- Route 3 North (Boston)

Figure 45 Potential Benefits and Risks of Public-Private Partnership Approaches

Potential Benefits to Public Sponsor	Potential Risks to Public Sponsor
• Reduced financial constraints/increased financial capacity • Expedited project initiation and faster delivery • Access to innovative techniques and specialized expertise • Integration of project development and delivery with life-cycle cost incentives • Greater choices in project approaches • Increased competition and accountability • Risk transfer to entity better able to manage	• Transaction/administrative costs to procure and monitor PPPs • Taxation constraints • Moral hazard • Control over transportation assets and toll rates • Public acceptance • Compensation and termination clauses • Environmental/archeological clearance • Permitting costs • Right-of-way costs
Potential Benefits to Private Sponsor	**Potential Risks to Private Sponsor**
• Higher rate of return compared to conventional project delivery approach • Greater control over assets/operation/user fees • Lower life-cycle costs • Increased revenues from financial transactions • Opportunity to apply best practices and new technology to increase productivity and meet performance standards at lowest life-cycle costs • Opportunity for value capture from direct users and indirect beneficiaries	• Change in law • Economic shifts • Public acceptance/protectionism • Currency/foreign exchange • Political support/stability • Moral hazard • Project development/maintenance costs • Project delivery schedule • Financial feasibility/traffic and revenue levels • Liability for latent defects • Prohibition against non-compete clauses • Compensation/termination clauses • Transparency requirements

Source: Curtis Lueck & Associates, July 2009.

Design/Build/Finance/Operate

- Capital Beltway HOT Lanes (I-495, national capital area)
- Dulles Greenway (Loudoun County, Virgina)
- Foley Expressway (Baldwin County, Alabama)
- South Bay Expressway SR 125 (San Diego County)

Existing Facilities

Operations & Maintenance Concession

- Washington, DC Streets
- Anton Anderson Memorial Tunnel (Prince William Sound, Alaska)

Long-Term Lease

- Chicago Skyway
- Indiana Toll Road

Hybrid Lease/Develop/Operate

- Pocahontas Parkway (Greater Richmond, Virginia)

Other Innovative PPPs

- Louisiana TIMED Program
- South Carolina 27 in 7
- New Mexico SR 44
- King Coal Highway (West Virginia)
- Heartland Corridor (Kentucky, Ohio, Virginia, and West Virgina)
- CREATE (Chicago Region Environmental and Transportation Efficiency Program)
- SmartWay Upgrade Kit (I-5 Corridor, Oregon)

7.2 Related State Planning Issues

Throughout the Statewide Transportation Planning Framework effort, stakeholders and the community identified related issues that they believe should be addressed either in this report or in the state's next update of the LRTP. These issues are primarily policy-related, and hence do not fit into the Recommended Statewide Scenario, which is composed of individual projects or programs.

The following brief discussions are intended to stimulate further thought and discussion. In some cases, the role of state government has already been defined, while in other cases it is not yet clear. ADOT has dealt with some of these issues for years, while others are new to the agency. Where appropriate, the relation of each issue to the Statewide Framework and suggestions for possible ADOT action are noted.

Because of their special importance to the future of Arizona and to long-range multimodal planning, the following topics are discussed separately at the following locations:

- Climate Change: Chapter 3
- Demographic and Social Change: Chapter 3
- Energy Cost and Price Volatility: Chapter 3
- Smart Growth: Chapters 1, 2, and 7
- Sustainability: Chapters 1, 2, and 6
- Wildlife Corridors, Green Connectivity, and Avoiding Habitat Fragmentation: Chapters 5 and 6

7.2.1 Access Management

Appropriate access management is essential to maximizing roadway safety and capacity on all arterials and higher-level roadways. ADOT is currently completing an Access Management Program, which will include an *Access Management Manual* for the state highway system.

Potential ADOT Action

The ADOT Access Management Program and its accompanying manual will become an important tool that ADOT can use in conjunction with bqAZ, the LRTP, and other statewide planning efforts. Managing access on state highways will enable ADOT to extract the most value from its highways over the coming decades of rapid growth in an environment of limited resources. It will also provide an important tool, in conjunction with good land use decision-making at the municipal level, to maximize capacity on existing and future roadway corridors, reducing congestion and improving safety.

7.2.2 Airport Access

Although the Statewide Framework does not address air travel per se, ground access to both commercial and general aviation is an important element of multimodal transportation planning. Airports need to be easily accessible by road, and in some cases by public transit as well. Especially in larger cities, mobility of air passengers and cargo between the airport and the entire urbanized region is critical to economic development.

Relation to Statewide Framework

Several roadway improvements in the Recommended Statewide Scenario maintain efficient connections between the state's principal commercial airports and the rest of Arizona. In addition, future intercity and commuter rail could serve Phoenix Sky Harbor, Tucson International, and Phoenix-Mesa Gateway airports.

As an example, the *Pinal County Comprehensive Plan* was updated during the same time period as the development of the Statewide Transportation Planning Framework Program, allowing coordination among study recommendations, specifically regarding a potential new commercial airport in Pinal County.

Pinal County sits in the middle of the Sun Corridor Megapolitan, an area expected to comprise 85 percent of the state's population in 2050. Because of the expected concentration of population and employment in the Sun Corridor, specifically in Maricopa, Pinal, and Pima counties, the Comprehensive Plan update included a high-level airport feasibility study, determining the likely need for an additional commercial airport within the Sun Corridor by 2050, above and beyond expansions to the Phoenix Sky Harbor, Tucson International, and Phoenix-Mesa Gateway airports. Based on a cursory review, a potential Pinal County commercial airport location was recommended at the future junction of the Hassayampa Freeway and North-South Freeway corridors, near Coolidge. An existing freight rail line runs north and south, adjacent to this location, and a future commuter/intercity rail corridor could be located in the existing rail corridor, or as a component of the North-South Freeway corridor. Because of these transportation connections, this site is also planned as a major intermodal hub. All of these recommendations–new freeways, potential future airport, freight and passenger rail improvements–were coordinated with the final Recommended Statewide Scenario.

Potential ADOT Action

ADOT recently moved its planning for aeronautics to ADOT-MPD, which includes roadway, rail, and public transportation divisions. This will facilitate future coordination between surface and air transportation planning statewide. Aviation considerations might be a component of all high-capacity transportation studies.

7.2.3 Border Master Planning

Because the Recommended Statewide Scenario does not consider specific transportation improvements at international ports of entry (POEs), ADOT will work to better coordinate planning and project delivery for the POEs and their transportation infrastructure. The objectives of this border master planning process are to strengthen mutual understanding of POEs and transportation planning on the Arizona and Sonora sides of the binational border, and to create a plan for advancing and prioritizing POE and related transportation projects. Although the study area extends 60 miles north and south of the border, ADOT will explore implications of its recommendations for population, employment and trade growth in the Sun Corridor and the rest of the state. The states of Arizona and Sonora already maintain communication through the Arizona-Mexico Commission, but border master planning will further institutionalize communication among federal, state, regional, and local stakeholders to identify and coordinate future POE improvements and solutions to infrastructure needs.

Relation to Statewide Framework

The Recommended Statewide Scenario is a starting point for transportation improvements along the Arizona-Sonora border anticipated through 2050. These recommendations were achieved through coordination with the Arizona-Mexico Commission, and therefore can be incorporated and prioritized in border master planning.

Potential ADOT Action

ADOT plans to initiate the border master planning process, using the Recommended Statewide Scenario as a baseline for future transportation improvements along the border.

7.2.4 Complete Streets

As described by the National Complete Streets Coalition, "Complete Streets are designed and operated to enable safe access for all users…Complete street policies direct transportation planners and engineers to consistently design with all users in mind." The coalition states that a complete streets policy should:

- Include a vision for how and why the community wants to complete its streets
- Specify that "all users" includes pedestrians, bicyclists and transit passengers of all ages and abilities, as well as trucks, buses, and automobiles.
- Encourage street connectivity and aim to create a comprehensive, connected network for all modes.
- Be adaptable by all agencies to cover all roads.
- Apply to both new and retrofit projects, including design, planning, maintenance, and operations, for the entire right-of-way.
- Make any exceptions specific and set a clear procedure that requires high-level approval of exceptions.
- Direct the use of the latest and best design standards while recognizing the need for flexibility in balancing user needs.
- Direct that complete streets solutions will complement the context of the community.

- Establish performance standards with measurable outcomes.
- Include specific next steps for implementation of the policy.

Relation to Statewide Framework

In both major cities and smaller communities, complete streets are related to multimodal mobility and Smart Growth principles. Complete streets encourage walking, bicycling, and transit use, and they complement mixed-use zoning, urban infill projects and transit-oriented development along with mixed-use zoning. They promote compatibility between transportation systems and the communities they serve.

Potential ADOT Action

ADOT can play a direct role in implementing complete streets when it improves or rehabilitates state highways that serve as de facto city streets or suburban arterials. ADOT might consider playing a technical assistance role in assisting local complete street development.

ADOT is currently preparing a policy for complete streets. An unofficial draft states that "Complete Streets is ADOT's approach to interdependent, multimodal transportation networks that safely accommodate access and travel for all users. A complete streets policy ensures that the entire right-of-way is routinely designed and operated to enable safe access for all users."

7.2.5 Context-Sensitive Solutions

CSS Principles

CSS is defined as a "collaborative, interdisciplinary approach that involves all stakeholders in providing a transportation facility that fits its setting. It is an approach that leads to preserving and enhancing scenic, aesthetic, historic, community, and environmental resources, while improving or maintaining safety, mobility, and infrastructure conditions." CSS has been evolving in transportation since the National Environmental Policy Act of 1969 required transportation agencies to consider the possible adverse effects of transportation projects on the environment. According to the *CSS Strategic Planning Process Summary Report* (March 2007), published by FHWA and the American Association of State Highway and Transportation Officials (AASHTO), the four core CSS principles are:

1. Strive toward a shared stakeholder vision to provide a basis for decisions.
2. Demonstrate a comprehensive understanding of contexts.
3. Foster continuing communication and collaboration to achieve consensus.
4. Exercise flexibility and creativity to shape effective transportation solutions, while preserving and enhancing community and natural environments.

CSS Qualities and Outcomes

The AASHTO/FHWA report says that CSS is guided by a process that:

- Establishes an interdisciplinary team early, including a full range of stakeholders, with skills based on the needs of the transportation activity.
- Seeks to understand the landscape, the community, valued resources, and the role of all appropriate modes of transportation in each unique context before developing planning and engineering solutions.
- Communicates early and continuously with all stakeholders in an open, honest, and respectful manner, and tailors public involvement to the context and phase.
- Uses a clearly defined decision-making process.
- Tracks and honors commitments through the life cycle of projects.
- Involves a full range of stakeholders in all phases of a transportation program.
- Clearly defines the purpose and seeks consensus on the shared stakeholder vision and scope of projects and activities, while incorporating transportation, community and environmental elements.
- Secures commitments to the process from local leaders.
- Tailors the transportation development process to the circumstances and uses a process that examines multiple alternatives, including all appropriate modes of transportation, and results in consensus.
- Encourages agency and stakeholders to jointly monitor how well the agreed-upon process is working, to improve it as needed, and when completed, to identify any lessons learned.
- Encourages mutually supportive and coordinated multimodal transportation and land use decisions.
- Draws on a full range of communication and visualization tools to better inform stakeholders, encourage dialogue, and increase credibility of the process.

CSS leads to outcomes that:

- Are in harmony with the community and preserve the environmental, scenic, aesthetic, historic, and natural resource values of the area.
- Are safe for all users.

- Solve problems that are agreed on by a full range of stakeholders.
- Meet or exceed the expectations of both designers and stakeholders, thereby adding lasting value to the community, the environment and the transportation system.
- Demonstrate effective and efficient use of resources among all parties.

CSS Benefits

According to *Context Sensitive Solutions: Quantification of the Benefits in Transportation (NCHRP 15-3)*, benefits of CSS include:

1. Improved predictability of project delivery
2. Improved project scoping and budgeting
3. Improved long-term decisions and investments
4. Improved environmental stewardship
5. Optimized maintenance and operations
6. Increased risk management and liability protection
7. Improved stakeholder/public feedback
8. Increased stakeholder/public participation, ownership, and trust
9. Decreased costs for project delivery
10. Decreased time for project delivery
11. Increased partnering opportunities
12. Minimized impacts to the human and natural environment
13. Improved mobility for users
14. Improved walkability and bikeability
15. Improved safety (vehicles, pedestrians, and bikes)
16. Improved multimodal options, including transit
17. Improved community satisfaction
18. Improved quality of life for the community
19. Improved speed management
20. Design features appropriate to context
21. Minimized construction-related disruption
22. Improved opportunities for economic development

FHWA and CSS

FHWA is committed to the advancement of CSS nationwide. The objective is to improve the environmental quality of decision-making by incorporating CSS principles in all aspects of planning and project development. FHWA efforts to achieve this objective include: development and delivery of CSS training; initiatives to integrate CSS concepts into university curricula; support and sponsorship of research projects, technical guidance handbooks, competitions and conferences; and management and coordination of contracts and partnerships involving CSS.

Relation to Statewide Frameworks

ADOT has acquired strong CSS skills through its recent award-winning plan/design/build project to reconstruct SR 179 from the Village of Oak Creek to Sedona. As the state continues to grow, application of CSS principles will become increasingly important to preserve Arizona's unique scenic assets, environmental diversity and quality of life. All transportation improvements in the Recommended Statewide Scenario will require context-sensitive design in order to pass muster with stakeholders and the community. Many of the recommendations derived from Scenario C, which entails the use of CSS to make communities more walkable and bikeable.

Potential ADOT Action

ADOT can continue to follow CSS principles in its future transportation projects–especially by safely accommodating all users and ensuring that the improvements complement the character and scale of their surroundings. As ADOT further develops its CSS expertise, it may also consider offering technical assistance to local governments that wish to apply CSS solutions to their mobility needs.

7.2.6 Emergency Evacuation

The state of Arizona has developed a *Mass Evacuation and Reception Plan* (summer 2009) that addresses mass evacuation scenarios for Maricopa and Pima counties, which are home to 76 percent of the state's population. The *Maricopa County Emergency Evacuation Strategy Phase II Plan* (December 2006) identifies mass evacuation and ingress scenarios. (The latter would apply to a mass evacuation of the Los Angeles area.) The state and county plans make Arizona a safer place for its residents, who are primarily concentrated in the Phoenix and Tucson metropolitan areas.

Relation to Statewide Framework

The designated Maricopa and Pima counties evacuation routes are vital to moving people out of the metropolitan region in an evacuation. Under the Recommended Statewide Scenario, these routes would benefit from increased capacity.

Guidelines for Consideration of Roadway and Rail Bypasses

Proposals for bypasses of several urban areas have emerged repeatedly in the Statewide Framework Program. A few specific bypass ideas have been studied in the past, but others have come up both before and during bqAZ.

Roadway and rail bypasses have been proposed for cities as diverse as Bullhead City, Flagstaff, Payson, Nogales, and Tucson. Such proposals have often generated controversy, however, in part because of potential economic impacts on the bypassed communities and the environmental impacts of new highway alignments.

Potential ADOT Action

ADOT may want to consider developing guidelines to determine when study of specific bypass routes, corridors or proposals is appropriate. This issue will continue to arise, and will remain controversial, as growth causes roadway congestion and road/rail crossing conflicts in more and more communities.

7.2.7 Homeland Security

The U.S. Department of Homeland Security, Customs, and Border Protection (CBP) has initiated three secure border programs: the Container Security Initiative (CSI), the Customs-Trade Partnership Against Terrorism (C-TPAT), and the Secure Border Initiative (SBI).

CBP created CSI to help secure the U.S. after the terrorist attacks in 2001. CSI addresses the threat to border security and global trade posed by potential terrorist use of a maritime container. CSI proposes a security regime to ensure that all containers posing a risk of terrorism are identified and inspected at foreign ports before they are placed on vessels destined for the U.S. CBP officials work with host customs administrations to establish security criteria for identifying high-risk containers. CBP and its foreign counterparts use non-intrusive inspection and radiation detection technology to screen high-risk containers before their shipment to U.S. ports.

The core elements of CSI are:

- Identify high-risk containers, using automated targeting tools, advance information and strategic intelligence
- Prescreen and evaluate containers before they are shipped.
- Prescreen high-risk containers to ensure that screening can be done rapidly without slowing down the movement of trade.

C-TPAT is a voluntary government-business initiative to build cooperative relationships that strengthen the international supply chain and U.S. border security. C-TPAT recognizes that CBP can provide the highest level of cargo security only through close cooperation with the owners of the international supply chain, such as importers, carriers, consolidators, licensed customs brokers, and manufacturers. Through this initiative, CBP asks businesses to ensure the integrity of their security practices and verify the security guidelines of their partners in the supply chain. By participating in this initiative, companies will provide a more secure and expeditious supply chain for their employees, suppliers, and customers. Beyond enhanced security, CBP will offer benefits to certain certified C-TPAT members, such as:

- Fewer CBP inspections
- Priority processing for CBP inspections
- Potential eligibility for the CBP Importer Self-Assessment program, with an emphasis on self-policing

Launched in November 2005, SBI is a comprehensive multi-year plan to secure U.S. borders and reduce illegal cross-border activity. Focusing on integration of border security programs, SBI aims to gain effective control of the Nation's borders through investments in technology, infrastructure, and enforcement personnel.

Relation to Statewide Framework

These border security initiatives are intended to make freight transportation across the international border safer and faster. In conjunction with recommended transportation improvements on the Arizona side, they will result in faster cross-border traffic movement and more efficient use of the roadway and rail system.

7.2.8 LEED for Neighborhood Development

As defined by the U.S. Green Building Council, Leadership in Energy and Environmental Design for Neighborhood Development (LEED-ND) is a certification process that integrates the principles of Smart Growth, new urbanism, and green building into the first national system for neighborhood design. Certification in LEED-ND verifies that a development's location and design meet high levels of environmentally responsible, sustainable development. Neighborhoods–whether infill sites or new developments adjacent to previously developed land–can apply for LEED-ND status after meeting a series of prerequisites and gaining the appropriate number of credits to qualify. The credits are grouped into three categories: (1) smart location and linkage, which establishes the location site; (2) neighborhood pattern and development, which promotes livability and transportation efficiency; and (3) green infrastructure and building, which seeks to reduce resource use and maximizes ecological opportunities.

LEED-ND is not meant to be a national standard that

replaces zoning codes or comprehensive plans, but a tool for local governments to grow more sustainably. By comparing a municipality's development practices with the rating system, public officials and planning departments can better identify code barriers that make it difficult, or even impossible, to undertake efforts at sustainable development.

Relation to Statewide Framework

The LEED-ND rating system can become an important reference tool for both large and small communities to update their zoning codes and comprehensive plans to enable more focused growth. The LEED-ND system encourages compact and mixed-use development, multimodal transportation options, energy-efficient buildings, and reduced dependency on non-renewable resources.

Potential ADOT Action

While ADOT is not responsible for land use planning at the local level, it can work with local communities to help meet the multimodal transportation prerequisites/credits associated with LEED-ND, through such initiatives as assisting with federal transit grants and locating future high-capacity transportation corridors in high-growth areas. An example would be close coordination with local communities in planning the future Phoenix-Tucson intercity rail corridor to maximize station area development potential, and to facilitate station access by all modes of transportation.

7.2.9 Light Pollution

According to the International Dark Sky Association, light pollution is any adverse effect of artificial light, including sky glow, glare, light trespass, light clutter, decreased visibility at night, and energy waste. Light pollution wastes energy, disrupts global wildlife and ecological balance, and has been linked to negative consequences to human health.

Two elements of light pollution particularly affect astronomers, who depend on dark skies to practice their profession. Sky glow is a result of fixtures that emit part of their light up into the sky where light scatters, creating an orange-yellow glow above a city. This light then interferes with sensitive optical instruments designed to capture light from distant galaxies. Light trespass occurs when poorly shielded or poorly aimed fixtures cast light into unwanted areas, such as an observatory, neighboring property and houses. This light also interferes with astronomical instruments.

Both sky glow and light trespass can be prevented by using fully shielded light fixtures that directs light where it is needed rather than wastefully into the sky. Some light sources are more astronomically friendly than others: for example, the near monochromatic yellow of low sodium pressure lighting is easily filtered out, and so preferred for use near observatories. Several Arizona communities, such as Flagstaff and Sedona, have been pioneers in adopting dark-sky ordinances.

Relation to Statewide Framework

Dark skies are important to the economic vitality of Arizona and the quality of life for its residents. Clear, dark skies have been a major attraction, drawing several world-class observatories (e.g., Kitt Peak National Observatory; the Mount Hopkins, Mount Graham and Mount Lemmon observatories; Sky Island; Lowell Observatory) and many amateur astronomers to the state. However, the night sky has already been lost in much of the state, and the rest is in danger as development spreads along with poor lighting practices. Transportation–specifically, vehicle headlights–is a major source of urban light pollution.

Potential ADOT Action

Sources of light pollution near highways, such as some electronic billboards, also pose a safety hazard because they can distract or disorient motorists. ADOT could work with local communities to more effectively control such displays.

7.2.10 Multimodal Freight Transportation Planning

Although the Recommended Statewide Scenario does not include freight facilities (except for safety improvements such as climbing and passing lanes), the *Statewide Rail Framework Study* gives equal consideration to freight and passenger rail. Eight of the thirteen strategic opportunities identified in the Rail Framework focus on freight transportation. In addition, ADOT recently completed the *Arizona Multimodal Freight Analysis Study*, which addresses current conditions, issues, challenges, and opportunities for highway (truck) and rail freight. ADOT recognizes that efficient, multimodal freight movement is vital to the Arizona economy, and that the state needs to position itself to benefit from economic opportunities created by the freight transportation sector.

Potential ADOT Action

ADOT will continue to implement a unified transportation

process for personal and freight transportation. Goods movement will be an integral part of the next *Long Range Transportation Plan* for Arizona.

7.2.11 Regional Planning

Planning in Arizona typically occurs within jurisdictional boundaries–communities, counties, COGs/MPOs, or the state as a whole. Improvements across regions, or areas with interlocking characteristics such as economic systems or shared natural resources, are not always in coordination.

In December 2009, MAG, CAAG, and PAG came together to sign a Resolution of Planning Coordination between the three COG/MPOs, acknowledging that the three agency entities face regional planning issues that transcend jurisdictional boundaries. The resolution asserts that the three COG/MPOs will work together to foster a successful and economically viable Sun Corridor Megapolitan, including coordination of population and employment projections, and travel demand models. Coordination with ADOT and ASLD will be approached from a more cooperative standpoint.

A Joint Planning Advisory Council (JPAC) was established to identify mutually agreed upon goals and interests, to provide guidance on possible technical assistance and joint planning activities, and to enhance communication and cooperation among the policymakers in the three regions.

In addition to MAG, CAAG, and PAG, a series of other agencies, including ADOT, were invited to participate in the JPAC to provide information on related regional initiatives, such as CANAMEX corridor planning efforts and planned and programmed improvements at the eight ports of entry along the binational border. The group quickly established its three main thrusts of coordination relative to:

1. Expanding and attracting major economic engines as means to spur growth in the Arizona economy.
2. Identifying the infrastructure and public policy necessary to support economic growth.
3. Creating lasting partnerships with public and private sector partners (e.g., Class I railroads, private developers, major manufacturing companies, etc.) on both sides of the Arizona/Sonora border to accomplish a diversified and sustainable economy.

Relation to Statewide Framework

Planning coordination between MAG, CAAG, and PAG can become an important tool in achieving the implementation of the Recommended Statewide Scenario, specifically in the Sun Corridor. Two of the three issues requiring further consideration, as defined in Section 6.8.4, affect the CAAG and PAG regions. The JPAC provides an arena for future deliberation and decision-making on these issues.

Potential ADOT Action

ADOT should continue to participate in the JPAC, using this structure as a forum to advance a comprehensive and interconnected multimodal transportation system in the Sun Corridor.

7.2.12 Potable Water Resources

Several years ago, the New York Times magazine published a cover story titled "The Perfect Drought: Will population growth and climate change leave the west without water?" This statement encapsulates a concern that the regional technical teams heard from communities throughout the state, as the process to establish the vision of the Statewide Transportation Planning Framework for 2050 began. Beyond the fast growing metropolitan areas of Phoenix and Tucson, growth is occurring in areas where there is limited water or where water sources are more difficult to access.

Will Arizona run out of water, stopping growth in its tracks? Experts agree that there is no one-word answer to this question. But there is a consensus that by 2030 demand will exceed supply in Maricopa, Pima, and Pinal counties if no action is taken. Water in Arizona is currently underpriced. To fund maintenance of an aging water infrastructure (for delivery, storage, and treatment) and construction of more efficient systems, the cost of water must increase significantly. New water supplies will be needed, including:

- Continued mining of ground water
- Continued conservation
- Continued retirement of agricultural land
- Improved operations of existing regional water systems
- Expanded use of reclaimed water
- Leases from Indian tribes
- Cooperative projects with other states
- Desalinization
- Development and treatment of poor quality water sources

All of these recommendations will help ensure that Arizona has water in the future, but not without comprehensive planning. Today, water resource, transportation, and land use planning studies are developed separately at local and

regional levels, despite some acknowledgment of the need for coordination. To accommodate growth and give the state a sustainable future, Arizona's communities and regions will need to unify and integrate long-range planning across the state. An effort that will be initiated by the Morrison Institute of Public Policy at Arizona State University (ASU) in 2010, tentatively entitled *Watering the Megapolitan*, will begin to look at addressing how a sustainable water supply can be developed to support megapolitan growth and how that is integrated with other related regional planning efforts.

7.2.13 Safe Routes to School (SRTS)

Congress created SRTS in SAFETEA-LU. The program is intended to combat growing childhood obesity and diabetes. SRTS was created to achieve three goals:

- To enable and encourage children, including those with disabilities, to walk and bicycle to school;
- To make bicycling and walking to school a safer and more appealing transportation alternative, thereby encouraging a healthy and active lifestyle from an early age; and
- To facilitate the planning, development, and implementation of projects and activities that will improve safety and reduce traffic, fuel consumption and air pollution near schools.

The program provides funds for schools and communities to implement infrastructure projects (such as sidewalk improvements, trails, and traffic calming) and other programs (such as education campaigns and law enforcement efforts).

Role of ADOT

At the state level, SRTS is a reimbursement program. Out of the applications that ADOT receives, some applicants are selected to request reimbursement for an amount agreed upon at the time of selection. The applicant must first spend the funds that it has already secured. Any work on the project that was performed prior to the project's selection is not eligible for reimbursement.

Arizona Examples

Phoenix

Phoenix works with parents and schools to create Safest Routes to School Maps. The maps show parents and students the recommended walking routes and crossing locations for students living inside the walking attendance boundary. The maps help city officials identify priorities for sidewalk repair. If a deficient or nonexistent sidewalk has been included in a path on the SRTS walking plan, the city builds the missing segments. Through this process, several miles of sidewalk segments have been built.

Pima County and Tucson

Pima County and the city of Tucson have launched a pilot program at seven local elementary schools to develop safe routes for children to walk or bicycle to school. This pilot program is funded by a federal grant, with matching funds from the county and the city. The seven schools participating in the pilot study represent four local school districts. The SRTS pilot program began in the fall of 2005 and was scheduled to last for two years, with hopes of extending the program to other schools later.

7.2.14 Statewide Travel Demand Model: Future Development and Use

Current and Potential ADOT Action

The first generation of the AZTDM was prepared using "quick response" techniques to support the Statewide Transportation Planning Framework studies. The model is not intended to be used for corridor-level planning or engineering studies. Rather, its purpose is the evaluation of systemwide framework alternatives, looking primarily at the connections between urban areas.

ADOT has begun work on the next generation of the AZTDM. Initial refinements already underway include adding detail in the TAZ geography to increase the number of TAZs from 1,098 to about 5,500. In this second generation model, ADOT is also adding more detail to the highway network. Other planned improvements include updated trip generation rates from the 2008 *National Household Travel Survey*, a refined trip distribution model, and an improved highway assignment process.

In the longer term, ADOT's plans for the model include a stratified trip distribution model, calibrated volume-delay functions, a refined truck traffic model, and a refined external trip model. ADOT envisions that the statewide model will ultimately include mode choice, with an intercity transit component. Adding the ability to model commodity flows, including movement by rail and pipeline, is also under consideration.

7.2.15 Travel Demand Management and Transportation Systems Management

TDM and TSM are different but often complementary

approaches to improving the performance of the transportation system without making major investments in additional roadway or transit capacity. TDM refers to techniques designed to reduce travel demand or shift it from peak to off-peak periods. Examples of TDM measures, from the Victoria (British Columbia) Transport Policy Institute, include:

- Alternative work schedules
- Bicycle parking and other cyclist accommodations (e.g., storage, lockers, showers)
- Commuter financial incentives
- Congestion pricing
- Flextime
- Guaranteed ride home
- HOV priority (including preferential parking)
- Parking management
- Parking pricing
- Ridesharing (carpooling, vanpooling)
- Telecommuting

This is a partial list that excludes capital or service improvements to alternative modes, and also omits land use policies. Many TDM measures can be implemented by individual commuters or employers. Maricopa County, for example, has adopted a travel reduction ordinance that requires a good faith effort from employers to meet numerical trip reduction goals, by choosing from a menu of incentives. Since TDM programs can work only if people know about them, marketing and communication are essential.

TSM aims to improve transportation system performance by managing the existing infrastructure and its use more efficiently–or by designing facilities more efficiently in the first place. ITS consists of high-technology TSM applications. Common examples of TSM measures (again, not an exhaustive list), include:

- Improved or innovative roadway design (e.g., the Arizona Parkway)
- Improved or innovative design of roadway junctions (intersections, interchanges)
- Access management
- Targeted traffic enforcement
- Incident response plans
- Improved traffic signal timing, phasing, and network coordination
- Signage, striping and lighting improvements
- Safety and capacity analysis
- Transit assessments
- Advanced traveler information systems (e.g., variable message signs, in-vehicle communication)
- Collision avoidance systems
- Electronic payment and pricing
- Freeway and arterial management systems (which may combine some or all of the above techniques)
- Infrastructure and fleet management systems (e.g., pavement and bridge management systems, roadway maintenance management systems)

Some strategies, such as congestion pricing, may be viewed as both TDM and TSM strategies. Considerable overlap exists between the two categories.

Relation to Statewide Framework

Although the Recommended Statewide Scenario is project-based, TDM and TSM measures will be vital elements in long-range, multimodal transportation planning. Not only do these techniques have a high ratio of benefits to costs, but they will be necessary to keep the transportation system operating in a rapidly growing state that can no longer build its way out of congestion.

Potential ADOT Action

ADOT has already developed plans for expansion of ITS on the state highway system. The agency will increasingly find itself in the TDM and TSM business, as well as in the highway construction and maintenance business.

8.0 Summary of Statewide Rail Framework Study

As the Statewide Transportation Planning Framework Program unfolded, it became clear that the scope of work did not allow adequate consideration of rail, a mode in which ADOT's involvement has historically been limited. However, both policymakers and the public have increasingly come to recognize the importance of multimodal passenger and freight transportation planning, especially for the long-term future. President Obama's administration has helped to spark renewed nationwide interest in both high-speed and conventional intercity rail. While the freight railroads are privately owned and operated, it is recognized that they serve a public purpose, not least in hauling freight that would otherwise have to travel by truck on the highway system, thereby degrading mobility, traffic safety and the physical infrastructure. Therefore, ADOT commissioned the *Statewide Rail Framework Study* as part of the overall Framework Program to ascertain long-range strategic opportunities for the state and to serve as the first phase of an updated State Rail Plan. Passenger rail elements proposed in the Rail Framework were included in Scenarios B and C of this study, and thereby appear as part of the Statewide Recommended Scenario for 2050.

8.1 The Case for Statewide Rail System Development

Arizona cannot address future congestion by continuing to rely almost exclusively on roadways to move people and goods. Rail offers a highly sustainable form of transportation. It is not only an environmentally friendly and resource-sensitive method of moving goods and people; it also provides connectivity to adjacent states and Mexico, linkages to major international transportation hubs (e.g., ports), and opportunities for stimulating economic growth and development. Expanding rail transportation can greatly enhance the state's transportation network.

Developing rail for both freight and passenger service is advantageous to the state. From a freight perspective, Arizona can benefit from diversion of truck traffic to rail to free highway capacity for passenger cars, reduce air pollution, conserve energy, and enhance traffic safety. Through truck traffic produces little direct economic benefit for the state, yet demands the state's resources to build and maintain Interstate and other highways. Furthermore, Arizona is impacted by emissions from tens of thousands of trucks traveling through the state daily. Carried by rail, freight does not drain the state's limited transportation funds, creates less pollution and greenhouse gases per ton mile, and uses less energy per ton mile. With rail transportation, the responsibility for infrastructure falls primarily to the private parties – railroads, and ultimately their customers.

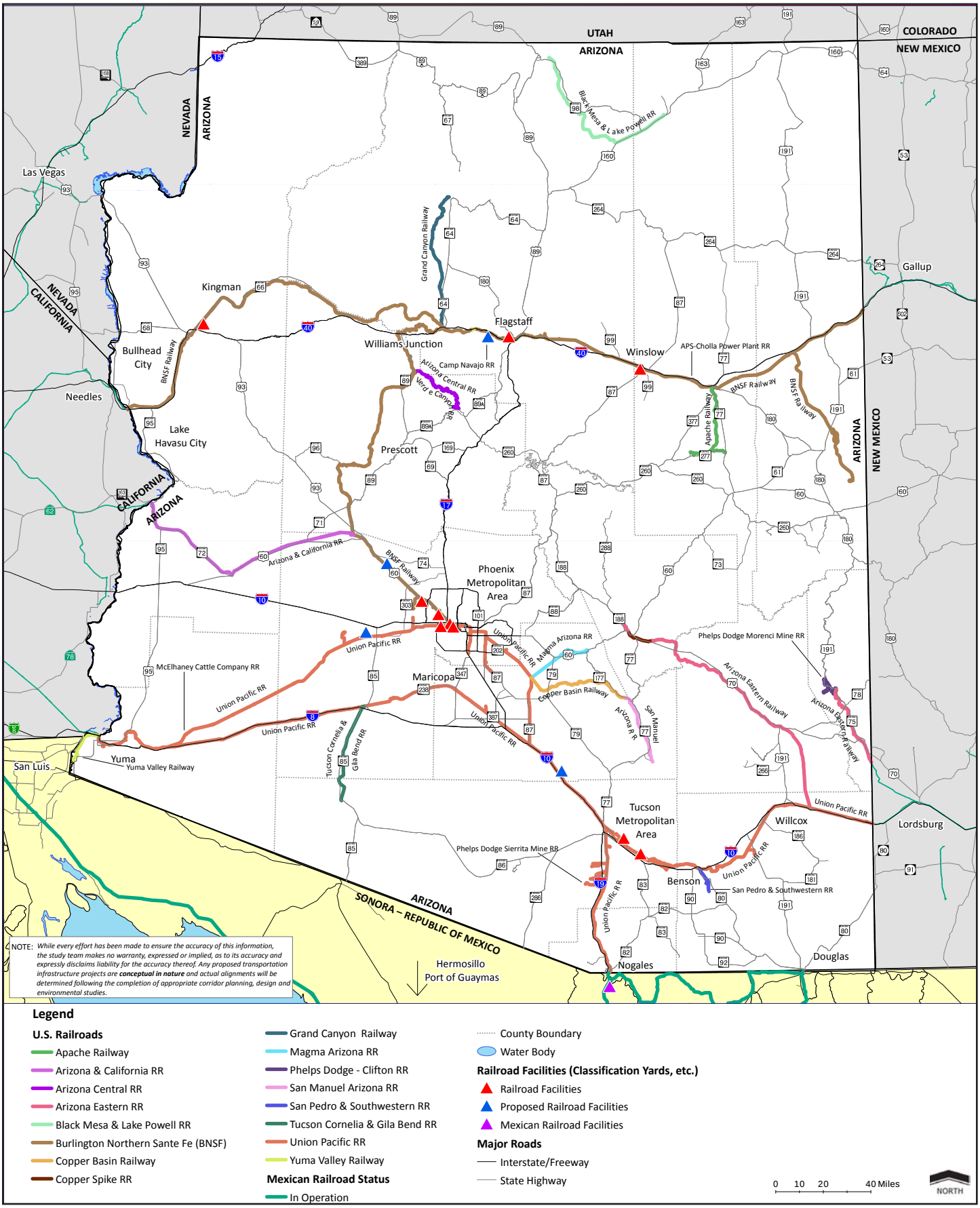
Passenger rail provides an alternative mode of travel for the state's residents, and allows the opportunity to focus growth in more sustainable development patterns throughout the Sun Corridor. Like freight rail, passenger rail can supplement highway capacity, enhance traffic safety, and cut air pollution by reducing automotive travel. National transportation policies are moving to include rail as a high-priority transportation mode. As a result, multimodal projects may have advantages over highway projects when competing for federal funds. The state should begin to take advantage of these new funding opportunities so that commuter rail, conventional intercity rail, and ultimately high-speed rail will all have a role to play in Arizona's transportation system.

8.2 Overview of Arizona's Rail Network

8.2.1 Freight Rail

There are over 1,800 linear miles of existing railroad right-of-way in Arizona. The largest carriers are UP (390 miles) and BNSF (691 miles), as in Figure 46 illustrates. These are both Class I carriers, defined as large railroad companies with an annual operating revenue of $250 million or more. The UP's mainline Sunset Route traverses the southern portion of the state in an east-west direction. This line carries large amounts of freight between cities on the Pacific Coast and major rail hubs in the Midwest and Texas. UP is improving this line into a high-capacity route, double-tracked throughout Arizona, which will increase its use in the future. Freight and transshipment destinations along the Sunset Route include Yuma and Tucson. UP also operates a branch route that runs north to Phoenix from Picacho and another from Tucson to Nogales. The former

Figure 46 Existing Arizona Railroads



brings automobiles, building supplies, and other freight into Phoenix daily, serving a large metropolitan area that has no mainline access.

The BNSF has a major east-west mainline, the Transcon, that operates approximately 120 trains per day over its double-tracked (in Arizona) 2,200-mile route from Los Angeles to Chicago. Like UP, BNSF has a branch route that serves Phoenix. The line comes from the north near Williams, where it branches off the Transcon.

Numerous short line railroads also exist in the state. Short lines are independent railroad companies that operate over relatively short distances. Short line operations exist in part to cost-effectively maintain rail operations to existing customers and industries that are no longer profitable to be served by the Class I railroads. The short line railroads in Arizona primarily serve mining industries, provide switching operations in support of the Class I systems, and act as feeder lines to those systems.

8.2.2 Passenger Rail

Passenger rail service in Arizona is limited to Amtrak and tourist railway services. Amtrak has two routes that travel on freight mainlines through Arizona, using the BNSF Transcon in northern Arizona and the UP Sunset Route in southern Arizona. Three tourist railroads exist in Arizona: the Grand Canyon Railroad, the Verde Canyon Railroad, and the seasonal Copper Spike service of the Arizona Eastern Railroad. These railroads provide excursions or service to and from one destination.

Numerous intercity rail and commuter rail passenger corridors have been studied in Arizona. Constructing a passenger rail line between Phoenix and Tucson would serve the greatest demand, even though many hurdles exist before implementation could begin, such as securing a funding source and potentially developing an agreement with UP for shared use of its corridors. MAG and PAG are studying potential future commuter rail in their regions. High-speed rail corridors could someday connect Phoenix with Los Angeles, San Diego, Las Vegas, and the Front Range (Albuquerque/Denver). Figure 47 illustrates passenger rail proposals in the state, as well as regional economic development areas which, as potential future employment centers, could eventually be served by intercity rail. High-speed rail corridors are designated by a wide swathe, in which an alignment may be designated in the future, after appropriate planning, design, and environmental studies have been completed and approved.

8.2.3 Anticipated Network Growth

Freight Rail

The relationship between trucking and rail has been a story of evolving common interests as the economic challenges presented by rising fuel costs force greater coordination between the systems. Major motor carriers describe themselves as "mode-neutral," because they use any form of transportation (truck, rail) that can effectively meet the service and cost requirements of their customers. For economic and competitive reasons, the rail and trucking industries form partnerships to transport merchandise as efficiently as possible. Rail industries have advantages over long distances, while trucking delivers the shipment to its final destination. As the number of trucks on crowded highways grows, Arizona will increasingly benefit by using more environmentally friendly methods of combining rail and truck activities where this is economically efficient.

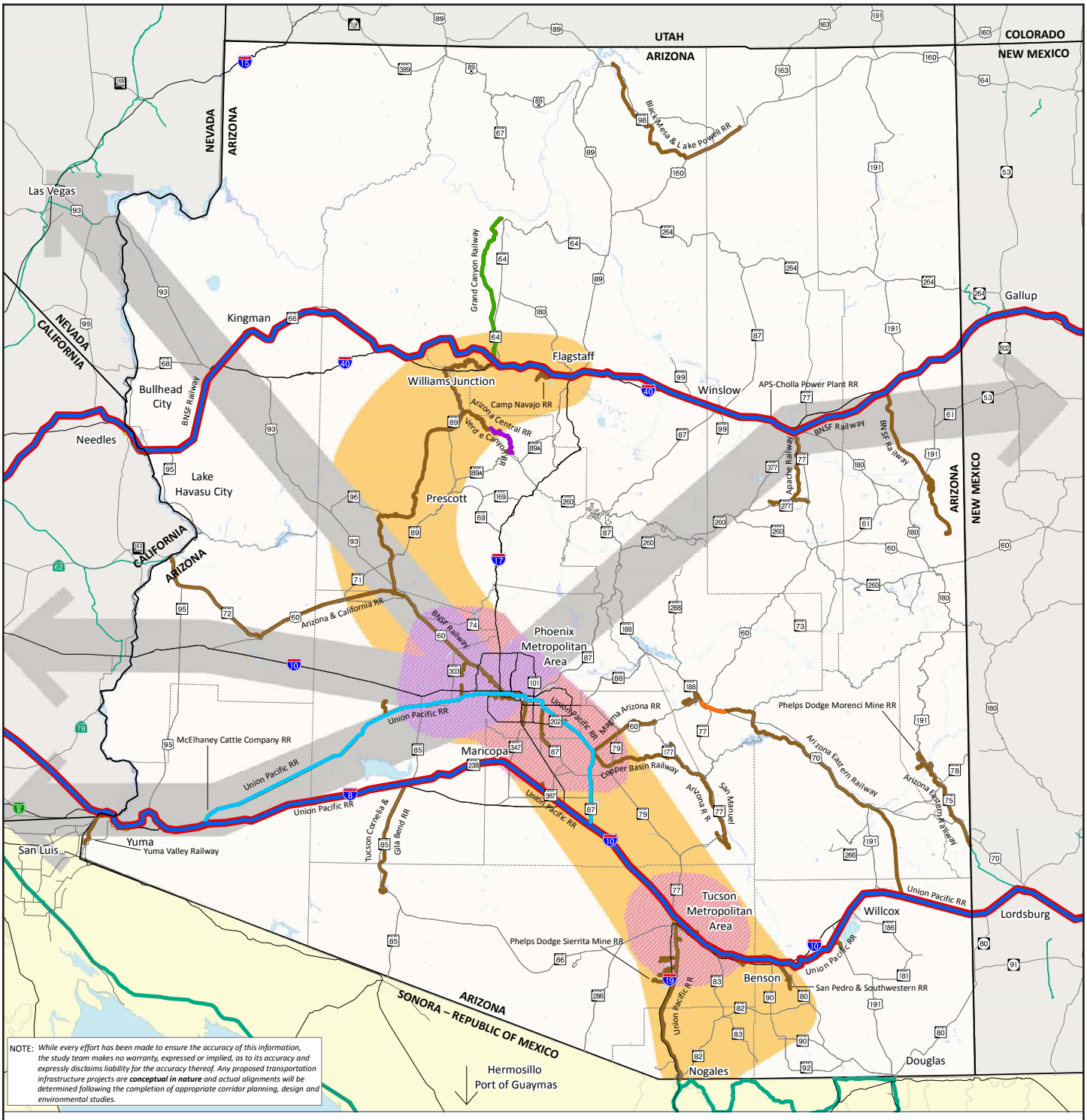
Increased freight rail investment creates both opportunities and challenges. The challenges include inconveniences to the public (e.g., public safety, traffic congestion, air pollution, noise), while the opportunities are provided through increased economic development. The UP and BNSF railroads wish to modernize their facilities in Arizona for the benefit of freight movements. UP plans a new classification yard near Red Rock, in the Sunset corridor southeast of Picacho. The BNSF is exploring a similar facility northwest of Phoenix. Both facilities might drive other commercial ventures nearby, such as industrial park development.

Passenger Rail

Strategic system planning, policy, and investment commitments will be necessary for passenger rail programs in Arizona to succeed. Passenger rail corridors help to build a seamless transit system when connections are made with the existing system, but this often requires coordination with other state, regional, and local agencies to address land use, population growth, and regional planning requirements. To help streamline the process, policies should be in place to begin setting aside right-of-way and restricting development in planned corridors to avoid obstacles to future land acquisition.

Intercity rail routes have undergone some high-level conceptual studies between the Tucson and Phoenix metropolitan areas, but will require close relationships and continued interaction with Class I railroads, especially UP. ADOT's dialogue with these railroads is in the earliest stages. Commuter rail programs in the MAG and PAG

Figure 47 Existing and Potential Passenger Rail Options



regions will also depend on a relationship with the Class I railroads. Both intercity and commuter rail concepts have reached a stage of discussion that is centered on freight business needs, safety, limited capacity, and other basic issues. Actual negotiations cannot occur until funding becomes available for passenger rail development.

8.2.4 ADOT's Role in Rail Planning

ADOT's current role in rail planning is focused on helping retain or improve rail service in partnership with private railroads and local governments. ADOT currently has four employees assigned to rail issues. Current responsibilities of ADOT staff include:

- Coordination with cities, towns, counties, COGs, MPOs, and tribal governments regarding ADOT rail planning and program development
- Liaison with the Federal Railroad Administration (FRA) and FTA on federal coordination of state rail funding, systems, corridor planning, and program development
- Liaison with U.S. border states, Sonora, Mexico, and special interest groups on rail planning, funding, and program development
- Coordination with other state agencies on rail-related issues
- Administration of the state railroad grant process
- Technical development of passenger rail corridor planning
- Project management and administration of state rail planning projects
- Management of the Section 130 program, which funds improvement to at-grade railroad crossings
- Oversight of the state grade crossing inventory and coordination with the FRA
- Coordination between railroads and other government agencies

8.3 Rail Framework Coordination and Collaboration

A variety of public outreach techniques were used to gather information for the *Statewide Rail Framework Study* and keep the general public and stakeholders informed of project activities and status. Five sets of community events occurred.

- **Rail Technical Advisory Team (RTAT):** The RTAT represented rail-related interests that provided technical input and review on the long-term direction of rail in Arizona. The RTAT provided input for each major task and reviewed each work product. Members of the RTAT included representatives of statewide agencies, regional and local agencies, federal agencies, railroads, interest groups, trade and economic development organizations, and freight users.
- **Focus Group Meetings:** Two focus groups were held in northern and southern Arizona to gain additional input on key issues. Groups that received invitations included environmental organizations, economic development organizations, cities, towns, counties, COGs/MPOs, Class I railroads, short line railroads, and special interest groups.
- **Stakeholder Meetings:** A series of stakeholder meetings was conducted to gain more in-depth information from particular groups or agencies. Such stakeholders included Class I railroads, short line railroads, trucking companies, and state and regional agencies.
- **Online Survey:** An online survey was distributed to gain input from stakeholders whom bqAZ ADOT and consultant staff could not interview personally. These surveys were distributed to four groups: private transportation-related companies, economic development agencies, local and regional governments, and state and federal agencies. The response rate was approximately 30 percent.
- **Border State Consultations:** Meetings were conducted with each bordering state to coordinate transportation planning efforts, including rail. Border state meetings involved state departments of transportation from California, Nevada, Utah, New Mexico, and Sonora, Mexico.

8.4 Strategic Opportunities

A series of strategic opportunities was developed, with recommended programs of action that may consist of modifications to existing rail systems or the establishment of new facilities and services. Five passenger rail and eight freight rail strategic opportunities were identified to serve as the foundation for specific implementation actions.

8.4.1 Passenger Rail Strategic Opportunities

High-Speed Interstate Passenger Rail

Overview:

Four potential high-speed rail corridors between Arizona and bordering states were identified in the Rail Framework. These corridors would link Phoenix and Tucson with Los Angeles, Las Vegas, San Diego, and the Front Range (Albuquerque/Denver). These cities are within the 100- to

600-mile range in which high-speed rail is competitive with other transportation modes, such as highway and air travel. This network would provide significant public benefits, especially increased mobility via a more sustainable transportation mode.

Purpose:

- Provides an additional option for regional Southwest travel, relieving airports and highways.
- Provides an additional mode choice for long-distance travel.
- Reinforces the Sun Corridor megapolitan region as a key economic activity center at the national level.
- Becomes part of the national high-speed rail network.
- Improves the economic competitiveness of the state by helping to attract jobs, skilled workers, and visitors.

Strategic Opportunity:

- Pursue a Phoenix-Tucson intercity rail corridor as the foundation for future high-speed rail.
- Become an active partner with the Western High-Speed Rail Alliance and other passenger rail organizations to study the feasibility of the four high-speed rail corridors listed above.

Phoenix-Tucson Intercity Rail

Overview:

ADOT has recently received FRA grant funding to conduct an AA/Environmental Overview (EO) on the Phoenix-Tucson intercity rail corridor to evaluate the feasibility of, and determine alternative alignments for, intercity rail between the two metropolitan areas. Such a corridor would create a high-capacity rail link throughout the megapolitan region, spurring economic development and focused growth. One of the critical aspects of development of a regional passenger rail system is creating seamless connections to local transit options, allowing riders to make easy connections to their final destinations.

Purpose:

- Establishes the base for a passenger rail system in the Sun Corridor.
- Provides a multimodal choice.
- Establishes station locations as economic activity centers.
- Provides the foundation for future high-speed rail.

Strategic Opportunity:

- Conduct AA and EO/EIS to identify, evaluate, and prioritize alternative alignment options for Phoenix-Tucson intercity rail to achieve a preferred corridor.
- Initiate intercity rail corridor as a precursor to high-speed rail.

Megapolitan Extensions of the Phoenix-Tucson Intercity Rail Corridor

Overview:

Phoenix-Tucson intercity rail has the potential to extend the length of the megapolitan region, stretching from Nogales/Sierra Vista to Prescott/Flagstaff. Well-positioned intercity rail stations could reinforce existing economic activity centers or become the focus of new economic activity centers. Upon completion of the AA and EO/EIS for the Phoenix-Tucson segment, further studies should be conducted on the potential intercity rail extensions to determine feasibility. If the extensions are feasible, then completion of environmental documentation and preliminary alignment options should be explored.

Purpose:

- Provides the spine for a rail transportation system in the Sun Corridor, with a potential linkage to the binational border
- Provides a multimodal choice for Arizona residents.
- Establishes station locations as economic activity centers.
- Provides a possible basis for future high-speed rail.

Strategic Opportunity:

- Study feasibility of an intercity rail extension to the north.
- Study feasibility of an intercity rail extension to the south/east.

Enhancement of Amtrak Services

Overview:

Enhancement of Amtrak services in Arizona will help provide a foundation for more intercity passenger rail service and eventual high-speed rail along certain corridors. Short-term service and track improvements can help the state take full advantage of its existing passenger rail assets, and long-term improvements would provide significant public benefits by fostering the creation of a passenger rail network. Investing in enhanced Amtrak services would provide additional mobility options and attract more riders in the state.

Purpose:

- Provides an alternate transportation option for long-distance interstate travel.
- Better uses existing Arizona rail infrastructure for

passenger service.
- Provides the foundation for future high-speed rail, intercity rail or commuter rail.

Strategic Opportunity:
- Pursue general Amtrak improvements.
- Support Sunset Limited/Texas Eagle capital improvements.
- Support Southwest Chief capital improvements.

Incorporation of MAG and PAG Commuter Rail Planning

Overview:
Both MAG and PAG have identified a set of potential commuter rail corridors in their regions. Implementation of the MAG corridors would create a commuter rail system in Maricopa County, complementing the more localized light rail and bus system. Similarly, a PAG commuter rail system would complement the Tucson modern streetcar and bus system. To have a truly connected passenger rail network in the Sun Corridor, links must be made between the various modes.

Purpose:
- Provides the base for a passenger rail system in the Sun Corridor.
- Provides a multimodal choice for commuters.
- Establishes station locations as local economic activity centers and possible transit-oriented developments.
- Provides a foundation for future intercity rail between Phoenix and Tucson.
- Ensures compatibility between systems to allow evolution of future intercity rail.

Strategic Opportunity:
- Pursue MAG commuter rail recommendations (BNSF/Grand Avenue corridor, UP/Yuma West corridor, East Valley corridors, potential extensions).
- Pursue PAG commuter rail recommendations.
- Coordinate MAG and PAG commuter rail logistics with the pending ADOT intercity rail AA and EO/EIS.

8.4.2 Freight Rail Strategic Opportunities

BNSF Phoenix Metropolitan Area Development and Operations

Overview:
The BNSF Phoenix Subdivision, or "Peavine" corridor, branches off the BNSF Transcon at Williams Junction and travels south into the Phoenix metropolitan area along US 60/Grand Avenue. The Peavine may provide a crucial link in a future statewide passenger rail system. Not only might it provide a leg of the proposed MAG commuter rail system, but it could also be used to develop a northern extension of intercity rail beyond the central Sun Corridor. All of this depends on the relocation of major classification activities outside of central Phoenix's Mobest Yard to a site farther north and west, freeing up capacity on the rail line.

Purpose:
- Fosters focused economic opportunities around freight-related facilities (e.g., classification yards).
- Allows commuter rail along the BNSF/Grand Avenue corridor.
- Provides the foundation for future intercity rail to the northern Sun Corridor and potentially for high-speed rail to California and Nevada.
- Achieves highest and best use of rail infrastructure and adjacent railroad and private properties.
- Relieves local railroad congestion and improves traffic safety.

Strategic Opportunity:
- Work to gain access to the Peavine corridor.
- Relocate BNSF classification activities out of the Phoenix metropolitan core.
- Construct safety improvements along the Peavine corridor.
- Pursue commuter rail on a portion of the Peavine corridor.
- Pursue intercity and possibly high-speed rail along the entire Peavine corridor to northern Arizona.

BNSF Statewide Development and Operations

Overview:
The BNSF Transcon is a major artery in the statewide rail system that can be improved to alleviate congestion on the rails and highways. This corridor primarily provides long-haul intermodal and carload service, most of which travels through Arizona between California and destinations to the east. Double-tracking of the BNSF Transcon is complete in Arizona. Handling 120 trains per day at its peak in 2008, the Transcon in Arizona was nearing its capacity. BNSF has begun triple-tracking through New Mexico and, when traffic levels recover, this will add traffic to the Arizona segment.

Purpose:
- Fosters focused economic opportunities along the railroad around freight-related facilities.
- Achieves highest and best use of rail infrastructure and related properties.
- Relieves railroad congestion in communities and

improves traffic safety.
- Captures a larger portion of the domestic freight market on rail.
- Preserves right-of-way for future bypasses, once appropriate studies have established the need and preferred alignment.
- Helps strengthen short line railroad development.

Strategic Opportunity:
- Facilitate BNSF Transcon capacity improvements (e.g., Flagstaff bypass).
- Implement safety improvements along the BNSF Transcon.
- Establish infrastructure solutions for heavy freight traffic through local communities along the BNSF Transcon.
- Facilitate coordination with environmental interests to mitigate habitat fragmentation and enable wildlife migration.

UP Tucson Metropolitan Area Development and Operations

Overview:
Like the BNSF Transcon, the UP Sunset Route is a major artery in the statewide rail system. This corridor travels through central Tucson, frequently interrupting local roadway traffic. UP has proposed constructing a new classification yard at Red Rock to alleviate some of the congestion in downtown Tucson and approaching rail corridors. This and other improvements can improve local circulation patterns and provide opportunities for increased economic development.

Purpose:
- Focuses economic opportunities along the railroad around freight-related facilities.
- Allows commuter rail to be established in the Tucson metropolitan area.
- Provides the foundation for future intercity rail to Phoenix and elsewhere.
- Achieves highest and best use of rail infrastructure and related properties.
- Relieves railroad congestion and improves highway safety.

Strategic Opportunity:
- Facilitate UP Sunset Route capacity improvements (e.g., Red Rock Classification Yard).
- Explore and prioritize options for improving freight train movements through and around Tucson (e.g., Tucson bypass).
- Construct safety improvements along UP mainline.

UP Statewide Development and Operations

Overview:
UP manages its Sunset Route and several branches. Many opportunities exist to take advantage of freight-related economic development along the mainline and branch routes, including the possible relocation of rail car classification activities out of central Phoenix to an expanded site in Buckeye, which, in conjunction with other strategic opportunities, could work to create a western freight bypass of the Phoenix metropolitan area. Additionally, improvements to other UP branch segments might offer new shared freight/passenger rail opportunities statewide.

Purpose:
- Helps focus economic opportunities around freight-related facilities, such as classification yards.
- Achieves highest and best use of rail infrastructure and related properties.
- Relieves railroad congestion in communities and improves automotive safety
- Captures a larger portion of the domestic freight market on rail.
- Preserves right-of-way for future bypasses, once appropriate studies have established the need and preferred alignment.
- Helps strengthen short line railroad development.

Strategic Opportunity:
- Facilitate UP capacity improvements (e.g., double-tracking, expanded Buckeye Yard).
- Study feasibility of a freight bypass around Nogales.
- Explore opportunity to reopen Wellton Branch for shared freight and passenger service.
- Monitor at-grade crossings and implement safety improvements.
- Facilitate coordination with environmental interests to mitigate habitat fragmentation and enable wildlife migration.

Development/Expansion of Mexican Deep-Water Ports

Overview:
Recent cargo volumes moving through the ports of Los Angeles and Long Beach, along with expensive labor and environmental regulations that limit capacity expansion in California, may provide opportunities for Mexican ports to capitalize on traffic between Asia and the U.S., which is expected to grow as the global recession eases. If development of deep-water ports in Mexico occurs, Arizona stands to realize economic benefits. Therefore, the state

should monitor port activity in Mexico so that responsive actions can be taken.

Purpose:

- Captures economic benefit of Asian trade through Mexican deep-water port development.
- Focuses industrial and economic development opportunities through inland ports/logistic facility expansion.

Strategic Opportunity:

- Monitor deep-water port opportunities and actions in Mexico.
- Continue transportation improvement coordination through the Arizona-Mexico Commission.
- Engage in partnerships with the private sector to take advantage of port development/enhancement.

Development/Expansion of Inland Ports

Overview:

Freight rail can aid economic development through value-adding activities that may include manufacturing, distribution, warehousing, and transloading. One of the most promising avenues for infrastructure investment related to freight rail is the development of intermodal inland ports and associated logistics facilities (e.g., warehouse/distribution). Inland ports allow containerized freight to be shipped directly from the port terminal to an inland facility for trade processing, sorting, and other value-adding services. The ability to develop inland port and logistic facilities in Arizona depends on meeting warehousing/distribution location requirements, particularly in relation to "just-in-time" product delivery needs. Arizona could benefit from facilitating freight-related economic development through expansion and development of inland ports and associated logistics facilities along Class I and short line railroads, or at transportation junctions.

Several initiatives are already underway or completed. The Port of Tucson is a successful, private inland port operating along the UP mainline southeast of Tucson, serving the railroad and local industries. The City of Flagstaff and FMPO undertook the *Northern Arizona Regional Freight Facility Market Analysis* in 2004 to understand the logistics and implications of a potential inland port/intermodal location at Camp Navajo, a site just west of Flagstaff; this site has not yet been developed. Additionally, ADOT and the Arizona Department of Commerce have jointly commissioned a study through the Greater Yuma Port Authority to evaluate the potential logistics of an inland port facility outside Yuma, along the UP mainline. This study will be complete in 2010.

Purpose:

- Creates jobs and supportive industrial development.
- Supports increased freight movement destined for Arizona, with its growing population and changing economy.
- Accommodates northbound and southbound North American Free Trade Agreement (NAFTA) traffic.

Strategic Opportunity:

- Facilitate education and coordination of state agencies and the private sector regarding the economic development benefits of inland ports.
- Monitor deep-water port opportunities and actions in Mexico.
- Monitor capacity issues and improvements at California ports.
- Identify infrastructure improvements that could support inland port development.
- Develop incentives and funding mechanisms for inland port development.

New Freight/Passenger Rail Corridor in the Greater Hassayampa Valley

Overview:

Arizona may benefit from constructing a new north-south rail corridor through the state. This corridor could create an additional connection to Mexico, link the BNSF and UP and their ancillary facilities, promote increased economic development opportunities, and serve as a high-capacity transit corridor in the Hassayampa and Hidden valleys–located in southern and western Maricopa County, and in western Pinal County. While such a corridor has been proposed only in the Hassayampa and Hidden valleys (from approximately Surprise to Gila Bend), it might extend farther south to Lukeville in the existing SR 85 right-of-way, providing a new rail connection to Mexico and benefiting Arizona freight mobility. It could also connect into a high-capacity rail corridor parallel to US 93 toward Las Vegas, becoming part of the national CANAMEX corridor to facilitate NAFTA-related freight movement.

Purpose:

- Develops a major north-south rail corridor in Arizona, combined with part of the existing BNSF Peavine corridor.
- Links two major Class I railroads, connecting potentially relocated classification yards for more efficient interchange service.
- Provides a western freight bypass of the Phoenix metropolitan area.
- Provides future commuter rail service to the Hassayampa and Hidden valleys.

- Enables BNSF to reach the UP Sunset Route, and both Class I railroads to potentially reach the Mexican border.
- Supports rail-related CANAMEX activities, catalyzing economic development.

Strategic Opportunity:

- Explore the feasibility of constructing a new rail corridor to connect the BNSF Peavine to the UP Wellton Branch.
- Explore the feasibility of constructing a new rail corridor to connect the UP Wellton Branch to UP Sunset Route.
- Explore the feasibility of constructing a new rail corridor to connect the UP Sunset Route to Mexico.

Development/Expansion of Short Line Railroads

Overview:

Short lines are an essential component of a fully-functioning rail network for Arizona. To work most effectively, the rail network needs a healthy balance of major and short line railroads. Class I carriers efficiently transport goods over long distances, but are less efficient for hauling freight over shorter distances on branch lines with less demand. As a result, these railroads have sold off many branches to short lines. Short lines can often foster community and economic development in places that may be uneconomical for larger carriers to serve. In some cases, short lines may also be more open to sharing rail corridors with passenger service. Arizona may benefit from preserving short line railroad right-of-way for freight and passenger use, and from increased economic development opportunities through the development of a funding assistance program for short line railroads.

Purpose:

- Expands industrial and economic development opportunities along short lines.
- Supports manufacturing, mining, and other new industries located away from the major Class I railroads.
- Supports Class I railroad switching/blocking activities; might serve as distribution link between Class I railroads and inland port facilities.
- Allows for potential passenger rail along short lines.

Strategic Opportunity:

- Develop a qualitative and quantitative inventory of short line railroad infrastructure in Arizona.
- Preserve out-of-service right-of-way.
- Preserve out-of-service short line right-of-way through rail banking (purchasing, and therefore preventing rail lines from being abandoned or removed).
- Attract industry to existing short lines.
- Monitor legislation for state or federal funding opportunities.

8.5 Implementation Pursuits and Actions

ADOT (or another responsible state agency) can embark on a series of actions to take advantage of the thirteen identified strategic opportunities. These actions are grouped into six key pursuits, recommended for implementation either immediately (by 2010), in the near term (2010 to 2015), or in the long term (2015 to 2050). While these recommendations are designed to be mutually reinforcing, they are also independent in their focus on different elements of the existing and envisioned statewide rail system. Each pursuit contains implementation actions designed to take advantage of one or more strategic opportunities. See the *Statewide Rail Framework Final Report* (2010) for full documentation of action items. These pursuits and implementation actions are incorporated in the larger Statewide Framework program recommendations to form a comprehensive, multimodal long-range vision and action plan for the state.

8.5.1 Passenger Rail

Passenger rail will provide an important alternative mode of transportation as Arizona's population and employment more than double over the next 40 years. It will provide improved connectivity between activity centers, thereby improving mobility and stimulating economic development. The following pursuits and actions lay the foundation for implementation of a coordinated intercity, high-speed, and commuter rail system, with connections throughout the state and the Southwestern U.S.

P1. Implement a passenger rail corridor as a multimodal spine to create and support focused growth and sustainable development in the Sun Corridor.

Growth of the Sun Corridor will lead to increased transportation demand for both passengers and goods. It will not be possible to solve congestion by improving either roadways or rail alone. Constructing a passenger rail corridor that traverses the Sun Corridor megapolitan region, starting with a Phoenix to Tucson link, will provide an alternative transportation option, improve regional connectivity, support focused growth, and reduce impacts to the environment by using existing rail corridors and cleaner technologies.

P2. Pursue a high-speed rail network in the Southwestern U.S.

A Phoenix/Tucson intercity rail corridor will serve as the foundation for eventual high-speed rail. It will show the state's commitment to passenger rail and prove the practicality of intercity rail between the two major metropolitan areas, thereby encouraging the federal government and bordering states to include Arizona in a Southwestern high-speed rail network.

8.5.2 Freight Rail

Investment by both Class I railroads and short lines is currently constrained by the economic downturn. Steps that can be taken to improve these conditions are defined and identified in the following four pursuits.

F1. Facilitate freight railroad investments statewide by laying the groundwork for public sector participation.

Railroads are important assets to the state. To bring them into public infrastructure plans, the state should establish a unified communication structure between public entities and private railroads, keep a comprehensive inventory of railroad assets, determine the appropriate level of public investment, and partner with the railroads to plan and implement projects that benefit both the taxpayers and the private sector.

F2. Relocate freight rail operations out of the central metropolitan areas of Phoenix and Tucson to improve safety and facilitate transportation efficiency.

There are more than 450 public at-grade railroad crossings in the Phoenix metropolitan area, and approximately 100 in the Tucson area. Both areas have experienced numerous accidents due to growing numbers of trains, motor vehicles, pedestrians and bicyclists. Reducing rail freight traffic in the central metropolitan areas can enhance traffic safety, decrease air pollution, and conserve energy. Additionally, removing freight traffic to areas where higher speeds can be achieved and less backtracking is required to switch and block freight cars can improve efficiency on the rails and roadways.

F3. Facilitate expansion of transcontinental railroad routes and other Class I facilities, while minimizing impacts on adjacent communities.

Both the UP and BNSF are expanding their transcontinental routes to achieve greater freight capacity. These routes cross many Arizona communities, causing potential traffic delays and safety problems. Mitigation measures as part of railroad improvements can improve safety and circulation for communities, and in some cases, increase the efficiency of railroads.

F4. Use railroad and related investments to stimulate economic development in Arizona.

Improvements to railroad infrastructure can spur economic development, by better serving businesses that locate near the railroad and helping to attract additional business for the railroad. Ancillary railroad facilities, such as deep-water ports and inland ports, provide opportunities to serve railroad customers while increasing local job growth and clustering ancillary industries.

8.5.3 Rail Organization/Governance

To carry out passenger and freight rail programs in partnership with public and private organizations, Arizona would benefit from establishing an effective governance structure. This could be carried out in several forms. ADOT, as the state DOT, could be the lead agency. Under this model, rail planning, development, oversight, safety and other programs for passenger and freight rail could be consolidated in a single office of ADOT.

Alternatively, a separate statewide rail authority could be developed to plan and develop statewide rail projects. The authority would be governed by an elected or appointed board, would be empowered to take full control of rail projects under its purview, and would interact directly with the stakeholders. The authority might have its own staff, or use state DOT personnel to perform technical analyses, conduct day-to-day operations, and carry out the policies of the Board of Directors. As a third option, a hybrid organization could be formed. For example, instead of being wholly housed in the state DOT or through an independent organization, a separate entity could be formed and staffed with ADOT employees.

G1. Develop a rail organization with a statewide perspective.

Development of a statewide rail organization (within or outside ADOT) can benefit the state by furthering economically beneficial rail interests, pursuing funding for strategic rail investments, and partnering with other state agencies, regional entities, and railroads to develop a comprehensive freight and passenger rail system. The purview of the organization would be statewide, but the agency could collaborate with multi-state and metropolitan rail organizations to fully implement the rail system.

8.5.4 Implementation Action Timeframes

Table 36 includes each rail pursuit and abbreviated descriptions of each implementation action in a matrix that proposes implementation timeframes for each action. The timeframes are immediate (2010), near-term (2010-2015), and long-term (2015-2050). Actions are highlighted in yellow for the beginning and continuation of the implementation item. The immediate actions generally consist of initiatives that are already underway, or those that ADOT can take with no new funding or legislative authorization. Many of the longer-term measures are not achievable with currently available resources. Some recommendations can be initiated immediately or in the near term, but will need to continue through 2050 and beyond as the state rail system matures.

Table 36 Rail Implementation Action Timeframes

Implementation Action		Immediate (2010)	Near-Term (2010-2015)	Long-Term (2015-2050)
Passenger Rail Pursuits				
P1	Implement an integrated passenger rail corridor as a multimodal spine to create and support focused growth and sustainable development in the Sun Corridor Megapolitan region.			
P1(a)	Complete a State Rail Plan			
P1(b)	Establish and maintain Statewide Passenger and Freight Rail Advisory Committee			
P1(c)	Initiate Alternatives Analysis/environmental document for the Phoenix/Tucson intercity rail corridor			
P1(d)	Complete Alternatives Analysis/Environmental Impact Statement for the initial Phoenix/Tucson intercity rail corridor			
P1(e)	Study the feasibility of including ICR as part of the Pinal North-South Freeway corridor design concept report			
P1(f)	Adopt new ADOT policy on multimodal corridor evaluation			
P1(g)	Promote a rail culture within state agencies and key stakeholders			
P1(h)	Negotiate agreements with stakeholders regarding intercity rail			
P1(i)	Work with MAG regarding coordinated commuter rail planning and ICR planning			
P1(j)	Coordinate with other regional planning entities regarding intercity rail			
P1(k)	Determine administration and governance of intercity rail system			
P1(l)	Examine system and design implications of intercity rail and high-speed rail			
P1(m)	Work to gain access to BNSF Peavine corridor			
P1(n)	Partner with BNSF to conduct infrastructure improvements on BNSF Peavine			
P1(o)	Explore the feasibility of partnering with Amtrak as a potential intercity rail operator			
P1(p)	Determine dedicated state funding source for rail construction and operations			
P1(q)	Pursue all opportunities for federal funding for intercity rail			
P1(r)	Plan for and implement transit-oriented development at rail access points			

Table 36 Rail Implementation Action Timeframes (continued)

Implementation Action		Immediate (2010)	Near-Term (2010-2015)	Long-Term (2015-2050)
P1(s)	Construct Phoenix/Tucson intercity rail corridor			
P1(t)	Work with UP regarding planning a southern intercity rail extension			
P1(u)	Work with BNSF regarding planning a northern intercity rail extension			
P1(v)	Construct Phoenix/Tucson ICR megapolitan extensions (if feasible)			
P2	Pursue an integrated high-speed network in the Southwestern U.S.			
P2(a)	Participate in regional and national high-speed rail organizations			
P2(b)	Build support for intercity passenger rail improvements			
P2(c)	Collaborate with business community to build high-speed rail support			
P2(d)	Work with bordering states to federally designate high-speed rail in Arizona			
P2(e)	Work with bordering states to plan high-speed rail in Arizona and adjacent states			
P2(f)	Work towards future implementation of high-speed in Arizona, linked into the Southwestern U.S. network			
Freight Rail Pursuits				
F1	Facilitate freight railroad investments statewide by laying the groundwork for public sector participation.			
F1(a)	Build better relationships with Class I railroads to coordinate investments, projects and programs that will benefit both the public and the railroads			
F1(b)	Establish a state funding source for strategic freight rail investments			
F1(c)	Adopt new ADOT policy to ensure project continuity			
F1(d)	Update state railroad asset inventory			
F2	Relocate freight rail operations out of the central metropolitan areas of Phoenix and Tucson to improve safety and facilitate transportation efficiency.			
F2(a)	Initiate discussions with BNSF to relocate Mobest Yard			
F2(b)	Work with UP to continue dialogue within state government in regard to the proposed classification yard at Red Rock			
F2(c)	Study feasibility of a UP bypass around Tucson			
F2(d)	Explore opportunity with UP for rehabilitation and reopening of Wellton Branch			
F2(e)	Initiate Hassayampa Freeway Alternatives Analysis/ Environmental Impact Statement; with rail as a considered mode			
F2(f)	Facilitate development of a new Hassayampa rail corridor			

Table 36 Rail Implementation Action Timeframes (continued)

Implementation Action		Immediate (2010)	Near-Term (2010-2015)	Long-Term (2015-2050)
F3	Facilitate continuing expansion of transcontinental railroad routes and other Class I facilities, while minimizing impacts on adjacent communities.			
F3(a)	Include studying the potential feasibility of a Flagstaff rail bypass in the I-40 Design Concept Report, working with BNSF			
F3(b)	Plan and accommodate rail corridor enhancements			
F3(c)	Work with Class I railroads to close at-grade railroad crossings			
F3(d)	Study feasibility of a rail bypass around Nogales, working with UP			
F3(e)	Collaborate with the Arizona Game and Fish Department regarding wildlife mitigation measures			
F4	Use railroad and related investments to stimulate economic development in Arizona.			
F4(a)	Monitor Mexican deep-water port opportunities that can benefit Arizona			
F4(b)	Monitor project-specific opportunities for port access, and partner with sponsors to implement			
F4(c)	Preserve abandoned rail corridors; deny future abandonments			
F4(d)	Develop a short line assistance program for strategic rail investments			
F4(e)	Maintain opportunity for shared use or purchase of Wellton Branch			
F4(f)	Formulate a plan to make use of inland port economic development opportunities			
F4(g)	Monitor inland port development opportunities			
Governance Pursuits				
G1	Develop a rail organization with a statewide perspective to promote rail interests.			
G1(a)	Define rail organizational needs for the state			
G1(b)	Work with state agencies to define organization and governance model			
G1(c)	Recommend appropriate statewide organizational/ governance structure			
G1(d)	Apply governance model to a project or program; assess performance			
G1(e)	Implement statewide rail governance structure			

Initiation and continuation of action item

9.0 Final Rollout of the Statewide Framework

In November 2009, ADOT presented the Recommended Statewide Scenario to the public and stakeholders for review and comment. After a short orientation film that established the context for a 40-year vision, a variety of displays took visitors through the guiding principles, and showed how each principle relates to transportation and affects the state's quality of life–including economic vitality, safety and security, the environment and sustainability. This final outreach activity also described how the work completed will be used in the next phase of statewide planning: the State Long Range Transportation Plan. The events took place from 3:00 to 7:00 p.m. at the following dates and locations:

- November 10, Tucson Convention Center (over 60 participants)
- November 12, High Country Conference Center, Flagstaff (over 60 participants)
- November 17, Mesa Convention Center (over 120 participants)

Participants were encouraged to comment both in writing and on video. The solicitation of comments emphasized thought-provoking questions encouraging continued dialogue on Arizona's transportation future.

9.1 Guiding Principle Displays

The final public outreach rollout events included a series of displays to orient participants with the Program's background and purpose, citing the need for planning for continued growth, as well as relieving future congestion. The Vision and Guiding Principles reinforced such needs, and outlined the relationship of transportation to other disciplines, such as economic vitality, sustainable growth, the natural environment, and safety and security.

This noted relationship is where the Statewide Transportation Planning Framework Program 2050 vision for the state of Arizona has gone above and beyond a traditional transportation study in taking a more holistic planning approach. Transportation is only one element of the built environment and communities in which the state's residents reside. This Program has made the linkage between transportation and land use/sustainable urban form, economic development, the natural environment–embracing a vision of a sustainable future.

Because the mobility elements of the Recommended Statewide Scenario have been explored in much detail in Chapter 6, the following subsections will summarize and provide representative illustrations of the displays relating transportation to other guiding principles–economic vitality, sustainability and the environment, and safety and security, as presented at the rollout events.

9.1.1 Economic Vitality

The main goals of the economic vitality guiding principle were to:

- Build a seamless transportation system that efficiently moves people and goods to ensure that Arizona's economy is competitive and thriving.
- Work toward an integrated system of roads, transit, passenger rail, non-motorized modes, aviation, and freight options to ensure Arizona's economic vitality.

The Statewide Recommended Scenario achieved such goals through:

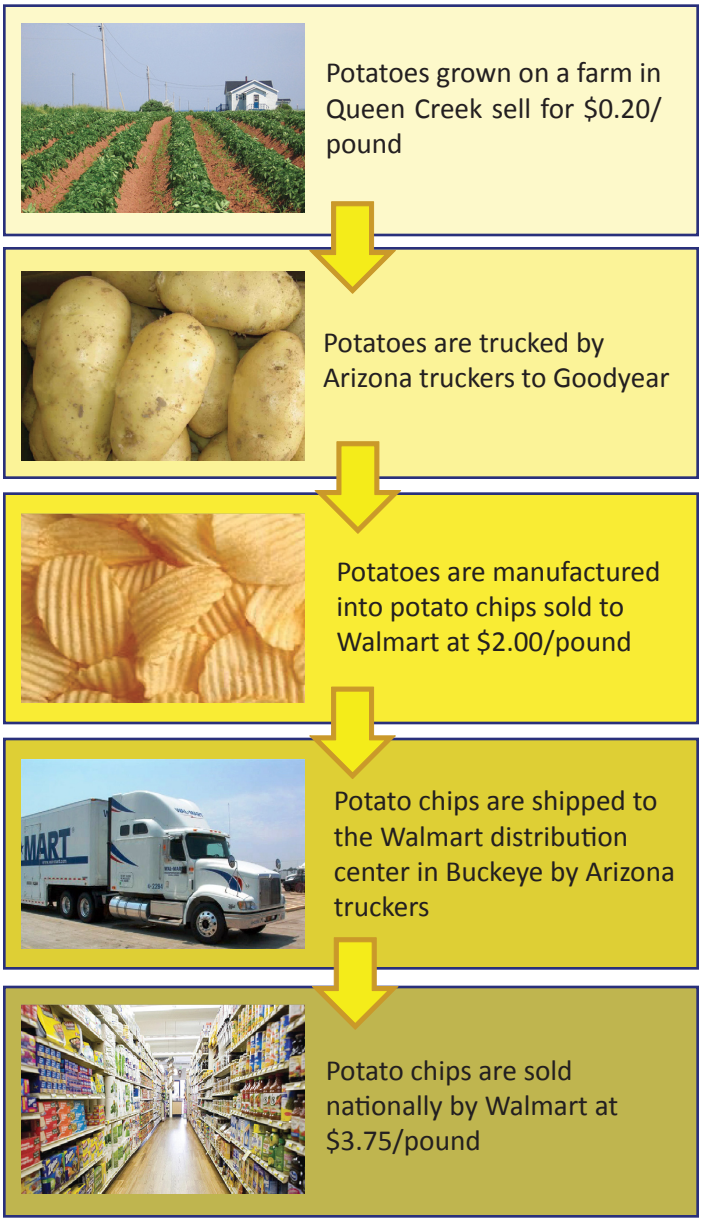
- Linking communities with regional commercial and employment activity centers through multimodal transportation options.
- Developing a multimodal transportation system that supports current and emerging statewide economic opportunities.
- Providing intermodal freight facilities that accommodate movement between air, rail and highway vehicles.
- Improving and expanding high-priority rail and highway freight corridors.
- Developing interstate and international transportation connections, including enhanced border crossings, that foster economic trade.
- Connecting industrial and employment centers statewide through a network of roads and rail that allows Arizona products to reach national and international markets efficiently.

A series of questions and supporting examples were used to further explain this relationship. For example, the question was posed, "What supports a competitive economy?"

Value-Added Manufacturing

One answer cited that value-added manufacturing creates jobs to build the Arizona economy. Value-added manufacturing refers to the process of taking a raw product, and through processing, packaging, and marketing, increasing its value, and resultant wealth creation for Arizona. An example of value-added manufacturing is shown in Figure 48, illustrating the life-cyle of potatoes grown locally in Arizona, to their end product as potato chips on a grocery store shelves in the U.S.

Figure 48 Value-Added Manufacturing



Tourism

Another answer cited that tourism supports a competitive economy, attracting visitors to Arizona. A few statistics that back this claim include:

- Direct travel spending in Arizona in 2008 was $19 billion.
- Arizona hosted 37 million overnight visitors in 2008, roughly equal to 102,000 visitors per day.
- More than one-half of all spending by visitors in 2008 was for leisure and hospitality services.
- Tax revenue supported by the travel industry is mostly provided by visitors rather than residents.
- Travel spending in Arizona generated 170,000 jobs with earnings of $5 billion in 2008.

9.1.2 Sustainability and the Environment

The main goals of the sustainability and environment guiding principle were to:

- Maintain a setting in which people want to live.
- Respect the natural environment.
- Plan for more sustainably built communities through focused growth patterns.
- Provide access to transportation options that are sensitive to the environment.

The Statewide Recommended Scenario achieved such goals through:

- Developing a multimodal transportation system that recognizes and strengthens the relationship between land use and transportation, and connects activity and employment centers.
- Uses transportation infrastructure as a tool to direct growth.
- Promotes context sensitive solutions in future planning and design to consider adjacent communities and natural lands.
- Supports infill development and revitalization through transportation investments that reinforce existing communities.
- Encourages mixed-use development to maximize trip purpose and foster use of alternative modes in daily travel.
- Maximizes use of existing transportation corridors and avoids recommending new or expanded transportation corridors in sensitive biological areas.
- Encourages development patterns and transportation solutions that reduce greenhouse gas emissions and improve air quality.
- Fosters energy independence through broader mode

choices, more efficient transportation infrastructure, and heavy emphasis on use of renewable energy sources.

The Recommended Statewide Scenario supports a future community urban form in a focused growth pattern, as opposed to a more conventional growth pattern of urban sprawl. A conventional growth pattern would include subdivision-style residential development, supportive strip commercial development, and isolated employment centers. Such land development patterns would continue earlier trends of consumption of agricultural and sensitive environmental land, significant road/pavement construction, and high local infrastructure requirements. A focused growth pattern, on the other hand, seeks to contain most new growth around existing urban centers, incorporates infill and redevelopment, limits urban sprawl, and protects sensitive environmental areas. It also reduces roadway and other public and private infrastructure construction, and concentrates infrastructure development by building within a more compact footprint and encouraging mid- and higher-density mixed-use development–encouraging a more sustainable pattern of development, in sync with the natural environment.

The effect and emphasis of focused growth relative to land use, transportation, the environment, and economic development are elaborated below, providing examples that contrast the implications of focused growth over conventional growth patterns.

Land Use

Focused growth emphasizes the creation of compact, walkable, mixed-use neighborhoods with multimodal connections to nearby communities, employment areas, and economic activity centers. New development occurs as infill development, redevelopment, or new development immediately adjacent to existing development.

- Two-thirds of the development on the ground in 2050 will be built after 2007, allowing ample opportunities for communities to shape growth.
- The average density of residential development in U.S. urban areas in 2005 was approximately 8 units/acre. Achieving a focused growth pattern in cities could raise the density to 12-14 units/acre.

Transportation

Contiguous growth supports multiple commuting options, including a robust transit system, reducing vehicle miles traveled, and allowing people to use their time more efficiently. Streets are more than channels for the movement of vehicles; they are also places for people to interact, with narrow widths, slow speeds, curbside parking, trees, and parking located behind frontage buildings.

- Residents of compact neighborhoods drive 1/3 fewer miles than those in automobile-oriented suburbs.
- Residents of a transit-rich neighborhood spend 9 percent of their annual family income on transportation; residents in an automobile- dependent suburb can spend up to 25 percent on transportation.

Environment

Compact growth reduces development's footprint on the land, increasing open space preservation, recreational opportunities, and wildlife connectivity, reducing stormwater runoff and groundwater pollution, and lowering greenhouse gas emissions.

- Private automobiles produce twice as much greenhouse gas emissions per passenger mile as light rail or commuter rail, and three times as much as intercity rail.
- Shifting 60 percent of new growth to compact development patterns would save 79 million tons of CO_2 annually by 2030.
- Compact development reduces typical per capita water usage by more than 10 percent.

Economic Development

Focused growth enables transit systems to support economic development, which occurs in integrated and mixed-use centers that cluster employment and residential uses together. Residents have housing choices and are not excluded by income from urban or central locations.

- Demographic forecasts show that the demand for attached and small-lot housing in 2030 will exceed the current supply by 71 percent.
- Properties in walkable, compact developments are valued approximately 15 percent higher than the same houses in a conventional subdivision.
- Compact developments tend to have up to 40 percent of employment for their residents on-site or nearby, creating a live-work-play environment.

9.1.3 Safety and Security

The main goals of the safety and security guiding principle were to:

- Design, build, operate, and maintain a transportation

system that promotes safety and security with less risk of injury and property damage on or near transportation facilities.

The Statewide Recommended Scenario achieved such goals through:

- Maintaining and enhancing transportation safety with less crashes, injuries, and deaths.
- Addressing high-priority safety improvements in the statewide transportation system.
- Reducing risks as more freight moves in and through the state.
- Providing alternate routes that provide another means of access in and around urbanized areas, as well as to provide detour routes during incident situations.
- Including homeland security measures, as appropriate, as international border crossings are upgraded, while maintaining efforts to promote cross-border economic opportunity and enhanced trade.

Improving safety and security throughout the statewide multimodal transportation system can be realized in many different ways. For example, participants were asked if they had ever been on I-10 or I-17 during an emergency incident and how long they sat idling in their cars. The Recommended Statewide Scenario accounts for such situations by proposing a series of alternate routes to provide another means of access in and around urbanized areas, as well as to provide detour routes in incident situations. All of these routes are illustrated on Figure 33, Recommended Statewide 2050 Transportation Framework Scenario, but can be summarized as:

- New Interstate connection between Las Vegas and Phoenix metropolitan areas, along the US 93 and Hassayampa Freeway routes.
- Upgrade of SR 89 to a freeway between I-40 and Wickenburg to serve as a western I-17 high-capacity alternate route.
- New freeway through Chino Valley and the Prescott area.
- Improvements to SR 377, SR 260, and SR 87 between I-40 and Phoenix to serve as an eastern I-17 alternate route.
- New Pinal County North-South Freeway connection between US 60 (Apache Junction) and I-10 (Eloy).
- Eastern Pinal County new freeway connection between US 60 (Florence Junction) and I-10.
- New high-capacity freeway/parkway corridor connecting Pinal and Pima counties; western parallel to I-10.
- Sahuarita Road upgrade, linking I-19 and I-10, around the southeast portion of the Tucson metropolitan area.

Additionally, understanding the interactions along Arizona's southern border with Sonora, Mexico, and that the Sun Corridor Megapolitan region will potentially extend south from Tucson to include portions of Mexico in the future, make binational transportation connections extremely important, as well as the related security issues that arise from traveling across an international border. This issue, as well as the planned transportation improvements on the U.S. and Mexico borders were presented at the final public outreach rollout, as illustrated earlier in Figure 28, International Border Improvements.

Lastly, a summary of major safety improvement mechanisms were presented to help event participants understand the types and implications of recommendations included in the Recommended Statewide Scenario, as elaborated below.

Grade Separations

- Located at heavily traveled roadway (e.g., freeway, parkway, major arterial) and railroad intersections.
- Divides two transportation corridors by height so that each route will not disrupt traffic flow on the other as they cross.
- Recommended Statewide Scenario proposes additional grade separations to improve safety while relieving traffic congestion.

Bus Pullouts

- Provides special zone on the side of a main roadway for buses to pick up and drop off passengers.
- Avoids blocking a lane of traffic and improves passenger safety while boarding and alighting.
- Recommended Statewide Scenario proposes bus pullouts on rural roadways to reduce traffic backups, avoid collisions, and provide safe, sheltered passenger waiting areas.

Congestion Management Strategies

- Results in more efficient use of transportation systems.
- Reduces pollution and greenhouse gas emissions.
- Provides parking and other information at destinations.
- Provides real-time information to travelers on traffic conditions and upcoming incidents.
- Reduces traffic congestion.
- Recommended Statewide Scenario proposes use congestion management strategies, such as variable messaging signs, at appropriate locations statewide.

Passing Lanes

- Provides a lane to pass slower-moving vehicles.
- Allows motorists to travel at their own pace.
- Can be an important component of rural state highways that vary in slope and have substantial slow-moving truck traffic, which often promotes unsafe passing.
- Recommended Statewide Scenario proposes construction of passing lanes along various state highways throughout Arizona.

Repair and Reconstruction of Aging Roadways

- Roads throughout the state are aging due to weather and typical wear and tear.
- One semi-truck does as much damage to road pavement as 9,600 cars.
- Upgrading routes heavily traveled by trucks is recommended statewide.
- Recommended Statewide Scenario proposes repair and reconstruction of aging roadways throughout the state.

Shoulders

- Includes additional pavement next to roadway travel lanes that serve many purposes to enhance safety, and should be routinely constructed on new and improved roadways.
- Enables a vehicle to pull off the roadway in case of emergency.
- Provides added space for construction and maintenance equipment.
- Reduces proximity of pavement edges to driving lane.
- Recommended Statewide Scenario proposes construction of shoulders along various highways throughout Arizona.

9.2 Graffiti Wall Dialogue

"Graffiti walls" were created at each guiding principle's display, posing such questions as how people would like to travel in the future and what they would like their communities to look like. Highlights of the written comments appear below.

9.2.1 Tucson

- Some participants, but not all, are enthusiastic about PPPs and tolls as a funding source.
- Increase the gas tax and use it for rail as well as highways.
- Consider a solar-powered rail system.
- Stress Complete Streets.
- Coordinate bike infrastructure with transit stops.
- Keep roads out of undeveloped areas.
- The state needs to follow Smart Growth policies to promote compact growth and limit sprawl.
- There is support for alternatives to traditional single-family homes, but much new urban multi-family housing is unaffordable to the average family.
- Explore a solar-powered high-speed train between Phoenix and Tucson.

9.2.2 Flagstaff

- Build passenger rail from Phoenix through Flagstaff to the Grand Canyon and New Mexico.
- Charge vehicles according to their size, weight, and distance traveled.
- Some feel the gas tax should be used to fund multiple modes; others are skeptical about its long-term feasibility as a revenue generator.
- Consider development impact fees.
- Arizona needs to become more than a pass-through route for rail freight.
- Rail and air are as important as roads for freight transportation. Greater use of rail can take trucks off the road.
- Explore a solar-powered rail system within Arizona.
- Diversify the state's economy into medical research/services and higher education.
- Identify alternative high-capacity roadway corridors to relieve pressure on existing facilities.
- More vertical growth is necessary, but with appropriate height limitations that consider historical characteristics.
- Accommodate a mix of lifestyle preferences.

9.2.3 Mesa

- Set short-term goals now so there will be time to achieve them.
- Explore PPPs (including tolling of new roadways), development impact fees, raising the gas tax, and possibly congestion fees in dense urban areas.
- Also consider a VMT charge to finance transportation improvements.
- Put the one-cent sales tax for transportation on the ballot.
- Both toll roads and freeways will become more efficient with improved ITS to manage traffic flow.
- Coordinate with neighboring states to develop a high-speed rail network.
- Invest in a mix of modes that cater to different purposes.

- Diversify the state's economy into manufacturing, solar energy, and agriculture.
- Tourism, unlike construction, is a stable industry if Arizona's natural beauty is preserved.
- Improved public transit serving smaller communities will improve their economic opportunities.
- Cell phone use and texting while driving are the biggest traffic hazards, but universal cell phone coverage is needed in case of emergencies.
- MAG region needs to provide direct HOV ramps at more arterial interchanges.
- Consider truck-only lanes in congested corridors; also truck bypass routes.
- Border crossings need to be more efficient for cars, trucks and trains.
- There needs to be a balance between high-density urban and low-density suburban development. Quality of urban schools is a major issue.

9.2.4 All Locations

- Provide intercity rail between Phoenix and Tucson.
- Provide rail passenger service for commuters.
- Transit can attract a greater share of trips, but only if it is much improved.
- Promote high-tech and environmental industries, such as solar energy.
- Need to reduce reliance on construction to build a stable and robust economy.
- Arizona should cater to eco-tourism.
- Encourage infill.
- We will continue to rely on oil for years to come, but alternative fuels must and will become more prevalent. Stress solar and other renewable resources.
- People will want to live in mixed-use neighborhoods with housing, work, and other activities near one another.
- Protect open spaces and ecologically sensitive areas from new transportation infrastructure, specifically freeways.
- Open space is essential to livable communities.

9.3 Video Dialogue

A "feedback zone" was positioned at the conclusion of the display set-ups to capture any overall thoughts and remaining comments on video. Participants were asked various questions, ranging from "Why is transportation personal?" to "What is your transportation vision?" Some people had specific transportation futures in mind, while others answered more generally.

Responses from each open house are grouped into two categories based on the questions posed and responses received: (1) why transportation is important, and (2) what the transportation future should hold.

Overall, the resounding opinion on why transportation is important is that it allows the freedom of choice to get from one place to another–whether for an individual traveling in a personal vehicle, or for someone limited in income or physical abilities using mass transit. Transportation provides the means to function in daily life. It also moves goods–which are equally important to a person's basic needs–which in turn stimulates the economy.

There are many visions of Arizona's transportation future, but most ideas transcend the physical transportation network. Having multiple transportation options was a priority: specifically, an emphasis on mass transit, and faster and cleaner technologies. Respondents also stressed the linkage between transportation and local communities. From now on, transportation must be approached in a holistic manner, benefiting other community systems–fostering environmental preservation, reducing carbon footprint, maximizing land use efficiency, and increasing economic development opportunities. The public expressed an interest in greater proximity of work, home, and recreation.

Highlights of the video dialogue responses from specific events are summarized below.

9.3.1 Tucson

Why transportation is important:

- Allows freedom of choice to get from point A to point B.
- The traveling public spends money, which boosts the economy.
- Allows accessibility.

What the transportation future should hold:

- Increases in mass transit access, residential densities, and gasoline taxes to reduce the need for and use of personal vehicles.
- The ability to get places fast. Build rail transit systems powered by the sun, with speeds competitive to systems in Japan or Europe.
- Energy-efficient transportation modes.
- Increased emphasis on and capture of freight movement through Arizona. Too much traffic travels right through Arizona without stopping.

- Mixed-use communities, allowing people to work, live, and play in closer proximity.
- Walkable streets for healthier living.

9.3.2 Flagstaff

Why transportation is important:

- Allows people to get from place to place.
- Moves people and goods throughout the state.
- Transportation is a basic need and part of every person's daily life.
- Multimodal options allow people who cannot drive to maintain mobility.
- Allows people and industry to reach rural locations.
- Fosters economic vitality in communities.
- Links population and employment centers.

What the transportation future should hold:

- Higher-speed and higher-tech transportation options (e.g., high-speed rail).
- Passenger rail options.
- A variety of transportation modes and connections between them.
- Connections between affordable housing locations and transit services.
- One car per household.
- A smaller carbon footprint and less impact to the environment.
- Incorporation of air transportation in the definition of "multimodal."
- Complete transportation corridors in communities (e.g., complete streets).
- System development that protects public lands and wildlife corridors.
- Less cars, more mass transit.

9.3.3 Mesa

Why transportation is important:

- It is a necessity in life.
- Moves people and goods.
- Allows personal freedom.
- Provides options for mobility of elderly and disabled residents.
- Transports tourists to Arizona, allowing the economy to thrive.

What the transportation future should hold:

- Public transportation connections between the metropolitan edges and urban cores.
- Decreased daily transportation demand due to technological advances (e.g., telecommuting).
- Maximize travelways by separating trucks and personal vehicular travel, and adding freight and passenger rail.
- Greater emphasis on mass transit with less reliance on personal vehicles.
- Alternative fuel systems and new transportation technologies.
- A robust roadway system, in addition to alternative transportation modes (e.g., rail).
- Increased investment in transportation system development.
- A change in mindset on the "right way" to travel (e.g., not only personal vehicles).
- Active traffic management.
- New funding options–public-private partnerships, tolling, etc.
- High-tech transportation modes that are fast and emit no greenhouse gases.

10.0 Next Steps

The implementation pursuits and actions from the *Statewide Rail Framework Study* are incorporated into the final Statewide Transportation Planning Framework recommendations. From there, two planning processes will take the next steps in identifying specific projects and funding for the future – the state's Long Range Transportation Plan (LRTP) and the State Rail Plan.

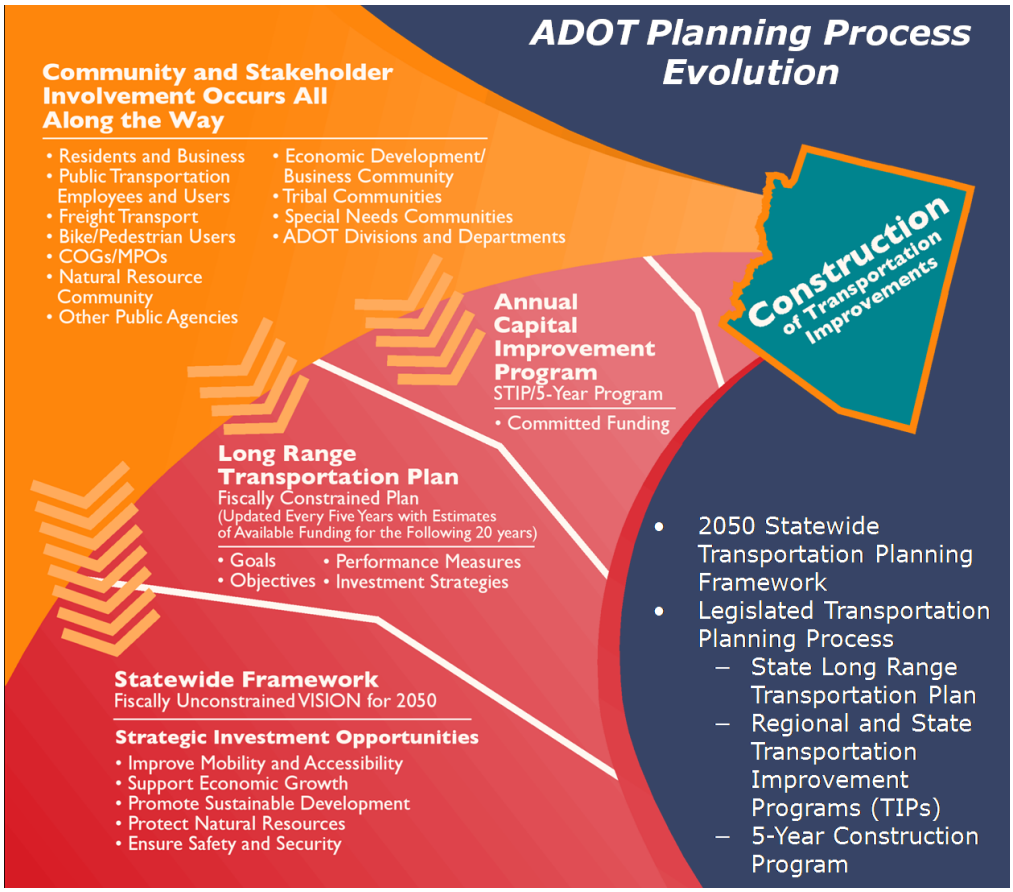
10.1 Long Range Transportation Plan

The recommendations from the Statewide Transportation Planning Framework Program provide a "fiscally unconstrained" vision for 2050 – meaning that the recommendations are not tied to available funding, but encompass all the capacity-related transportation investments needed for a connected and functional transportation system. "What Moves You Arizona," the long-range transportation planning process, will take the input and recommendations from the Statewide Transportation Planning Framework Program and match projects to a time line with available funding. The LRTP will use performance measures to evaluate recommended projects and determine investment strategies to fund them. The plan will be updated every five years with estimates of available funding for the following 20 years. Figure 49 shows how the Statewide Framework and LRTP fit into ADOT's comprehensive planning and programming process.

10.2 State Rail Plan

A State Rail Plan addresses current and future needs for passenger and/or freight rail investment at a statewide level. With the recent enactment of the Passenger Rail Infrastructure Investment Act in October 2008, the nation is experiencing a surge in statewide rail planning as DOTs mobilize to become eligible for federal funding. To obtain funding for such projects as intercity and high-speed rail planning and design, states are required to have a FRA-approved state rail plan. With the *Statewide Rail Framework Study* providing the foundation, ADOT has embarked on developing its first Arizona State Rail Plan, to be published in 2010.

Figure 49 ADOT Planning Process Evolution



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