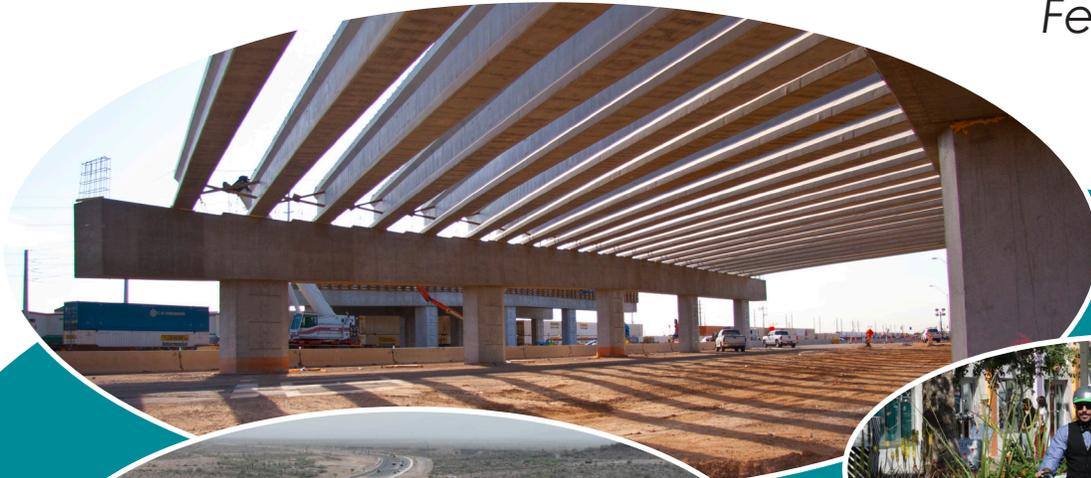


2040 REGIONAL TRANSPORTATION PLAN (RTP) UPDATE

February 26, 2020



2040 REGIONAL TRANSPORTATION PLAN UPDATE

FEBRUARY 26, 2020

Maricopa Association of Governments
302 North First Avenue, Suite 300
Phoenix, Arizona 85003
Phone: (602) 254-6300
Fax: (602) 254-6490
www.azmag.gov

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INTRODUCTION

The 2040 Regional Transportation Plan (RTP) Update is a comprehensive, performance-based, multi-modal plan that covers the period between Fiscal Year (FY) 2020 and FY 2040. The RTP covers all modes of transportation from a regional perspective, including freeways and highways, streets, public mass transit, airports, bicycle and pedestrian facilities, freight, and special needs transportation. Key transportation-related activities are addressed, such as transportation demand management, system management, safety and security, and air quality conformity analysis. The RTP is prepared, updated, and adopted by the Maricopa Association of Governments (MAG), the regional planning agency for the Phoenix metropolitan area. The RTP is developed through cooperation among government, business, and public interest groups, and includes community outreach and a public involvement program. It is anticipated this 2040 RTP Update will be the last update in the Proposition 400 era as MAG has begun efforts to develop a new regional transportation plan to inform the next generation of investments.

Maricopa Association of Governments

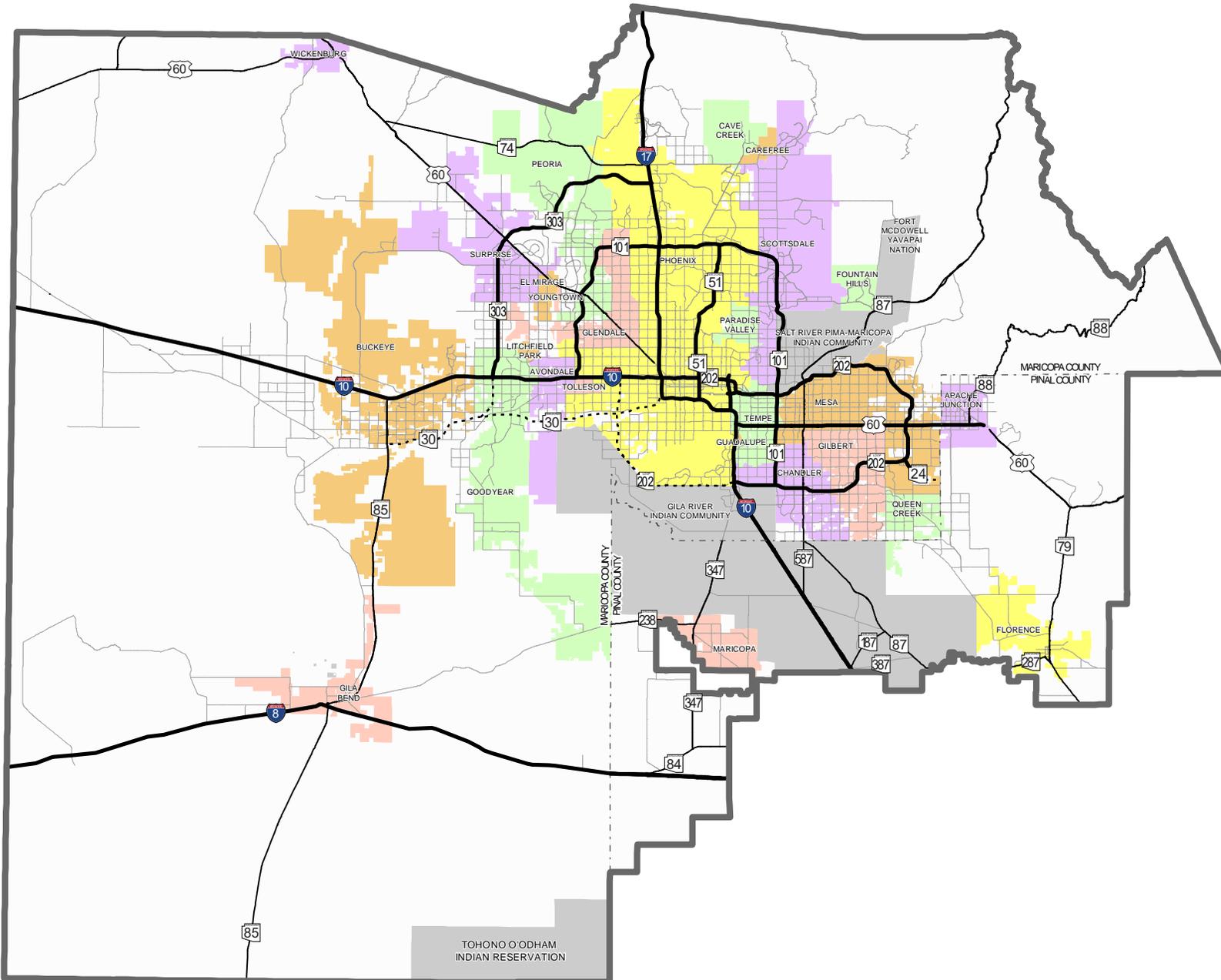
MAG was formed in 1967, as the designated Metropolitan Planning Organization (MPO) for transportation planning in the Phoenix metropolitan area. On May 9, 2013, the Governor of Arizona approved an expanded metropolitan planning area (MPA) boundary for MAG. As shown in Figure I-1, the MAG MPA boundary extends significantly into Pinal County per federal regulations (§450.312 - MPA Boundaries), which require MPAs to encompass the existing urbanized area and the contiguous area expected to become urbanized within a 20-year forecast. The current MAG MPA boundary was determined using 2010 Census data and the most current long-range population forecasts for Maricopa and Pinal counties.

In addition to transportation planning, MAG is designated by the Governor of Arizona to serve as the principal regional planning agency for air quality, water quality, and solid waste management. MAG is responsible for a regional air quality conformity analysis to demonstrate that the RTP complies with the provisions of air quality plans and standards. MAG also develops population estimates and projections for the region and conducts human services planning. MAG member agencies include 27 incorporated cities and towns, Maricopa County, Pinal County, the Gila River Indian Community, the Fort McDowell Yavapai Nation, the Salt River Pima-Maricopa Indian Community, and the Arizona Department of Transportation (ADOT).

The RTP is developed under the direction of MAG's Transportation Policy Committee (TPC). The TPC is a public/private partnership established by MAG charged with finding solutions to the region's transportation challenges. The Committee consists of 23 members, including a cross-section of MAG member agencies, community business representatives, and representatives from transit, construction, freight, and ADOT. The TPC is dedicated to transportation planning and decision making that addresses diverse transportation needs throughout the region. The Committee makes recommendations to the MAG Regional Council, which adopts the final RTP. The MAG Regional Council consists of elected officials from each member agency. Maricopa County representatives from the State Transportation Board sit on Regional Council but only vote on transportation-related issues. Policy and technical committees provide analysis and

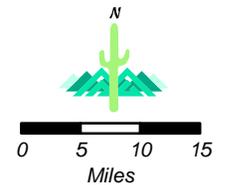
Figure I-1: MAG Region

2040
Regional Transportation Plan
Update



- Metropolitan Planning Area
- County Boundary
- Indian Communities
- Existing Freeway
- Planned Freeway/Highway
- Highways

Disclaimer: While every effort has been made to ensure the accuracy of this information, the Maricopa Association of Governments (MAG) makes no warranty, expressed or implied, as to its accuracy and expressly disclaims liability for the accuracy thereof.



information to the Regional Council. The MAG Regional Council is the ultimate approving body for the MAG RTP and MAG Transportation Improvement Program (TIP); changes to the MAG RTP or the funded projects that affect the TIP must be approved by the MAG Regional Council.

Regional Transportation Plan Updates

The RTP was adopted by the MAG Regional Council on November 25, 2003, and culminated in a three-year comprehensive planning effort. The development of the Plan is distinguished by the use of performance-based planning and the application of performance measures in the evaluation of alternatives. In a letter dated December 9, 2003, the U.S. Department of Transportation (USDOT) issued a finding of air quality conformity for the MAG RTP, as adopted by MAG on November 25, 2003.

Since its adoption in 2003, the RTP has been updated periodically to reflect changing conditions and new information. On July 27, 2005, the MAG Regional Council approved the RTP 2005 Update. Modifications in the 2005 RTP Update affected the phase in which specific highway and arterial projects were scheduled for construction. These changes were reflected, as appropriate, in the MAG FY 2006-2010 TIP. In a letter dated August 31, 2005, the USDOT issued a finding of air quality conformity for the MAG RTP, as approved by MAG on July 27, 2005.

On July 26, 2006, the MAG Regional Council approved the RTP 2006 Update. The 2006 Update summarized the elements of the previously adopted RTP, provided revised revenue estimates, and included life cycle programs for freeways and highways, arterial streets, and transit. The life cycle programs replaced the project phasing designations and funding levels originally identified in the RTP. In a letter dated August 17, 2006, the USDOT issued a finding of air quality conformity for the MAG RTP, as approved by MAG on July 26, 2006.

On July 25, 2007, the MAG Regional Council approved the RTP 2007 Update. The 2007 Update was structured to comply with the regional transportation planning requirements of the Federal Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). These requirements are in effect for any plans adopted after July 1, 2007. In response to SAFETEA-LU, the 2007 Update addressed new topics, including consultation on environmental mitigation and resource conservation, transportation security, and an updated public participation process. In addition, it included revised transportation revenue estimates, and updated life cycle programs for freeways and highways, arterial streets, and transit. In a letter dated August 16, 2007, the USDOT issued a finding of air quality conformity for the MAG RTP, as approved by MAG on July 25, 2007.

On July 28, 2010, the MAG Regional Council approved the RTP 2010 Update. The 2010 Update of the RTP addressed capital improvements and operational activities in the MAG area regional transportation system. The 2010 Update and regional transportation planning process continued to comply with SAFETEA-LU, Arizona House Bill 2292, and Arizona Revised Statute 28-6354. A significant focus of the 2010 update process was maintaining the balance between program costs and available revenues expected over the period covered by the plan. In a letter dated

August 25, 2010, the USDOT issued a finding of air quality conformity for the MAG RTP, as approved by MAG on July 28, 2010.

On January 29, 2014, the MAG Regional Council approved the MAG 2035 RTP, which included cost and revenue-balanced long-range programs for freeways, transit, and arterials. The programs were the result of a multi-year process to review and assess future transportation costs and revenues, and adjust implementation programs to accommodate lower transportation revenue forecasts. The 2035 RTP was developed consistent with the regional transportation planning requirements of SAFETEA-LU. Although new federal transportation legislation, Moving Ahead for Progress in the 21st Century Act (MAP-21), was signed into law by President Obama on July 6, 2012, MAP-21 regulations were not available in time to apply them to the development of the 2035 RTP. Representatives of the Federal Highway Administration and the Federal Transit Administration confirmed that SAFETEA-LU regulations would be adequate in this circumstance. In a letter dated February 12, 2014, the USDOT issued a finding of air quality conformity for the MAG 2035 RTP, as approved by MAG on January 29, 2014.

On June 28, 2017, the MAG Regional Council approved the MAG 2040 RTP, which was the first to establish a performance-based planning process for the region, as required by the Fixing America's Surface Transportation (FAST) Act, signed into law by former President Obama on December 4, 2015. The FAST Act is the first law enacted in over ten years that provides long-term (5-year) funding certainty for surface transportation. The FAST Act maintains the program structures and planning concepts contained in previous transportation legislation, MAP-21. The 2040 RTP was developed consistent with SAFETEA-LU and FAST Act requirements. In a letter dated July 17, 2017, the USDOT issued a finding of air quality conformity for the MAG 2040 RTP, as approved by MAG on June 28, 2017.

2040 Regional Transportation Plan Update

The 2040 RTP Update is organized into three major sections:

- **Section One: Planning Process** (Chapters 1-6): Addresses the approach taken to develop the Plan, including: organizational relationships; federal and state planning mandates; public involvement; Title VI and Environmental Justice considerations; consultation efforts; planning goals and objectives; and the regional development outlook.
- **Section Two: Transportation Modes** (Chapters 7-17): Covers modal investment strategies, including: planned transportation facilities; capital investments by mode; programs such as special needs and enhancement activities; and a financial plan.
- **Section Three: System Management, Operations, and Performance** (Chapters 18-24): Describes programs that monitor and improve the performance of the existing system, including: system management and operations; performance monitoring and assessment; demand and congestion management; and transportation safety and security. Air quality conformity is also covered in Section Three.

Federal Transportation Planning Requirements

The 2040 RTP Update was developed consistent with the regional transportation planning requirements of federal transportation legislation. It addresses key metropolitan transportation planning concepts identified in federal legislation, including: transportation facilities and planning factors; performance measures and targets; system performance reporting; mitigation activities; financial plans; operational and management strategies; capital investment and other strategies; and transportation enhancement activities.

The FAST Act established performance-based programs and set forth requirements for performance goals, outcomes, and targets. The Federal Statewide and Metropolitan Planning Rule state that an MPO shall establish performance targets no later than 180 days after the date on which the relevant state and/or provider of public transportation establishes performance targets. The MAG region has two provider agencies required to identify performance measures and targets: the City of Phoenix and Valley Metro-RPTA. MAG policy committees reviewed and supported the performance targets as established by both transit partner agencies. Additionally, MAG, ADOT, and regional providers of public transportation signed a Performance Measure Target Setting and Data Sharing Charter in June 2018.

CHAPTER ONE

REGIONAL TRANSPORTATION PLANNING APPROACH

The Maricopa Association of Governments (MAG) 2040 Regional Transportation Plan (RTP) Update covers the period between Fiscal Years (FY) 2020 and 2040 and addresses all major transportation modes and related transportation activities from a regional perspective. The RTP identifies future transportation facilities, discusses potential environmental mitigation activities, includes operational and capital investment strategies, provides a financial plan for implementation, coordinates with the development of air quality control measures, and was developed using an extensive public participation process. The regional transportation planning approach was designed to respond to federal and state mandates directed at the metropolitan transportation planning process. Many stakeholders participate in developing, implementing, and monitoring the RTP, which includes preparation of long-range plans, identification of programs and projects, construction of projects, and provision of transportation services.

Regional Roles and Responsibilities

Regional and state agencies and committees coordinate, manage, plan, oversee, and implement projects related to the RTP. A brief description of these agencies and committees, as well as their role in the RTP process, is provided below.

Maricopa Association of Governments

The MAG was formed in 1967, as the designated Metropolitan Planning Organization (MPO) for transportation planning in the Phoenix metropolitan area. On May 9, 2013, the Governor of Arizona approved an expanded metropolitan planning area (MPA) boundary for MAG. As shown in Figure I-1, the MAG MPA boundary extends significantly into Pinal County per federal regulations (§450.312 - Metropolitan Planning Area Boundaries), which require that metropolitan planning areas encompass the existing urbanized area and the contiguous area expected to become urbanized within a 20-year forecast. The current MAG MPA boundary was determined using 2010 Census data and the most current long-range population forecasts for Maricopa and Pinal counties. MAG members include the region's 27 incorporated cities and towns, Maricopa County, Pinal County, the Gila River Indian Community, the Fort McDowell Indian Community, the Salt River Pima-Maricopa Indian Community, and the Arizona Department of Transportation.

MAG is responsible for the coordination of the following regional planning activities:

- Multimodal transportation planning
- Air quality
- Wastewater
- Solid waste
- Human services
- Socioeconomic projections

MAG develops plans that are comprehensive, consistent, and compatible with one another. The RTP is in conformance with air quality plans for the metropolitan area. MAG is responsible for the air quality conformity analysis and ensures the transportation plan complies with the provisions of air quality plans and other air quality standards. MAG is also responsible for the development of the Arterial Street Life Cycle Program (ALCP). Projects in the ALCP are constructed by member agencies.

The MAG Regional Council is the decision-making body of MAG. The Regional Council consists of elected officials from each member agency. Maricopa County representatives from the State Transportation Board also sit on Regional Council but only vote on transportation-related issues. Policy and technical committees provide analysis and information to Regional Council. The MAG Regional Council is the ultimate approving body for the MAG RTP and MAG Transportation Improvement Program (TIP). Any change in the RTP or funded projects that affect the TIP, including priorities, must be approved by the MAG Regional Council.

Transportation Policy Committee

The MAG Transportation Policy Committee (TPC) met for the first time in September 2002 and was initially tasked with developing the Regional Transportation Plan (RTP) and recommending the plan for adoption to the MAG Regional Council. The TPC recommended a plan in September 2003, which was unanimously approved and adopted by the MAG Regional Council on November 25, 2003. The plan served as the core concept for the MAG RTP, with updates applied periodically to reflect changing conditions and new information. In addition to developing the RTP, the TPC advises Regional Council on transportation issues, such as the MAG TIP; the freeway, arterial, and transit Life Cycle Programs; and requested material changes and amendments to the RTP.

The TPC and its role in developing the RTP was later codified into state statute. The TPC is comprised of 23 members and is a public/private partnership. Six members represent business interests and 17 are MAG member agency representatives, which include 13 representatives from a geographic cross-section of cities and towns within the MAG region, and one representative each from the ADOT State Transportation Board, the County Board of Supervisors, and Native nations. The business representatives are from businesses with region-wide interest, including one who must represent transit interests, one who represents construction interests and one who represents freight interests. Three of the business representatives are appointed by the Speaker of the Arizona House of Representatives, and the other three are appointed by the President of the Arizona State Senate.

Arizona Department of Transportation

The primary role of the ADOT is to provide a transportation system that meets the needs of the citizens of Arizona. ADOT is responsible for planning, building, and operating the complex State Highway System, which is designed to provide safe and efficient highway travel around the state. The MAG Freeway Life Cycle Program (FLCP) is part of the State Highway System.

ADOT manages the implementation of the FLCP, including all design, engineering, right of way acquisition, construction, and maintenance activities. ADOT is instrumental to the FLCP by making projections of available revenues and developing financing strategies to fund projects. ADOT also has a role for the arterial streets program. Although MAG is responsible for the development of the ALCP, in accordance with ARS 28-6303.D.2, ADOT maintains the arterial street fund and issues bonds on behalf of the MAG ALCP.

State Transportation Board

The State Transportation Board has statutory authority over the State Highway System and sets priorities for the System (except the MAG FLCP), establishes a five-year construction program for airport and highway projects, awards construction contracts, issues bonds, and creates statewide policies. The Board consists of seven members who are appointed by the Governor of Arizona and represent six geographic regions across Arizona, including two from Maricopa County. Members serve six-year terms.

The Board approves the ADOT Five-Year Highway Construction Program for statewide projects, inclusive of MAG's FLCP, on an annual basis. The FLCP incorporates priorities set forth by the MAG Regional Council. ADOT and MAG cooperatively develop the FLCP for the MAG region. The State Transportation Board cannot approve projects within the MAG area that are not consistent with the MAG RTP and TIP, ensuring the participation of local governments in project selection and conformity with air quality standards.

The State Transportation Board adopts policies that affect the MAG FLCP. The Board has the authority to issue bonds, supported by both the Regional Area Road Fund and the Highway User Revenue Fund, and issue other forms of debt. The issuance of bonds allows for significant acceleration of the MAG FLCP.

Valley Metro/Regional Public Transportation Authority

The Valley Metro/Regional Public Transportation Authority (RPTA) is a political subdivision of the State of Arizona overseen by a board of elected officials. Membership is open to the county government and all municipalities in Maricopa County. In 1993, the RPTA Board adopted Valley Metro as the identity for the regional transit system. The Valley Metro Boards of Directors guide the agency by providing transportation leadership that best serves the region and communities. Members are represented by an elected official, appointed by their jurisdiction. The Valley Metro RPTA Board includes: Avondale, Buckeye, Chandler, El Mirage, Fountain Hills, Gilbert, Glendale, Goodyear, Maricopa County, Mesa, Peoria, Phoenix, Queen Creek, Scottsdale, Surprise, Tempe, Tolleson, Wickenburg, and Youngtown. The Board cannot approve projects or programs within the MAG region that are not consistent with the MAG RTP and TIP.

Valley Metro plans, builds, operates and maintains the regional, multimodal transportation system by connecting communities and enhancing lives. The RPTA provides and operates local, express and RAPID commuter bus service; neighborhood circulators; rural bus routes; paratransit

service; vanpool service; and commuter programs, including Rideshare. The RPTA is also responsible for maintaining the Transit Life Cycle Program (TLCP).

In November of 2004, the passage of Proposition 400 increased funding for public transit from approximately two percent of total half-cent sales tax revenues (\$5 million annually inflated) to 33 percent, which began on January 1, 2006. These monies are deposited in the Public Transportation Fund (PTF), which was created as part of the Proposition 400 legislation. The RPTA administers monies in the PTF for use on transit projects, including light rail projects, as identified in the MAG RTP. Valley Metro RPTA must separately account for monies allocated to light rail transit, capital costs for other transit, and operation and maintenance costs for other transit. In addition to Proposition 400 funding, Valley Metro utilizes blocks of federal transit funding for capital expenditures on transit in the region.

Valley Metro Rail

Valley Metro Rail is a non-profit, public corporation that oversees the design, construction, and operation of light rail and streetcar. The Valley Metro Rail Board of Directors includes elected officials appointed by their respective agencies. Currently, the Board includes Chandler, Mesa, Phoenix, and Tempe.

The Valley Metro Rail Board of Directors establishes procedures for the administration and oversight of design, construction, and operation of light rail. They also receive and disburse funds and grants from federal, state, local, and other funding sources. The Board has the authority to enter into contracts for streetcar and light rail design and construction, contract or hire staff for light rail or streetcar projects and undertake extensions to the system. Valley Metro cannot approve projects and programs within the MAG area that are not consistent with the MAG RTP and TIP.

In March 2012, Valley Metro RPTA and Valley Metro Rail decided to merge and employ a single chief executive officer (CEO) to oversee both agencies. Subsequently, the staffs of the two agencies integrated into a single organization under the direction of the CEO. The combined staff organization addresses all administrative, planning and operational functions for both agencies, including: communications and marketing; planning and development; design and construction; operations and maintenance; finance; administrative and organizational development; legal; and intergovernmental relations. The legal structure and Boards of the two agencies were not affected.

Citizens Transportation Oversight Committee

In 1994, ARS 28-6356 established a Citizens Transportation Oversight Committee (CTOC) in counties with a population of one million, two hundred thousand or more persons and a transportation sales tax, which included Maricopa County. The COTC facilitated citizen involvement in the decision-making process regarding the Maricopa regional freeway system. The committee served as an advisory board to the Governor, Valley Metro, and MAG; made

recommendations on revisions to the RTP; and contracted an annual audit of all expenditures for the regional area road fund and public transportation fund. On May 19, 2017, the Governor of Arizona signed House Bill 2369, eliminating CTOC. The elimination of CTOC also removed the Chairman of COTC from the MAG Regional Council and MAG TPC.

Regional Transportation Plan Partners

Key agencies in the region formed an ad hoc group, the "RTP Partners", aimed at coordinating the implementation of Proposition 400 with projects in the MAG RTP. Participating agencies, including MAG, ADOT, and Valley Metro, meet periodically to ensure overall coordination of transportation planning and implementation activities. Specific goals of the group are to prepare uniform revenue forecasts, establish consistent life cycle programming procedures, maintain an integrated approach to the long-term development of transportation corridors and services, and provide clear, concise information to the public and receive public input on issues connected with the implementation of Proposition 400.

U.S. Department of Transportation – Code of Federal Regulations (CFR)

The RTP complies with U.S. Department of Transportation metropolitan transportation planning requirements described in 23 CFR/Part 450 and 49 CFR/Part 613.100. Final rulemaking pertaining to these regulations was jointly issued by the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) on May 27, 2016. The major requirements of "*23 CFR/Part 450/Section 324 - Development and Content of the Metropolitan Transportation Plan*" and the approach of the RTP in addressing each requirement are summarized below:

The transportation plan shall address no less than a 20-year horizon and consider the planning factors in 23 CFR Part 450.306. (See 23 CFR Part 450.324(a).)

- The transportation planning process shall address at least a 20-year planning horizon. The RTP covers a period of at least a 20-years from the effective date of the Plan. The effective date of the Plan is defined in 23 CFR Part 450.322 as the date of a conformity determination by the FHWA and FTA. This determination is typically received within two months of the approval of the Plan by MAG. (See Introduction and Chapter 1.)
- The transportation plan shall consider the planning factors in 23 CFR Part 450.306. The RTP addresses the planning factors covered in 23 CFR Part 450.306 as described below.
 - Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency. Two objectives identified in the Plan are: 1) maintain an acceptable level of service (LOS) on transportation and mobility systems serving the region, taking into account performance by mode and facility type. 2) Provide residents of the region with access to jobs, shopping, educational, cultural and recreational opportunities, and provide employers with reasonable access to the workforce in the region. The RTP addresses economic vitality through

projects and programs that reduce congestion and increase system efficiency through the effective management of system operations and development of transportation facility capacity improvements. In addition, MAG has been highly active in promoting economic development activities within the metropolitan planning area, as well as the larger central Arizona/Sun Corridor region. The activities of the MAG Economic Development Committee are described in Chapter 3. (See Chapters 2, 3, and 17.)

- Increase the safety of the transportation system for motorized and non-motorized users. Safety is a critical element of transportation and the RTP addresses safety issues in a separate chapter. Safety was identified as a focus. One of the Plan objectives is to provide a safe and secure environment for the traveling public, address roadway hazards, pedestrian and bicycle safety, and transit security. The RTP includes a safety planning program that enables safety issues to be addressed as part of the planning process. The MAG Transportation Safety Committee pursues safety planning and implementation. This includes developing and updating the MAG Strategic Transportation Safety Plan, maintaining safety information management systems, and conducting safety workshops. (See Chapter 21.)
- Increase the security of the transportation system for motorized and non-motorized users. Transportation security is covered in a separate chapter of the RTP. MAG conducted and documented an inventory of security activities and programs in the region. The information was assessed to gain insights into the role MAG might play to advance and facilitate the effective application of security measures to the transportation system. MAG already participates in security efforts through its role in the implementation of 9-1-1 and the Community Emergency Notification System. (See Chapter 22.)
- Increase the accessibility and mobility of people and freight. The RTP identifies three objectives related to mobility options: 1) maintain a reasonable and reliable travel time for moving freight into, through and within the region, as well as provide high-quality access between intercity freight transportation corridors and freight terminal locations, including intermodal facilities for air, rail, and truck cargo; 2) Provide people in the region with the transportation modes necessary to carry out essential daily activities and support equitable access to the region's opportunities; and, 3) Address the needs of the elderly and other population groups that may have special transportation needs, such as non-drivers or those with disabilities. The RTP increases accessibility and mobility options by calling for significant investments in freeways, highways, streets, bus service, high-capacity transit facilities, bicycle and pedestrian facilities, and airports. The Plan also provides the planning foundations for freight and special needs transportation. (See Chapter 2 and Chapters 9-16.)

- Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and state and local planned growth and economic development patterns. Early in the RTP process, the need to sustain the environment was recognized. The RTP objectives related to this issue include: 1) identify and encourage implementation of mitigation measures that will reduce noise, visual, and traffic impacts of transportation projects on existing neighborhoods; 2) Encourage programs and land-use planning that advance efficient travel patterns in the region; and, 3) Make transportation decisions compatible with air quality conformity and water quality standards, the sustainable preservation of regional ecosystems, and desired lifestyles.

The RTP discusses environmental mitigation activities that may address environmental functions affected by the Plan. Air quality issues are addressed in a separate conformity analysis document prepared for the RTP. Reductions in transportation energy use across the region are closely tied to air quality goals. In addition, the RTP identifies regional funding for environmental concerns such as freeway landscaping and litter pickup.

The planning process supports consistency between transportation improvements and planned growth and economic development patterns at the state and local level. As part of the transportation planning process, MAG consults with the state and local agencies responsible for land use management, natural resources, environmental protection, conservation, and historic preservation. Also, the process to develop long-range population and employment forecasts, which provides the foundation for the transportation planning effort, starts with local and state land use plans and forecasts. (See Chapter 2 and Chapters 9-16.)

- Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight. One of the objectives of the RTP is to maintain a reasonable and reliable travel time for moving freight into, through, and within the region, as well as to provide high-quality access between intercity freight transportation corridors and freight terminal locations, including intermodal facilities for air, rail, and truck cargo. The broad range of multimodal improvements in the RTP facilitates the movement of people and goods and enhance system connectivity throughout the region. The RTP chapters on airports and freight highlight the importance of developing an integrated approach to planning for passenger and freight movement. In addition, MAG employs a multimodal, integrated process for forecasting and analyzing travel demand. (See Chapters 2, 7, 12, and 14.)
- Promote efficient system management and operation. A central theme in the RTP is minimizing congestion and delays. One of the objectives is to maintain an acceptable and reliable LOS on transportation and mobility systems that serve the region, taking into account performance by mode and facility type. Traffic congestion analysis is addressed throughout the MAG planning process and includes the use of MAG

transportation models to analyze future traffic demand and levels of service. Projects funded from regional sources are rated by an air quality rating system and a congestion management rating system. System operations and management are addressed in the RTP, including chapters that identify strategies and describe ongoing planning efforts in the areas of System Management and Operations, Demand Management, Congestion Management Process, Transportation Safety, Transportation Security, and System Performance Monitoring and Targets. (See Chapter 2 and Chapters 18-23.)

- Emphasize the preservation of the existing transportation system. The RTP process recognizes the importance of maintaining regional transportation infrastructure. The RTP identifies maintenance as a critical Plan element. The main objective is to provide for the continuing preservation and maintenance of transportation facilities and services in the region and eliminate maintenance backlogs. The high level of importance placed on preservation is reflected by the allocation of major blocks of regional-level funding to improving the existing roadway network and conducting maintenance. In addition, the RTP discusses ongoing operations and maintenance efforts at state and local levels. (See Chapter 2 and Chapters 9-11.)
- Improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation. System operations and management are addressed in Chapter 18, which includes efforts to improve the resiliency and reliability of the transportation system. Resiliency and reliability are concerns of studies described in Chapter 16, including the “MAG Managed Lanes Development Strategy” and the “Interstate 10/Interstate 17 Corridor Master Plan Study.” Storm water runoff and other water resource concerns are addressed in Chapter 6 and Appendix B, as part of the consultation with environmental and resource agencies. (See Chapters 6, 16, 18 and Appendix B.)
- Enhance travel and tourism. MAG actively promotes economic development activities within the metropolitan planning area and the larger central Arizona/Sun Corridor region. These activities include travel and tourism. The efforts of the MAG Economic Development Committee are described in Chapter 3. (See Chapter 3.)

The transportation plan shall include both long-range and short-range strategies that lead to an integrated multimodal transportation system. (See 23 CFR Part 450.324(b).)

The RTP contains long- and short-range concepts and covers the full spectrum of transportation modes. A project-specific listing of improvements for all major transportation modes is included for the entire planning period. The list acts as a blueprint to develop the MAG five-year TIP, and guides the schedule of long-range facility development studies, such as corridor, area, and design concept reports. In addition to covering the major transportation modes, the RTP addresses bicycle and pedestrian facilities, airports, special needs transportation, transportation system operations, and demand management. (See Chapters 9-16 and Chapters 18-20.)

The metropolitan planning organization shall review and update the transportation plan at least every four years in nonattainment areas. (See 23 CFR Part 450.324(c).)

The most recent update of the RTP was approved by MAG on June 28, 2017 and received a finding of air quality conformity from FHWA and the FTA on July 17, 2017. (See Chapter 24.)

The metropolitan planning organization shall coordinate the development of the regional transportation plan with the transportation control measures (TCMs) in the State Implementation Plan (SIP). (See 23 CFR Part 450.324(d).)

MAG is the regional air quality planning agency and maintains an extensive air quality planning process through which TCMs are identified, selected, and implemented as part of the SIP. The MAG regional air quality plans are developed through a cooperative effort between the Arizona Department of Environmental Quality, ADOT, Maricopa County, and MAG. The agencies generate information on emissions inventories and air quality modeling, as well as the description, assumptions, and cost-effectiveness of TCMs. (See Chapter 24.)

The metropolitan planning organization shall base updates on the latest available estimates for population, land use, travel, employment, congestion, and economic activity. (See 23 CFR Part 450.324(e).)

The RTP is based on the most recently available population and employment projections for the region. According to Executive Order 2011-04, the Arizona Department of Administration (ADOA) is responsible for preparing official population projections for Arizona and each of its counties. ADOA prepared residential population projections for Maricopa County and Pinal County consistent with the 2010 Census. MAG is responsible for developing a set of sub-regional projections for communities within Maricopa County, and Central Arizona Governments (CAG) is responsible for developing a set of sub-regional projections for communities within Pinal County. These projection figures, which consider recent population and employment information, were produced in early 2019 and approved for Maricopa County by the MAG Regional Council on June 26, 2019, and for Pinal County by the CAG Regional Council on September 25, 2019. (See Chapter 3.)

The metropolitan transportation plan shall, at a minimum, include the following: (See 23 CFR Part 450.324(f).)

- The transportation plan shall include current and projected transportation demand of persons and goods in the metropolitan planning area over the period of the transportation plan. The MAG transportation planning process includes an extensive travel modeling component that provides estimates of future travel associated with the demand for person and goods movement in the region. The model includes travel by all major modes including autos, trucks, bus transit, streetcar and light rail transit for the full period covered by the RTP. The travel modeling process is based on the most recently available population and employment forecasts, which are consistent with the horizon

year of the Plan. The RTP includes a separate chapter on the transportation demand of persons and goods, which addresses current and future travel demand. (See Chapter 7.)

- The transportation plan shall include existing and proposed transportation facilities that should function as an integrated system. The RTP identifies the network of existing and planned transportation facilities that function as an integrated system to serve the travel demand of the region. The system includes major modal components represented by the freeway and highway system, the arterial street network, and public transit operations and facilities. Other modal programs addressed in the RTP include airports, bicycle and pedestrian facilities, freight, and special needs transportation. The location and connectivity of regional transportation networks by mode, as well as the phasing of future improvements to the transportation system, are depicted in the RTP. The major modal systems are inventoried and analyzed using an integrated travel demand modeling system. (See Chapters 9-15.)
- The transportation plan shall include a description of the performance measures and targets used in assessing the performance of the transportation system. The RTP dedicates Chapter 23 to transportation system performance measures, targets, and monitoring. The chapter reviews the status of performance monitoring procedures, as well as the process to establish performance measures and targets. Title 23 CFR Part 450.306(d)(3) states that: "Each MPO shall establish the performance targets under paragraph (d)(2) of this section not later than 180 days after the date on which the relevant state or provider of public transportation establishes the performance targets." System congestion targets for the MAG region have been identified and were approved by the MAG Regional Council on June 6, 2018. (See Chapter 23).
- The transportation plan shall include a transportation system performance report and subsequent report updates evaluating the condition and performance of the transportation system with respect to the performance targets described in 450.306(d). A transportation system performance report that evaluates the condition and performance of the transportation system with respect to the aforementioned performance targets has not yet been prepared. Upon completion, the RTP will be revised to include the performance report.
- The transportation plan shall include operational and management strategies to improve the performance of existing transportation facilities. The RTP addresses operational and management strategies to improve transportation system performance, relieve congestion, and enhance safety and mobility through a wide range of planning efforts. A section of the RTP is dedicated to system management, operations, and performance. This section includes chapters that identify strategies and describe ongoing planning efforts in system management and operations, demand management, congestion management, transportation safety, transportation security, performance targets, and system performance reports. (See Chapters 18 -23).

- The transportation plan shall consider the results of the congestion management process. MAG developed a congestion management process (CMP), designed to be an integral part of the planning and programming activities. The effort included identification of best practices, development of a performance measurement framework, and preparation of a CMP project assessment tool. The CMP provides a mechanism for considering congestion management impacts of projects and project packages and providing input to the development of the TIP. In addition, periodic facility congestion and level of service surveys are conducted to assess current congestion and provide a basis for modeling future congestion. MAG established an ongoing performance monitoring program, which is a key component of the congestion management process. The performance monitoring program formalizes data collection and refines the process for assessing the effectiveness of congestion management strategies. The congestion management process and the performance monitoring program are addressed in individual chapters in the RTP. (See Chapters 20 and 23).
- The transportation plan shall include an assessment of capital investment and other strategies to preserve the existing system and provide for multimodal capacity increases. The RTP covers capital investment strategies to preserve existing transportation infrastructure and increase multimodal capacity based on regional priorities. For the major modal components, the Plan includes detailed 20-year programs for improvements to the existing system, as well as the development of new facilities. In addition, potential needs in other modal programs, such as airports, bicycle and pedestrian facilities, freight, and special needs programs are addressed in the RTP. The Plan process recognizes the importance of maintaining regional transportation infrastructure, which is reflected by the allocation of major blocks of regional-level funding to improve the existing roadway network and conduct maintenance. (See Chapters 9-15.)
- The transportation plan shall include transportation and transit enhancement activities. MAG participated in a transportation enhancement program administered by ADOT. The program involved the development of project proposals by the councils of governments and MPOs around the state. With the passage of MAP-21, procedures for enhancement projects are being altered consistent with federal planning regulations. A chapter on enhancement projects is included in the RTP. (See Chapter 16.)
- The transportation plan shall include descriptions of all existing and proposed transportation facilities in sufficient detail for conformity determinations. MAG maintains multimodal transportation networks of existing and proposed facilities as part of the regional travel demand modeling process. The networks are described in sufficient detail and utilized as input to the air quality conformity process required by 40 CFR 93 (EPA's transportation conformity rule). The scope and cost of the networks is described in the RTP and includes all facilities regardless of funding source. (See Chapters 9-15.)

- The transportation plan shall include a discussion of potential environmental mitigation activities to restore and maintain environmental functions affected by the transportation plan. The RTP includes environmental mitigation activities that have the potential to address environmental functions affected by the Plan. The effort consulted a broad range of federal, state, and tribal agencies that deal with wildlife, land management, and environmental regulation. The transportation planning process and future environmental implications were addressed with the agencies, and concepts for potential environmental mitigation activities were identified. The primary goal of the RTP consultation effort is to gain insights about environmental concerns involving future planning efforts and future Plan elements. (See Chapter 6.)
- The transportation plan shall include a financial plan that demonstrates how the adopted transportation plan can be implemented. The RTP includes a financial plan that identifies funding to carry out the improvements and programs by mode. All funding sources are reasonably available throughout the planning period, with a long history of providing funding for the RTP. Sources include: the half-cent sales tax, originally approved in 1985 and extended in 2004; the Arizona Highway Users Revenue Fund, a continual funding source for transportation in Arizona since 1974; federal highway and transit funding programs, which represent a national commitment to transportation; and local government and private funding, which parallel the residential and commercial development process. Estimates of future federal, state, and regional funds were developed cooperatively by MAG, Valley Metro, and ADOT. In addition, Arizona State Statutes require transportation implementing agencies in the MAG area to develop and maintain Life Cycle Programs that ensure transportation program costs can be met by future revenues. The life cycle programs are reflected in the RTP. (See Chapter 8.)
- The transportation plan shall include pedestrian walkway and bicycle transportation facilities. MAG maintains an active role in promoting and establishing travel opportunities for bicyclists and pedestrians. Planning efforts conducted by MAG and its member agencies have led to bicycle and pedestrian-oriented policies, programs, and roadway improvements. The MAG Active Transportation Plan was initiated in FY 2017 and will be completed in FY 2020. Pedestrian walkway and bicycle transportation facilities are addressed in a separate chapter in the RTP. (See Chapter 13.)

The metropolitan planning organization shall consult with state and local agencies responsible for land use management, natural resources, environmental protection, conservation, and historic preservation regarding development of the transportation plan. (See 23 CFR Part 450.324(g).)

As part of the development of the 2040 RTP Update, MAG consulted with state and local agencies responsible for land use management, natural resources, environmental protection, conservation, and historic preservation. The process identified key databases, conservation maps, inventories of natural or historic resources, and other information sources for use in the regional transportation planning process. Previously adopted projects in the RTP undergo

extensive environmental and resource assessment by the implementing agencies. As noted under mitigation activities, the primary goal of the consultation effort was to gain insights about concerns involving future planning efforts and Plan elements. A chapter in the RTP is dedicated to describing the consultation process and discussing potential environmental mitigation activities. (See Chapter 6.)

The transportation plan should integrate priorities in safety plans, as well as disaster preparedness plans that support homeland security and personal security of users. (See 23 CFR Part 450.324(h).)

The RTP discusses safety in Chapter 22, which covers the MAG safety planning program and addresses safety issues as part of the regional transportation planning process. MAG has a standing committee for safety planning, develops a safety information management system, and conducts safety workshops. The Strategic Transportation Safety Plan (STSP), currently being updated, is maintained by MAG and coordinated with ADOT's Strategic Highway Safety Plan (SHSP) that was released at the end of October 2014. Ongoing coordination between MAG and ADOT planning efforts will lead to the establishment of regional road safety performance goals and targets that follow similar goals and targets established for the state. This meets the requirements outlined in the U.S. Department of Transportation proposed rulemaking related to MAP-21 safety performance measures. The STSP identifies areas in which road safety can be considered during the MAG TIP process. The approach for mainstreaming safety in the planning process, the STSP, was approved by MAG Regional Council in October of 2015. The RTP also has a separate chapter on security (Chapter 22).

An inventory of ongoing security activities and programs in the MAG area was conducted and documented. The information was assessed to gain insights into the role MAG might play to advance and facilitate the effective application of security measures to transportation systems in the region. (See Chapter 21 and 22.)

The metropolitan planning organization may voluntarily elect to develop multiple scenarios for consideration as part of the development of the metropolitan transportation plan. (See 23 CFR Part 450.324(i).)

MAG elected not to undertake an extensive scenario identification and evaluation effort as part of the current plan update. However, scenario concepts are utilized in the process of establishing and evaluating transportation system performance measures and targets. (See Chapter 23.) Also, the core elements of the 2040 RTP Update are based on previous planning efforts, which included the performance evaluation of a series of long-range plan scenarios. In addition, a chapter is included in the 2040 RTP Update describing MAG studies that address future transportation demand and the need for additional or improved facilities and services. Topics in the chapter include inter-regional cooperation and coordination, modal and area transportation studies, and illustrative corridors and projects. (See Chapter 17).

The Metropolitan Planning Organization shall provide interested parties with a reasonable opportunity to comment on the transportation plan. (See 23 CFR Part 450.324(j).)

Throughout the RTP process, interested parties are provided extensive opportunities to comment on the Plan or potential future additions to the Plan. This is accomplished through a participation plan that is structured to maximize input opportunities for interested individuals and groups. The development of the participation plan included extensive consultation with citizens, citizen interest groups, public agencies, and private transportation providers. In addition, MAG recognizes the significance of transportation to all residents of the metropolitan area and the importance of Title VI/Environmental considerations in the transportation planning process. As a result, an environmental justice analysis of the RTP was prepared. Public involvement activities are described in a separate chapter. (See Chapters 4 and 5.)

The metropolitan transportation plan shall be published or otherwise made readily available for public review. (See 23 CFR Part 450.324(k).)

The RTP is made available for public review through printed and electronic media. A variety of methods are used to promote public education and obtain comments on the RTP, including outreach efforts, accessible meetings and workshops, graphical visualization techniques, and online posts. The web is a means of providing the public with access to planning information for review and input. The RTP and other planning reports are posted on the web, which is also used to disseminate preliminary planning information, progress reports, and meeting or workshop notices. (See Chapter 4.)

The Metropolitan Planning Organization shall not be required to select any project from the illustrative list of additional projects included in the financial plan. (See 23 CFR Part 450.324(l).)

The RTP identifies illustrative projects in a separate chapter. The projects could potentially be included if additional resources beyond the reasonably available financial resources identified in the plan became available. They are discussed in the RTP for illustrative purposes only and are not included in the financial plan or air quality conformity determination. There is no requirement to select any project from an illustrative list of projects in a metropolitan transportation plan at some future date, when funding might become available. In addition, no priorities are stated or implied by inclusion as an illustrative corridor. (See Chapter 17.)

The metropolitan planning organization must make a conformity determination on any updated or amended transportation plan in accordance with transportation conformity regulations. (See 23 CFR Part 450.324(m).)

MAG conducts the appropriate air quality conformity analyses of the RTP to comply with air quality conformity regulations. Any updates or amendments to the MAG Plan must first undergo conformity analysis and approval is contingent upon a finding of conformity by FHWA and FTA. (See Chapter 24.)

Arizona Revised Statutes (A.R.S.)

Arizona state legislation establishes guidelines and factors to be considered during the development of the RTP. Arizona Revised Statute 28-6308 identifies requirements of the regional transportation plan and addresses a range of planning considerations, such as a 20-year planning horizon, the use of a performance-based planning approach, the allocation of funds between highways and transit, and priorities for expenditures. The relevant requirements of A.R.S.28-6308 are summarized below, and the approach of the RTP to each is discussed.

Through the regional planning agency, the transportation policy committee shall recommend a twenty-year, comprehensive, performance-based, multimodal, and coordinated regional transportation plan, including transportation corridors by priority and a construction schedule. (See A.R.S. 28-6308.B.1.)

- Cover a 20-year term. The RTP covers at least a 20-year planning horizon. In addition, the Plan addresses issues that extend beyond this planning period.
- Be comprehensive, performance based, multimodal, and coordinated. The RTP is comprehensive in scope, taking into account future land use and growth throughout the region. It is multimodal and includes freeways, highways, streets, bus service, high-capacity transit and other transit services, airports, bicycles, and pedestrians. The approach used to develop the RTP is distinguished by performance-based planning and the application of performance measures in the evaluation of system operations. The RTP coordinates the functions of each mode through regional modeling, construction phasing, and financial planning. The transportation analysis used to develop the RTP includes Indian Communities and portions of contiguous counties forecasted to develop during the planning period. The growth projected for these areas and the associated impacts on transportation demand are considered in the planning process.
- Include a transportation corridor prioritization and construction schedule. The RTP includes modal life cycle project program schedules that dictate when projects are programmed for construction during the planning period. The schedule is based on factors such as traffic volumes, LOS, project readiness, and cash flow availability.

The transportation policy plan shall include the following mode classifications (freeways, major arterials streets, public transportation) with a revenue allocation to each classification. (See A.R.S. 28-6308.C.1.)

- Include the following mode classifications: freeways, major arterial streets, public transportation. The RTP addresses major modes (i.e., freeways, major arterial streets, public transportation) and dedicates a chapter to each mode. An in depth description of the regional network and planned improvements for each mode is provided along with project costs and schedules.

- Include a revenue allocation to each modal classification. The RTP includes a financial plan for each major modal element (i.e., freeways, major arterial streets, public transportation) that allocates funding among and across modes by funding source. Allocations are projected through the horizon year of the RTP.

Costs and Revenue Estimates

Periodic RTP updates are needed to respond to changing conditions and new information. Cost estimates are subject to changes in price for right of way acquisition, materials, equipment, personnel, and facility design requirements. Similarly, revenue collections and long-term revenue receipts may be affected by changes in local and national economic conditions. Proposition 400 legislation acknowledges the need to respond to changing conditions and new information while implementing a long-range plan. The legislation calls for five-year performance audits of the RTP; specifies consultation steps for major amendments to the RTP; and requires life cycle programs for highways, streets, and transit to ensure programmed projects can be completed within available revenues. Cost and revenues in the 2040 RTP Update reflect the most recent estimates. However, the long-term outlook regarding construction and right of way costs, and transportation revenues is subject to continued adjustments. Maintaining a balance between program costs and revenues is an ongoing challenge.

In response to federal planning requirements (23 CFR Part 450.324(f)(11)(iv), costs and revenues are expressed in “Year of Expenditure” (YOE) dollars throughout the RTP. Therefore, revenue and funding forecasts reflect the actual number of dollars projected to be available, while project cost estimates incorporate the potential effects of future price inflation and represent the actual number of dollars that would be expended. Detailed project listings in the appendix of the report are expressed in 2019 dollars.

RTP Planning Period

The planning period for the 2040 RTP Update covers FY 2020 through FY 2040, with FY ending on June 30th. To facilitate the discussion of plan concepts and project priorities, three project groupings associated with intervals in the planning period have been identified:

- Group 1 (FY 2020 - FY 2024): Corresponds to the period covered by the MAG FY 2020 - FY 2024 TIP. Corridor discussions may refer to construction that is underway during this period but may have been programmed earlier.
- Group 2 (FY 2025 - FY 2026): Corresponds to the period beyond the TIP but within the Life Cycle Programs, which extends through FY 2026.
- Group 3 (FY 2027 - FY 2040): Corresponds to the period beyond the Life Cycle Programs but within the RTP planning period, which extends through FY 2040.

For highway projects, the groups are used to indicate the period in which funds are programmed for construction work. For example, a highway project labeled "Group 3" is funded for construction during FY 2027 - FY 2040, but may have funding for design activities or right of way acquisition in earlier periods. For arterial projects, the groups indicate the period in which a project is anticipated to be completed. Reimbursements from regional funding sources for arterial projects may occur in later periods. For transit capital expenditures, the group indicates the period when equipment or other capital items are acquired or when construction of facilities is funded. For bus operations, the group represents the first period in which at least some funding was provided for the route from regional sources. Funding continues during subsequent periods, and service improvements on certain routes may also be initiated in a later period. For streetcar, light rail or high-capacity transit operations, the group indicates the period when service is initiated. No regional funding is provided for streetcar, light rail transit or high-capacity transit operating expenses.

Future Updates of the 2040 RTP

Changing conditions and new information continually arise during the course of implementing a long-range transportation plan. Certain planned projects may no longer respond to evolving travel patterns, or may no longer be consistent with available funding. Revenue sources may not provide funding levels initially forecasted or may be structured differently than originally anticipated. Public attitudes regarding transportation issues may shift and new concerns may emerge. These and other factors potentially require new strategies and revised priorities.

The 2040 RTP Update provides a detailed view of future transportation projects and programs in the region and the financial resources needed to implement planned improvements. It serves as a blueprint to guide transportation investments through FY 2040. However, it does not preclude future reevaluation of plan strategies, projects and programs as part of the regional transportation planning process. Factors such as system development strategies, project selection priorities, and modal revenue allocations are subject to change. In future updates of the RTP, plan and program goals may be updated, and new long-range transportation strategies defined. The allocation of revenues among modes and projects may be altered and new modal emphasis areas identified. Changes to the RTP will include public involvement and be accomplished through the MAG committee process, with final approval by the MAG Regional Council.

CHAPTER TWO

GOALS, OBJECTIVES AND PRIORITY CRITERIA

Regional goals and objectives provide the planning process with a basis for identifying options, evaluating alternatives, and making decisions on future transportation investments. The MAG Transportation Policy Committee has identified a total of four goals and 15 objectives, which were approved on February 19, 2003. In addition, Arizona Revised Statute 28-6354.B directs MAG to develop criteria to establish the priority of corridors, corridor segments, and other transportation projects. As part of the regional transportation planning process, MAG applied various priority criteria for the development of the Regional Transportation Plan (RTP).

Goals and Objectives

A goal is a general statement of purpose that represents a long-term desired end to a specific state of affairs and is typically measurable by qualitative means. By identifying broad goals that are both visionary and practical, and which respond to the values of the Region, the focus of the planning process can be effectively communicated to the public. The goals can be defined in greater detail by specifying multiple objectives.

An objective is very similar to a goal, as it represents the desired end to a specific state of affairs. However, an objective is an intermediate result that must be realized to reach a goal. An objective is more focused than a goal and is more subject to being measured. Objectives can be further assessed through performance measures that are identified for each objective.

Certain goals and objectives are related to the way in which the regional transportation system is performing overall. Others may be used to evaluate individual components of the transportation system or to evaluate proposed projects. They can also serve as the basis to monitor how the transportation system performs as the RTP is implemented. In addition, goals and objectives relate to the planning process and the importance of accountability during the development and implementation of the plan. Individual goals with their supporting objectives are listed below.

Goal 1: System Preservation and Safety

Transportation infrastructure that is properly maintained and safe, preserving past investments for the future.

- Objective 1A: Provide for the continuing preservation and maintenance needs of transportation facilities and services in the Region, eliminating maintenance backlogs.
- Objective 1B: Provide a safe and secure environment for the traveling public, addressing roadway hazards, pedestrian and bicycle safety, and transit security.

Goal 2: Access and Mobility

Transportation systems and services that provide accessibility, mobility, and modal choices for residents, businesses, and the economic development of the Region.

- Objective 2A: Maintain an acceptable and reliable level of service on transportation and mobility systems serving the Region, taking into account performance by mode and facility type.
- Objective 2B: Provide residents of the Region with access to jobs, shopping, educational, cultural, and recreational opportunities and provide employers with reasonable access to the workforce in the Region.
- Objective 2C: Maintain a reasonable and reliable travel time for moving freight into, through and within the Region, as well as provide high-quality access between intercity freight transportation corridors and freight terminal locations, including intermodal facilities for air, rail, and truck cargo.
- Objective 2D: Provide the people of the Region with transportation modal options necessary to carry out their essential daily activities and support equitable access to the Region's opportunities.
- Objective 2E: Address the needs of the elderly and other population groups that may have special transportation needs, such as non-drivers or those with disabilities.

Goal 3: Sustaining the Environment

Transportation improvements that help sustain our environment and quality of life.

- Objective 3A: Identify and encourage implementation of mitigation measures that will reduce noise, visual, and traffic impacts of transportation projects on existing neighborhoods.
- Objective 3B: Encourage programs and land use planning that advance efficient trip-making patterns in the Region.
- Objective 3C: Make transportation decisions that are compatible with air quality conformity and water quality standards, the sustainable preservation of key regional ecosystems, and desired lifestyles.

Goal 4: Accountability and Planning

Transportation decisions that result in effective and efficient use of public resources and strong public support.

- Objective 4A: Make transportation investment decisions that use public resources effectively and efficiently, using performance-based planning.
- Objective 4B: Establish revenue sources and mechanisms that provide consistent funding for regional transportation and mobility needs.
- Objective 4C: Develop a regionally balanced plan that provides geographic equity in the distribution of investments.
- Objective 4D: Recognize previously authorized corridors that are currently in the adopted MAG Long-Range Transportation Plan; i.e., Loop 303 and the South Mountain Corridor.
- Objective 4E: Achieve broad public support for needed investments in transportation infrastructure and resources for continuing operations of transportation and mobility services.

Priority Criteria

Arizona Revised Statute (ARS) 28-6354.B directs MAG to develop criteria to establish the priority of corridors, corridor segments, and other transportation projects. These criteria include public and private funding participation; the consideration of social and community impacts; the establishment of a complete transportation system for the Region; the construction of projects to serve regional transportation needs; the construction of segments to provide connectivity on the regional system; and other relevant criteria for regional transportation.

As part of the regional transportation planning process, MAG has applied these kinds of criteria, both for the development and the implementation of the regional Transportation Plan (RTP). The RTP was developed through a performance-based process that evaluated alternatives relative to a range of performance measures. Also, specific criteria were considered as part of the process to schedule the implementation of transportation projects throughout the duration of the planning period. The discussion below describes how the criteria applied in the RTP planning process correspond to the categories included in ARS 28-6354.B.

Extent of Local Public and Private Funding Participation

A higher level of local, public, and private funding participation in the RTP benefits the Region by leveraging regional revenues and helping to ensure local government commitment to the success of the regional program. The extent of local public and private funding participation is addressed in a number of ways in the MAG transportation planning process.

- Project Matching Requirements - In developing funding allocations among the various RTP components and project types, local matching requirements have been established. The local matching requirements in the RTP are:

- 30 percent of major street projects, including Intelligent Transportation System (ITS) elements.
 - 30 percent of bicycle and pedestrian projects.
 - For air quality and transit projects involving federal funds, minimum federal match requirements are assumed. Depending on the specific project funding mix, this match may be provided from regional revenue sources.
- Private Funding Participation - As part of the policies and procedures developed for the Arterial Street Life Cycle Program, private funding participation is recognized as an applicable local match for half-cent funds for street and intersections projects. This policy helps free local monies that may then be applied to additional transportation improvements.
 - Local Government Incentives - In the Arterial Street Life Cycle Program, incentives to make efficient use of regional funds have been established by ensuring that project savings by local governments may be applied to new projects in the jurisdiction that achieved those savings.

Social and Community Impacts

Regional transportation improvements can have both beneficial and negative social and community impacts. It is important to conduct a thorough assessment of these impacts to ensure that they are taken into account in the decision-making process. The MAG planning effort assesses social and community impacts at each key stage of the transportation planning and programming process. Similar efforts are carried out by the agencies implementing transportation improvement projects.

- Public Participation and Community Outreach - A citizen participation and outreach program is conducted to obtain public views on the potential community and social impacts of transportation improvements. Public input is sought regarding the possible impacts of transportation alternatives on the community's social values and physical structure.
- Social Impact Assessment - The social impact of transportation options is evaluated as part of the Title VI/Environmental Justice assessment. In this assessment, potential transportation impacts are evaluated for key populations of concern, including minority, low-income, elderly, mobility disability, and female head of household populations. In addition, community goals are taken into account by basing future travel demand estimates on local land use plans.
- Corridor and Community Impact Assessment - Corridor-level analyses are conducted, which assess the possible social and community impacts of alternative facility alignments based on neighborhood factors such as noise, air quality, and land use. Community

impacts of transportation facilities are further analyzed by assessing air quality effects through the emissions analysis of plan alternatives, as well as conducting a federally required air quality conformity analysis of the RTP. In addition, the process for annually updating the regional Transportation Improvement Program includes project air quality scores, which reflect the potential community impacts of the projects.

Establishment of a Complete Transportation System for the Region

The RTP identifies major investments in all elements of the regional transportation system over the next several decades. It is critical that these expenditures result in a complete and integrated transportation network for the Region. The MAG planning process responds directly to this need by conducting transportation planning at the system level, giving priority to segments that can lead to a complete transportation system, and maintain a life cycle programming process for all the major modes.

- System Level Planning Approach - The regional planning effort is conducted at the system level, taking into account all transportation modes in all parts of the MAG geographic area. This systems-level approach is applied in identifying and analyzing alternatives, as well as specifying the final RTP. In this way, the complete transportation needs of the Region, as a whole, are identified and addressed in the planning process.
- Project Development Process and Project Readiness - The implementation of regional transportation projects includes a complex development process. This process involves extensive corridor assessments, environmental studies, and engineering concept analyses. This is followed by right of way acquisition and final design work, before construction commences. For a variety of reasons, certain projects may progress through this process more rapidly than others. By moving forward, where possible, on those projects with the highest level of readiness for construction, important transportation improvements can be delivered efficiently.
- Progress on Multiple Projects - Major needs for transportation improvements exist throughout the MAG area. The scheduling of projects is aimed at proceeding with improvements to the transportation network throughout the planning period in all areas of the Region. This will lead to a complete and functioning regional transportation system that benefits all parts of the MAG area.
- Revenues, Expenditures and Life Cycle Programming - Cash flow patterns from revenue sources limit the amount of work that can be accomplished within a given period of time. Project expenditures need to be scheduled to accommodate these cash flows. Life cycle programs have been established that take these conditions into account and implement the projects in the RTP for the major transportation modes: freeways/highways, arterial streets, and transit. The life cycle programs provide a budget process that ensures that the estimated cost of the program of improvements does not exceed the total amount

of revenues available. This ensures that a complete transportation system for the Region will be developed within available revenues.

As part of the life cycle programming process, consideration is given to bonding a portion of cash flows to implement projects that provide critical connections earlier than might otherwise be possible. This has to be weighed against the reduction in total revenues available for constructing projects, which results from interest costs.

Construction of Projects to Serve Regional Transportation Needs

The resources to implement the RTP are drawn from regional revenue sources and should address regional transportation needs. Transportation projects that serve broad regional needs should have a higher priority than those that primarily only serve a local area. At the same time, the nature of regional transportation needs varies across the MAG area, and the same type of transportation solution does not work everywhere in the Region. For example, enhancing the arterial network may represent the most pressing regional need in one part of the Region, whereas adding new freeway corridors may be the key need in another, and expanding transit capacity may represent the best approach in yet another area. Throughout the process of developing the RTP, it was recognized that this is the nature of regional transportation needs in the MAG area. As a result, the RTP is structured to respond to different types of needs in different parts of the MAG area.

Although the modal emphasis of the transportation improvements identified in the RTP varies by area within the Region, the effects of these improvements can be assessed using common measures of system performance and regional mobility. Example measures that can be utilized for this purpose are described below. These criteria can be used to evaluate alternatives and establish implementation priorities. They can also be applied to evaluate potential adjustments to the priority of corridors, corridor segments, and other transportation projects and services.

- Facility/Service Performance Measures - Facility performance measures focus on the amount of travel on specific facilities, the usage of transportation services, the degree of congestion, and other indicators of the level of service as provided:
 - Accident rate per million miles of passenger travel.
 - Travel time between selected origins and destinations.
 - Peak period delay by facility type and geographic location.
 - Peak hour speed by facility type and geographic location.
 - Number of major intersections at a level of service "E" or worse.
 - Miles of freeways at a level of service "E" or worse during peak period.
 - Average Daily Traffic on freeways/highways and arterials.
 - Total transit ridership by route and transit mode.
 - Cost-effectiveness (e.g., trips served per dollar invested).

- Mobility Measures - Mobility measures focus on the availability of transportation

facilities and services, as well as the range of service options as provided:

- Percentage of persons within 30 minutes travel time of employment by mode.
- Jobs and housing within a one-quarter mile distance of transit service.
- Percentage of the workforce that can reach their workplace by transit within one hour with no more than one transfer.
- Per capita vehicle miles of travel (VMT) by facility type and mode.
- Households within one-quarter mile of transit.
- Transit share of travel (by transit sub-mode).
- Households within five miles of park-and-ride lots or major transit centers.

Construction of Segments that Provide Connectivity with other Elements of the regional Transportation System

The phasing of the development of the transportation network should be done in a logical sequence so that maximum possible system continuity, connectivity, and efficiency are maintained. In the RTP, appropriately located transportation facilities around the Region enhance the general mobility throughout the Region. To the extent possible, facility construction and transportation service should be sequenced to result in a continuous and coherent network and to avoid gaps and isolated segments, bottlenecks, and dead-end routes. Segments that allow for the connection of existing portions of the transportation system should be given a higher priority than segments that do not provide connectivity.

Other Relevant Criteria Developed by the regional Planning Agency

As part of the RTP, a series of objectives for the regional transportation network were identified. Two key objectives are to achieve broad public support for the needed investments and to develop a regionally balanced plan that provides geographic equity in the distribution of investments. Specific criteria related to these objectives are:

- Transportation decisions that result in the effective and efficient use of public resources and strong public support.
- Geographic distribution of transportation investments.
- Inclusion of committed corridors.

CHAPTER THREE

REGIONAL DEVELOPMENT OVERVIEW

The Maricopa Association of Governments (MAG) Metropolitan Planning Organization (MPO) is located in the south-central region of the State of Arizona. The MAG Region encompasses an area of 10,654 square miles and contains 27 incorporated cities and towns, three Native nations, and a large area of unincorporated land across Maricopa and Pinal counties. The Region is in the Sonoran Desert with elevations generally ranging from 500 to 2,500 feet above sea level. In 2010, the MAG MPO contained approximately 63 percent of the population of Arizona, as well as nine of ten cities in Arizona with populations greater than 100,000 people.

According to the Arizona State Land Department, in 2016 of the land within the MAG MPO: 29.3 percent was under private ownership; 26.9 percent was managed by the Bureau of Land Management; 10.8 percent fell under the jurisdiction of the Department of Defense; 12.4 percent was managed by the State Land Department; 10.4 percent was managed by the U.S. Forest Service; 8 percent was comprised of Native nations; and the remaining 2 percent of lands were classified as “other” public lands.

Census 2010 and 2018 Population Update

In April 2010, the U.S. Census Bureau conducted Census 2010. The Census found a population for the MAG MPO of 4,055,276 people. This represented an increase of 864,874 people or about 28 percent since Census 2000, which found a population of 3,160,402. The Census also determined populations for each city and town within the MAG MPO. MAG updated the population count to provide estimates that correspond to a mid-2018 timeframe. Table 3-1 lists population numbers by jurisdiction for April 1, 2000 and July 1, 2018. During this period, many of the fastest-growing cities in the MAG MPO showed increases greater than 25 percent. The Town of Queen Creek had the highest percentage increase of 86.9 percent, followed by the City of Buckeye (49.7%), the City of Goodyear (29.7%), and the City of Litchfield Park (22.2%) The City of Phoenix had the largest net increase in population, with an addition of 150,610 residents.

Population Forecasting

For the past several decades, the MAG MPO has been one of the fastest-growing metropolitan areas in the United States among those with populations of more than one million people. Population growth of approximately 28 percent was experienced in the decade from 2000 to 2010. MAG and Central Arizona Governments (CAG) Socioeconomic Projections indicate that this high growth rate is expected to continue.

Population Forecasting Process

According to Executive Order 2011-04, the Arizona Department of Administration is responsible for preparing an official set of population projections for Arizona and each of its counties. The Arizona Department of Administration prepared a set of residential population projections for

TABLE 3-1
TOTAL RESIDENT POPULATION BY JURISDICTION
CENSUS 2010 AND JULY 1, 2018 UPDATE

Jurisdiction	Total Population			Percent Growth		Share	
	April 1, 2010	July 1, 2018	Change	Overall	Annual	Share of Growth	Share of Region
Apache Junction	35,840	40,611	4,771	13.31%	1.66%	0.89%	0.87%
Avondale	73,238	82,605	9,367	12.79%	1.60%	1.75%	1.78%
Buckeye	50,876	76,145	25,269	49.67%	6.21%	4.72%	1.64%
Carefree	3,363	3,722	359	10.67%	1.33%	0.07%	0.08%
Cave Creek	5,015	5,760	745	14.86%	1.86%	0.14%	0.12%
Chandler	236,326	262,322	25,996	11.00%	1.38%	4.86%	5.65%
El Mirage	31,797	34,292	2,495	7.85%	0.98%	0.47%	0.74%
Florence	25,536	27,507	1,971	7.72%	0.96%	0.37%	0.59%
Fort McDowell Yavapai Nation	971	1,019	48	4.94%	0.62%	0.01%	0.02%
Fountain Hills	22,489	24,029	1,540	6.85%	0.86%	0.29%	0.52%
Gila Bend	1,922	2,014	92	4.79%	0.60%	0.02%	0.04%
Gila River Indian Community	11,712	11,993	281	2.40%	0.30%	0.05%	0.26%
Gilbert	208,352	253,036	44,684	21.45%	2.68%	8.35%	5.45%
Glendale	226,721	241,844	15,123	6.67%	0.83%	2.83%	5.21%
Goodyear	65,275	84,659	19,384	29.70%	3.71%	3.62%	1.82%
Guadalupe	5,523	6,342	819	14.83%	1.85%	0.15%	0.14%
Litchfield Park	5,476	6,689	1,213	22.15%	2.77%	0.23%	0.14%
Maricopa	43,482	52,117	8,635	19.86%	2.48%	1.61%	1.12%
Mesa	439,041	488,925	49,884	11.36%	1.42%	9.32%	10.53%
Paradise Valley	12,820	14,011	1,191	9.29%	1.16%	0.22%	0.30%
Peoria	154,065	176,118	22,053	14.31%	1.79%	4.12%	3.79%
Phoenix	1,447,128	1,597,738	150,610	10.41%	1.30%	28.14%	34.42%
Queen Creek	26,361	49,261	22,900	86.87%	10.86%	4.28%	1.06%
Salt River Pima-Maricopa Indian Community	6,289	6,798	509	8.09%	1.01%	0.10%	0.15%
Scottsdale	217,385	245,417	28,032	12.90%	1.61%	5.24%	5.29%
Surprise	117,517	132,852	15,335	13.05%	1.63%	2.87%	2.86%
Tempe	161,719	185,301	23,582	14.58%	1.82%	4.41%	3.99%
Tolleson	6,545	7,017	472	7.21%	0.90%	0.09%	0.15%
Wickenburg	6,363	7,506	1,143	17.96%	2.25%	0.21%	0.16%
Youngtown	6,156	6,590	434	7.05%	0.88%	0.08%	0.14%
Unincorporated Maricopa County	272,552	295,620	23,068	8.46%	1.06%	4.31%	6.37%
Unincorporated Pinal County	178,799	211,973	33,174	18.55%	2.32%	6.20%	4.57%
Total MAG MPO	4,106,654	4,641,833	535,179	13.03%	1.63%	100.00%	100.00%

Sources: U.S. Bureau of the Census, Census 2010, Arizona Department of Administration, Maricopa Association of Governments, Central Arizona Governments

TABLE 3-2
TOTAL RESIDENT POPULATION BY MPA, 2019 MAG & CAG PROJECTIONS
JULY 1, 2018 and PROJECTIONS JULY 1, 2020 to JULY 1, 2040

MPA	Total Resident Population 2018	Total Resident Population 2020	Total Resident Population 2030	Total Resident Population 2040
Apache Junction	59,000	60,800	70,000	92,000
Avondale	84,200	86,700	101,800	111,900
Buckeye	89,000	97,700	186,600	305,400
Carefree	3,700	3,800	4,100	4,200
Cave Creek	5,900	6,000	6,500	7,000
Chandler	270,300	279,500	309,100	321,100
El Mirage	34,300	35,100	36,500	36,900
Florence	79,400	85,500	120,300	160,500
Fort McDowell Yavapai Nation	1,000	1,100	1,100	1,100
Fountain Hills	24,000	24,700	26,200	26,600
Gila Bend	2,500	2,700	3,700	3,700
Gila River Indian Community	12,000	12,200	12,300	12,300
Gilbert	256,500	265,900	293,500	308,800
Glendale	272,200	279,100	306,400	323,400
Goodyear	87,300	92,100	140,300	192,200
Guadalupe	6,300	6,400	6,700	6,800
Litchfield Park	13,300	14,000	15,400	15,700
Maricopa	59,800	67,000	90,800	106,400
Mesa	533,400	552,800	607,500	649,400
Paradise Valley	14,000	14,100	14,700	15,100
Peoria	188,500	196,600	232,400	273,700
Phoenix	1,653,500	1,697,700	1,881,900	2,019,300
Queen Creek	58,700	65,000	90,900	109,000
Salt River Pima-Maricopa Indian Community	6,800	6,100	5,700	5,800
Scottsdale	245,500	253,800	281,900	299,400
Surprise	144,000	150,300	216,700	307,500
Tempe	185,300	190,000	217,100	247,000
Tolleson	7,000	7,100	8,600	10,300
Unincorporated Maricopa County	97,900	101,200	110,500	116,800
Unincorporated Pinal County	66,800	68,600	79,100	93,700
Wickenburg	8,200	8,500	9,400	9,500
Youngtown	6,600	6,800	7,300	7,700
Total MPO	4,576,900	4,738,900	5,495,000	6,200,200

Note: Rounded to the nearest 100. For Maricopa County only. Employment projections may show declines in future years because construction employment follows development.
Sources: Maricopa Association of Governments, Central Arizona Governments, Caveats for Socioeconomic Projections.

Maricopa County and Pinal County consistent with the 2010 Census. MAG is responsible for developing a set of sub-regional projections for communities within Maricopa County, and CAG for developing a set of sub-regional projections for communities within Pinal County. These projection figures, which take into account recent population and employment information, were produced in early 2019 and approved for Maricopa County by the MAG Regional Council on June 26, 2019, and for Pinal County by the CAG Regional Council on September 25, 2019.

Population Projections

As calculated by the 2019 MAG and CAG Socioeconomic Projections, by 2040, the MAG Region population is projected to increase by more than 35.5 percent over the 2018 base population, an anticipated total of 6.2 million people. The Region will experience a growth of nearly 74,000 people annually through 2040. Table 3-2 displays the total resident population for Municipal Planning Areas (MPAs) from July 1, 2018, to July 1, 2040. Total resident population includes the population in households and group quarters, such as dorms, nursing homes, prisons, and military establishments. Over the 22-year period (2018-2040), five MPAs are projected to grow by more than 100,000 persons: Phoenix, Buckeye, Surprise, Mesa, and Goodyear. Eight MPAs are projected to experience population growth greater than 50,000 persons: Glendale, Gilbert, Florence, Scottsdale, Queen Creek, Peoria, Chandler, and Tempe.

Currently, six MPAs within the MAG Region have populations of over 200,000 persons: Phoenix, Mesa, Glendale, Chandler, Scottsdale, and Gilbert. By 2020, Peoria will nearly surpass 200,000 in population. By 2040, Phoenix, the largest MPA, will contain over 2 million persons, followed by Mesa at over 649,000, Surprise at over 307,000, Chandler at over 321,000, and Glendale at over 323,000. Figures 3-1 and 3-2 are maps displaying the population concentrations for 2018 and 2040. Population concentration measures the average population within a one-mile radius. The analysis smooths out differences in geographies and identifies underlying spatial patterns in the data. The pattern of population concentrations illustrates the shape of urban form as it is projected to evolve according to local land use plans and densities.

Employment Forecasting

By 2040, employment totals in the MAG Region are projected to increase by 43.1 percent over 2018 levels. Employment within the Region will grow by an average of more than 40,000 jobs per year through 2040. Employment projections are by place of work, and not by place of residence as reported by the Census Bureau.

Community Job Centers

Community Job Centers are areas comprised of an identifiable concentration of employment activities and land uses that are entirely, or predominantly non-residential. Delineated Community Job Centers consist of concentrated or mixed areas of industrial, office, retail, airport, and government land uses and employment activities. Due to the significant commercial and industrial base, these areas generate a high level of vehicular and freight-related trips.

**Figure 3-1: Total Population Concentration, 2018
Maricopa and Pinal Counties, Arizona**

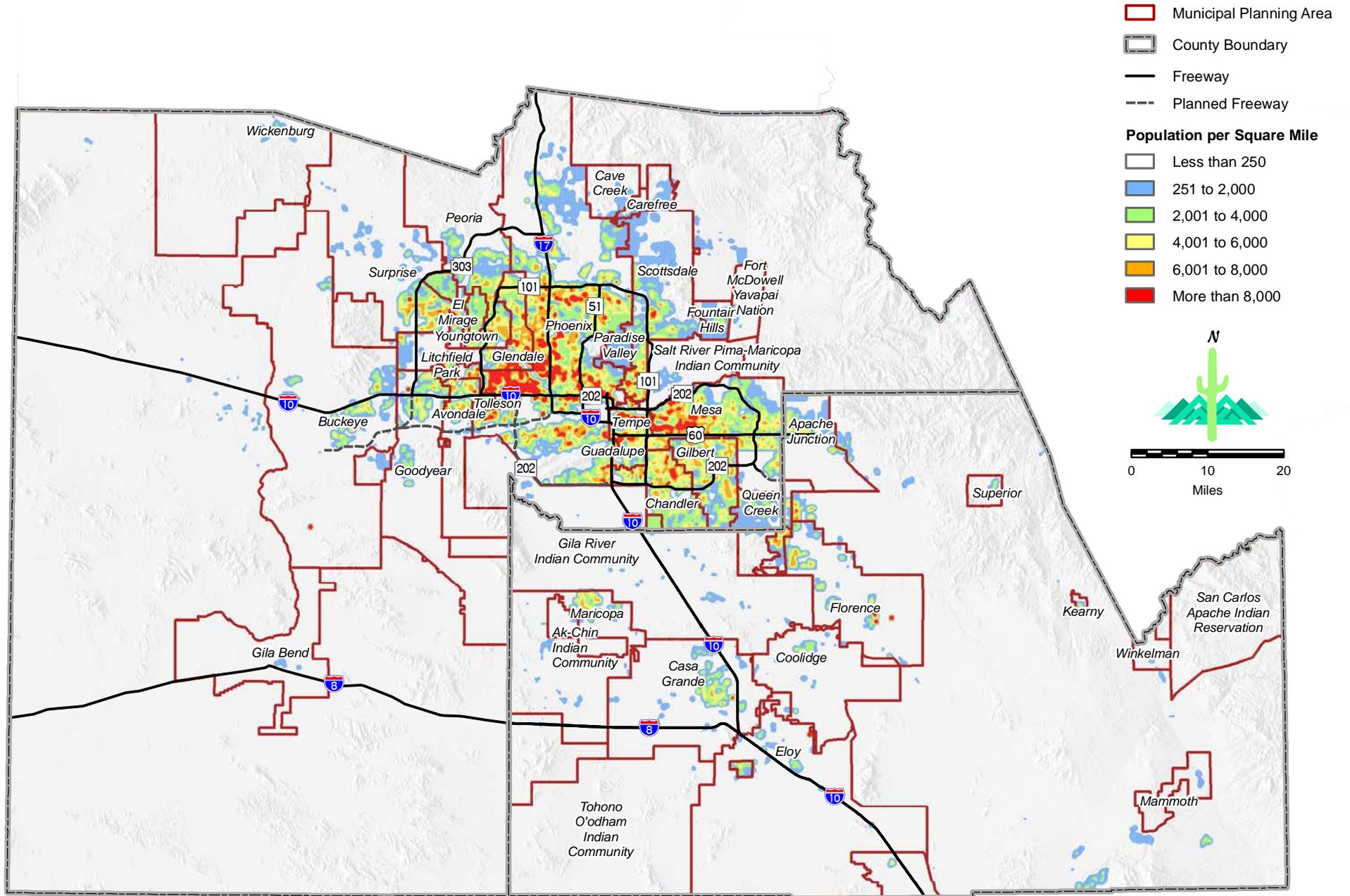


TABLE 3-3
TOTAL EMPLOYMENT BY MPA, 2019 MAG & CAG PROJECTIONS
JULY 1, 2018 and PROJECTIONS JULY 1, 2020 to JULY 1, 2040

MPA	Total Employment 2018	Total Employment 2020	Total Employment 2030	Total Employment 2040
Apache Junction	7,800	8,800	13,100	17,800
Avondale	22,400	23,200	30,400	36,200
Buckeye	21,600	26,900	42,900	64,500
Carefree	1,600	1,600	2,100	2,400
Cave Creek	2,200	2,400	2,700	2,900
Chandler	145,500	154,700	182,300	202,100
El Mirage	5,000	5,100	6,500	7,200
Florence	11,000	12,100	17,000	26,400
Fort McDowell Yavapai Nation	2,200	2,400	2,400	2,500
Fountain Hills	7,100	7,700	9,100	9,800
Gila Bend	900	900	1,200	1,300
Gila River Indian Community	10,500	10,700	11,500	13,100
Gilbert	92,800	98,600	120,200	135,900
Glendale	103,800	111,400	134,000	153,100
Goodyear	35,900	37,200	50,600	69,000
Guadalupe	1,300	1,300	1,500	1,600
Litchfield Park	3,800	4,400	5,200	5,900
Maricopa	6,200	7,100	11,400	18,200
Mesa	197,200	205,900	249,000	296,000
Paradise Valley	6,300	6,300	6,800	7,100
Peoria	58,200	62,400	73,100	84,800
Phoenix	897,700	937,600	1,084,000	1,189,200
Queen Creek	15,500	16,400	19,900	24,000
Salt River Pima-Maricopa Indian Community	21,200	22,900	28,200	33,900
Scottsdale	197,200	207,400	235,500	252,000
Surprise	33,600	36,400	59,500	86,400
Tempe	190,000	200,500	231,200	257,700
Tolleson	17,700	18,300	21,200	23,900
Unincorporated Maricopa County	28,600	31,500	35,500	41,100
Unincorporated Pinal County	3,500	3,900	6,000	8,900
Wickenburg	4,400	4,600	5,200	5,600
Youngtown	1,500	1,800	2,200	2,700
Total MPO	2,154,200	2,272,400	2,701,400	3,083,200

Note: Rounded to the nearest 100. For Maricopa County only. Employment projections may show declines in future years because construction employment follows development.

Sources: Maricopa Association of Governments, Central Arizona Governments, Caveats for Socioeconomic Projections.

MAG coordinates with municipal planning and economic development directors throughout the Region to identify and inventory existing and future job centers. As of 2018, there are a total of 166 job centers within the MAG Region. These job centers include 29,700 employers or 52 percent of the employers with five or more employees. More than 1.1 million employees work in job centers, which accounts for 67 percent of the total number of employees in the Region. Job center information provides valuable insight on: employment types at each job center; demographic data; existing and anticipated employment totals; floor area and total square footage of locations; existing acreage; and the total build-out of each identified job center.

Employment Forecasts

Table 3-3 displays projected regional employment totals by MPA as calculated for the 2019 MAG and CAG Socioeconomic Projections, which is reported by total employment from July 1, 2018, to July 1, 2040. Total employment categories include individuals that work at home and construction employment. Since construction employment typically follows development, the projected employment numbers may show declines in future years for certain MPAs when the area’s growth has slowed down.

Regional Land Use Patterns

MAG maintains regional Geographic Information System databases of existing and future land uses for Member Agencies. The existing land use data set depicts the status of land as it is built presently. The future land use data set is created using current adopted General Plans and known developments from all MAG member agencies. The data sets are instrumental in developing socioeconomic projections. Therefore, they are updated regularly and reviewed by MAG member agency staff to check for errors or omissions.

**TABLE 3-4
MAG MPO REGION EXISTING AND FUTURE LAND USE**

Land Use	Existing Land Use (Sq. Mi.)	% Developed Land (Existing)	Future Land Use (Sq. Mi.)	% Developed Land (Future)
Residential	814	7.0%	2594.5	22.7%
Commercial	59	0.5%	109.3	0.9%
Industrial	57	0.5%	97.4	0.9%
Office	15	0.1%	17.9	0.16%
Other/Public/Transportation	365	3.1%	447.1	3.9%
Open Space	7120	61.4%	7282.7	63.8%
Mixed Use	0.05	0.0%	785.3	6.9%
Vacant	2517	21.7%	0	0.0%
Agriculture	641	5.5%	87.5	0.7%

Note: For the MAG MPO only and does not include the Yavapai County parts of Peoria and Wickenburg.
Source: MAG Existing Land Use 2017

Table 3-4 displays existing and future land use data for the MAG Region. MAG tracks development projects. Currently, the MAG development database has 4,762 projects that have not yet reached completion, including active, entitled, and conceptual developments, covering over 770,044 acres and could add approximately 1.37 million housing units to the MAG Region.

Consistency with State and Local Planned Growth Patterns

The regional transportation planning process maintains consistency with state and local planned growth patterns by incorporating them into the socioeconomic forecasting process, which provides the basis for travel demand modeling, and taking them into account in sub-regional and corridor transportation studies.

Socioeconomic Forecasting

The primary purpose of population and socioeconomic projections developed by MAG is for input into the MAG transportation and air quality models. The projections are also used for regional planning programs such as human services, regional development, and by MAG member agencies in developing plans. Important objectives of the modeling process are to (1) establish a linkage between transportation, land use, and air quality models, (2) test various policy alternatives and land-use scenarios, and (3) incorporate a Geographic Information System into the process, which allows for better data sharing and review with member agencies, and maintains an innovative approach to land use planning. State and local planned growth and economic development patterns are considered when accomplishing these objectives.

The land use, population, and socioeconomic modeling processes are based on a three-tier modeling approach. The first tier is a demographic model, or a cohort-component model, which produces county-level control totals of population by characteristics such as sex, age, and race. The model considers factors such as the state's interaction with the rest of the country; long-term trends affecting birth, death, and migration rates; and short-term economic conditions. The demographic model, operated by the Arizona State Demographer within the Arizona Office of Economic Opportunity, projects population out to 2055.

The second and third tier models are heavily customized versions of the UrbanSim modeling system, which is used worldwide for socioeconomic modeling. The second tier involves a set of models using county-level population control totals, matches a set of employment control totals to them, and allocates population and employment to sub-regions or "market areas" defined within the county. The allocation is based on regional trends in home building, employment, and transportation infrastructure. The results of the allocation by market area are used in third tier models as refined control totals at the smaller market area geography. The third-tier models are sophisticated regression and multinomial logit "choice" models that predict the location behavior of individual household and employment records to built space records tied to neighborhood-level polygons. The third-tier models also simulate the demand and supply of built space by household and employment occupants. The models build and redevelop land polygons as predicted by choice models, while respecting the local development plans, land use plans, and policies of MAG member agencies. The results of the third-tier models are

aggregated to traffic analysis zones (along with other geographies) to be used in other modeling, planning, or analysis as needed.

Existing land use coverage data is important to projections because it establishes areas that are developed or are not suitable for further development. The developed areas are ineligible for the allocation of population and employment growth, except where the area is planned for redevelopment. Non-developable areas include open space, environmentally sensitive lands, or areas where relief makes construction infeasible. The existing land use database is digitized based on input from MAG member agencies and then circulated back to the agencies for review and verification. Changes are made based on comments provided.

Future land use coverage is also important for forecasting. The future land use database is based on the plans of MAG member agencies and identifies the type of development that is anticipated to occur in the future and the density of that development. The Future Plan Land Use database allows for the direct comparison between existing and planned land use and helps determine where development may take place.

Subregional and Corridor Transportation Studies

Area and corridor transportation planning studies are the foundation of the MAG Regional transportation planning process. The studies assess transportation conditions within a specified geographic area or modal facility system and evaluate potential new facilities and services or improvements to existing elements. Travel demand and facility interactions over the entire region are recognized as part of the process to ensure that compatible system improvements are proposed.

One of the major steps in the area/corridor study process is the inventory of land use and economic development factors. Data on existing, planned, and future conditions are assembled through consultation with state and local agencies. The process identifies potential land use and economic issues that may affect the area or corridor under study. Information on existing and possible future conditions is a major input for the identification of alternatives. Land use and economic development data are also an input for the development of evaluation criteria and the assessment of alternatives. The evaluation process provides insights regarding possible land use and economic effects and helps take these factors into account in future decisions on proposed transportation corridors or improvements to existing facilities and services.

MAG Economic Development Program

The 2008-2009 economic downturn caused significant decline in the *Maricopa County Transportation Excise Tax "Proposition 400"* (half-cent sales tax), a major source of funding for the regional Transportation Plan (RTP). This resulted in the need to reprogram freeway, transit, and arterial street projects in the RTP. The reduction in sales tax funds, plus the downturn resulting in nearly 64,000 pending and foreclosed homes, led MAG to form the Economic Development Committee (EDC) in October of 2010. The formation of the committee was consistent with federal requirements to tie economic development into the transportation planning process.

The EDC develops opportunity-specific and action-oriented initiatives to foster and advance infrastructure, especially transportation infrastructure that furthers economic development opportunities for the MAG Region. This is done in concert with federal transportation legislation, including MAP-21 and the FAST Act, which support the economic vitality of the Region by enabling global competitiveness, productivity, and efficiency. The EDC consists of 35 members appointed by the MAG Regional Council, including 19 elected officials from member agencies, one from the Arizona Department of Transportation (ADOT), and 15 business representatives.

The EDC goals focus on increasing job opportunities, strengthening Arizona's ability to compete in the global economy, and planning for the development and improvement of Arizona's infrastructure to make the Region more economically competitive. Specific objectives are to enhance communications and work cooperatively with state and economic development agencies, such as the Greater Phoenix Economic Council (GPEC), the Arizona Commerce Authority (ACA), and the Arizona-Mexico Commission. MAG collaborates with GPEC and the Metropolitan Export Alliance (MPEXA) on the Export Explorer Program, and with the ACA on a regional ExporTech Program. The programs offer training and resources to help companies find new export opportunities and tap into available resources to reach global markets.

MAG continues outreach with other countries to enhance relationships, improve global competitiveness and engage in international trade missions. The agency coordinated a trade mission to Mexico City for Arizona elected officials and business leaders to stimulate economic development. The mission connected key business leaders and newly elected officials to support commerce corridors connecting Arizona and Mexico. In addition, MAG made a delegation trip to Calgary, Canada, with a focus on expanding bi-lateral trade relationships, business, and tourism opportunities. The delegation met with the City of Calgary and the U.S. Consul in Calgary. The trip strengthened and expanded economic and tourism ties with the Calgary region. The delegation participated in business meetings focused on industry sectors, such as advanced manufacturing, tourism, real estate, and emerging technology.

MAG also coordinated and hosted a delegation of business leaders from Montreal, Canada. The trip focused on smart mobility, including autonomous vehicles, regulations, user experience, and last-mile delivery. MAG continues outreach with Canada to enhance relationships and improve global competitiveness. MAG led the Region's largest delegation to Montreal to celebrate Air Canada's first nonstop flight between Phoenix and Montreal. More than 40 elected officials and community leaders from Arizona participated in meetings with Canadian officials and businesses. Partnerships with the Canada Arizona Business Council, ACA, and GPEC helped bring this trip to fruition.

Through the Economic Development program, MAG engages in initiatives including the Ari-Son Megaregion, an effort to build a globally competitive "megaregion" with Mexico. The Ari-Son Megaregion Council was formally an affiliated group of the League of Arizona Cities and Towns at an annual conference in August 2016. MAG staff collaborates with representatives from Sonora's Secretary of the Economy and Sonora Arizona Commission to invite elected officials, economic development directors, and representatives from 20 sister cities located in Arizona

and Sonora to the annual Arizona League conference. Events include meetings, workshop discussions around transportation, tourism, and the Ari-Son Megaregion Council meeting. Arizona benefits from border traffic, therefore MAG supports the Shopping and Tourism Initiative to extend the border zone to all of Arizona. A resolution to extend the border zone for Border Crossing Cards from the current 75-mile zone to the entire state and streamline the Mexican visa process at land ports of entry is supported by regional planning agencies throughout Arizona. The extension would allow pre-vetted Mexican travelers with a border crossing card to travel throughout the entire state of Arizona. As part of this project, MAG requested the University of Arizona conduct an economic impact analysis of Mexican spending that would result from extending the border zone. The report estimated the generation of up to \$181 million in additional spending and 2,179 additional jobs in 2016. At the Ari-Son Megaregion Council Meeting, the council unanimously passed a letter of support to extend the Tourism and Shopping zone to the entire State of Arizona.

Mexico is the largest bilateral trading partner with Arizona, accounting for an estimated \$30 million in two-way trade each day. MAG works with Arizona border towns, such as the Cities of Nogales and San Luis, to assist in improving border crossings and to improve the traffic flow and rail crossings. Approximately \$20 billion in two-way trade flows through the Nogales Port of Entry. In addition, MAG and Arizona's other regional planning agencies work cooperatively to advocate for the exploration of additional funding, creative financing, and statutory flexibility to advance the construction of the preferred build alternative for State Route (SR)-189 into the ADOT Five-Year Transportation Facilities Construction Program. State Route 189 serves as a bypass route for commercial truck traffic to and from Mexico and provides a critical international commerce connection from the Mariposa POE to Interstate 19. The regional planning agencies in Arizona believe that to effectively enhance and facilitate the flow of international commerce, it is necessary to advance improvements to SR-189. MAG joined partners from around the state to support a federal Transportation Investment Generating Economic Recover (TIGER) grant submission that in 2018 was successful in receiving \$25 million in funding.

CHAPTER FOUR

PUBLIC INVOLVEMENT

The transportation planning process for the development of the regional Transportation Plan (RTP) benefits from incorporating broad-based public input, which is received through an extensive public involvement process. During the comprehensive development of the RTP in 2002 and 2003, MAG talked to thousands of people to identify public issues and concerns regarding future transportation needs. As part of this process, MAG held 150 public input opportunities, 173 stakeholder input opportunities, and 117 agency meetings to solicit input from the public, community groups, business associations, transportation stakeholders, elected and appointed leaders, city planners, municipal technical staffs, transportation councils, and the Region's Native nations. In addition to these efforts, MAG pursues its continuing public involvement process throughout the year, which is described below.

Development of the Public Participation Plan

MAG is dedicated to ensuring that all people in the Region have an opportunity to provide input into the transportation planning and programming process. MAG follows guidelines set forth in its Public Participation Plan. MAG's Public Participation Plan was updated in 2019 to reflect current practices and to provide a user-friendly guide for how to engage with MAG.

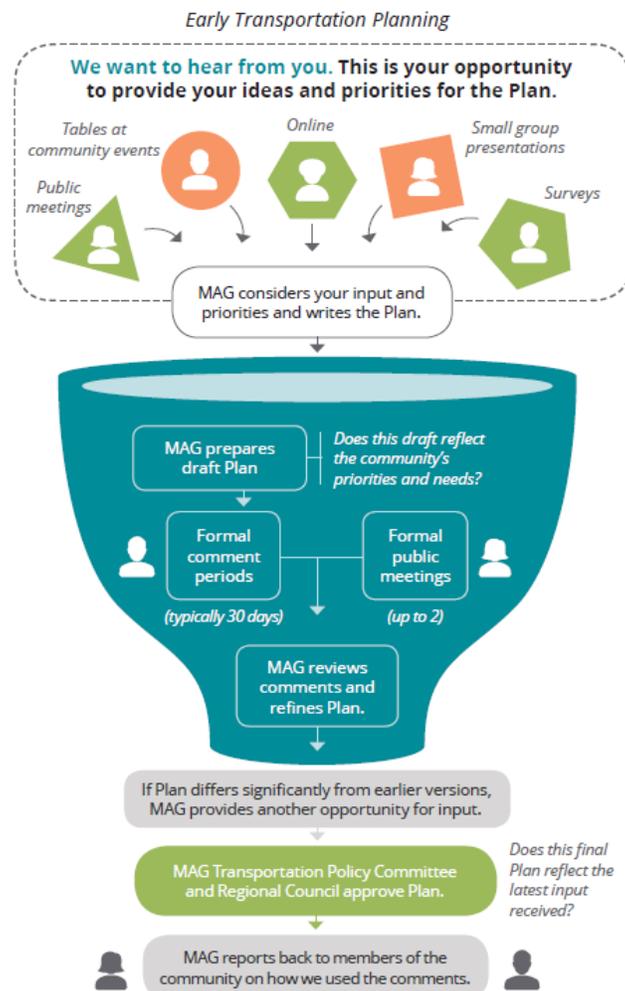
The Public Participation Plan was developed in consultation with all interested parties. A public comment period of 45 days was provided for review, and on May 22, 2019, the MAG Regional Council approved the updated Public Participation Plan. The plan includes MAG's guiding principles for public participation and outlines processes for providing input. The plan conforms to guidelines set forth in transportation legislation, Fixing America's Surface Transportation (FAST) Act. MAG continually reviews the plan to ensure it remains viable for the public and compliant with all federal regulations. Any changes made will follow federal protocols. As required under CFR Title 23, Section 134, the purpose of the MAG Public Participation Plan is to "provide citizens, affected public agencies, representatives of public transportation employees, public ports, freight shippers, providers of freight transportation services, private providers of transportation (including intercity bus operators, employer-based commuting programs, such as a carpool program, vanpool program, transit benefit program, parking cash-out program, shuttle program, or telework program), representatives of users of public transportation, representatives of users of pedestrian walkways and bicycle transportation facilities, representatives of the disabled, and other interested parties, with a reasonable opportunity to comment on the transportation plan."

MAG Public Involvement Process

The community's input is needed to plan projects that provide benefits to the Region and meet the wide-ranging needs of residents. The guiding principles for public participation include:

- Include a diverse blend of voices in the decision-making process. MAG is committed to learning about the diverse communities that make up the MAG Region. By getting to know the residents of the Region and understanding their values and priorities, MAG can make better decisions to guide the Region’s future.
- Engage people early and often in meaningful conversations about the policies and plans that affect the near- and long-term future of the MAG Region. MAG offers multiple ways for people to take part in planning processes in the places and languages that feel most comfortable. MAG strives to meet people where they are and tailor outreach appropriately.
- Be clear and transparent in all communication with members of the community. MAG provides accurate and easy-to-understand information, informs the public how to give input, explains the decisions the public can influence, and how MAG considers input.
- Listen and act. MAG builds relationships with members of the community and stakeholders by listening to their ideas and including them in the Region’s plans and projects.
- Report back to people who offer time and feedback to MAG’s planning efforts and explain how their comments helped shape final plans.

**FIGURE 4-1
MAG PUBLIC INVOLVEMENT PROCESS**



How MAG Collects Input

Decisions made by MAG affect everyone in the Region, and MAG welcomes community input, especially during the development of the RTP and Transportation Improvement Program (TIP). MAG works closely with state, local, and regional agencies, and consults with the public to determine which projects to prioritize and include in each of these plans. Figure 4-1 shows an example of the process and questions that guide MAG during updates of the RTP and TIP.

Outreach activities include presentations to community and civic groups, special events, hosting booths at community events, distributing press releases and newsletters, and coordinating with partner agencies such as the Arizona Department of Transportation (ADOT), Valley Metro, and the City of Phoenix Public Transit Department (Figure 4-2). Additional activities include:

- Communities of Concern: Title VI is a federal law that requires no person in the United States of America shall, on the grounds of race, color, or national origin, be excluded from the participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which MAG receives federal financial assistance. Other federal laws, for example, Executive Order 12898 on Environmental Justice, protect minority and low-income populations. There are additional protections for people with disabilities and older adults. The MAG Elderly and Persons with Disabilities Transportation Committee addresses the needs of the elderly and people with disabilities under the Human Services Coordination Transportation Plan. In addition, MAG considers the needs of those underserved by existing transportation systems by collaborating with the human services planning staff, which plans services for people with low-incomes, older adults, and people with disabilities. MAG seeks to provide Title VI and Environmental Justice populations full and fair participation in the transportation decision-making process. MAG recognizes that environmental justice is more than a set of legal and regulatory obligations. Following environmental justice principles and procedures improves all levels of transportation decision-making. Additional information about MAG's Title VI and Environmental Justice Program can be found in Chapter 5, or on the MAG website at www.azmag.gov.
- Open Meetings: MAG conducts meetings in accordance with open meeting laws. Meetings of technical committees, working groups, and policy committees are open to the public.
- Public Comment Opportunities: Members of the public are provided opportunities to speak at all technical and policy committee meetings, including Regional Council. The first opportunity is during a Call to the Audience, in which members of the public can comment on items not on the agenda that fall under MAG's jurisdiction, or on items that are on the agenda but are not scheduled for action. The public is given an opportunity to comment on Consent Items, as well as Action Items. Citizens have three minutes to comment during each opportunity but may exceed three minutes at the discretion of the Chair. MAG meetings are typically held at the MAG Offices, 302 N. First Ave, Phoenix. For a comprehensive list of meetings, please refer to the MAG website.

- MAG Website: MAG maintains a website that includes information about MAG, planning activities, committee meetings, input opportunities, press releases, events, datasets, and publications, as well as agendas and minutes for all policy committee meetings. In addition, the website houses proposal requests, employment notices, and electronic versions of MAG documents, including, plans, studies, and agenda-related materials and resources. MAG's website can be found at www.azmag.gov.
- Community Outreach Tables: MAG hosts community outreach tables at local libraries, festivals, and other public events. Typically, these include opportunities for people to engage with MAG staff and to take a paper or electronic survey about their transportation priorities, concerns, and preferences.
- Newsletters and Publications: MAG produces communication materials, including fact sheets, web articles, and printed newsletters. The materials provide information of general interest on events and programs at MAG, and the RTP and TIP. MAG produces a quarterly newsletter, MAGAZine, that summarizes activities and includes a calendar of meetings and input opportunities.
- Press Releases: Press releases are prepared and distributed to local media in conjunction with periodic news events. All press releases are posted on the MAG website.
- Meeting Notices and Advertisements in Principal Newspapers: All formal public hearings and public involvement opportunities are announced via public notices and/or display advertisements in the largest circulation newspaper and minority-oriented newspapers. Where appropriate, information is provided in a bilingual format.
- Direct Mailing: MAG maintains a current mailing list that includes: interested citizens; affected transportation agencies and other public agencies; representatives of environmental and resource agencies; private providers of transportation; advocates for Title VI and Environmental Justice populations; and representatives of community groups with interest in transportation. This mailing list is used to announce meetings, distribute newsletters, and share other opportunities for public involvement. Interested individuals are added to the mailing list upon request.
- Staff Contacts: The name of an appropriate staff contact is published on project pages of the MAG website and in other published transportation documents.
- Public Records Requests: MAG responds to and accommodates all public records requests, as appropriate.
- Social Media: MAG uses social media platforms, including Twitter, Facebook, and YouTube, to engage with the public and provide updates and information on MAG activities.

- **Other Input Opportunities:** MAG hosts other input opportunities for the public, such as public meetings, hearings, and special events. Before the completion of plans and programs, draft documents are available to the public for review and comment, so public concerns can be considered and reflected in final documents. Upon completion, draft studies, plans, programs, and reports are presented to the MAG Management Committee, Transportation Policy Committee, and Regional Council for review and action, but are also available for public review. Historical reference files of all documents are maintained and are available for public review. MAG’s diverse committee structure involves technical professionals, administrative personnel, elected officials, business interests, and citizen volunteers, all representing many jurisdictions, professions, and interest groups. The meetings of the committees follow the policy described above under “Open Meetings.” Descriptions of each committee and meeting materials are available on the MAG website.

Visualization Techniques

With the help of communications, graphics, web, and Regional Analytics staff, MAG utilizes innovative techniques to help residents better understand what transportation investments are included in the transportation plan. These techniques help residents visually conceive what the plans look like when completed. Examples include: project-specific maps and graphs, digital photography, high-resolution graphic displays, Geographical Information Systems, map overlays, PowerPoint presentations, aerial photography, photo simulations, technical drawings, charts, and graphs. Alternative scenarios, including visual depictions of scenarios, are presented to demonstrate differences among solutions or approaches.

**FIGURE 4-2
HOW TO GET INVOLVED AT MAG**

<p>Stay informed</p> <p> Visit our website at azmag.gov for all of the latest project information, meeting calendars, and opportunities to get involved.</p> <p> Sign up for email updates at azmag.gov/subscribe</p> <p>Follow us on social media</p> <p> MAG – Maricopa Association of Governments</p> <p> @MAGRegion</p> <p> MAGCommunications</p> <p> Request a briefing for your community group. Call (602) 254-6300 and ask for the community outreach planner.</p>	<p> Attend a MAG committee meeting. MAG holds regularly scheduled meetings, typically at its downtown Phoenix offices, that are open to the public. See page 12 and 18 for more details.</p> <p> Look for us in your area. MAG or its partner agencies hold open houses and host tables or booths at libraries and community events.</p> <p> Check your local news. MAG alerts news media to major activities and events.</p> <p> Browse our blog at azmag.gov/newsroom</p> <p> Explore our interactive maps and data visualizations at maps.azmag.gov to learn more about your area.</p>	<p>Share your voice</p> <p> Take our Community Feedback Survey and share your priorities at surveymonkey.com/r/MAGwebsite</p> <p> Fill out our online comment form at azmag.gov/comment</p> <p> Email us at mag@azmag.gov.</p> <p> Call us at (602) 254-6300.</p> <p> Speak up at a public meeting. MAG provides public comment opportunities so that policymakers hear priorities, ideas, and concerns directly from you.</p> <p> Contact your local agency. Visit azmag.gov/participate for more information about how to share your comments with local agencies, where many of MAG's projects begin.</p>
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CHAPTER FIVE

TITLE VI AND ENVIRONMENTAL JUSTICE

The consideration of vulnerable populations plays a vital role in regional planning at the Maricopa Association of Governments (MAG). MAG's policy is to assure full compliance with Title VI of the Civil Rights Act of 1964, the Civil Rights Restoration Act of 1987, Executive Order 12898 on Environmental Justice, and related statutes and regulations in all programs and activities. Title VI requires that no person in the United States of America shall, on the grounds of race, color, or national origin, be excluded from the participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which MAG receives federal financial assistance. Additional protections are provided in other federal and state statutes for religion, sex, disability, and age. MAG strives to ensure nondiscrimination in all programs and activities, whether they are federally funded or not. MAG has prepared a Title VI and Environmental Justice Program to help integrate the needs of vulnerable populations into planning activities. The Title VI and Environmental Justice (Title VI/EJ) Program serve as an important element in the regional transportation planning process.

The Title VI/EJ process includes the development of a demographic profile identifying the locations of Title VI/EJ groups and an analytical process that identifies the effects of transportation system investments on these groups. The goals of these activities are as follows:

- Comply with the public involvement and environmental justice requirements of the federal and state regulations.
- Avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.
- Provide opportunities for the public and community-based organizations to provide input on the subject areas addressed in the planning activities of MAG.
- Ensure full and fair participation by all potentially affected communities in the transportation decision-making process.
- Inform members of the public about ongoing MAG planning activities, and their potential role in those activities.

MAG Title VI and Environmental Justice Program

On May 22, 2019, the MAG Regional Council approved the MAG Title VI/EJ Program, which reflects activities that fulfill the responsibilities set forth by the Federal Transit Administration (FTA), the Federal Highway Administration (FHWA), and the U.S. Department of Justice. The program is reviewed annually, updated, and developed at least every three years in accordance with federal regulations. After a new program is developed, it is presented to the MAG Regional Council for approval. MAG is actively engaged in Title VI/EJ activities because the agency is a

sub-recipient of federal funding. The prior MAG Title VI/EJ Program received approval by the MAG Regional Council on May 23, 2018.

MAG reaches out to thousands of people in the region to ensure the planning process reflects the voices and visions of the diverse population. Title VI/EJ activities are pursued to ensure that people of all races, income levels, ages, and abilities have an equal voice in the planning process and receive a fair, equitable distribution of benefits from the results of such planning.

The MAG Title VI/EJ Program describes the planning process to support Title VI activities. Communities of concern define populations determined by the federal government or the Metropolitan Planning Organization (MPO) as benefiting from protections to ensure their meaningful involvement in planning of services. Demographic profiles are developed to identify the locations of Title VI/EJ groups. The presence of Title VI populations is compared against the regional threshold for each community of concern to identify Title VI neighborhoods. Linguistic isolation, or limited English speaking households, follow federal guidance at five percent within a census block, or 1,000 people or more within a neighborhood. The planning process identifies the transportation needs of communities of concern. The process takes an analytical approach that identifies the benefits and burdens of transportation system investments for different communities of concern, imbalances that may exist, and responds to the analysis produced. In response, agency roles and the outreach needed to fully engage vulnerable populations in the regional planning process, including complaint procedures and forms, are identified in regard to communities of concern.

Compliance with Title VI and MAG's nondiscrimination policies is an ongoing effort; each division at MAG reviews its work to ensure communities of concern have equal access. MAG provides an assurance to comply with all applicable provisions governing records, accounts, documents, information, facilities, or compliance reviews, and/or complaint investigations.

Public Involvement Process for Title VI/EJ Communities

Regardless of the population, transportation needs are a key concern. People rely on a range of transportation services to earn a living, secure education, and access medical care. Limited access to safe, affordable, reliable transportation options significantly impairs one's ability to live independently. Vulnerable populations are more deeply affected due to scarcity of alternatives and the depth of need for assistance. MAG addresses Title VI/EJ Communities through public outreach activities targeted to minority groups and the general public as a whole.

MAG employs a range of tools, which are used consistently to facilitate dialogue and to fully engage communities of concern. Outreach materials contain the Title VI public notice. Vital materials are translated into Spanish. Additional materials are translated and offered in alternative formats upon request. Visual aids in public involvement planning are essential to assist public understanding of transportation plans and programs. The following details some examples of MAG's engagement tools.

Events: Engaging communities of concern in public, openly accessible events is a priority to MAG. Going to where people are instead of requiring them to attend meetings at the MAG offices increases the level of participation and the diversity of people offering feedback. MAG public involvement staff participates in events focused on Title VI populations each year, and coordinates efforts with partners at the Arizona Department of Transportation (ADOT), Valley Metro, and the City of Phoenix Public Transit Department. Visualization techniques in public involvement planning are essential to assist public understanding of transportation plans and programs. MAG utilizes videos, maps, graphics, printed materials, web posts, and other forms of visual aid to help event attendees better understand the transportation network of the future. Participation in events enables MAG staff to better inform the public on the implementation and planning of the Regional Transportation Plan (RTP).

Surveys: MAG staff distributes community feedback surveys at events to gauge public awareness of MAG plans and programs. The results from the surveys inform MAG's efforts to pursue public awareness and involvement in the transportation planning process. The survey asks respondents for their feedback on transportation improvement priorities and ideas. The survey tracks what forms of transportation respondents currently use. This information helps inform regional planning activities. The survey is made available routinely at MAG Human Services Division events, which draw significant Title VI population attendance. The MAG Communication Division conducts the distribution of survey supplements outreach.

Focus groups and stakeholder group meetings: Focus groups and stakeholder group meetings offer opportunities for small groups of communities of concern to offer detailed feedback on specific topics. These group meetings are conducted as needed. For example, the MAG Human Services Division conducts focus groups with vulnerable populations to gauge emerging needs, including those related to transportation. Meetings are held with communities of concern and the agencies that serve them to inform planning activities as they move forward. Feedback from communities of concern is provided to the appropriate MAG committees on the summary transmittal sent with the meeting materials on each agenda topic.

Newsletters: The MAGAZine newsletter is produced and distributed via print, online, and direct mailing, to increase awareness of MAG's responsibilities and activities. Residents benefit from timely notice of MAG events and a better understanding of how to participate in planning activities. Translations of publications are available upon request. The MAG Human Services Division releases an electronic newsletter to a distribution list of more than 900 nonprofit agencies, faith-based organizations, and community groups that serve communities of concern. All significant publications feature the Title VI public notice.

MAG Transportation Ambassador Program (TAP): The MAG TAP program offers training, information, and networking opportunities to communities of concern and the agencies that serve them. Training meetings are held quarterly for participants in public venues, such as libraries and community centers. There are more than 650 self-subscribed participants in TAP. TAP provides a valuable source of feedback. Participants contribute the input needed to complete the gaps analysis required in the MAG Human Services Coordination Transportation

Plans. These plans are required by federal legislation. Strategies to address the gaps analysis are provided with each plan and implemented with the support of the TAP participants and communities of concern.

Social Media: MAG uses social media platforms to spread information and engage the general public. These offer an effective way to maintain a steady presence that is nimble and relevant for populations who may not engage through more traditional outlets, such as the newspaper. The number of followers for MAG's Facebook page, twitter account, and YouTube videos continues to increase. As of November 2019, the MAG Facebook page has 1,174 followers; MAG's Twitter feed has 3,182 followers; and 91 subscribe to MAG's YouTube channel.

Communities of Concern

Communities of concern describe populations determined by the federal government or the MPO as benefiting from protections to ensure their meaningful involvement in planning and services. These vulnerable populations were identified through the Civil Rights Act of 1964, Executive Order 12898, Executive Order 13166, and related statutes and regulations to end discrimination and ensure equal access to federally funded services. To identify Title VI neighborhoods, the presence of Title VI populations is compared against the regional threshold for each community of concern. Based on the most recently available census data, the threshold for each mandated community of concern is as follows (see Table 5-1):

- Minority population: 43.2 percent of population or higher.
- Age 65+: 14.3 percent of population or higher.
- Population in poverty: 15.6 percent of population or higher.
- Population with a disability: 11.1 percent of population or higher.
- Limited English Proficiency (LEP) persons: 5.0 percent of households or higher.
(Consistent with Federal guidance, 5.0 percent is used instead of the county average of 8.9 percent. See footnote (d) Table 5-1.)

The U.S. Census Bureau data is used for determining the EJ communities of concern. The unit of analysis is the block group, or small, relatively permanent statistical subdivisions of census tracts within a county. Local participants delineate most block groups prior to each decennial census in accordance with guidelines through the Census Bureau's Participant Statistical Areas Program. Block groups provide a stable set of geographic units for the presentation of statistical data. Block groups contain between 600 and 3,000 people, with an ideal size of about 1,500; the boundaries generally follow visible and identifiable features. Following local review for the decennial census, block groups may be split due to population growth or merged because of a substantial population decline. This analysis uses block groups to determine an area that best matches the boundary of the MPO. The MPO boundary does not precisely align with block group boundaries. Instead, those block groups where the centroid falls within the MPO boundary are assigned to the MPO for calculating statistics.

**TABLE 5-1
COMMUNITIES OF CONCERN IN THE MAG METROPOLITAN PLANNING AREA (MPA)**

Category	Population		Census Block Groups (e)			
	MPA		Number of Block Groups \geq MPA Average	% Block Groups	Affected Population (f)	% of Affected Population Captured in Block Groups
	Total	Percent				
Population Base	4,407,419	100.0%	2,610	100.0%	--	--
Minority Population (a)	1,905,079	43.2%	1,047	40.1%	1,316,349	69.1%
Age 65+ Population	631,192	14.3%	906	34.7%	397,442	63.0%
Population below Poverty Level (b)	676,768	15.6%	956	36.6%	492,507	72.8%
Population with a Disability (c)	485,431	11.1%	1,162	44.5%	270,323	55.7%
Limited English Proficiency Persons (d)	367,428	8.9%	1,255	48.1%	326,169	88.8%

Source: U.S. Census Bureau, 2013 to 2017 American Community Survey (ACS) 5-Year estimates

ACS data are based on a sample and are subject to sampling variability (see www.census.gov/acs)

(a) Minority includes total population minus White (Non-Hispanic).

(b) Percent of the population for whom poverty status is determined does not include institutionalized persons or persons under 5 years of age. Data from 2017 ACS 5-Year estimates, Table B17001.

(c) Disability status is determined for the civilian noninstitutionalized population based on six types of difficulty: hearing, vision, cognitive, ambulatory, self-care, and independent living difficulty. Data from 2017 ACS 5-Year estimates, Table B18101. Disability data are allocated to block groups using a proportional distribution based on the Census 2010 population count.

(d) Guidance for Limited English Proficiency (LEP) DOT recipients refers to persons age 5 years and over who speak English less than "very well." For LEP persons, the Federal guidance (FTA Circular 4702.1B) notes DOT has adopted the DOJ's Safe Harbor Provision, which stipulates the target minimum number of recipients regarding the translation of written materials for LEP populations is five percent or 1,000 persons, whichever is less, of the total population of persons eligible to be served. Thus for determining the number of affected Census Block Groups and population, 5% is used as the guideline rather than the MPO percentage of 9%. See http://www.lep.gov/guidance/guidance_Fed_Guidance.html Data from 2017 ACS 5-Year estimates, Table B16005.

(e) Affected population is the total persons that fall into the specified category for all Census Block Groups that have greater than or equal to the percentage for the MPO area as defined by the Census geography, (see note f) or as designated for LEP populations (see note d).

(f) All percentages are based on Census Block Groups with their centroid inside the MPO boundary. This analysis uses Census block groups to determine an area that best matches the MPO boundary. Because the MPO boundary does not follow precisely along block group boundaries, only those block groups with their center inside the MPO boundary are considered. The base numbers for all values in this table are for this Census-based defined area which, includes 2,610 Census block groups.

Communities of concern are block groups where the identified group represents a percentage of the population equal to or greater than that of the MPA threshold. For LEP persons, the federal guidance (FTA Circular 4702.1B) notes the target minimum number of recipients of translated written materials for LEP populations is five percent or 1,000 persons, whichever is less, of the total population eligible for service. As a result, five percent is used as the guideline rather than the MPA percentage of 8.9 percent. Table 5-1 indicates the number of people represented by block groups identified as communities of concern, and the percentage of the total MAG population for that community of concern.

Environmental Justice Analysis

MAG is committed to ensuring that no person is discriminated against on the grounds of color, race, or national origin, as per Title VI of the Civil Rights Act of 1964 and related legislation. Title VI asserts that “no person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance.” Additional protections are provided in other federal and state statutes for religion, sex, disability, and age. MAG strives for nondiscrimination in all of its programs and activities, whether federally funded or not. Environmental justice is a planning consideration based on Title VI of the 1964 Civil Rights Act, and Executive Order 12898 of 1994 (*Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*), which aims to ensure all groups may benefit equally from the transportation system without shouldering a disproportionate share of its burdens.

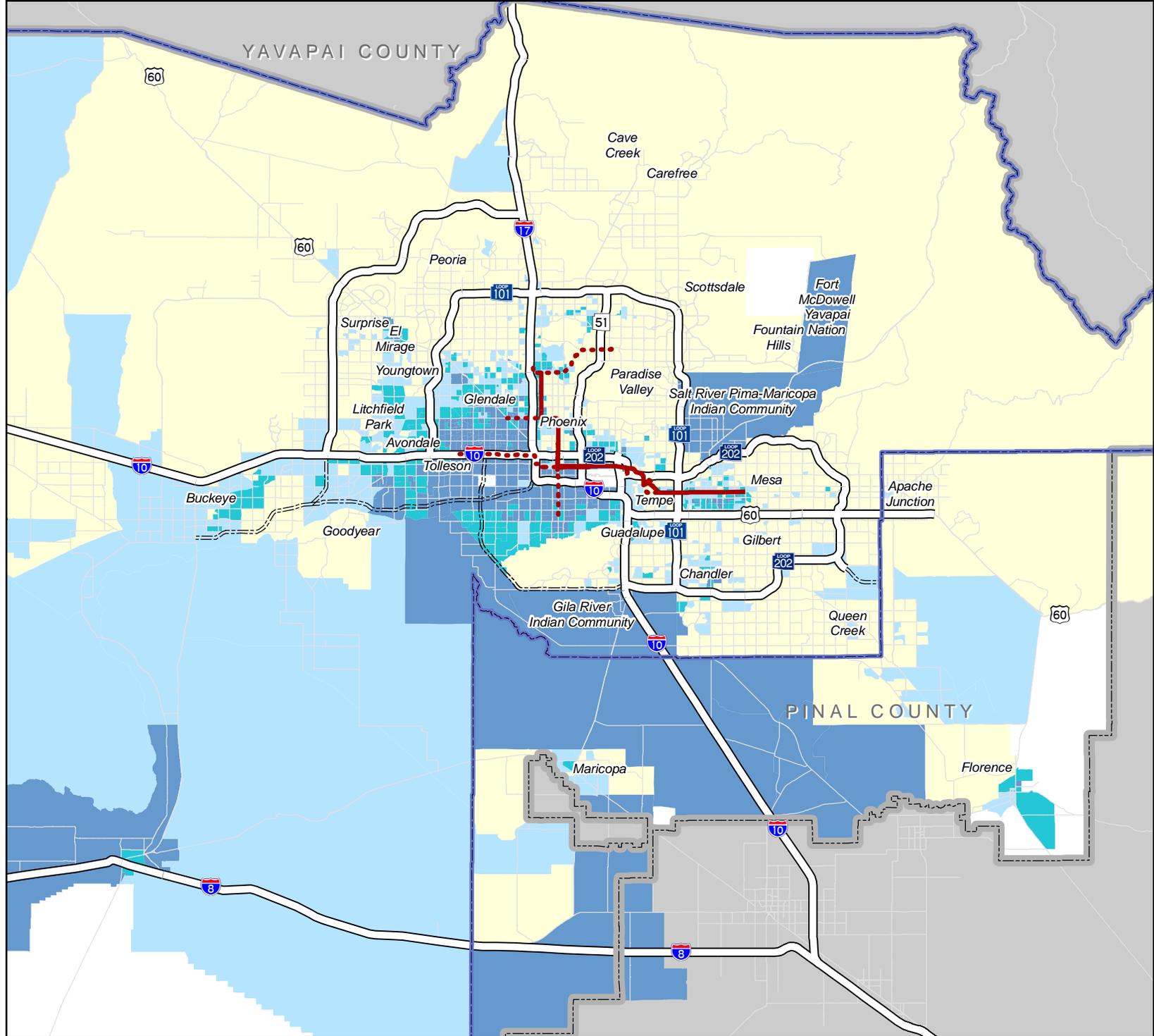
To assess the effects of the RTP, an overlay analysis of communities of concern is conducted. What one population group may perceive as an adverse effect of a transportation facility or service, another group may perceive as a benefit. Even within the same population group, a transportation facility or service may be perceived by some as having an adverse effect, while others within the group may view it as a benefit. Given the difficulty of meaningfully identifying the split of opinion across all population groups on a vast multimodal transportation network, an overlay analysis relying on proximity to transportation facilities and services was determined as the best way to assess the equity of the transportation planning process. To gauge the relative effects of the transportation system among population groups, the presence of existing and planned transportation facilities or services within the geographical areas of the communities of concern was compared to the presence in other areas.

Based on this approach, the major components of the RTP were analyzed to assess the geographic distribution of facilities and services. This analysis determined the percentage of block groups in each community of concern served by the long-range freeway/highway, transit, and arterial networks included in the RTP. The percentage of block groups covering areas not considered communities of concern was also determined. These percentages were compared to assess the relative distribution of benefits and burdens. Due to the ubiquitous nature of the arterial system, (i.e., all block groups are served); the arterial analysis is based only on new or improved segments in the network.

Minority Populations

In 1998, the FHWA published actions to address EJ in minority populations and low-income populations. Figure 5-1 indicates the location and density of minority households in the MAG region. FHWA guidance defines minority as: Black (having origins in any of the black racial groups of Africa); Hispanic (of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race); Asian American (having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands); American Indian and Alaskan Native (having origins in any of the original people of North

Figure 5-1: Minority Population



- Freeway
- Planned Freeway
- Light Rail
- Planned Light Rail
- Maricopa County
- MPO 2013 Boundary

Percent Minority

- Less than 43.2%
- 43.2% to 60%
- 60.1% to 80%
- More than 80%

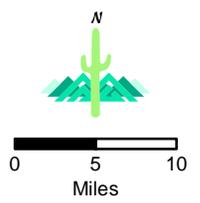
43.2% of the population in the MPO identify as a minority.

Minority is defined as any race or ethnicity other than non-hispanic white.

Sources: 2013-2017 American Community Survey 5-Year Estimates; 2010 Census Block Group Boundaries; 2013 MPO Boundary

American Community Survey (ACS) estimates are period estimates which means they represent the characteristics of the population and housing over a specific data collection period. These multiyear estimates provide the average values for data collected throughout the full period. For more information visit the ACS website at www.census.gov/acs

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America and who maintain cultural identification through tribal affiliation or community recognition). Following the FHWA guidance, MAG includes these groups as defined by the U.S. Census: by ethnicity, Hispanic or Latino; and/or by race (not Hispanic or Latino): Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, some other race, and persons of two or more races.

Minorities represent 43.2 percent of the population in the MAG planning region. There are 1,047 block groups with minority populations equal to or greater than this percentage, or 40 percent of the 2,610 block groups in the region. 69 percent of the minority population in the MPA is found within these block groups. Areas with a higher concentration of minorities (i.e., greater than 60 percent) are the central and south-central parts of the region, as well as the sovereign nations of the Gila River Indian Community, the Salt River Pima-Maricopa Indian Community, the San Lucy District of the Tohono O’Odham Nation, and the Fort McDowell Yavapai Nation.

The transportation needs of minority populations reflect the transportation needs of society as a whole (excluding economic status, which is considered in the next section). Thus, transportation facilities in minority communities should be reflective of those in non-minority communities. Figure 5-2 presents a comparison of service provided by the major RTP components, freeways/highways, transit, and arterials, in both minority and non-minority block groups.

FIGURE 5-2
PERCENT MINORITY vs. NON-MINORITY BLOCK GROUPS AFFECTED BY THE RTP

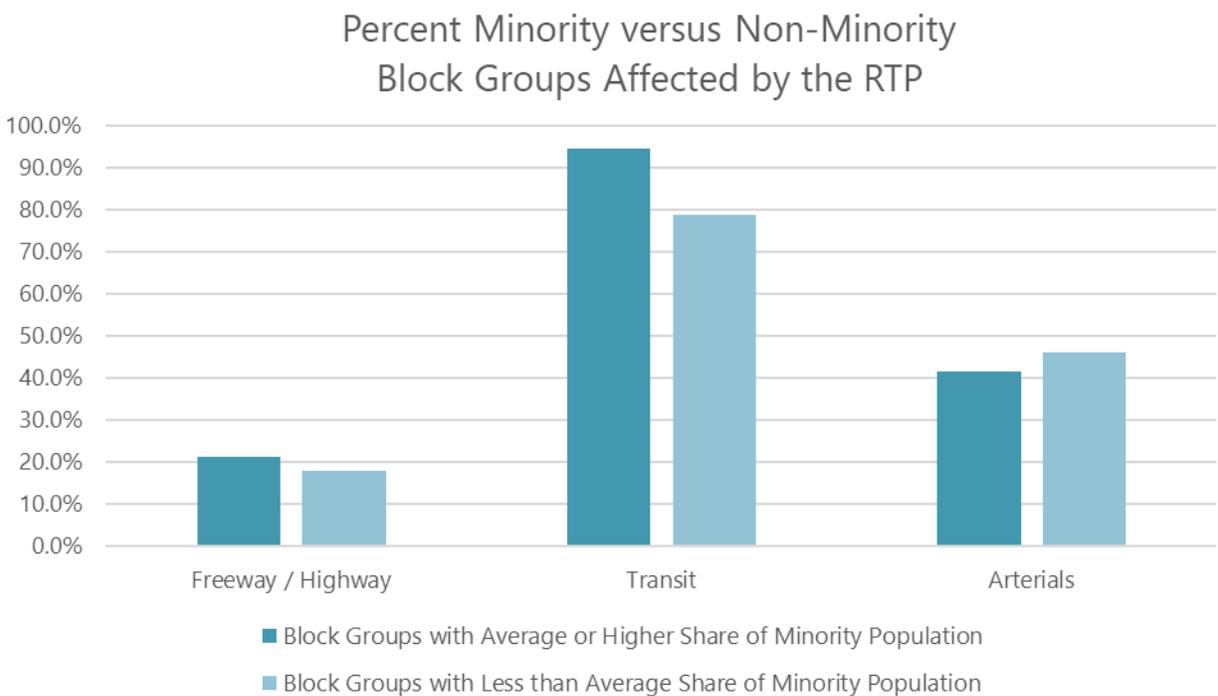
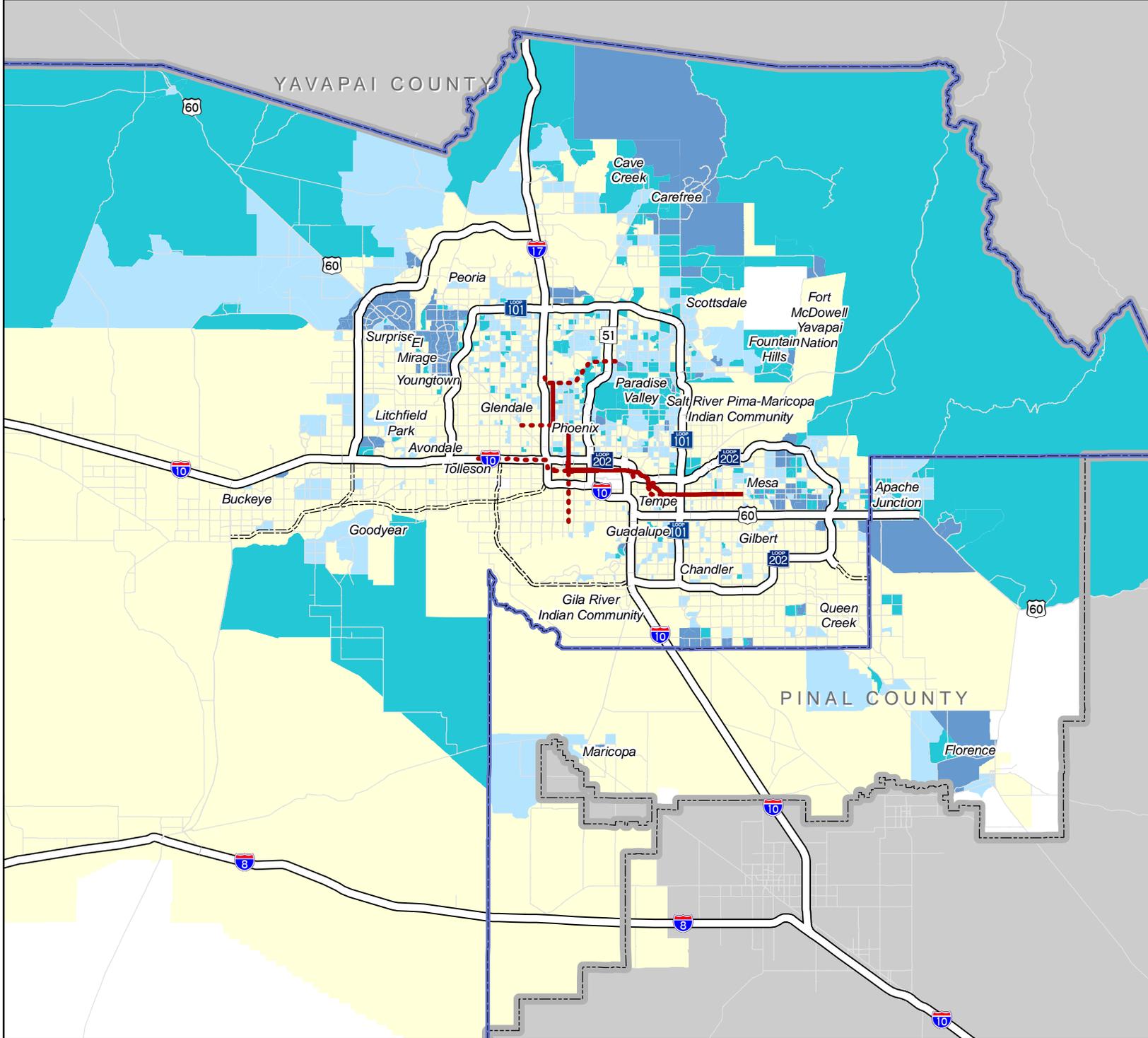


Figure 5-3: Population Age 65 and Over



- Freeway
- Planned Freeway
- Light Rail
- Planned Light Rail
- Maricopa County
- MPO 2013 Boundary

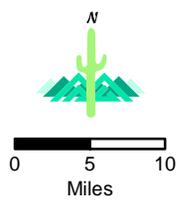
- Percent Age 65+**
- Less than 14.2%
 - 14.3% to 25%
 - 25.1% to 50%
 - More than 50%

14.3% of the population in the MPO are age 65 and Over.

Sources: 2013-2017 American Community Survey 5-Year Estimates; 2010 Census Block Group Boundaries; 2013 MPO Boundary

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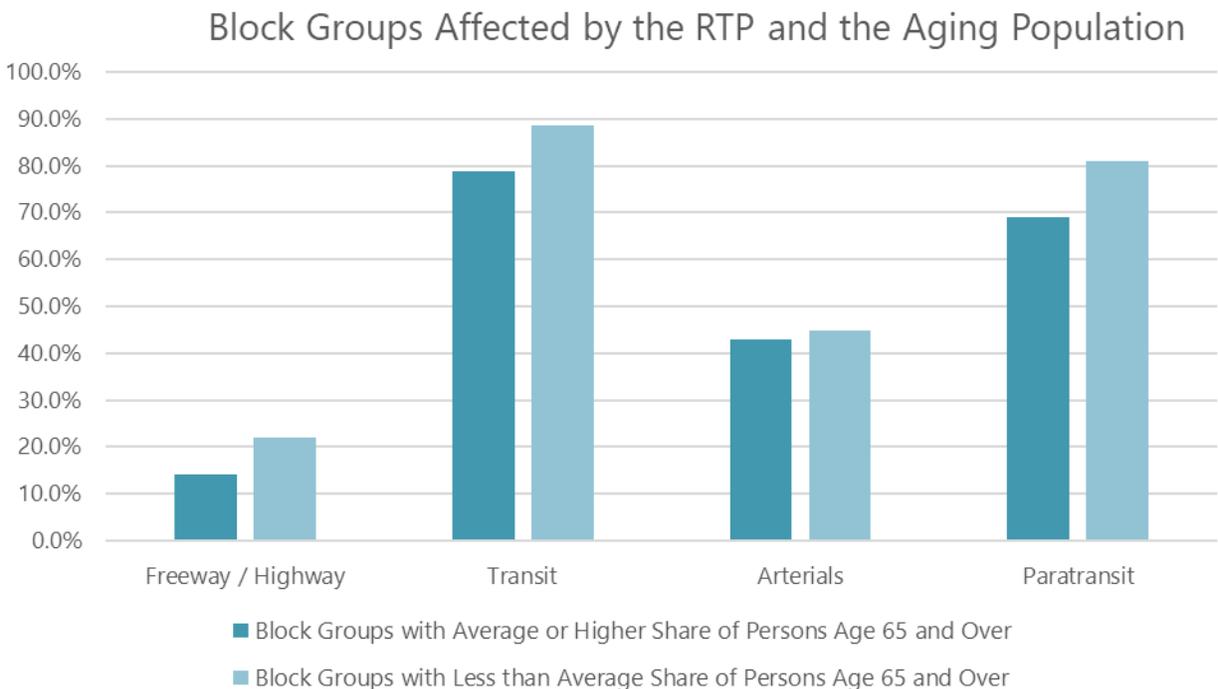


The percentage of minority block groups served by the freeway/highway system (21 percent) is marginally higher than that of non-minority block groups (18 percent). Transit routes serve 95 percent of minority block groups and 79 percent of non-minority block groups. Arterial street projects serve 42 percent of minority block groups compared to 46 percent for non-minority. Based on the review of the major components, the RTP provides roughly equal or better benefits to minority communities without causing disproportionately high adverse impacts.

Age

Age is another population characteristic that defines a community of concern. In the MAG MPA, individuals 65 years of age or older represent 14.3 percent of the population. There are 906 census block groups with a 65 or older population equal to or greater than this percentage, or 35 percent of the 2,610 block groups in the planning region. 63 percent of the population in this age group is within these 906 block groups. Figure 5-3 indicates the location and density of individuals 65 and over in the MPA. Areas with a higher concentration of individuals 65 and over (more than 50 percent) are located in Sun City/ Surprise, sections of the East Valley, and North Scottsdale/Carefree area.

FIGURE 5-4
PERCENT AGE 65 or OLDER vs. REMAINING BLOCK GROUPS AFFECTED BY THE RTP



The transportation needs of older residents may not be the same as those of the general population. Commuting needs may not be as great, and there may be a greater need for transit or specialized mobility services. Figure 5-4 presents a comparison of the service provided by freeways/highways, transit, and arterials in 65 or older areas and the remaining block groups.

The percentage of the 65 or older block groups served by the freeway/highway system (12 percent) is lower than the remaining block groups (24 percent). Transit routes serve 68 percent of 65 or older block groups and 96 percent of the remaining block groups. Arterial street projects serve 37 percent of the 65 or older block groups compared to 49 percent for the remaining block groups. The service area of paratransit covers 69 percent of the block groups included in the 65 or older group, compared to 81 percent coverage for the region as a whole.

Based on the review of freeway/highway, transit, and arterial improvements, 65 or older communities do not have the same level of proximity to transportation services as other groups covered in the analysis. While 14 percent of the MPA population is aged 65 and older, 63 percent of this age group live in a block group with a higher concentration of persons in their age group than the MPA overall, representing 35 percent of block groups. These block groups tend to be concentrated in outer areas and contain retirement communities that are removed from major transportation facilities. The resulting pattern of proximity to transportation may have occurred to some degree by choice of the members in this community. The paratransit system in the region enhances the level of transit service for 65 or older communities.

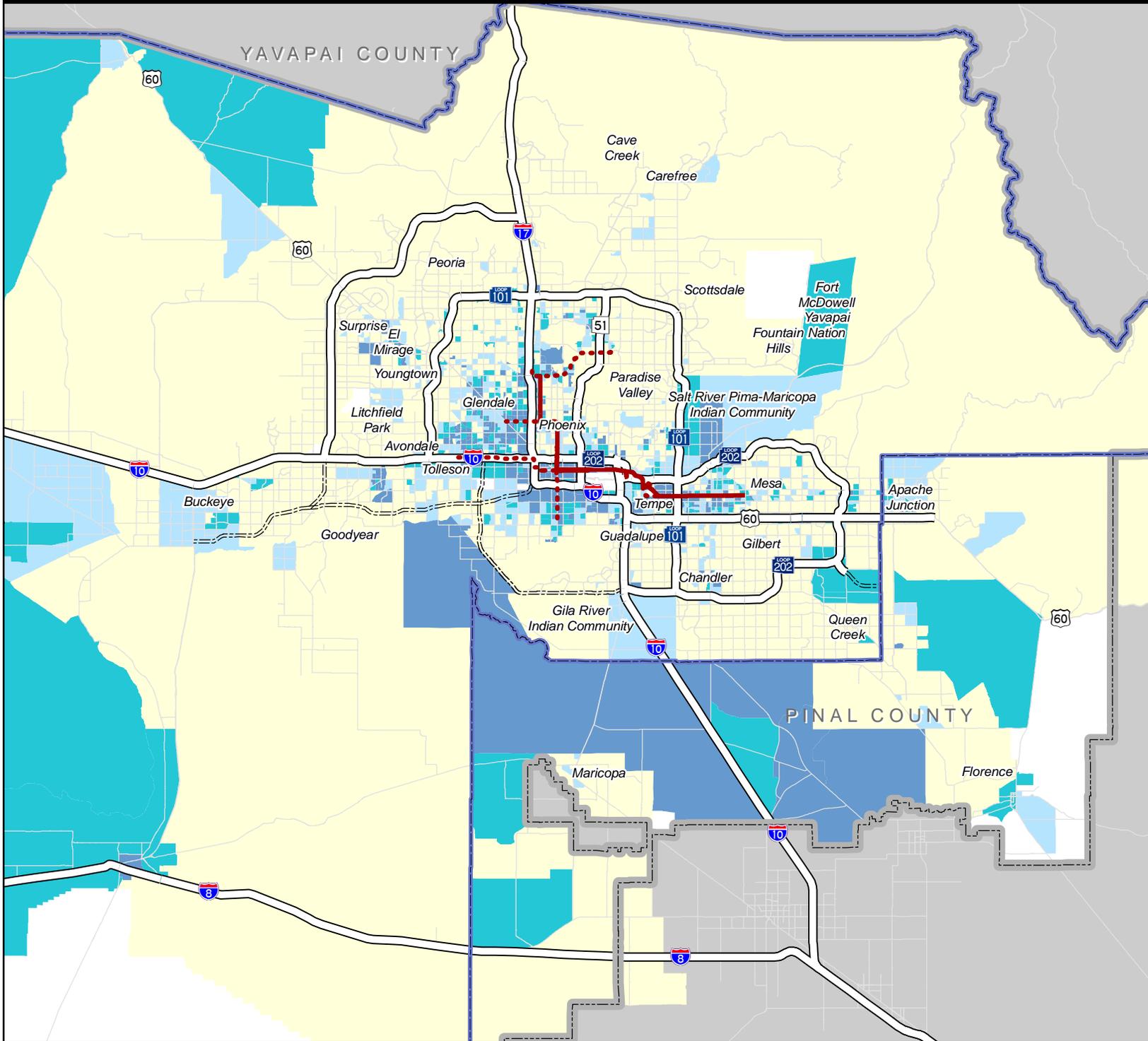
Poverty Status

Poverty status is determined by comparing annual income to a set of dollar values, or thresholds, that vary by family size, number of children, and age of householder. If a family's before-tax income is less than the dollar value of their threshold, the family and each individual are considered to be in poverty. For people not living in families, poverty status is determined by comparing the individual's income to his or her threshold. Poverty thresholds are updated annually by the U.S. Department of Health and Human Services to allow for changes in the cost of living using the price index for all urban consumers. Poverty thresholds are the same across the country and are not adjusted for regional, state, or local variations in the cost of living.

Figure 5-5 indicates the location and density within the region of persons with income below the federal poverty threshold. To some extent, areas that contain a higher percentage of people living in poverty are coincident with areas of higher minority populations. Areas where poverty is above the MPA threshold, but minority populations are not, include the northwestern portion of Maricopa County, east Mesa, and Glendale south of the Loop 101. The transportation needs of poverty communities may be better met by more transit service than the general population.

Figure 5-6 presents a comparison of the service provided by freeways/highways, transit, and arterials in poverty and non-poverty communities. The poverty block groups served by the freeway/highway system (19 percent) is the same as for non-poverty communities (19 percent). Transit routes serve nearly all of the block groups identified as poverty (93 percent) but a smaller portion (80 percent) of non-poverty areas. Arterial street projects serve approximately 38 percent of poverty areas compared to 48 percent for non-poverty. The analysis of planned improvements demonstrate that populations in poverty benefit from the RTP at the same level as those not identified in poverty, with transit services being provided at a higher level. The higher level of transit service is consistent with the needs of this community of concern.

Figure 5-5: Population with Income Below Poverty



- Freeway
- Planned Freeway
- Light Rail
- Planned Light Rail
- Maricopa County
- MPO 2013 Boundary

Percent in Poverty

- Less than 15.6%
- 15.6% to 25%
- 25.1% to 35%
- More than 35%

15.6% of the MPO population have income below poverty.

Poverty status is determined for non-institutionalized persons aged 5 and over.

Sources: 2013-2017 American Community Survey 5-Year Estimates; 2010 Census Block Group Boundaries; 2013 MPO Boundary

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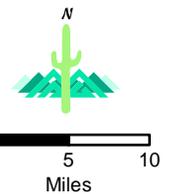
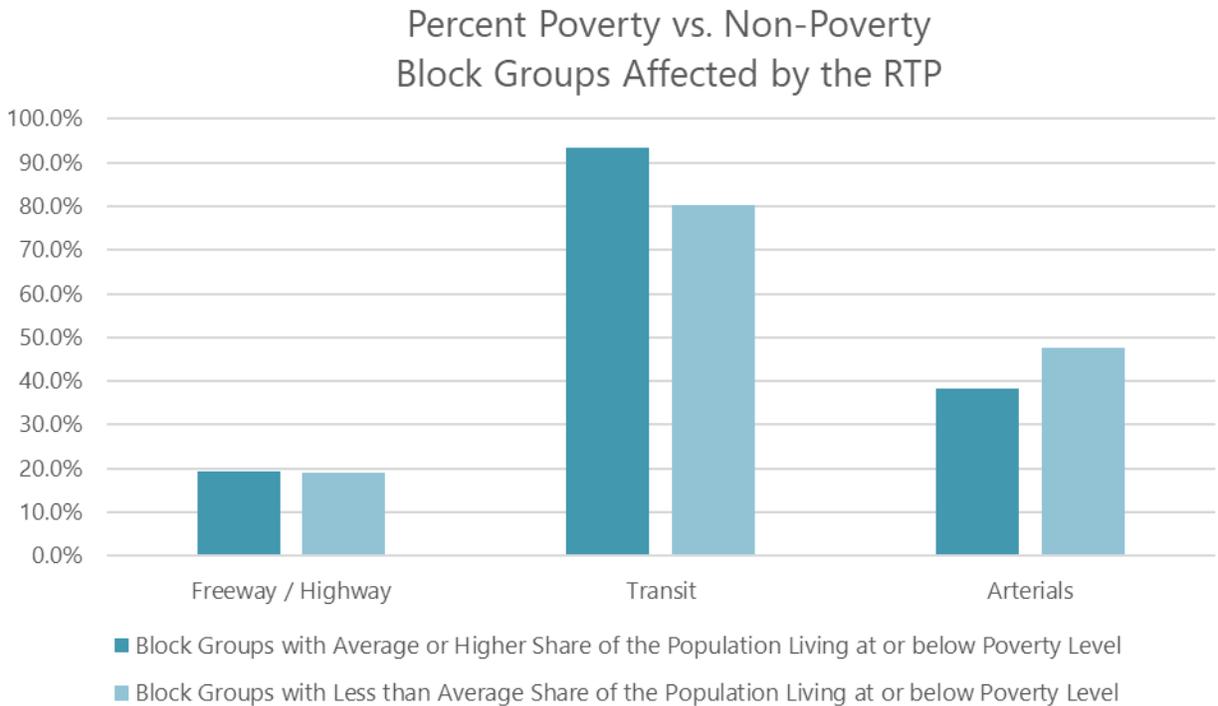


FIGURE 5-6
PERCENT POVERTY vs. NON-POVERTY BLOCK GROUPS AFFECTED BY THE RTP

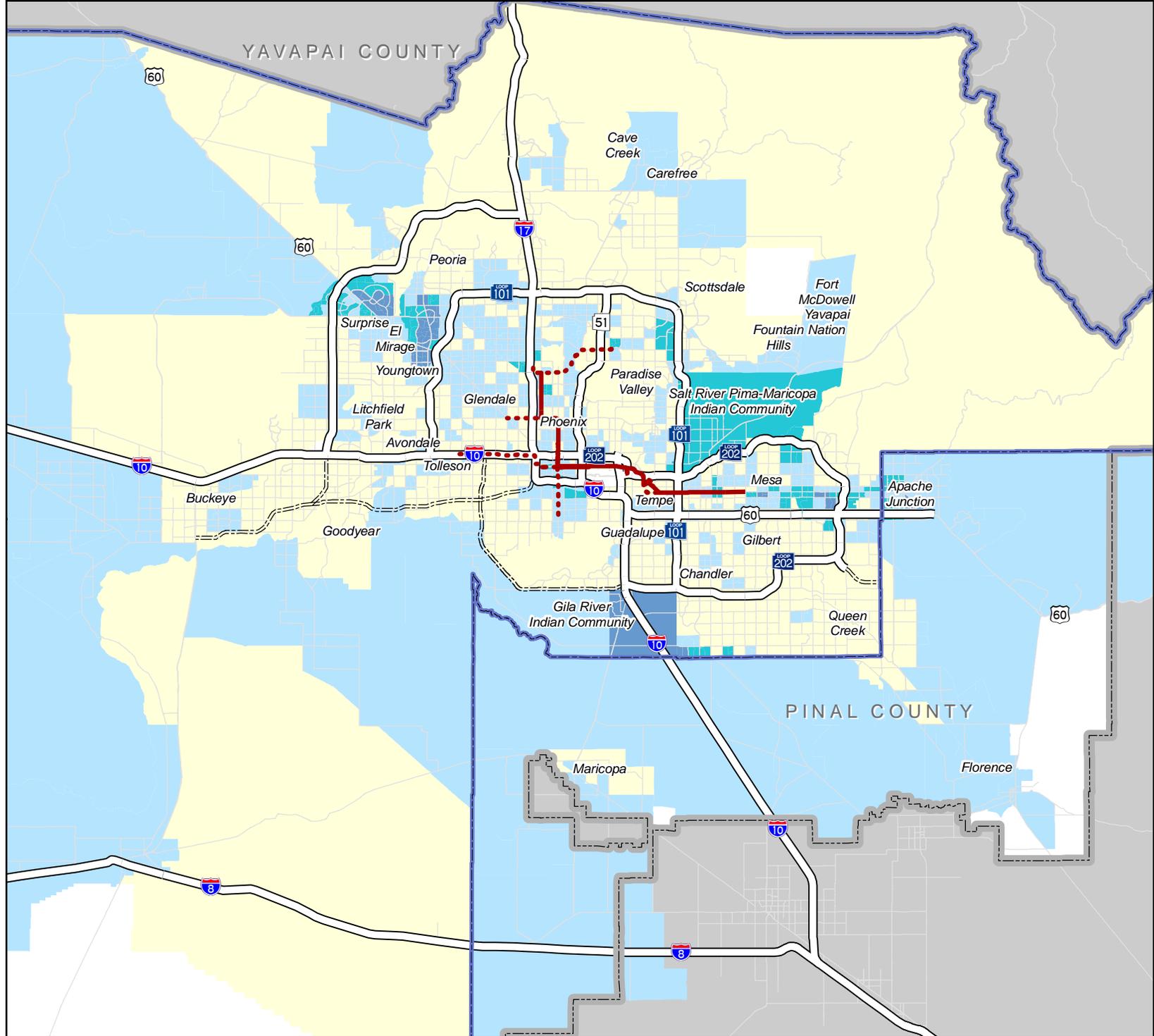


Disability Populations

In 2008, section 42 U.S.C. § 12102 of the Americans with Disabilities Act of 1990 was amended to define disability as a physical or mental impairment that substantially limits one or more major life activities of such individual, with a record of such an impairment, or being regarded as having such an impairment. Disabilities may be physical or cognitive. Figure 5-7 indicates the location and density of persons age 5 years and over with a disability within the region. The U.S. Census Bureau further defines disability as: “a long-lasting physical, mental, or emotional condition. This condition can make it difficult for a person to do activities such as walking, climbing stairs, dressing, bathing, learning, or remembering. This condition can also impede a person from being able to go outside the home alone or to work at a job or business.”

Block groups with an above threshold percentage of people who reported a disability are scattered throughout Maricopa County, with notable concentrations in the northwest area of the Valley and southeast Mesa. The transportation needs of residents who reported a disability are not the same as those of the general population. People with disabilities may require a special apparatus for vehicular transportation. Therefore, people who reported a disability may be more reliant on the transit system or paratransit services to meet their transportation needs.

Figure 5-7: Population with a Disability



- Freeway
- Planned Freeway
- Light Rail
- Planned Light Rail
- Maricopa County
- MPO 2013 Boundary

Percent Disabled

- Less than 11.1%
- 11.1% to 20%
- 20.1% to 30%
- More than 30%

11.1% of the non-institutionalized civilian MPO population have a disability.

Disability is based on hearing, vision, cognitive, ambulatory, self-care, and/or independent living difficulties.

Sources: 2013-2017 American Community Survey 5-Year Estimates; 2010 Census Block Group Boundaries; 2013 MPO Boundary

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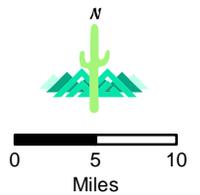


FIGURE 5-8
PERCENT DISABILITY vs. NON-DISABILITY BLOCK GROUPS AFFECTED BY THE RTP

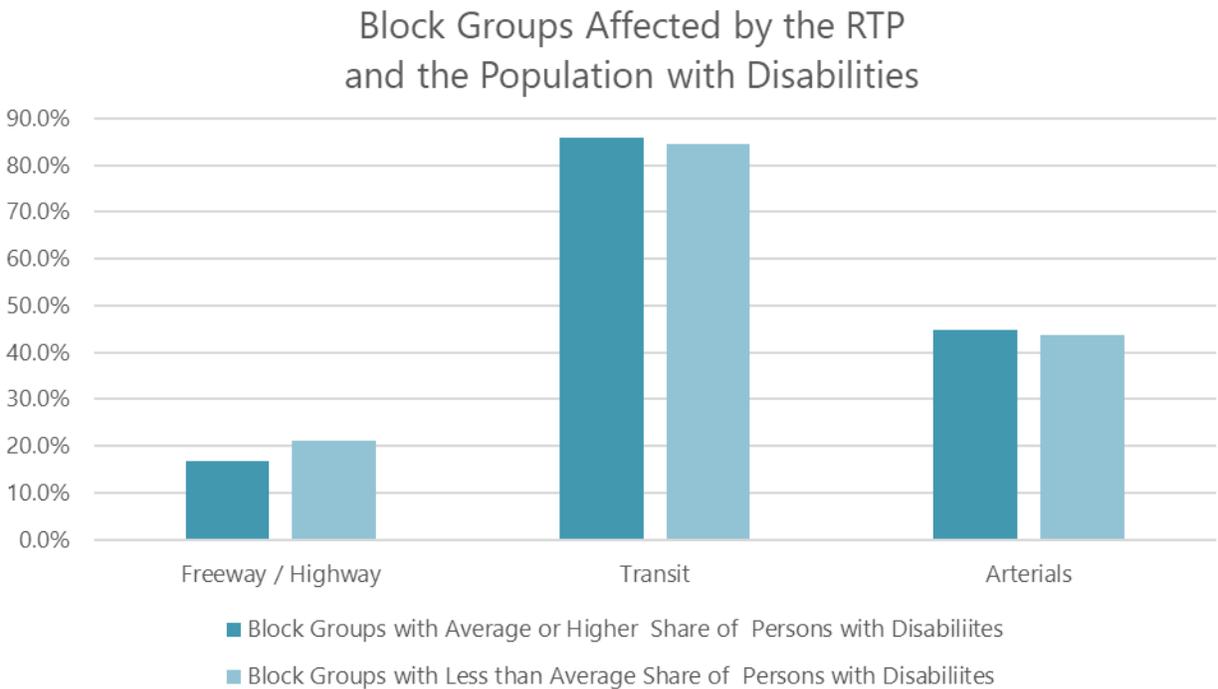


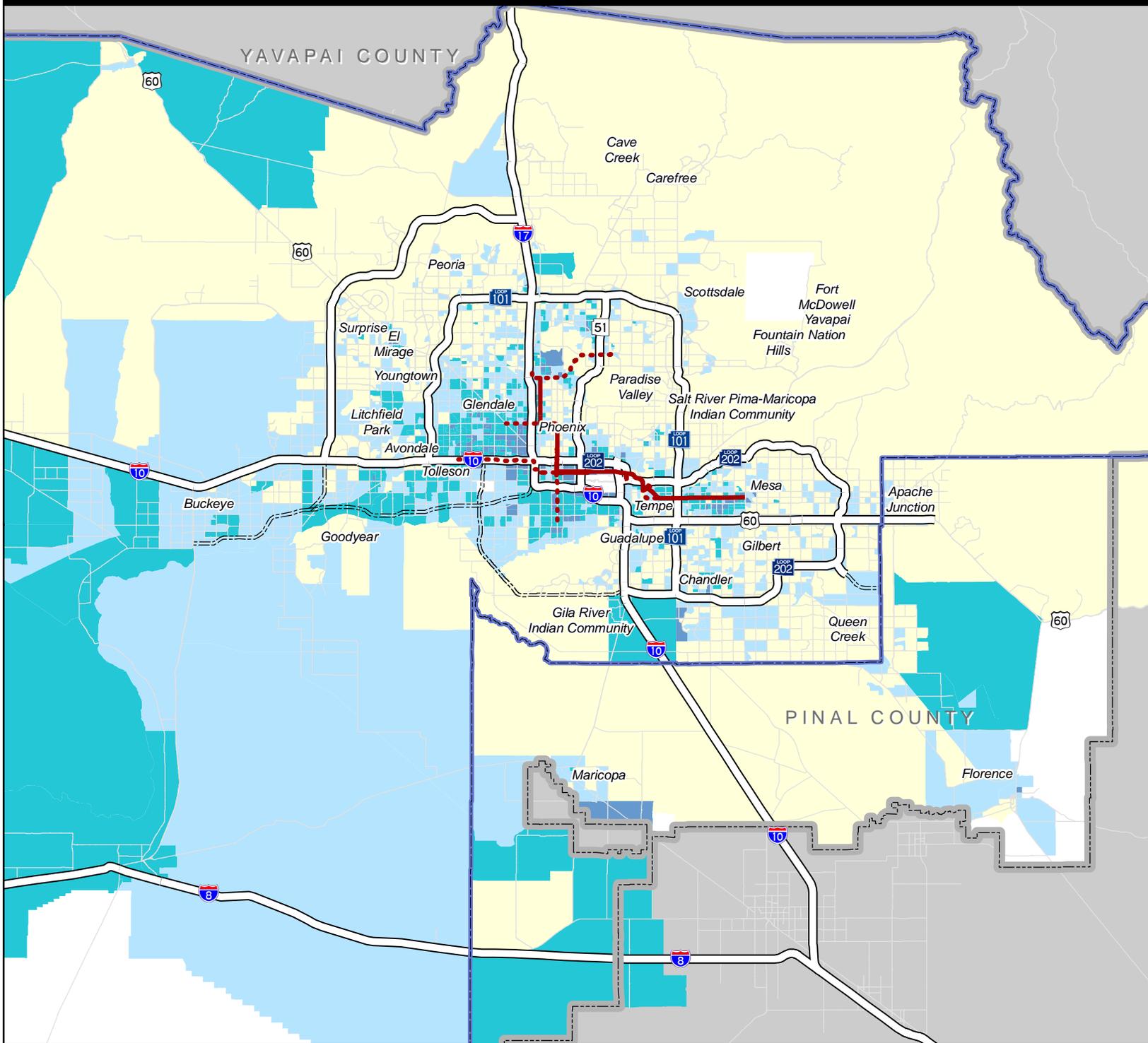
Figure 5-8 presents a comparison of the service provided by major RTP components in areas with and without high concentrations of persons with a disability. The portion of block groups with a high percentage of persons who reported having a disability and are served by the freeway/highway system (16 percent) is lower than those areas with fewer persons with a disability (21 percent). Transit routes serve the majority of block groups identified as disability (86 percent), which is virtually the same percentage (85 percent) for non-disability areas. Arterial street projects serve approximately 45 percent of the disability areas, which is virtually the same percentage for areas identified as non-disability (44 percent). The analysis of the plan improvements shows that populations of persons who reported having a disability generally benefit from the RTP at the same level as block groups not identified with this characteristic.

The paratransit system in the region enhances the level of transit service for individuals with disabilities. This includes paratransit services mandated by the Americans with Disabilities Act (ADA), as well as paratransit services beyond ADA requirements provided some jurisdictions in the region. Recently, paratransit services in the region were fully coordinated to eliminate transfers across jurisdictional boundaries.

Limited English Proficiency

The federal guidance to define LEP refers to persons aged five years and over who speak English less than “very well”. Data from the 2017 American Community Survey five year (2013-2017) est-

Figure 5-9: Population with Limited English Proficiency (LEP)



- Freeway
- Planned Freeway
- Light Rail
- Planned Light Rail
- Maricopa County
- MPO 2013 Boundary

Percent with LEP

- Less than 5%
- 5.1% to 15%
- 15.1% to 30%
- More than 30%

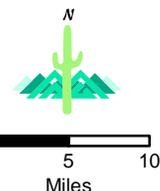
8.9% of MPO residents over 5 years old have Limited English Proficiency (LEP). Targeted areas are those with at least 5% LEP persons (FTA Circular 4702.1B).

LEP is defined as a person age 5 or older who speaks English less than "Very Well."

Sources: 2013-2017 American Community Survey 5-Year Estimates; 2010 Census Block Group Boundaries; 2013 MPO Boundary

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imates were used to identify the block groups corresponding to this community of concern. Figure 5-9 indicates the location and density of LEP persons in the Region. Block groups of higher-than-threshold LEPs are coincident with those containing a higher-than-threshold percentage of minorities.

FIGURE 5-10
PERCENT LEP vs. NON-LEP BLOCK GROUPS AFFECTED BY THE RTP

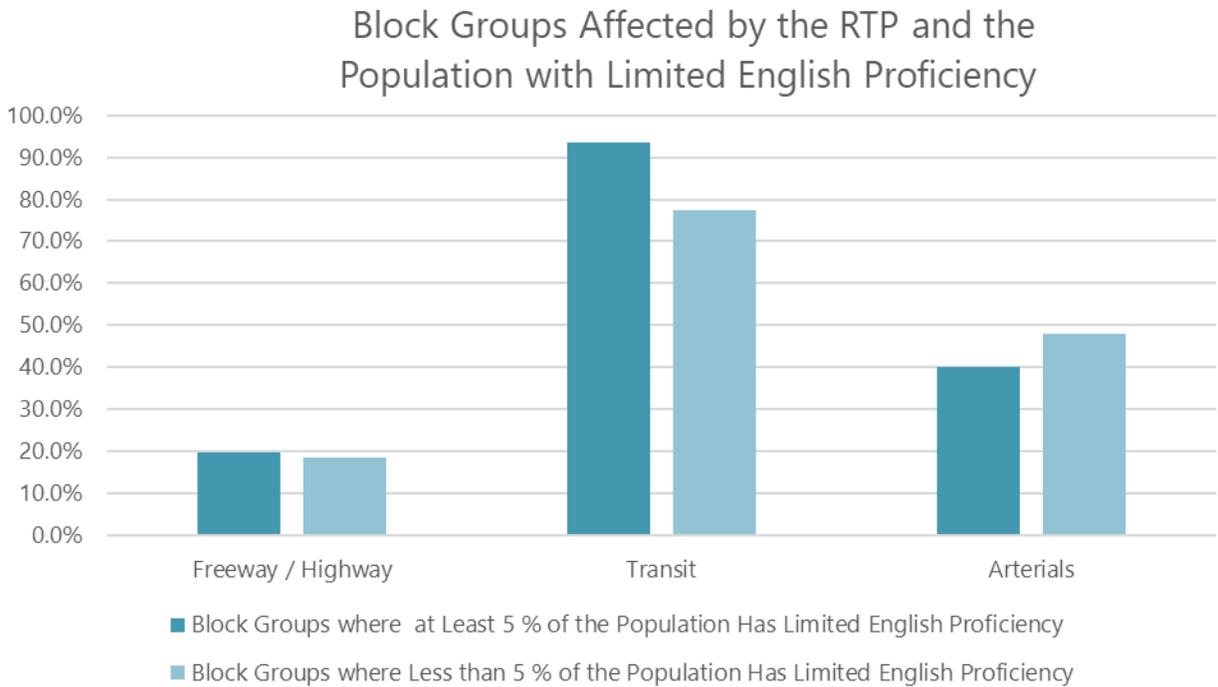


Figure 5-10 presents a comparison of the service provided by freeways/highways, transit, and arterials in both LEP and non-LEP block groups. The portion of LEP block groups served by the freeway/highway system (20 percent) is essentially the same as block groups identified as non-LEP (19 percent). Transit routes serve nearly all block groups identified as LEP (93 percent), while 77 percent of the non-LEP block groups are served. Arterial street projects serve approximately 40 percent of the LEP block groups, compared to 48 percent for non-LEP. The analysis of the RTP improvements demonstrates that LEP populations benefit from the planned improvements at about the same level as those block groups not identified as LEP.

Conclusion

MAG incorporates environmental justice into regional transportation planning. MAG prepared a Title VI/EJ Program to fully integrate the needs of vulnerable populations, and this plan feeds into the regional transportation planning process. MAG demonstrates a commitment to listening to residents through continuous outreach efforts, and numerous events and activities. To be effective, these efforts must be sustained, and through the continued outreach effort, transportation planning for the region can equitably address the needs of all residents.

As detailed in the above sections, MAG conducted an environmental justice overlay analysis to assess the effects of planned improvements in the RTP on the communities of concern. The analysis demonstrated that communities of concern generally benefit from the RTP at the same level as block groups not identified as communities of concern. The RTP provides for a high level of transit service to communities of concern in particular, which is consistent with the transportation needs of those groups. In addition, the plan regionally funds ADA complimentary paratransit service, which provides additional mobility for communities of concern.

The results of the justice overlay analysis correspond to an analysis in the MAG Title VI/EJ FY2020 Program, approved on May 22, 2019. Maps representing the current bus and capital transportation investments in the *FY 2020-2024 MAG TIP* were prepared. The maps include population concentrations of people with disabilities, LEP communities, minorities, and poverty communities. Analysis of the maps concluded that communities of concern receive equal benefit from the investments and that they do not shoulder a disproportionate burden. (Appendix A).

The EJ analysis found that 65 or older communities do not have the same level of proximity to transportation services as other groups covered in the analysis. However, the block groups associated with this community tend to be concentrated in outer areas of the region and contain retirement communities that are removed from major transportation facilities. The resulting pattern of proximity to transportation may have occurred to some degree by the choice of the members of these communities. Still, elderly mobility is a continuing concern at MAG. The MAG Elderly and Persons with Disabilities Transportation Program and Age-Friendly Arizona, a program hosted by MAG, works with individual communities to meet the transportation needs of older adults.

Proximity to transportation facilities and services is only one of many issues related to transportation equity that MAG pursues. MAG addresses the needs of underserved populations throughout the planning and programming process and provides outreach, including the Title VI Community Outreach Program, Geographic Information System mapping, the Human Services division of MAG, and through programs run by Valley Metro using MAG funds. Through the Community Outreach Program, MAG coordinates with minority communities to solicit input and to serve as a liaison between MAG and the communities. In addition to minority communities, MAG targets and solicits input from persons with disabilities. Through Valley Metro's complementary paratransit plan, the needs of the elderly and people with disabilities are served.

A MAG committee reviews and prioritizes applications for federal assistance under the Enhanced Mobility of Seniors and Individuals with Disabilities Transportation program, which provides capital investments to projects serving the elderly and people with disabilities. MAG transportation plans and programs are submitted to the Human Services Coordinating Committee for review, and MAG provides multimodal transportation information for review and comment to the Human Services planning process. The needs of older adults are further being addressed through projects related to aging services planning, such as the City Leaders Institute on Aging in Place and the Enhancing Age-Friendly Cities Initiative. These projects address the changing mobility options that are needed as people age.

CHAPTER SIX

CONSULTATION ON ENVIRONMENTAL MITIGATION AND RESOURCE CONSERVATION

The MAG long-range transportation planning process is structured to make planning decisions and prepare planning products that are sensitive to environmental mitigation and resource conservation considerations. These activities are consistent with federal metropolitan transportation planning requirements for consultation with state and local agencies regarding inventories of natural or historic resources, as well as consultation with federal, state, tribal, wildlife, and regulatory agencies on potential environmental mitigation activities.

Environmental and Resource Factors in MAG Transportation Planning

The process of developing transportation improvements to meet the travel demands of a growing metropolitan area, such as the MAG Region, must address concerns related to resource conservation and environmental mitigation. A major element in this effort is consultation with environmental and resource agencies, conducted as part of the periodic updating of the Regional Transportation Plan (RTP). Another environmental aspect of the MAG transportation planning process is contained in area and corridor transportation studies. As part of these studies, environmental and resource factors are assessed, and agencies are solicited for early input so that environmental mitigation and resource conservation considerations are taken into account at all key stages of the planning effort.

Air quality conformity analysis of the MAG TIP and the RTP is an important environmental factor in the MAG transportation planning process. For a finding of conformity, the air quality analysis must demonstrate that the TIP and RTP are in conformance with regional air quality plans and will not contribute to air quality violations. The conformity analysis must also demonstrate that the criteria specified in the federal transportation conformity rule for a conformity determination are satisfied by the TIP and RTP. A description of the conformity tests and results of the conformity analysis is provided in Chapter 24.

Agency Consultation Process

As part of the planning process for the update of the RTP, MAG reaches out to federal, state, tribal, regional, and local agencies to consult on environmental and resource issues and concerns. Specific topics of interest include: land use management, wildlife, natural resources, environmental protection, conservation, historic preservation, and potential environmental mitigation activities. The primary goal of this consultation effort is to make transportation planning decisions and prepare planning products that are sensitive to environmental mitigation and resource conservation considerations. All of the cities, towns, counties, and Native nations in the MAG planning area, as well as the Arizona Department of Transportation (ADOT), are routinely involved in the RTP and its development as members of MAG.

An important consideration in the consultation process is the recognition that previously adopted projects in the RTP undergo extensive environmental and resource impact assessment by the implementing agencies, such as ADOT, Valley Metro, cities, towns, and counties. With these processes already well established, which include requirements for input on mitigation and resource issues, the primary goal of the RTP consultation effort is to gain insight regarding concerns that may potentially involve future transportation planning efforts and Plan elements. This approach avoids duplicating work efforts and burdening agencies with multiple requests for the same information.

Environmental and Resource Agency Involvement

The approach to the consultation process includes three types of activities: agency workshops, individual agency meetings, and participation in the MAG public involvement process.

- Agency Workshops - The consultation effort can include workshops held for the agencies involved in environmental and resource issues in the MAG Region. The purpose of the workshops is to receive input from the environmental and resource agencies, regarding the application of environmental mitigation and resource conservation concepts in the transportation planning process. Workshops are held when substantive updates to the RTP are anticipated.
- Individual Agency Meetings - In addition to workshops, meetings with individual agencies to discuss resource conservation and environmental mitigation issues are held, as may be appropriate. These meetings provide the opportunity for detailed discussions on concerns and issues and identify available data and information resources in depth.
- MAG Public Involvement Process - As part of the consultation process, the environmental and resource agencies are included in the MAG public involvement process. Chapter 4 outlines MAG’s Public Involvement Process.

A comprehensive listing of agencies with which MAG consults is provided in Table 6-1.

**TABLE 6-1
ENVIRONMENTAL AND RESOURCE AGENCIES**

Federal	U.S. Bureau of Indian Affairs, Pima Agency
Federal Aviation Administration	U.S. Bureau of Indian Affairs, Salt River Agency
Federal Emergency Management Agency	U.S. Bureau of Land Management
Federal Highway Administration	U.S. Bureau of Reclamation
Federal Railroad Administration	U.S. Department of Agriculture
Federal Transit Administration	U.S. Department of Homeland Security
Luke Air Force Base	U.S. Department of the Interior-Environmental
National Forest Service	Policy & Compliance
National Park Service	U.S. Environmental Protection Agency
U.S. Army Corps of Engineers	U.S. Fish and Wildlife Service

State Arizona Commerce Authority Arizona Department of Economic Security Arizona Department of Emergency & Military Affairs Arizona Department of Environmental Quality Arizona Department of Public Safety Arizona Department of Transportation Arizona Department of Water Resources Arizona Game and Fish Department	Arizona Geological Survey Arizona Office of Tourism Arizona Sports and Tourism Authority Arizona State Land Department Arizona State Parks Arizona State Parks & Trails, State Historic Preservation Office Arizona State Parks, Historic Preservation Office State Transportation Board
Council of Governments Central Arizona Governments	Pima Association of Governments Sun Corridor Metropolitan Planning Organization
County Flood Control District of Maricopa County Maricopa County Air Quality Department Maricopa County Department of Transportation	Maricopa County Environmental Services Maricopa County Parks & Recreation Maricopa County, Travel Reduction Task Force Pinal County Public Works Department
Native Nations Ak-Chin Indian Community Fort McDowell Yavapai Nation	Gila River Indian Community Salt River Pima-Maricopa Indian Community Tohono O'odham Nation
Other ABILITY360 Amalgamated Transit Union #1433 Arizona Association of Providers for People with Disabilities (AAPPD) Arizona Chamber of Commerce Arizona Disability Coalition Arizona Lodging & Tourism Association Arizona Municipal Water Users Association Arizona State University, Parking & Transit Services Arizona Transit Association Arizona Trucking Association Arrow Stage Lines Charter Service Association of Pedestrian & Bicycle Professionals ASU Campus Shuttle BNSF Railway Central Arizona Project City of Phoenix, Public Transit Department Coalition of Arizona Bicyclists Fedex Freight First Transit Friends of Transit Greater Phoenix Chamber Greater Phoenix Economic Council GreyHound Hispanic Chamber of Commerce International Union of Operating Engineers Local 428 (IUOE)	J.B. Hunt Transport Services, Inc. LISC Phoenix Lyft MV Transportation Inc. National Center for American Indian Enterprise Development Phoenix Port 2605 Phoenix Sky Harbor International Airport Phoenix-Mesa Gateway Airport Phoenix-Mesa Gateway Airport Port 2682 Regional East Valley First Transit RTW Management Salt River Project Scottsdale Airport Port 2681 Second Generation Inc., DBA Ajo Transportation Southwest Charter Southwest Gas, Central Arizona Division Swift Transportation Teamsters (Labor Union) Tempe Bicycle Action Group Total Transit Totalride Transdev Uber Union Pacific Railroad UPS Valley Metro Yellow Cab

FY 2017 Agency Workshop

MAG approved the most recent RTP update, the 2040 RTP, in June 2017. The 2040 RTP was a transitional plan that largely maintained the existing modal program structure. In addition, the 2040 RTP documented progress on the development of federally required performance measures and targets.

During FY 2017, technical work for preparation of the 2040 RTP was finalized, building on the background information developed in FY 2016. This effort addressed plan components such as: (1) transportation modal systems, (2) financial resources, (3) system management and operations, (4) transportation performance measures and targets, (5) travel demand and system capacity, (6) public involvement and agency consultation, (7) population and employment forecasts, and (8) special needs transportation. In addition, supporting activities such as transportation network modeling, air quality analysis, and public participation was conducted to meet all federal planning requirements.

A stakeholder workshop to obtain input on the RTP update process was held on August 22, 2016. In addition to environmental and resource agencies, MAG member agencies were notified of the workshop. Since the update of the RTP did not consider any new corridors, the workshop focused on the project programming process, as well as refinements to the existing Freeway Life Cycle Program (FLCP). The meeting began with presentations from MAG staff related to the public involvement process, transportation planning and programming, and current rebalancing efforts of the regional freeway and highway program. The presentations concluded with an overview of upcoming important dates to help stakeholders in understanding the MAG planning and programming efforts and facilitate future input to the process. Following the presentations, a stakeholder discussion was held where agency representatives were encouraged to share information, ask questions, or discuss future projects.

A summary of the discussion at the August 22, 2016, Workshop is provided in Appendix B.

FY 2013 Agency Workshop

An update of the RTP was not conducted during FY 2011. Beginning in FY 2012, and continuing into FY 2013, work proceeded on the preparation of the 2035 RTP, which was targeted for adoption in the summer of 2013. In conjunction with the development of the 2035 RTP, an agency workshop was held on November 6, 2012, to receive input from environmental and resource agencies, regarding the application of environmental mitigation and resource conservation concepts in the transportation planning process.

The November 2012 workshop focused on work MAG conducted in the areas of: (1) sustainable transportation and land use integration, (2) complete streets guidelines, and (3) bicycle and pedestrian planning. An overview of the approach to developing the 2035 RTP was provided, which covered background on the contents of the current plan, new factors to be considered in preparing the updated plan, and future opportunities for comment on the planning process.

Agencies were encouraged to provide input, at the workshop or through later correspondence, regarding any experiences, insights, or concerns from their agency perspective on the studies MAG conducted, as well as perspectives and insight on the overall regional transportation planning process.

Key comments received from the November 6, 2012, Workshop are summarized in Appendix B.

FY 2010 Agency Workshop

The development of the 2010 Update of the RTP continued through calendar year 2009, and an additional agency workshop was held on November 9, 2009, to receive input from environmental and resource agencies, regarding the application of environmental mitigation and resource conservation concepts in the transportation planning process.

The emphasis at the November 2009 workshop was on proposed legislation at the federal level that may influence the transportation planning process. Considerable activity had been occurring at the federal level in the areas of clean energy, climate change, and national funding for transportation. Many of the concepts in this proposed legislation address issues affecting the environmental and resource conservation aspects of transportation planning. The goal of the workshop was to discuss pending legislation and develop insights and draw conclusions about the potential future direction of the regional transportation planning process.

Key comments at the November 9, 2009, Workshop are summarized in Appendix B.

FY 2009 Agency Workshop

MAG engaged federal, state, tribal, regional, and local agencies to consult on environmental mitigation and resource conservation issues and concerns during the development of the 2010 Update of the RTP. As part of this effort, an agency workshop was held on November 13, 2008, to review MAG studies and receive input from environmental and resource agencies on the application of environmental mitigation and resource conservation concepts in the transportation planning process.

Three studies were discussed at the workshop, including the I-10/Hassayampa Valley Transportation Framework Study, the I-8 and I-10 Hidden Valley Transportation Framework Study, and the Regional Transit Framework Study. Preliminary information from the first two of these studies was presented at the FY 2008 Workshop, and the FY 2009 Workshop provided an opportunity to discuss the studies in greater detail. In addition, preliminary information from the MAG Regional Transit Framework Study was presented, which evaluates future transit needs beyond those contained in the RTP.

Key comments at the November 13, 2008, Workshop are summarized in Appendix B.

FY 2008 Agency Workshop

MAG generally updates the RTP annually, although federal regulations allow metropolitan transportation plans to be updated every four years. However, during FY 2008, a decision was made to postpone the update of the RTP until FY 2009, due to uncertainties regarding federal policies for programming CMAQ funds and the completion date of a cost review of the FLCF.

Although the RTP was not updated during FY 2008, an agency workshop was held on November 6, 2007, to obtain input on ongoing MAG transportation studies. The main purpose of the workshop was to receive input on two MAG studies that assess transportation needs in developing areas of the Region. These studies were the I-10/Hassayampa Valley Transportation Framework Study, and the I-8 and I-10/Hidden Valley Transportation Framework Study.

Key comments at the November 6, 2007, Workshop are summarized in Appendix B.

FY 2007 Agency Workshop

As part of the process of preparing the 2007 Update of the RTP, MAG conducted an extensive outreach program to obtain input from environmental and resource agencies. This effort was initiated with an agency workshop, which was held on August 17, 2006. The workshop provided an opportunity to familiarize the agencies with MAG's organization and planning responsibilities, as well as the goals of the consultation process. Agency input was obtained on environmental mitigation and resource conservation issues, available databases and other information resources, and future steps in the planning process.

Following the workshop, MAG staff held additional individual meetings with thirteen key environmental and resource agencies during September/October 2006. These meetings allowed in-depth discussions regarding concerns specific to those agencies. In addition, it provided a means to gain excellent insight into environmental mitigation and resource conservation methods that would have potential application to the transportation planning process.

Also, during FY 2007, environmental and resource agencies were invited to participate in the MAG public involvement process. The agency workshop was held in conjunction with the early phase of this process. As part of the mid-phase of the public involvement process, which includes a public hearing on regional transportation issues, the agencies received a copy of the Draft 2007 RTP Update and were invited to submit written comments. Lastly, as part of the final phase of the process, which provides an opportunity for final comment on the RTP, TIP, and Air Quality Conformity Analysis, agencies were given notice of the hearing and invited to comment.

Key comments at the August 17, 2006, Workshop and follow-up individual agency meetings are summarized in Appendix B.

Discussion of Environmental Mitigation, Natural and Historic Resource Conservation, and Planning Process Considerations

A broad range of federal, state, and tribal agencies that address wildlife, land management, and regulatory matters are consulted about environmental mitigation activities with the greatest potential to address environmental functions affected by the Plan. The transportation planning process and future environmental implications are discussed, and concepts for environmental mitigation activities identified. Since previously adopted projects in the RTP undergo extensive environmental and resource assessment by the implementing agencies through the National Environmental Policy Act process, the primary goal of the consultation effort is to gain insights regarding issues that may involve future planning efforts and Plan elements.

In addition, state and local agencies are consulted regarding transportation planning issues affecting land use management, natural resources, environmental protection, conservation, and historic preservation. These discussions included the identification of conservation maps, inventories of natural or historic resources, and other information sources for use in the regional transportation planning process. Like the environmental mitigation discussions, the consultation effort was aimed at identifying resource and conservation concerns that address future planning efforts and future Plan elements. During meetings with agencies, discussions led to the area of transportation planning and how environmental and resource concerns can be effectively integrated into the planning process. Discussions included the identification of key databases, conservation maps, inventories of natural or historic resources, and other information sources to utilize in the regional transportation planning process.

Appendix B documents the input provided through the environmental and resource conservation consultation effort, representing a valuable resource for the ongoing transportation planning process. The points listed are not intended to represent MAG policies, but rather, are factors for consideration in the transportation planning process.

Consultation for Area and Corridor Transportation Planning Studies

Area and corridor transportation planning studies play a vital role in the MAG transportation planning process. These studies assess evolving transportation needs not covered by the adopted MAG RTP. They provide the opportunity to review transportation conditions in detail within a specified geographic area or modal facility system, identifying potential new RTP elements for consideration in the decision-making process. The area/corridor studies are conducted within the context of the entire regional system, so that travel demand and facility interactions throughout the Region are recognized.

One of the major steps in the area/corridor study process covers the inventory of environmental and resource factors. Environmental and resource agencies are solicited for input early in the process, so data on existing conditions can be assembled thoroughly and accurately. In addition to data collection, the process includes the identification of potential environmental, cultural, and natural resource issues affecting the area or corridor under study. The information on

existing conditions and potential issues provides a key input for the identification of alternatives. Once alternatives are identified, environmental and resource data and issues identified in the inventory phase are input for the development of evaluation criteria and the assessment of alternatives. This evaluation process provides valuable information on environmental and resource impacts and identifies mitigation considerations connected with potential future decisions on proposed new transportation corridors or improvements to existing facilities.

Modal and area transportation planning studies, completed or are ongoing, are discussed in Chapter 17. The findings and recommendations from these studies identify potential new corridors or other transportation improvements for consideration in future updates of the RTP. In several cases, illustrative projects/corridors have been identified as a result of the studies and included in the RTP (Chapter 17). Illustrative corridors and projects are provided for in the federal transportation planning regulations to allow identification of plan elements that could be included in the Plan if funding were available. A major benefit of identifying illustrative corridors is the early and thorough vetting of potential environmental mitigation and resource conservation issues. In addition, the status of study results as illustrative plan elements provides the opportunity to assess potential environmental and resource conservation effects, so that they may be considered throughout the decision-making process.

CHAPTER SEVEN

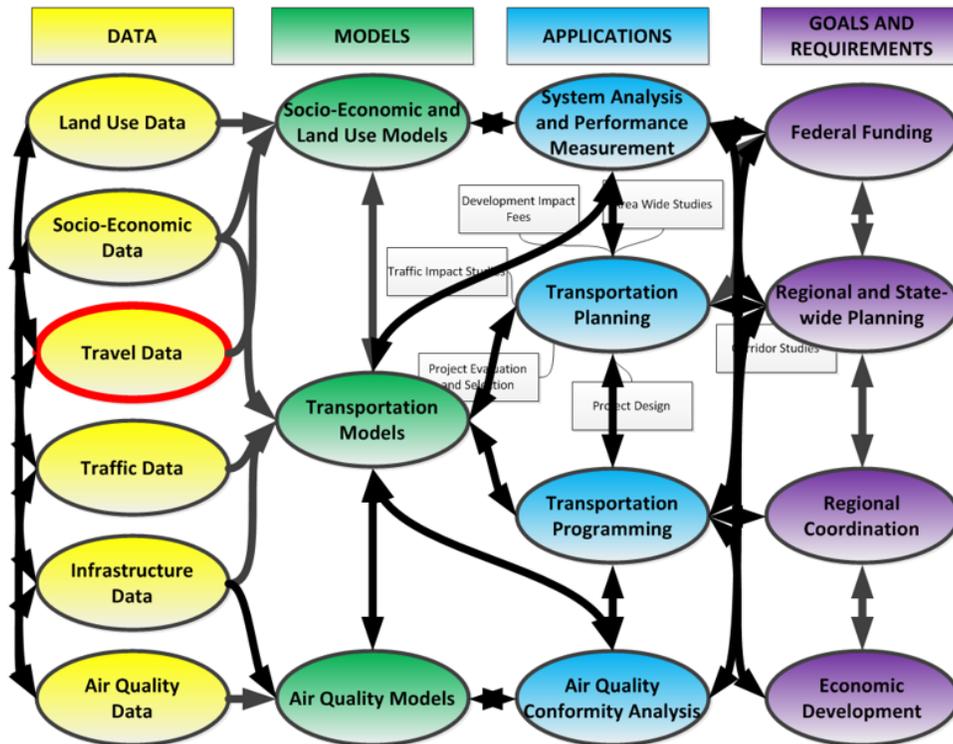
TRANSPORTATION DEMAND OF PERSONS AND GOODS

Transportation system analysis and forecasting are critical components in the regional transportation planning process. They lay the foundation for identifying future transportation solutions, evaluating alternatives, and making infrastructure investment decisions. Regional household travel surveys are periodically conducted by MAG to collect information for travel model development and transportation system analysis. As a part of the system analysis, MAG continuously monitors and analyzes travel patterns in the Region. In addition, MAG develops and maintains state-of-the-practice and state-of-the-art transportation demand modeling tools.

Transportation Data Collection and Transportation Modeling

Transportation system analysis and forecasting rely on an extensive set of data and modeling tools designed and developed to evaluate current trends and project future conditions of the regional transportation system. Transportation data sets and modeling tools are used to develop future year projections and evaluate current travel patterns. Observed transportation data is the foundation of transportation models, which develop quantitative projections of future demand for moving people and goods on the regional road and transit networks. Figure 7-1 depicts the relationships among data sources, modeling tools, and transportation planning applications.

**FIGURE 7-1
TRANSPORTATION DATA, MODELING AND PLANNING RELATIONSHIPS**

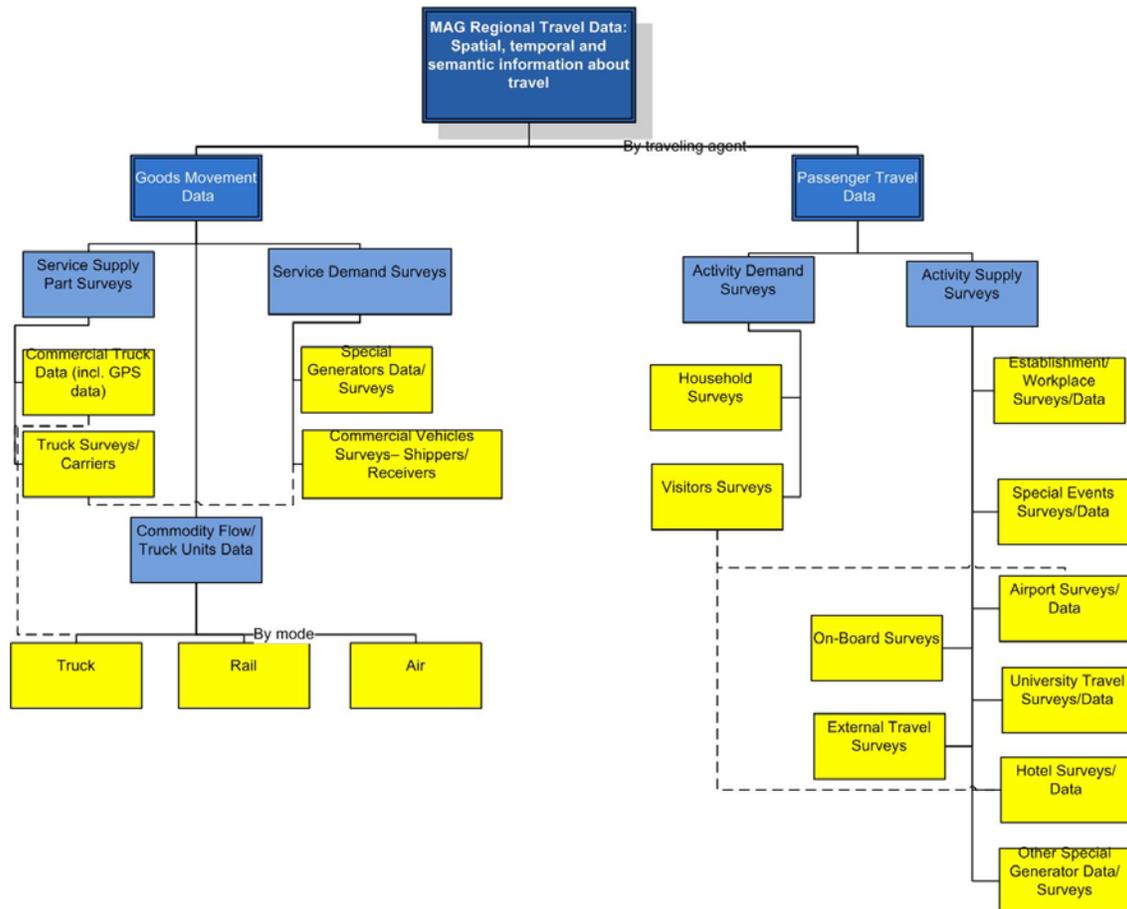


Transportation Data Collection

The major data sets that are currently utilized in the system analysis and forecasting process can be classified as: travel data, traffic data, infrastructure data, and other modeling inputs.

- Travel Data** - Travel data includes passenger travel and goods movement data. Passenger travel data is temporal and spatial information about people's travel, including trip purpose, trip origins and destinations, how trips are linked together, mode of travel, time of travel, and other travel characteristics. Travel information characterizes travel demand in the Region for both passenger and goods movement. Travel information is complemented by socioeconomic characteristics of travelers, such as household composition, car ownership, age, income, employment status, and number of workers. Economic data about establishments is collected and includes industry classification, size, location, and other characteristics. Simultaneous collection of socioeconomic and travel data during travel surveys is necessary for the development of regional travel demand forecasting models. These models estimate travel of different socioeconomic groups and travel demand generated by different types of establishments.

**FIGURE 7-2
TRAVEL DATA SOURCES**



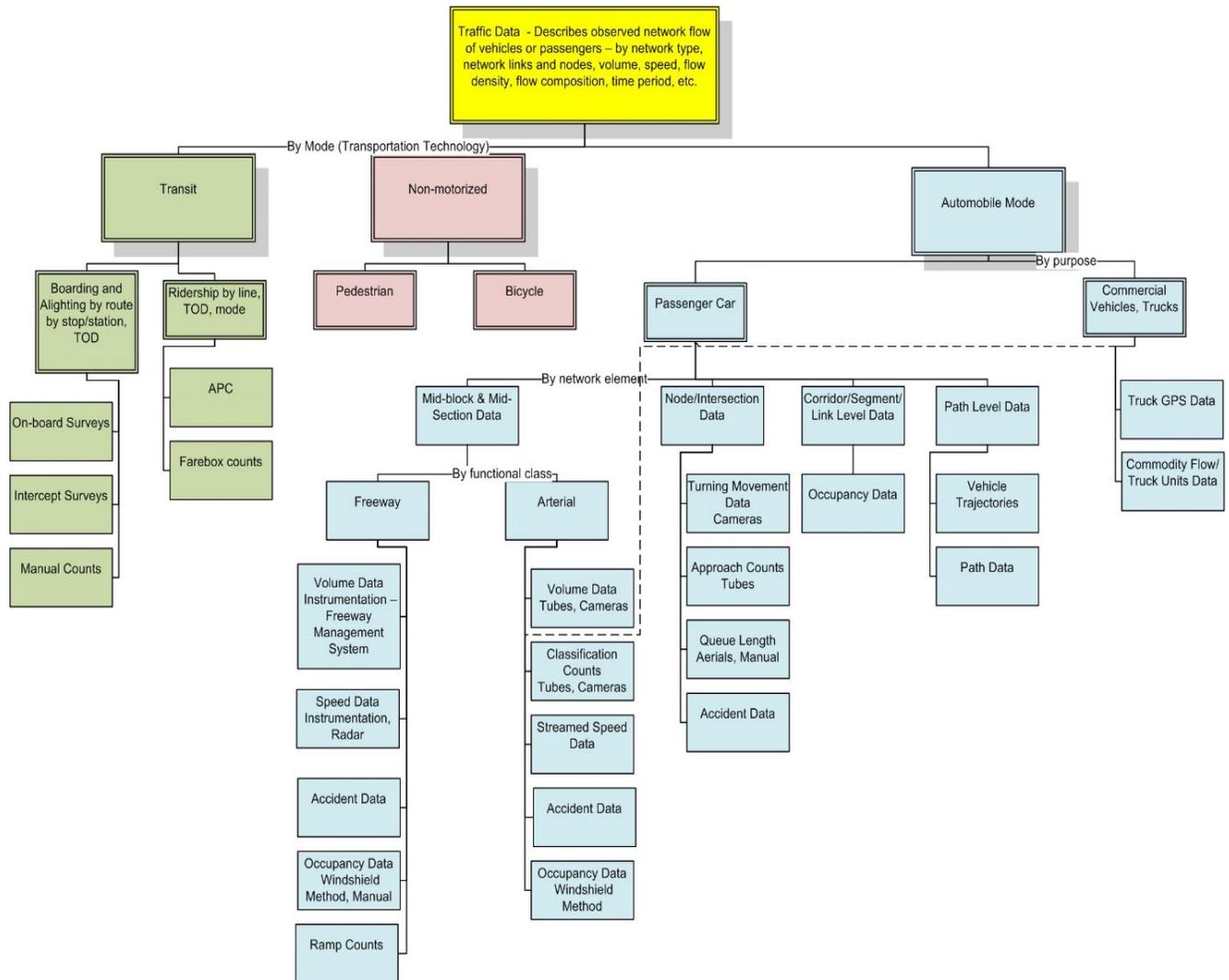
MAG acquires and collects travel data from a variety of sources (Figure 7-2). Regional household travel surveys are conducted to collect information for travel model development and transportation system analysis. Household travel surveys collect data about passenger travel, such as trips to work, shopping, and other purposes.

MAG completed the 2016-2017 Household Travel Survey with innovative technologies. The survey is based on a 100 percent Global Positioning System (GPS) sample collected through a smart phone application or GPS logger. Parallel to the household travel survey, a Regional Establishment Survey was conducted. The surveys were conducted at the same time to facilitate the development of advanced travel demand forecasting models. Truck GPS-based data collections were part of the establishment survey and complimented commercial truck GPS data purchases. MAG investigates opportunities to increase efficiency of data collection processes and reduce associated costs as new travel datasets become commercially available. In 2019, MAG purchased origin-destination travel data, which was used to develop and update external travel models. The data was a fraction of previous costs, when external travel data had to be collected through field surveys. MAG is currently conducting a regional Special Events Survey to update the 2009 Special Events Survey Data. The survey is important for regional transit planning and forecasting, as well as economic development requests for the member agencies.

- Traffic Data - Traffic data provides information about vehicles or passenger flows in relation to network characteristics, such as facility type, time periods, and trip end locations. Key traffic data characteristics include: speed data, classification and volume counts, truck GPS datasets, vehicle traces and trajectories, turning movements, queue lengths, bottleneck information, and traffic flow. Traffic data can be linked to safety data or meteorological data and include records of accidents linked to specific network elements. MAG traffic data is compiled into databases. The main components of traffic data are reflected in Figure 7-3. Similar to travel data, surveys that collect traffic data are increasingly replaced by data acquisitions from commercial data providers. For example, commercial speed data and travel time data replaced individual travel time and speed studies. These "big data" sources often provide larger samples of data, with better quality and at a reduced cost compared to previous transportation studies.

Region-wide traffic data recently collected includes: regional traffic counts in 2018-2019, regional traffic volume and classification screen line counts in 2018-2019, purchases of regional speed data from commercial sources under Arizona Department of Transportation (ADOT) licenses, and truck GPS data. MAG purchases or acquires speed data on an annual basis and utilizes the National Performance Management Research Data Set made available to metropolitan planning organizations (MPOs), by the Federal Highway Administration (FHWA), and ADOT data made available to state MPOs. Traffic counts taken by MAG member agencies were processed and used in the count database and count maps. There are over 30,000 traffic counts in the MAG traffic counts data portal. MAG traffic counts data is publicly available at www.magtrans.org. Distribution of some data is limited by corresponding data license agreements with the vendors.

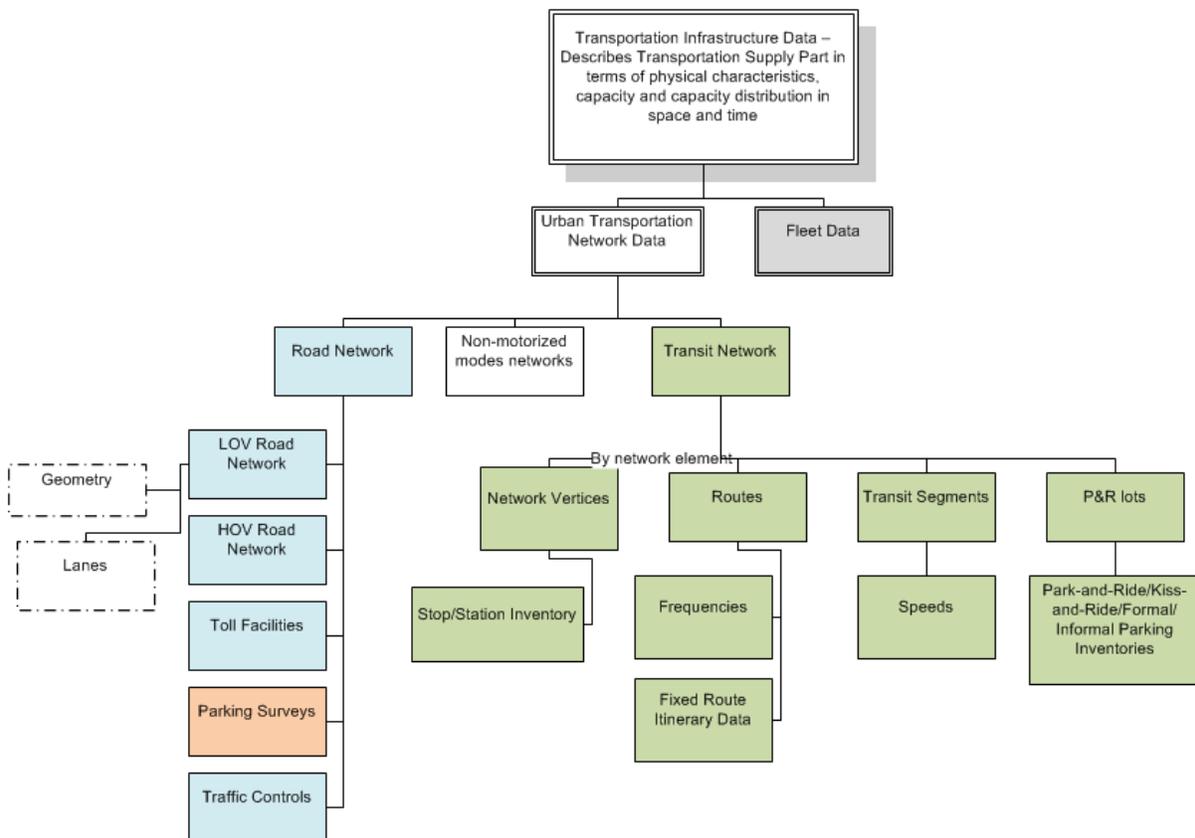
**FIGURE 7-3
TRAFFIC DATA SOURCES**



MAG periodically conducts regional bottleneck studies that identify, rank, and analyze traffic bottlenecks. The information is used at the micro-level to plan specific corridor improvements and at the macro-level to provide broad quantitative datasets for large regional planning studies. Results of the 2015-2016 Regional Bottleneck Study are publicly available through an interactive web portal on the MAG website. The study used speed data and unique aerial photography data collection techniques that allowed the processing of ground truth information about individual vehicle trajectories. This information is a key source for traffic operational improvements and calibration of MAG traffic microsimulation models. Detailed reports of completed traffic studies are available from the MAG website. MAG is investigating opportunities to collect bottleneck data with emerging innovative technologies.

- Infrastructure Data** - Infrastructure data for the MAG Region includes descriptions of: road systems, transit networks, bicycle routes, street intersections, freeway interchanges, and other network elements. MAG collects and manages information about road and transit facilities of regional significance. Network information, including current network conditions and future projects, is stored in databases (Figure 7-4). A TransCAD geodatabase provides detailed information about freeways and arterial roads, and various network elements and attributes. TransCAD transportation modeling networks detail information about intersections, road and transit segments, area type, facility type, network topology, number of lanes, transit route itineraries and frequencies, and other network characteristics.

**FIGURE 7-4
TRANSPORTATION INFRASTRUCTURE DATA**



- Other Modeling Inputs** - Other important inputs to the transportation modeling and forecasting process include:

Socioeconomic Data: Socioeconomic data provides information about social, demographic, and economic characteristics of the regional population and businesses. Some of the data is collected during travel surveys, while other datasets are acquired from governmental and private data-providers. Projections of socioeconomic data on

various geographic levels are a primary input into travel demand forecasting. These projections are developed at MAG using socioeconomic models maintained in-house. Population data include information about residential, transient, and seasonal populations, as well as household and personal level information for base and future years. Business and establishment data include economic characteristics, such as industry type and size. Socioeconomic information is collected from a variety of sources, including commercially available databases, data from various governmental resources, information from surveys, and statistics.

Land Use Data: Land use data is another important data input for transportation modeling. The data includes information about land use types at different levels of geography, such as residential, commercial, industrial, recreational, agricultural, and other land use characteristics. Land use data is regularly collected from local jurisdictions, the County Assessor's files, and other data sources.

Air Quality Data: Air quality data (e.g., meteorological and emissions data) are used for air quality modeling. Transportation models also provide inputs for air quality models. Air quality data and modeling are critical components of the air quality conformity process.

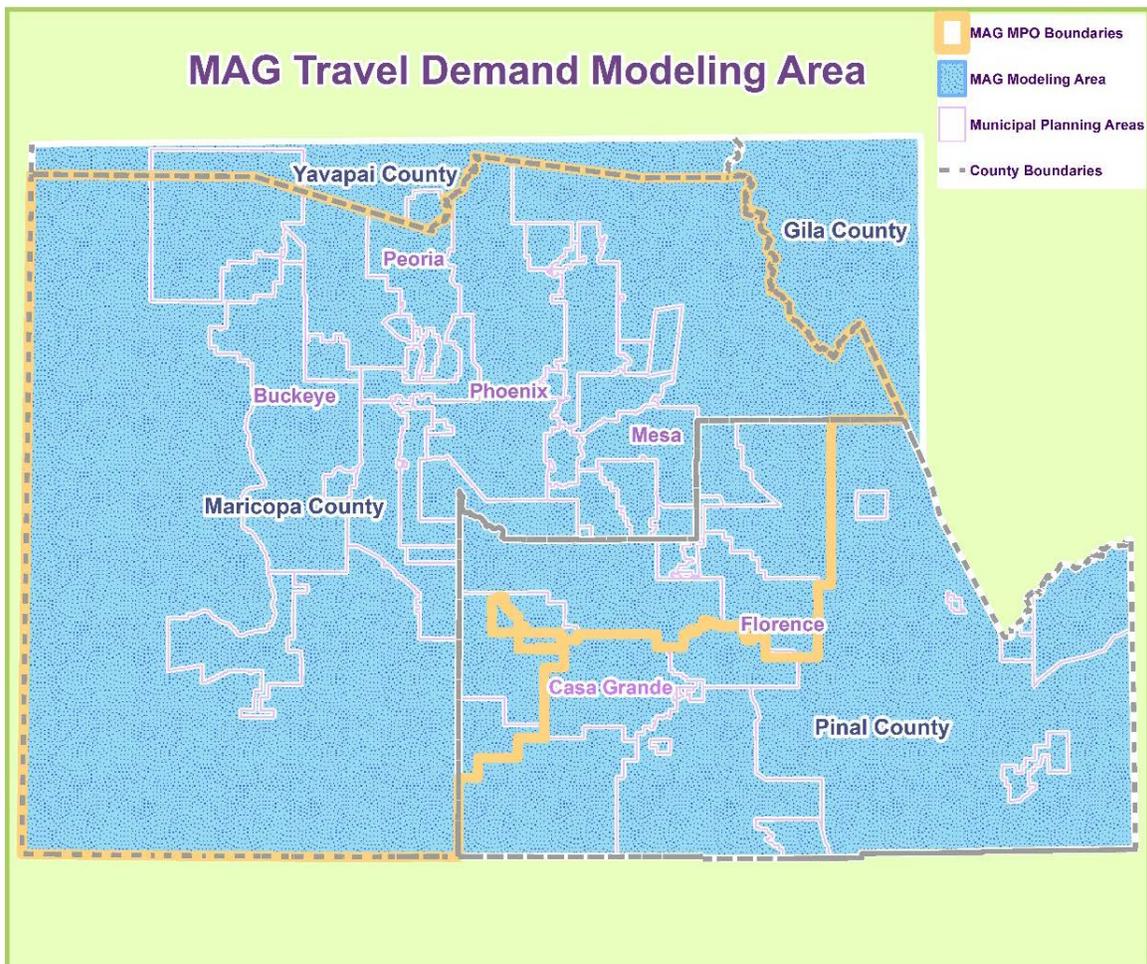
Transportation Modeling

MAG develops and maintains state-of-the-practice and state-of-the-art modeling tools. Large-scale models include:

- Regional four-step trip-based transportation forecasting model
- Regional activity-based model
- Regional microsimulation model
- Mega-regional behavioral agent-based freight model
- Truck models
- Special events model
- Other specialized modeling tools

Each modeling tool has a range of applications to the regional transportation planning process. The MAG regional travel demand forecasting model incorporates an area of 16,080 square miles (Figure 7-5), including Maricopa and Pinal counties and portions of Gila and Yavapai counties. For travel demand modeling, the base year estimates and future year projections of population, employment, and land use require spatial allocation to smaller geographical areas within the modeling area. This permits the modeling of trip origins and destinations throughout the planning area. The movement of goods in the MAG Region plays a vital role in the local, regional, and state economy. MAG established significant freight modeling capabilities and has purchased and developed data sets to assist regional freight planning efforts.

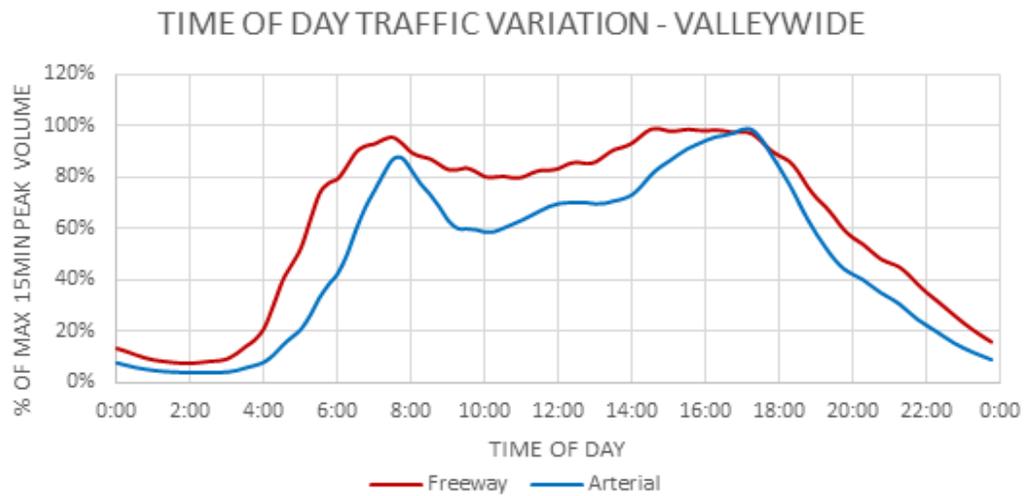
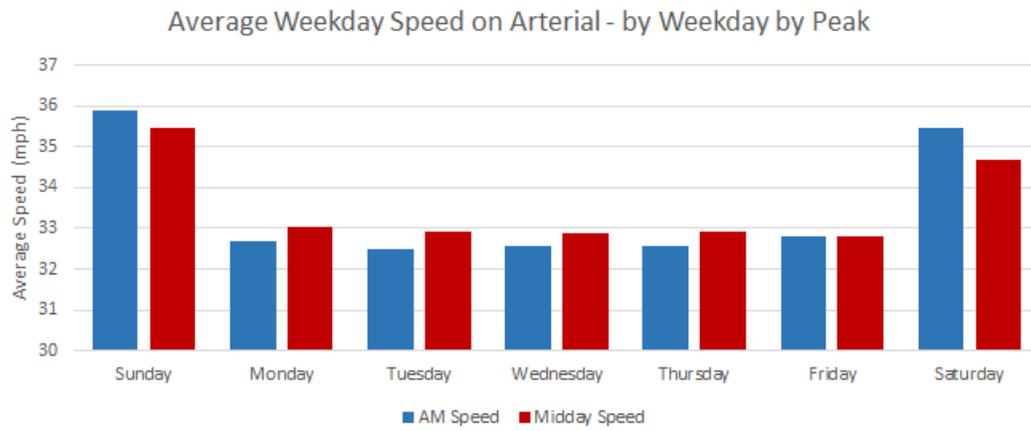
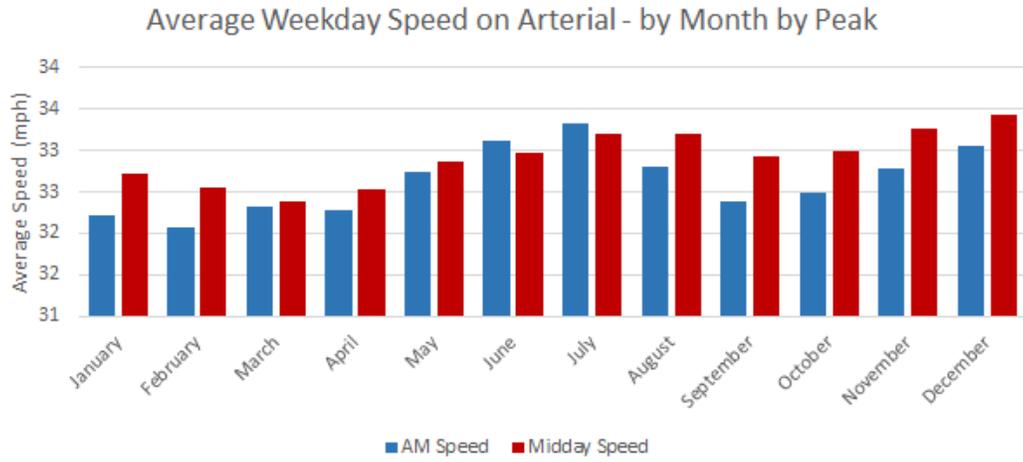
**FIGURE 7-5
MAG REGIONAL MODELING AREA**



The regional four-step transportation forecasting model estimates traffic volumes and speeds for four different time periods, including: morning peak period, mid-day, afternoon peak period, and night. Estimates cover five different vehicle classes: high and low occupancy passenger vehicles, as well as light, medium, and heavy trucks. The activity-based travel demand forecasting model is capable of producing traffic demand projections on a continuous timeline. The modeling networks maintained at MAG represent freeway and major arterial roads. The forecasting model output contains projections of link-level traffic volumes, with links one-half to one mile in length. Models estimate the future level of service (LOS) on the regional network.

New transportation technologies can significantly, if not drastically, alter transportation supply and demand. New technologies in both passenger and freight transportation, such as autonomous vehicles and ridesharing, are positioned to change the ways people and goods move in the future. MAG is working on developing tools and methods to facilitate planning efforts to address these changes. The MAG activity-based travel demand forecasting model and

**FIGURE 7-6
TEMPORAL TRAVEL PATTERNS - 2018**



agent-based freight model are major tools for developing and quantifying planning scenarios that could not be adequately evaluated with the previous generation of forecasting tools and methods. MAG developed an innovative tool to model advanced autonomous vehicles scenarios. MAG models are nationally recognized in professional publications and presentations, and the travel demand forecasting models have gone through rigorous peer review processes.

Current Travel Patterns and Travel Forecasts

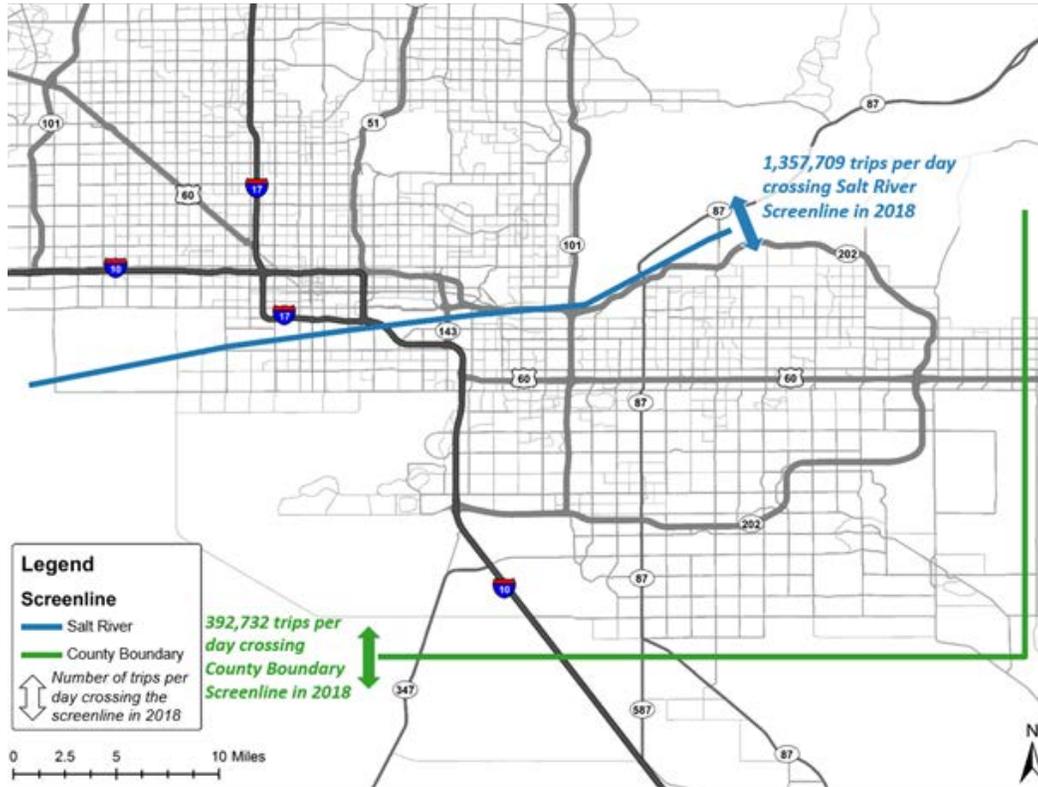
MAG continuously monitors and analyzes travel patterns in the Region. Forecasts of future person trips and goods movement, based on the latest socioeconomic projections, are developed and updated on a regular basis. This data on current travel patterns and future travel demand is critical for understanding trends in the MAG Region and provides a foundation for the regional transportation planning process.

Current Travel Patterns

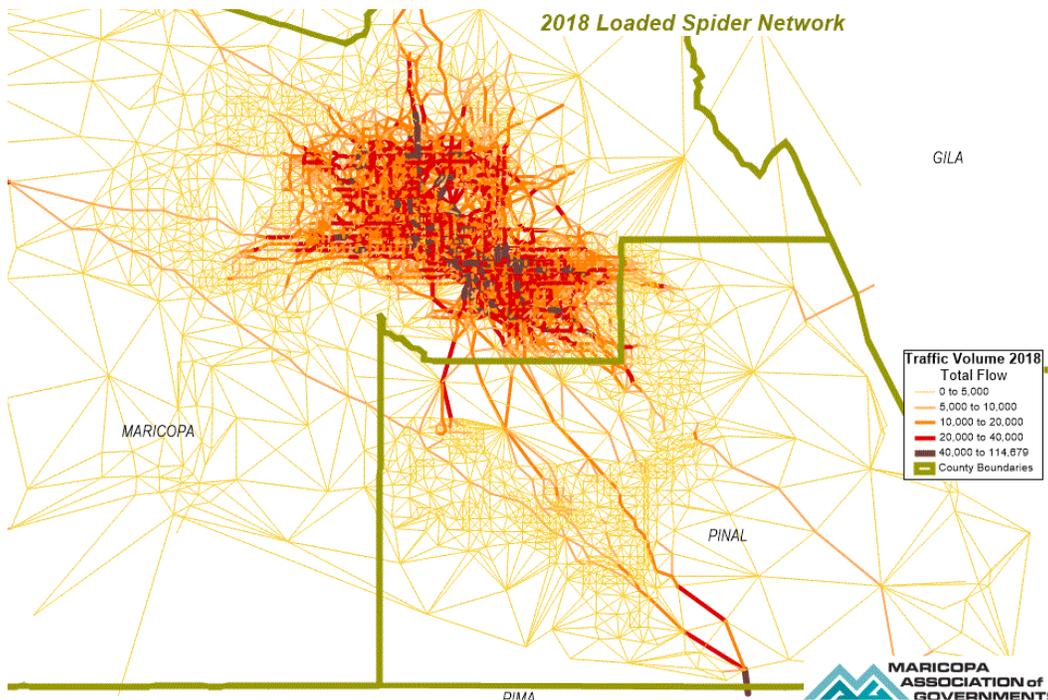
Analysis of current travel patterns is based on the observed data described in previous sections. Temporal, spatial, and semantic aspects of travel trends and characteristics are compared with outputs from MAG models to ensure strict validation procedures and improve the accuracy of the regional travel forecast.

- Temporal Travel Patterns - Seasonal, daily, and weekly traffic patterns are distinctive in large urbanized areas (Figure 7-6). Seasonal trends in the MAG Region manifest in reduced traffic volumes during hot summer months when schools are closed, resulting in higher traffic speeds. Weekly trends indicate traffic peaks on weekdays, with the highest average speeds on Saturday and Sunday. Daily temporal trends and patterns in traffic volumes reveal morning and afternoon peak periods characteristic of large growing regions. The afternoon peak has become more pronounced and increased in duration, a typical phenomenon in large regions. This is likely due to a broader range of trip purposes and departure times compared to the morning peak period. Both arterial and freeway regional traffic patterns exhibit similar time of day patterns.
- Spatial Travel Patterns – The spatial distribution of regional travel is monitored by traffic count stations along major screen lines or imaginary lines that monitor traffic movements between sub-areas. Figure 7-7 shows some major screen lines indicating large traffic volumes moving between Maricopa and Pinal counties, and from the Southeast Valley to the other parts of the Region. More detailed analysis of the spatial distribution of regional travel is conducted with the activity-based model and travel survey data to identify regional patterns by trip purpose, time of day, and mode of travel. Travel demand and average spatial travel demand patterns are analyzed with modeling tools. “Spider networks” show the size and direction of desired travel from origin to destination. Figure 7-8 displays 2018 travel demand patterns.

**FIGURE 7-7
SPATIAL TRAVEL PATTERNS IN THE MAG REGION - 2018**



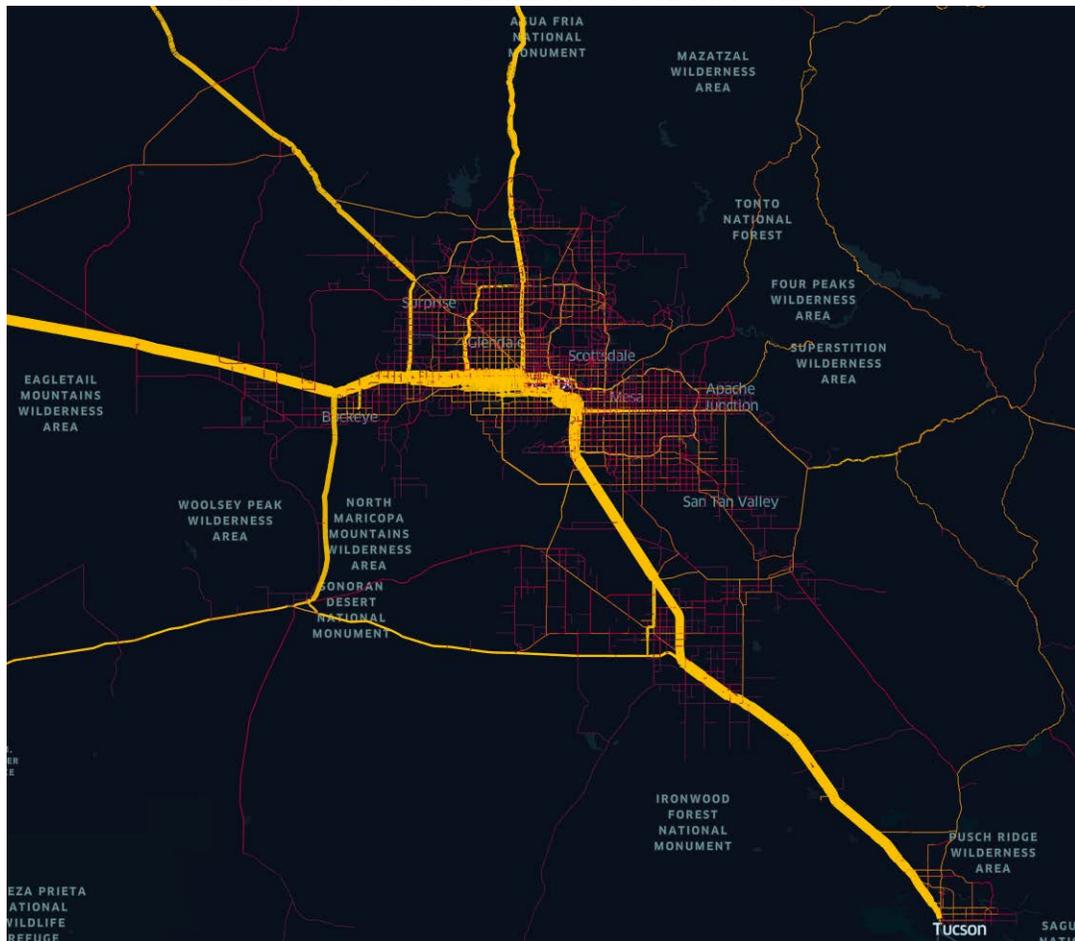
**FIGURE 7-8
REGIONAL VEHICLE TRAVEL DEMAND PATTERNS – 2018**



- Goods Movement - MAG completed several freight planning projects, including the 2018 MAG Freight Plan and the Strategic Highway Research Plan (SHRP2) Freight model for the Region and the Arizona Sun Corridor. The MAG truck model was updated, recalibrated, and improved in 2019. As part of the freight planning projects and modeling requirements, MAG purchased and developed data sets to assist in transportation planning and regional freight planning efforts.

Regional freight clusters were analyzed to identify critical urban freight corridors for heavy, medium, and light trucks. As part of the freight planning process, MAG staff analyzed this data to identify freight corridors that provide access between existing freight clusters and national intercity corridors. As shown in Figure 7-9, commercial vehicle truck GPS data from the American Transportation Research Institute (ATRI) illustrates major truck corridors, or the national highway freight network, in the Arizona Sun Corridor. This data identifies critical urban and rural freight corridors that will connect to the national highway freight network, developing the MAG freight network.

**FIGURE 7-9
HEAVY TRUCK MOVEMENT IN THE MAG REGION**



Travel Forecasts

Forecasts of future travel demand are essential to the transportation planning process, and guide decision-making on needs for operational and capital improvements to transportation infrastructure in the Region. Forecasts of travel on the roadway and transit systems are developed via computer simulations of the future transportation network. These simulations are based on assumptions regarding potential future improvements to the transportation system, projections of future population levels, and other factors such as land use densities and patterns. Computer simulations allow the testing of various network options to determine how future system performance is affected by alternative investment strategies. The data presented below corresponds to transportation facilities and socioeconomic forecasts included in the 2040 Regional Transportation Plan Update. In addition, baseline statistics for 2018 are listed, which serve as the starting point for the forecasting process.

- Roadway Infrastructure** – Transportation modeling networks provide details about network elements including intersections, road and transit segments, area type, facility type, network topology, number of lanes, transit route itineraries and frequencies, and other network characteristics. Aggregate characteristics of the modeled MAG regional network are provided in Table 7-1. These values may differ from on-the-ground measurements and do not represent all road mileage in the Region. In addition, facility types do not correspond directly to federal functional classification systems. However, the data represents the nature of the roadway system in the MAG Region. As indicated below, the total number of roadway lane miles in the Region will increase by 40 percent from 2018 to 2040, while the split among facility types remains relatively constant.

**TABLE 7-1
ROADWAY SYSTEM MODELING NETWORK - LANE MILES**

Facility Type	Year									
	2018	%	2020	%	2025	%	2035	%	2040	%
Freeway (1)	3,143	17.0	3,352	17.7	3,539	16.0	4,010	16.0	4,194	16.2
HOV (2)	396	2.1	442	2.3	465	2.1	562	2.2	562	2.2
Expressway (3)	802	4.3	797	4.2	866	3.9	913	3.6	968	3.7
Arterial (4)	14,124	76.5	14,329	75.7	17,289	78.0	19,638	78.2	20,149	77.9
Total	18,465	100.	18,919	100.	22,159	100.	25,123	100.	25,873	100.

Notes: (1) Includes: Ramps and Collector-Distributor roads. (2) Includes: HOV-GP connectors. (3) Includes: Parkway. (4) Includes: Collectors, 6-leg arterials and unpaved roads.

- Person Trips** – The forecast of future person trips and goods movement is based on the socioeconomic projections that MAG develops and regularly updates (Chapter 3). The projected growth in population and employment results in growth of travel. This data determines future travel demand and is critical for understanding trends in travel demand patterns. Table 7-2 shows the pattern of future person trips in the Region,

which are projected to increase over 42 percent between 2018 and 2040. The percent of transit trips is forecasted to increase by 29 percent, with a corresponding increase in mode split from 1.4 percent in 2018 to 1.8 percent in 2040. The average auto occupancy rate is anticipated to remain at 1.3 persons per vehicle.

**TABLE 7-2
PERSON TRIPS BY MODE (in thousands)**

Mode	2018	2020	2025	2035	2040
Bus Person Trips	196.4	209.4	239.9	305.8	316.3
Light Rail Person Trips	57.1	66.6	93.4	141.3	154.4
Total Transit Person Trips	253.5	276.0	333.3	447.1	470.7
Total Vehicle Person Trips	15,817.1	16,360.5	17,843.5	20,580.0	22,109.3
Total Person Trips	18,422.6	19,159.6	20,955.2	24,466.7	26,148.7
Mode Split (% Transit)	1.4	1.4	1.6	1.8	1.8
Vehicle Occupancy Rate	1.3	1.3	1.3	1.3	1.3

- Vehicle Miles of Travel - An important measure of travel activity is vehicle miles of travel (VMT). VMT provides a gauge of the vehicle travel demand placed on the Region's roadway facilities and can be aggregated into categories. Table 7-3 shows the anticipated growth in VMT and how it is distributed by facility type. Total VMT is expected to increase by 49 percent between 2018 and 2040, while the share of VMT carried by the freeway system, including high occupancy vehicle (HOV) lanes, remains at approximately 52 percent.

**TABLE 7-3
VEHICLE MILES OF TRAVEL BY FACILITY TYPE (in millions)**

Facility Type	Year									
	2018	%	2020	%	2025	%	2035	%	2040	%
Freeway (1)	40.8	37.2	43.7	38.0	47.7	37.7	58.0	38.2	62.0	37.8
HOV (2)	4.8	4.4	5.1	4.5	5.6	4.4	7.0	4.6	7.2	4.4
Expressway (3)	3.1	2.9	3.2	2.8	3.9	3.1	4.8	3.2	5.2	3.2
Arterial/Local (4)	61.0	55.6	62.8	54.7	69.4	54.8	81.8	54.0	89.4	54.6
Total	109.7	100.0	114.8	100.0	126.6	100.0	151.6	100.0	163.8	100.0
Auto VMT	102.3	93.3	107.1	93.3	118.1	93.3	141.2	93.1	152.2	92.9
Truck VMT (5)	7.4	6.7	7.7	6.7	8.4	6.7	10.4	6.9	11.6	7.1
Total	109.7	100.0	114.8	100.0	126.6	100.0	151.6	100.0	163.8	100.0

(1) Includes: General purpose (GP) lanes, ramps, and collector-distributor roads. (2) Includes: HOV lanes and HOV-GP connectors. (3) Includes: Expressway and Parkway. (4) Includes: Arterials, collectors, 6-leg arterials, unpaved roads, and centroid connectors. (5) Includes: Heavy and medium trucks.

- Freight Demand - Future freight demand, in VMT and truck traffic volumes on road segments, is estimated in MAG truck and freight models. Global Insight Transearch commodity flow data provides commodity flow estimates and served as an input in the development of the MAG behavioral freight model. VMT by trucks is also included in Table 7-3 and forecasted to increase by 57 percent between 2018 and 2040.
- Level of Service - The transportation modeling process estimates future LOS on the regional roadway network. LOS is represented by six levels from A to F, with A being the highest level and F being the lowest. LOS A indicates average speeds at the posted speed limit or higher. LOS F indicates severe congestion, with breakdowns in traffic flow and stop-and-go movement of traffic. Table 7-4 shows the changes in LOS on the Region's roads with and without the 2040 Regional Transportation Plan Update projects coded in the future networks. In 2040, if all planned projects are built, 41.7 percent of VMT will be traveled under LOS A and 7.7 percent under LOS F. Without the planned improvements, VMT under LOS A falls to 28.3 percent and that under LOS F increases to 16.8 percent.

**TABLE 7-4
PERCENT VMT BY LEVEL OF SERVICE - BUILD vs. NO-BUILD**

Year	Build		No-Build	
	LOS A	LOS F	LOS A	LOS F
2018	48.7	5.6	N.A.	N.A.
2020	48.0	5.3	46.1	6.3
2025	47.0	5.7	40.2	8.3
2035	44.0	6.7	31.3	13.8
2040	41.7	7.7	28.3	16.8

CHAPTER EIGHT

FINANCIAL PLAN

The major regional funding sources for the Regional Transportation Plan (RTP) include: (1) a county sales tax for transportation, (2) Arizona Department of Transportation (ADOT) Funds, and (3) MAG Area Federal Transportation Funds. In addition to regional funding sources, the implementation of the RTP is accomplished through local funds and other state revenues. Since local funds and other state revenue sources are generally program-specific, they are identified in the individual modal chapters.

The RTP revenue sources are reasonably available throughout the planning period and have had a long history of funding availability for the RTP in the past. Revenue projections are expressed in “Year of Expenditure” (YOE) dollars, which reflect the actual number of dollars collected each year. In the individual modal chapters that follow, costs are also presented in terms of YOE dollars, which reflect the estimated effects of future price inflation and represent that actual number of dollars expended.

Half-Cent Sales Tax

On November 2, 2004, the voters of Maricopa County passed Proposition 400, which authorized the continuation of the existing half-cent sales tax for transportation in the Region (also known as the *Maricopa County Transportation Excise Tax*). This action provides a 20-year extension of the half-cent sales tax through calendar year 2025 to implement projects and programs identified in the MAG RTP. The previous half-cent sales tax for transportation was approved by the voters of Maricopa County in 1985 through Proposition 300 and expired on December 31, 2005. The current half-cent sales tax extension approved through Proposition 400 went into effect on January 1, 2006.

The revenues collected from the half-cent sales tax are deposited into the Regional Area Road Fund (RARF) and allocated between freeway/highway and arterial street projects; and into the Public Transportation Fund (PTF) for public transit programs and projects. These monies must be applied to projects and programs consistent with the MAG RTP. As specified in ARS 42-6105.E, 56.2 percent of all sales tax collections will be distributed to freeways and highways (RARF); 10.5 percent will be distributed to arterial street improvements (RARF); and 33.3 percent of all collections will be distributed to transit (PTF).

Table 8-1 displays the distribution of projected Maricopa County revenues to the RARF and the PTF, including the sub-allocation of the RARF to freeway/highway and arterial street uses. As displayed in this table, total half-cent revenues from FY 2020 through FY 2040 are projected to be approximately \$17.8 billion (YOE \$'s). Of this total, \$10.0 billion will be allocated to freeway/highway projects; \$1.9 billion to arterial street improvements; and \$5.9 billion to transit projects and programs. These figures assume the renewal starting collections in January 2026.

TABLE 8-1
MARICOPA COUNTY TRANSPORTATION EXCISE TAX: FY 2020-2040
 (Year of Expenditure Dollars in Millions)

Fiscal Year	Regional Area Road Fund (RARF)		Public Transportation Fund (PTF) (33.3%)	Total
	Freeways (56.2%)	Arterial Streets (10.5%)		
2020	279.7	52.3	165.7	497.7
2021	296.3	55.4	175.6	527.3
2022	311.9	58.3	184.8	554.9
2023	327.3	61.1	193.9	582.3
2024	343.9	64.3	203.8	612.0
2025	360.9	67.4	213.8	642.1
2026	378.6	70.7	224.3	673.7
2027	397.2	74.2	235.4	706.8
2028	416.8	77.9	246.9	741.6
2029	437.3	81.7	259.1	778.1
2030	458.8	85.7	271.8	816.3
2031	481.3	89.9	285.2	856.5
2032	505.0	94.4	299.2	898.6
2033	529.8	99.0	313.9	942.8
2034	555.9	103.9	329.4	989.2
2035	583.2	109.0	345.6	1,037.8
2036	611.9	114.3	362.6	1,088.8
2037	642.0	120.0	380.4	1,142.4
2038	673.6	125.9	399.1	1,198.6
2039	706.7	132.0	418.8	1,257.5
2040	741.5	138.5	439.4	1,319.4
Totals	10,039.7	1,875.8	5,948.8	17,864.3

Arizona Department of Transportation Funds

ADOT relies on funding from two primary sources: the Highway User Revenue Fund (HURF) and federal transportation funds. The HURF is comprised of funds from the gasoline and use fuel taxes, a portion of the vehicle license tax, registration fees, and other miscellaneous sources.

ADOT Revenues

Of the total HURF funding, approximately 35 percent comes from the gasoline tax and another 14 percent comes from the sale of diesel fuel. The portion of the Vehicle License Tax (VLT) that flows into the HURF accounts for about 31 percent of the total HURF funds. The remaining 20 percent is derived from registration, motor carrier, and operator license fees. According to the Arizona constitution, HURF funds can only be used on highways and streets; and cannot be used

for transit. For revenue forecasting, total HURF funds were estimated based on projected population and economic growth, assuming no change in tax rates. Total HURF funds were then distributed to ADOT and the other entities based on the current statutory formula and policy.

State statutes provide that 12.6 percent of the HURF funds flowing to ADOT are earmarked for the MAG Region, and the region comprising the Pima Association of Governments (PAG). In addition, the State Transportation Board established a policy that another 2.6 percent of ADOT HURF funds would be allocated to the two regions. These funds are divided into 75 percent for the MAG Region and 25 percent for the PAG Region, and are referred to as "15 Percent Funds." After the deduction of the 15 Percent Funds, ADOT must pay for operations, maintenance, and debt service on outstanding bonds. This includes funds for the Motor Vehicle Division, administration, highway maintenance, and additional funding for Department of Public Safety. The remaining HURF funds are then combined with federal highway funds to provide the basis for the ADOT Highway Construction Program, often referred to as "ADOT Discretionary Funds."

ADOT Funding in the MAG Region

It is projected that a total of \$9.6 billion (YOE \$'s) in ADOT funds will be available for the construction and improvement of freeways and highways in the MAG RTP between FY 2020 and FY 2040. Funding for ADOT expenses for operations and maintenance is drawn from statewide sources and is not included in this estimate.

- 15 Percent Funding - The MAG Region receives annual funding from ADOT in the form of ADOT 15 Percent Funds, which are allocated from the Highway User Revenue Fund (HURF). These funds are spent on improvements on limited access facilities on the State Highway System in the MAG area. The RTP assumes an increase in state gas taxes in 2025. A total of \$3.6 billion is projected to be available from this source (Table 8-2).
- Maricopa County Area ADOT Discretionary Funds - A 37 percent share of ADOT Discretionary Funds is targeted to the Maricopa County area of the MAG Region. Arizona Revised Statute 28-304 C.1 states that the percentage of ADOT discretionary monies allocated to the MAG Region in the RTP shall not increase or decrease unless the State Transportation Board, in cooperation with the regional planning agency, agrees to change the percentage of the discretionary monies. A total of \$6.3 billion is projected to be available from this source (Table 8-2).
- Pinal County Area ADOT Discretionary Funds - A 50 percent share of ADOT Discretionary Funds is targeted to areas other than Maricopa County and Pima County. It is projected that this would amount to \$8.6 billion (YOE \$'s) for the period of FY 2020 - FY 2040. Capital projects on state highways in Pinal County within the MAG MPA are estimated to total \$803.6 million (YOE \$'s), about 8.1 percent of available statewide funding. Reasonably available funding could be identified for these projects and included in the future ADOT Discretionary Funds for the MAG area (Table 8-2.) These projects are not included in the Freeway/Highway Life Cycle Program.

TABLE 8-2
ADOT FUNDING IN MAG AREA: FY 2020-2040
 (Year of Expenditure Dollars in Millions)

Fiscal Year	15% Funds	ADOT Discretionary	Total
2020	89.1	196.5	285.6
2021	92.8	265.4	358.1
2022	95.3	167.3	262.6
2023	98.1	238.3	336.5
2024	101.1	240.1	341.2
2025	155.4	316.4	471.8
2026	159.9	264.3	424.2
2027	164.6	272.2	436.8
2028	169.4	280.4	449.8
2029	174.3	288.8	463.2
2030	179.4	297.5	476.9
2031	184.7	306.4	491.1
2032	190.1	315.6	505.7
2033	195.6	325.1	520.7
2034	201.3	334.8	536.1
2035	207.2	344.9	552.1
2036	213.3	355.2	568.5
2037	219.5	365.9	585.3
2038	225.9	376.8	602.7
2039	232.5	388.1	620.6
2040	239.3	399.8	639.1
Maricopa County	3,588.8	6,339.8	9,928.6
Pinal County	N/A	803.6	803.6
Total	3,588.8	7,206.6	10,732.2

MAG Area Federal Transportation Funds

In addition to the half-cent sales tax revenues and ADOT funding, federal transportation funding sources are available for implementing projects in the MAG RTP. These sources are summarized in Table 8-3 and Table 8-4. It is projected that a total of \$7.4 billion (YOE \$'s) will be available from these sources for projects in the MAG Region between FY 2020 and FY 2040, with approximately \$2.8 billion from Federal Highway Administration (FHWA) sources and \$4.6 billion from Federal Transit Administration (FTA) sources. Arizona is included in the "Sliding Scale Rates in Public Land States" (Notice N 4540.12), in which some federal programs may allow for a higher federal participation rate. Rates notated in the following federal programs may differ based on the FHWA and FTA programs as approved by the oversight agency and are subject to change. Details are noted in the MAG Programming Guidebook.

TABLE 8-3
MAG FHWA TRANSPORTATION FUNDS: FY 2020-2040
 (Year of Expenditure Dollars in Millions)

FY	HSIP	Transp. Alt.	STP			CMAQ					Grand Total	
			Fwy./ Hwy.	Art. Pgm.	Total	SM+O Pgm.	Art. & ITS	Transit Pgm.	Bike/ Ped.	Air Qual.		Total
2020	0.0	5.0	0.0	53.6	53.6	9.9	6.9	18.5	8.8	7.5	51.6	110.2
2021	0.0	5.1	0.0	54.6	54.6	10.0	7.0	18.9	8.9	7.7	52.5	112.2
2022	0.0	5.1	0.0	55.3	55.3	10.2	7.1	19.1	9.1	7.8	53.3	113.7
2023	0.0	5.2	0.0	56.2	56.2	10.4	7.3	19.6	9.3	8.0	54.5	115.9
2024	0.0	5.3	0.0	57.4	57.4	10.6	7.4	19.9	9.4	8.1	55.4	118.1
2025	0.0	5.4	0.0	58.5	58.5	10.8	7.6	20.3	9.6	8.2	56.5	120.4
2026	0.0	5.5	0.0	59.6	59.6	11.0	7.7	20.7	9.8	8.4	57.6	122.7
2027	0.0	5.6	0.0	60.8	60.8	11.2	7.9	21.1	10.0	8.6	58.7	125.1
2028	0.0	5.7	0.0	61.9	61.9	11.4	8.0	21.5	10.2	8.7	59.8	127.5
2029	0.0	5.8	0.0	63.1	63.1	11.6	8.2	21.9	10.4	8.9	61.0	129.9
2030	0.0	6.0	0.0	64.3	64.3	11.9	8.3	22.3	10.6	9.1	62.1	132.4
2031	0.0	6.1	0.0	65.6	65.6	12.1	8.5	22.7	10.8	9.2	63.3	135.0
2032	0.0	6.2	0.0	66.8	66.8	12.3	8.6	23.2	11.0	9.4	64.5	137.5
2033	0.0	6.3	0.0	68.1	68.1	12.6	8.8	23.6	11.2	9.6	65.8	140.2
2034	0.0	6.4	0.0	69.4	69.4	12.8	9.0	24.1	11.4	9.8	67.0	142.9
2035	0.0	6.5	0.0	70.8	70.8	13.0	9.2	24.5	11.6	10.0	68.3	145.6
2036	0.0	6.7	0.0	72.1	72.1	13.3	9.3	25.0	11.8	10.2	69.6	148.4
2037	0.0	6.8	0.0	73.5	73.5	13.6	9.5	25.5	12.1	10.4	71.0	151.2
2038	0.0	6.9	0.0	74.9	74.9	13.8	9.7	26.0	12.3	10.6	72.3	154.1
2039	0.0	7.1	0.0	76.3	76.3	14.1	9.9	26.5	12.5	10.8	73.7	157.1
2040	0.0	7.2	0.0	77.8	77.8	14.3	10.1	27.0	12.8	11.0	75.1	160.1
Total	0.0	126.0	0.0	1,360.8	1,360.8	250.9	176.0	471.6	223.3	191.8	1,313.7	2,800.4

Federal Highway Administration Funding

The FHWA is an agency in the U.S. Department of Transportation that supports state and local governments in the design, construction, and maintenance of the Nation’s highway system (Federal Aid Highway Program), and federally and tribal owned lands (Federal Lands Highway Program). FHWA’s role in the Federal-aid Highway Program is to oversee federal funds used for constructing and maintaining the National Highway System (e.g., Interstate Highways, U.S. Routes, and State Routes). This funding mostly comes from the federal gasoline tax. FHWA oversees projects using these funds to ensure that federal requirements for project eligibility, contract administration, and construction standards are adhered to. The FHWA funding programs applicable to the MAG Region are described below.

- Federal Highway (MAG STBGP) Funds - MAG Surface Transportation Block Grant Program (STBGP) funds are the most flexible federal transportation funds and may be used for highways, transit, or streets. The statutory match for STP program funding is 94.3 percent federal, 5.7 percent local. Approximately \$1.4 billion (YOE \$’s) will be available from STP funds for projects during the period from FY 2020 through FY 2040.

TABLE 8-4
MAG FTA TRANSPORTATION FUNDS: FY 2018-2040
 (Year of Expenditure Dollars in Millions)

FY	5307/ 5340	5310	5337			5339	STP- AZ	5309 New Strt.	AVN- GDYR & State	Grand Total
			FGM	Hi Bus	Total					
2020	57.5	3.3	4.2	4.2	8.3	6.4	3.0	150.0	6.4	235.0
2021	58.5	3.4	4.2	4.2	8.5	6.5	3.0	150.0	5.9	235.8
2022	59.5	3.5	4.3	4.3	8.6	6.6	3.0	150.0	6.0	237.2
2023	61.3	3.5	4.4	4.1	8.5	5.7	3.0	148.3	5.0	235.3
2024	63.1	3.6	5.7	4.2	10.0	5.8	3.0	80.0	5.1	170.6
2025	65.0	3.7	5.8	4.4	10.2	6.0	3.0	50.0	5.1	143.0
2026	66.9	3.7	5.9	4.5	10.4	6.2	3.0	0.0	5.2	95.5
2027	68.9	3.8	6.4	4.6	11.0	6.4	3.0	100.0	5.3	198.4
2028	71.0	3.9	6.5	4.8	11.3	6.6	3.0	100.0	5.3	201.0
2029	73.1	3.9	6.6	4.9	11.5	6.8	3.0	100.0	5.4	203.7
2030	75.3	4.0	7.3	5.1	12.3	7.0	3.0	100.0	5.5	207.1
2031	77.5	4.1	7.4	5.2	12.6	7.2	3.0	40.9	5.5	150.8
2032	79.8	4.2	7.6	5.4	12.9	7.4	3.0	0.0	5.6	112.9
2033	82.2	4.3	9.2	5.5	14.8	7.6	3.0	0.0	5.7	117.5
2034	84.6	4.3	9.4	5.7	15.1	7.9	3.0	0.0	5.8	120.7
2035	87.1	4.4	9.6	5.9	15.4	8.1	3.0	200.0	5.8	323.9
2036	89.7	4.5	9.8	6.0	15.8	8.3	3.0	200.0	5.9	327.3
2037	92.4	4.6	9.9	6.2	16.2	8.6	3.0	200.0	6.0	330.7
2038	95.1	4.7	10.1	6.4	16.5	8.8	3.0	200.0	6.1	334.3
2039	98.0	4.8	10.3	6.6	16.9	9.1	3.0	200.0	6.2	337.9
2040	100.9	4.9	10.5	6.8	17.3	9.4	3.0	145.8	6.3	287.5
Total	1607.5	85.1	155.1	109.1	264.3	152.4	62.8	2,315.0	119.0	4,606.0

* CMAQ funding "flexed" to transit shown in Table 8-3.

- Federal Highway (MAG CMAQ) Funds - MAG Congestion Mitigation and Air Quality (CMAQ) funds are available for projects that improve air quality in areas that do not meet clean air standards ("non-attainment" areas). Projects may include a variety of highway, transit, and alternate modes that contribute to improved air quality. Due to the high congestion levels and air quality issues in the Region, MAG receives the major share of CMAQ funds for Arizona. The statutory match for STP CMAQ program funding is 94.3 percent federal, 5.7 percent local. Approximately \$1.34 billion will be available from CMAQ funds for projects during the period from FY 2020 through FY 2040.
- Federal Highway (HSIP) Funds - The Highway Safety Improvement Program is a Federal-aid program aimed at significant reduction in fatalities and serious injuries on all public roads, including non-state-owned public roads. Projects are intended to correct or improve a hazardous road location, feature, or address a highway safety problem.

Eligibility of specific projects, strategies, and activities are based on consistency with a state's strategic highway safety plan and data-supported safety performance compliance. The federal share for highway safety improvement projects is 90 percent. ADOT distributes HSIP funding to jurisdictions throughout the state project-by-project.

- Federal Highway Transportation Alternatives Funds - The Transportation Alternatives Program (TAP) provides funding for programs and projects defined as transportation alternatives, including on- and off-road pedestrian and bicycle facilities; infrastructure projects for improving non-driver access to public transportation and enhanced mobility; community improvement activities and environmental mitigation; recreational trail program projects; safe routes to school projects; and projects for the planning, design or construction of boulevards and other roadways in the right of way of former Interstate System routes or other divided highways. The federal share for TAP projects in Arizona is 94.3 percent federal, 5.7 percent local. This funding source is expected to generate \$126 million for transportation alternatives projects from FY 2020 through FY 2040.

Federal Transit Administration Funding

The FTA is an agency within the United States Department of Transportation that provides financial and technical assistance to local public transit systems. The federal government, through the FTA, provides financial assistance to develop new transit systems and improve, maintain, and operate existing systems. The FTA oversees grants to state and local transit providers, primarily through its 10 regional offices. Grants are managed by the "governor-approved" Designated Recipient of FTA funds. These grantees are responsible for managing their programs in accordance with federal requirements, and the FTA is responsible for ensuring that grantees follow federal mandates along with statutory and administrative requirements. The FTA funding programs applicable to the MAG area are described below.

- Federal Transit (5307/5340) Funds - The Urbanized Area (UZA) Formula Funding program (5307/5340) provides funding to UZAs for public transportation capital, planning, job access and reverse commute projects, as well as operating expenses in certain circumstances. This funding source is expected to generate \$1.6 billion for transit development from FY 2020 through FY 2040. These funds constitute a core investment in the enhancement and revitalization of public transportation systems in UZAs, which depend on public transportation to improve mobility and reduce congestion. Recipients must expend one percent for transportation security projects or certify that it is not necessary. Under the FAST Act, operating costs are eligible up to certain limits, for grantees in areas with populations greater than 200,000 and that operate a maximum of 100 buses in fixed-route service during peak hours (rail fixed guideway excluded). Transit enhancements are removed and replaced by "associated transportation improvements", where recipients must expend at least one percent of their 5307 apportionment on these improvements. Funding provided by other government agencies or departments that are eligible to be expended on transportation may be used as a local match. Certain

expenditures by vanpool operators may be used as local match. The transfer of 5307 transit funds to highway projects is not allowed under the FAST Act.

- Avondale-Goodyear/UZA Funds - These funds are part of the 5307 category. They are distributed to the designated recipient for small UZAs to provide general transit services and capital improvements, specifically for that area. This funding source is expected to generate \$119 million for transit development from FY 2020 through FY 2040.
- Federal Transit (5309) Funds - Transit 5309 funds are available through discretionary grants from the FTA, and applications are on a competitive basis. They include grants for new and expanded rail, bus rapid transit, and ferry systems that reflect local priorities to improve transportation options in key corridors. This program defines a new category of eligible projects, known as core capacity projects, which expand capacity by at least 10 percent in existing fixed-guideway transit corridors that are already at or above capacity today or are expected to be at or above capacity within five years. The program also includes provisions for streamlining aspects of the “New Starts” process to increase efficiency and reduce the time required to meet critical milestones. This discretionary program requires project sponsors to undergo a multi-step, multi-year process to be eligible for funding. Over the planning horizon, it is estimated that \$2.3 billion in 5309 funds for bus and rail transit projects will be made available to the MAG Region.
- Federal Transit (5310) Funds - This program is intended to enhance mobility for seniors and persons with disabilities. It provides funds for programs to serve the special needs of transit-dependent populations beyond traditional public transportation services and Americans with Disabilities Act (ADA) complementary paratransit services. The Federal share of eligible capital costs may not exceed 80 percent of the net cost of the activity. At least 55 percent of program funds must be used on capital projects that are public transportation projects planned, designed, and carried out to meet the special needs of seniors and individuals with disabilities when public transportation is insufficient, inappropriate, or unavailable. The remaining 45 percent may be used for public transportation projects that: (1) exceed the requirements of the ADA, (2) improve access to fixed-route service and decrease reliance by individuals with disabilities on complementary paratransit, or (3) provide alternatives to public transportation that assist seniors and individuals with disabilities. In addition, operating assistance is available under this program. The Avondale-Goodyear UZA and rural portions of the MAG planning region apply through a statewide competitive process with ADOT. Also, the Phoenix-Mesa UZA receives an annual funding allocation for which projects competitively apply. This funding source is expected to generate \$85 million for transit development from FY 2020 through FY 2040.
- Federal Transit (5337) Funds - This is a formula-based, “State of Good Repair” program dedicated to repairing and upgrading the nation’s rail transit systems along with high-intensity motor bus systems that use high-occupancy vehicle (HOV) lanes, including bus rapid transit. Projects are limited to replacement and rehabilitation or capital projects

required to maintain public transportation systems in a state of good repair. The federal share is 80 percent with a required 20 percent match. The program comprises two separate formula programs: High Intensity Fixed Guideway and High Intensity Motorbus. High-intensity motorbus is defined as public transportation that shares lanes with other HOV vehicles. Projects are limited to replacement, rehabilitation, and capital projects required to maintain public transportation systems in a state of good repair. Projects must be included in a Transit Asset Management Plan. This funding source is expected to generate \$264 million for transit development from FY 2020 through FY 2040.

- Federal Transit (5339) Funds - The objective of this “Bus and Bus Facilities Program” program is to provide capital funding to replace, rehabilitate and purchase buses and related equipment and to construct bus-related facilities. The Federal share is 80 percent with a required 20 percent local match. Under the FAST Act, funds are eligible to be transferred by the state to supplement urban and rural formula grant programs (5307 and 5311, respectively). This funding source is expected to generate \$152 million for transit development from FY 2020 through FY 2040.
- STP-AZ Funds - These are (STP) Flexible Funds ADOT makes available for transit purposes in urban and rural Arizona. Upon transfer from FHWA, these funds are made available by FTA to the designated recipients and applied for through grants for applicants that operate general public transit and/or elderly/disabled transit systems. These funds are expected to generate \$63 million for transit development from FY 2020 through FY 2040.

Regional Revenue Summary

Regional revenue sources for the MAG RTP between FY 2020 and FY 2040 are summarized in Table 8-5 (in YOE \$'s). They include: the Proposition 400 half-cent sales tax extension (\$17.8 billion); ADOT funds (\$10.6 billion); Federal Transit funds (\$4.6 billion); Federal Highway Surface Transportation Block Grant Program (STBGP) funds (\$1.4 billion); Federal Highway Congestion Mitigation and Air Quality (CMAQ) funds (\$1.3 billion); and other Federal Highway Funding (\$126 million). The total of all these revenue sources is projected to amount to \$34.8 billion between FY 2020 and FY 2040.

Table 8-5 indicates the distribution of regional revenues among the transportation modes and programs covered by the RTP. This funding is consistent with the allocation of revenues originally adopted by MAG in November 2003, as part of the major plan update prior to the vote on Proposition 400. At that time, modal funding levels were established after completion of the facility planning process and reflected project needs determined through the technical planning process. The distribution of regional revenues considers federal and state restrictions on how individual funding sources may be applied to specific program areas. As indicated previously, the Regional revenue forecasts are presented in terms of “Year of Expenditure” (YOE) dollars. YOE dollars reflect the actual number of dollars collected/expended each year, with no correction or discounting for inflation. Specific assumptions regarding bonding or other debt financing are included in the modal chapters.

TABLE 8-5
SOURCES AND DISTRIBUTION OF REGIONAL REVENUES: FY 2020-2040
 (Year of Expenditure Dollars in Millions)

Sources	Uses						Total
	Highways / Freeways	Arterial Streets	Transit	Bicycle / Ped.	Air Quality	Other Programs	
Proposition 400: Half-Cent Sales Tax Extension	10,039.7	1,875.8	5,948.8				17,864.3
ADOT Funds (Includes HURF and Federal Aid)	10,618.8						10,618.8
Federal Transit Funds			4,606.0				4,606.0
Federal Highway (MAG STBGP)		1,360.8					1,360.8
Federal Highway (MAG CMAQ)		176	471.6	223.3	191.8	250.9	1,313.7
Federal Highway (MAG Other)						126.0	126.0
Total	20,658.5	3,412.5	11,026.4	223.3	191.8	376.9	35,889.4

In addition to regional level sources summarized in Table 8-5, the implementation of the RTP is accomplished through local funds and other state revenues. Local resources provide funding for capital projects and maintenance and operations in the arterial street and transit programs. Funds in the form of transit farebox receipts contribute significant funding for transit operations. Local and private sources provide funding for the expansion of street and transit networks throughout the Region in parallel with new residential and commercial development. Other state revenues provide funding for the routine maintenance and operation of the regional freeway/highway system, as well as the pavement preservation program. Local funds and other state revenue sources are program-specific and are identified in the individual modal chapters.

All revenue sources in the RTP are reasonably available throughout the planning period, having had a long history of providing funding. This includes the half-cent sales tax, which was originally approved in 1985 and extended in 2004; the State Highway User Revenue Fund, which includes the state gasoline tax (a major and continuing funding source for transportation in Arizona since 1921); federal highway and transit funding programs, which represent a national commitment to transportation; and local government and private funding, which proceed in parallel with the residential and commercial development process.

MAG recognizes the need to ensure continuation of future transportation funding. Strategies include: (1) briefings to MAG committees on the long-term revenue outlook and alternatives for addressing future needs; (2) presentations to elected officials, business leaders, other stakeholders, and the general public, concerning future transportation funding issues; (3) polling the public regarding attitudes and concerns affecting funding for transportation projects and services; and (4) communication with national representatives and involvement with national organizations regarding future transportation needs and funding requirements.

CHAPTER NINE

FREEWAYS AND HIGHWAYS

The freeway/highway system in the MAG area represents one of the major elements in the regional Transportation Plan (RTP). The RTP calls for new freeway/highway corridors, as well as added travel lanes on existing facilities. In addition, new interchanges with arterial streets on existing freeways, along with direct connections between high occupancy vehicle (HOV) lanes at freeway-to-freeway interchanges, are included. The RTP also provides regional funding for maintenance on the freeway system, directed at litter pickup and landscaping. The need to keep traffic flowing smoothly is addressed through funding identified for freeway management functions.

Current Freeway/Highway System

The freeway/highway system serving the MAG area is shown in Figure 9-1, as modeled for 2019. This system includes routes on the Interstate System, urban freeways and highways, and rural highway mileage. All the facilities in this system are on the State Highway System, which is constructed, maintained and operated by the Arizona Department of Transportation (ADOT).

Table 9-1 lists the approximate centerline mileages in this system in the MAG area by route. A total of 889 existing centerline miles are included in the freeway/highway network, and an additional 81 miles are planned for future development during the planning period. This leads to a system totaling 970 centerline miles in the year 2040.

Freeway/Highway Corridor Development

The freeway/highway element of the RTP includes both new facilities and improvements to the existing system. Operation and maintenance of the system are also addressed. Projects include new freeway corridors, additional lanes on existing facilities, new interchanges at arterial cross streets, HOV ramps at system interchanges, and maintenance and operations programs. The amount identified in the RTP for the planning period (FY 2020 - FY 2040) for development and maintenance of the freeway/highway system totals \$25.5 billion year of expenditure (YOE \$'s). Most funding is provided by regional sources.

The projected configuration of the future freeway/highway network in 2040 is depicted in Figure 9-2. The improvements planned for the system, including both new freeway corridors and improvements to existing freeway and highway facilities, are shown in Figure 9-3. Figure 9-4 depicts how projects will be phased over the planning period, with group designations indicating the period in which funds are programmed for construction of a facility. Projects may have funding for design activities and right of way acquisition in earlier periods. A detailed listing of the timing and cost of planned improvements and other programs is provided in Appendix C.

**TABLE 9-1
FREEWAY/HIGHWAY MILEAGES IN THE MAG AREA**

Route No.	Facility	Centerline Mileage			Route No.	Facility	Centerline Mileage		
		Existing	Planned	Total			Existing	Planned	Total
I-8	Yuma-Casa Grande Hwy.								
	Yuma County to SR 85	37	--	37	US 60	Quartzsite-Wickenburg Hwy.			
	SR 85 to Pinal Co. Line	31	--	31		La Paz County to US 93	31	--	31
	Maricopa Co. Line to MPA Bndry.	14		14		Sub-total Aguila Hwy.	31	--	31
	Sub-total I-8	82	--	82					
					US 60	Grand Avenue			
I-10	Papago/Maricopa Freeway					US 93 to SR 74	10	--	10
	La Paz Co. Line to SR 85	42	--	42		SR 74 to 303L	18	--	18
	SR 85 to 303L	12	--	12		303L to 101L (Agua Fria)	10	--	10
	303L to 101L	11	--	11		101L (Agua Fria) to Van Buren St	11	--	11
	101L to I-17	7	--	7		Sub-total Grand	49	--	49
	I-17 to SR 51	5	--	5					
	SR 51 to I-17	3	--	3	US 60	Superstition Freeway			
	I-17 to US 60	6	--	6		I-10 to 101L (Price)	5	--	5
	US 60 to 202L (Santan)	6	--	6		101L (Price) to SR 87	4	--	4
	202L (Santan) to Pinal Co. Line	7	--	7		SR 87 to 202L (Red Mtn./Santan)	12	--	12
	Maricopa Co. Line to MPA Bndry.	17	--	17		202L (Red Mtn./Santan) to Pinal Co. Line	4	--	4
	Sub-total I-10	116	--	116		Maricopa Co. Line to MPA Bndry.	25	--	25
						Sub-total Superstition	50	--	50
I-11	Interstate Freeway								
	I-10 to MPA Bndry.	--	44	44	US 60	Business Route 60			
						Sossaman Rd. to Meridain Rd.	5	--	5
I-17	Black Canyon Freeway					Sub-total Business Route 60	5	--	5
	I-10 (East) to I-10 (West)	7	--	7					
	I-10 (West) to 101L (Agua Fria/Pima)	14	--	14	SR 71	Aguila-Congress Jct. hwy.			
	101L (Pima) to New River Rd.	17	--	17		US 60 to Yavapai Co. Line	5	--	5
	New River Rd. to Yavapai Co. Line	10	--	10		Sub-total SR 71	5	--	5
	Sub-total I-17	48	--	48					
					SR 74	Morristown-New River Hwy.			
SR 24	Gateway Freeway					US 60 (Grand) to 303L	25	--	25
	202L (Santan) to Ellsworth Rd.	2	--	2		303L to I-17	6	--	6
	Ellsworth Rd. to Pinal Co. Line	--	3	3		Sub-total SR 74	31	--	31
	Sub-total SR 24	2	3	5					
					SR 79	Pinal Parkway			
SR 30	Tres Rios Freeway					US 60 to SR 287	17	--	17
	SR 85 to 303L	--	11	11		SR 287 to MPA Bndry.	7	--	7
	303L to 202L/South Mtn.	--	13	13		Sub-total SR 79	24	--	24
	202L/South Mtn. to I-17	--	5	5					
	Sub-total SR 30	--	29	29	SR 84	Gila Bend-Casa Grande Hwy.			
						I-8 to SR 347	6	--	6
SR 51	Piestewa Freeway					SR 348 to MPA Bndry.	4	--	4
	202L (Red Mtn.) to 101L (Pima)	16	--	16		Sub-total SR 84	10	--	10
	Sub-total SR 51	16	--	16					

TABLE 9-1 FREEWAY/HIGHWAY MILEAGES IN THE MAG AREA (CONTINUED)

Route No.	Facility	Centerline Mileage			Route No.	Facility	Centerline Mileage		
		Existing	Planned	Total			Existing	Planned	Total
SR 85	Gila Bend-Buckeye Hwy.				202L	Red Mountain Freeway			
	Pima Co. Line to I-8	32	--	32		I-10/SR 51 to 101L (Pima)	9	--	9
	I-8 to I-10	37	--	37		101L (Pima) to US 60 (Superstition)	22	--	22
	Sub-total SR 85	69	--	69		Sub-total Red Mountain	31	--	31
SR 87	Beeline Highway				202L	Santan Freeway			
	MPA Bndry. To Maricopa Co. Line	19	--	19		US 60 (Superstition) to SR 87	17	--	17
	Pinal Co. Line to Ocotillo Rd.	3	--	3		SR 87 to 101L (Price)	4	--	4
	Elliot Rd. to US 60 (Superstition)	2	--	2		101L (Price) to I-10	4	--	4
	202L (Red Mtn.) to Gila Co. Line	46	--	46		Sub-total Santan	25	--	25
	Sub-total SR 87	70	--	70					
SR 88	Apache Trail				202L	South Mountain Freeway			
	Pinal Co. Line to Gila Co. Line	33	--	33		I-10 (East) to SR 30	17	--	17
	Sub-total SR 88	33	--	33		SR 30 to I-10 (West)	5	--	5
						Sub-total So. Mtn. (Under Const.)	22	--	22
SR 93	Kingman-Wickenburg Hwy.				SR 238	Mobile Highway			
	Wickenburg Bypass	1	--	1		SR 347 to Mobile	17	--	17
	Wickenburg Bypass to Yavapai Co. Line	3	--	3		Sub-total SR 238	17	--	17
	Sub-total US 93	4	--	4					
101L	Agua Fria Freeway				SR 287	Florence-Coolidge Hwy.			
	I-10 to US 60 (Grand)	10	--	10		SR 79 to MPA Bndry.	4	--	4
	US 60 (Grand) to I-17	12	--	12		Sub-total SR 287	4	--	4
	Sub-total Agua Fria	22	--	22	303L	Estrella Freeway			
101L	Pima Freeway					SR 30 to I-10	--	5	5
	I-17 to SR 51	7	--	7		I-10 to US 60 (Grand)	15	--	15
	SR 51 to 202L (Red Mtn.)	21	--	21		US 60 (Grand) to I-17 (Interim)	18	--	18
	Sub-total Pima	28	--	28		Sub-total 303L	33	5	38
101L	Price Freeway				SR 347	Maricopa Road			
	202L (Red Mtn.) to US 60 (Superstition)	4	--	4		I-10 to SR 238	16	--	16
	US 60 (Superstition) to 202L (Santan)	6	--	6		SR 238 to SR 84	13	--	13
	Sub-total Price	10	--	10		Sub-total SR 347	29	--	29
SR 143	Hohokam Expressway				SR 387	Casa Grande-Coolidge Hwy.			
	I-10 to 202L (Red Mtn.)	3	--	3		I-10 to SR 87	7	--	7
	202L (Red Mtn.) to McDowell Rd.	1	--	1		Sub-total SR 387	7	--	7
	Sub-total SR 143	4	--	4	SR 587	I-10 Mesa Hwy.			
SR 187	Casa Grande-Olberg Hwy.					I-10 to SR 87	6	--	6
	SR 87 to I-10	6	--	6		Sub-total SR 587	6	--	6
	Sub-total SR 187	6	--	6					
						Regional Totals	889	81	970

A description of the major freeway/highway corridors and planned improvements included in the RTP is provided below. In addition to these projects, there is a history of past major improvements to the regional freeway system that have been completed over several years. The reader is referred to the series of reports that have been prepared beginning in 2005, which provide detailed information on specific project accomplishments. (See Annual Reports on the Status of the Implementation of Proposition 400, MAG.)

In the discussion below, the timing of project implementation refers to groupings as follows:

- Group 1: FY 2020 - FY 2024
- Group 2: FY 2025 - FY 2026
- Group 3: FY 2027 - FY 2040

These groups indicate the period in which most of a project is programmed for construction activity. Projects may be programmed for design and right of way acquisition in earlier periods.

Interstate 10/Papago Freeway/Maricopa Freeway

- Corridor Description - The Papago/Maricopa Freeway crosses through the heart of the MAG area, extending 116 miles from the La Paz County border on the west to the MAG metropolitan planning area (MPA) boundary in Pinal County on the east. It traverses highly urbanized areas, as well as areas in the process of development, and serves as a vital link to the core of the MAG area. It provides passenger and freight mobility and is also a major national truck route, linking the MAG Region to population centers in Southern California and throughout the Southwestern U.S.

On May 24, 2017, the MAG Regional Council approved incorporation of the recommendations for the 31-mile portion of Interstates 10 and 17 (I-10 and I-17 "Spine" Corridor Master Plan study) into the 2040 RTP. The 31-mile Spine corridor begins at the I-17/Loop 101 North Stack interchange and continues south and east to the I-10/I-17 Split Interchange. The corridor continues east and south along I-10 to the interchange with Loop 202 (Pecos Stack). The study recommendations include improvements focused on operations and safety. Key recommendations of the Corridor Master Plan include the concept of additional managed lanes (such as HOV), modernization of 24 traffic interchanges, safer pedestrian and bicycle crossings at 20 different locations (including nine structures), and coordinated crossings of light rail transit at four locations.

- Development Outlook -
 - Group 1 projects include: (1) constructing general purpose lanes and interchange improvements between Verrado Way and SR-85, (2) constructing new interchanges at Fairview Drive and Chandler Heights Road, and (3) constructing general purpose and HOV lanes, bike/pedestrian crossings, and rebuilding of interchanges between the I-17 Split and SR-202L.

- Group 2 projects include: (1) rebuilding the interchange at the Sky Harbor west access to/from I-10, and (2) constructing general purpose and HOV lanes between Loop 202 and Riggs Road.
- Group 3 projects include: (1) reconstructing the traffic interchange at Baseline Road, (2) constructing collector-distributor lanes between Baseline and Elliot roads, and (3) constructing of general-purpose lanes between Riggs Road and the MAG MPA boundary (this would not be part of the Freeway/Highway Life Cycle Program (FLCP) as it is located outside Maricopa County).

Interstate 11 Corridor

- Corridor Description - The Phoenix and Las Vegas metropolitan areas are the largest in the nation not linked by an Interstate Highway corridor. The combined population of the Phoenix, Tucson, Las Vegas and Reno areas was less than 700,000 when the Federal Aid Highway Act of 1956 was enacted. Today, the combined population of these regions is 8 million and is expected to grow even further, prompting the need for better surface transportation connections to accommodate not only the travel demand between these metropolitan areas, but also improved mobility for freight shipments throughout the Intermountain West and inland portions of the West Coast.

An Interstate 11 (I-11) corridor to address this need was designated as part of the federal transportation bill, Moving Ahead for Progress in the 21st Century Act (MAP-21), which was signed into law by President Obama on July 6, 2012. Subsequently, I-11 was officially designated by the United States Congress in the 2015 Fixing America's Surface Transportation Act. It is planned to run from Nogales, Arizona to Reno, Nevada.

On September 27, 2017, the MAG Regional Council approved a Major Amendment to the MAG 2040 RTP to add the Interstate 11 corridor from Interstate 10 to US-93.

- Development Outlook -
 - ADOT is conducting a Tier I Environmental Impact Statement study that will recommend either a 2,000-foot-wide corridor for the facility or a No-Build Alternative. The Tier 1 EIS is expected to be complete in 2020.

Interstate 17/Black Canyon Freeway

- Corridor Description - The Black Canyon Freeway serves as the north-south backbone of the freeway system, terminating at the junction of I-10 in the center of the urban area. In addition to serving the core of the Region, it provides mobility to residential and commercial development in the central and northern parts of the MAG area. This freeway route connects the MAG Region with I-40 to the north, representing a vital link to Northern Arizona and the rest of the Interstate System.

On May 24, 2017, the MAG Regional Council approved incorporation of the recommendations for the 31-mile portion of Interstates 10 and 17 (I-10 and I-17 “Spine” Corridor Master Plan study) into the 2040 RTP. The Spine corridor begins at the I-17/Loop 101 North Stack interchange and continues south and east to the I-10/I-17 Split Interchange. The corridor continues east and south along I-10 to the interchange with Loop 202 (Pecos Stack). Key components of the Corridor Master Plan Recommendations include the concept of additional managed lanes (such as high occupancy vehicle/HOV), modernization of 24 traffic interchanges, safer pedestrian and bicycle crossings at 20 different locations (including nine separate structures), and coordinated crossings of light rail transit at four locations.

- Development Outlook -

- Group 1 projects include: (1) rebuilding the Central Avenue over-crossing, (2) rebuilding the Indian School Road traffic interchange, (3) rebuilding the Happy Valley and Pinnacle Peak Roads traffic interchanges, (4) improving drainage/flood control between Peoria Avenue and Greenway Road, and (5) constructing general purpose to I-17 between Anthem Way and the end of the MPA.
- Group 2 projects include: (1) rebuilding the Camelback Road traffic interchange, and (2) constructing auxiliary lanes from the I-10 Split to 19th Avenue.
- Group 3 projects include: (1) constructing direct HOV ramps at the I-10 Split interchange, (2) constructing lanes and reconstructing interchanges from the I-10 Split to 19th Avenue, (3) reconstructing the mainline and constructing HOV lanes from 19th Avenue to Indian School Road, (4) reconstructing the mainline and constructing HOV lanes from Indian School Road to Dunlap Avenue, (5) constructing direct HOV ramps at US-60/Grand Avenue, (6) rebuilding the Glendale Avenue traffic interchange, (7) rebuilding the Northern Avenue traffic interchange, (8) reconstructing the mainline and constructing HOV lanes from Dunlap Avenue to SR-101L, (9) rebuilding the Thunderbird Road traffic interchange, (10) rebuilding the Bell Road traffic interchange, (11) constructing direct HOV ramps at the SR-101L interchange, and (12) constructing HOV lanes between SR-74 and Anthem Way.

State Route 24/Gateway Freeway

- Corridor Description - The Gateway Freeway is a new corridor extending from Loop 202/Santan south to the Phoenix-Mesa Gateway Airport, and east to the Pinal County line. Its first mile was completed from the Santan Freeway to Ellsworth Road. MAG envisions the Pinal County portion, which is currently not funded as part of the RTP, would extend eastward toward US-60 south of the Gold Canyon area. The Gateway Freeway enhances access to the arterial system in the southeast part of the Region. SR-24 it will provide access to job centers, commercial areas and residential development in

the far East Valley, including the Phoenix-Mesa Gateway Airport, which is a major regional activity center. In addition, expected growth in the MAG portion of Pinal County will benefit from this freeway linkage into to the regional transportation system.

- Development Outlook -
 - Group 1 projects include: Constructing the phase 1 freeway for the segment from Ellsworth to Ironwood roads.
 - Group 3 projects include: converting the segment from SR-202L to Ironwood Road to a full freeway.

State Route 30/Tres Rios Freeway

- Corridor Description - State Route 30 is planned as an east-west facility south of I-10 in the vicinity of Southern Avenue connecting I-17 and SR-85. This facility will provide a second major east-west freeway corridor to points west of the central area, relieving traffic on I-10. State Route 30 will improve accessibility to the areas south of I-10, which include truck terminals and other generators of truck traffic. The route was initially identified in 2003 as a freeway between Loop 202 and Loop 303, and as an arterial roadway between Loop 303 and SR-85 (with right of way preservation for a future freeway facility). Recommendations from the MAG Interstate 10/Hassayampa Valley Transportation Framework Study noted the need to continue planning for SR-30 as a freeway corridor south of downtown Buckeye, linking to a junction with Loop 303. In addition, the MAG Central Phoenix Transportation Framework Study noted the need for a freeway link along the SR-30 study alignment between Loop 202/South Mountain and I-17. The need stemmed from the growing travel demand along the Interstate 10 segment between Loop 202/South Mountain and I-17 at the Stack traffic interchange.

On September 27, 2017, the MAG Regional Council approved a Major Amendment to add the MAG 2040 RTP to add the Arizona State Route 30 corridor as a freeway facility, from SR-85 to Loop 303 and from Loop 202/South Mountain to I-17.

- Development Outlook -
 - Group 1 projects include: Preserving right of way for the SR-30 corridor between Loop 202 and Loop 303.
 - Group 3 projects include: (1) Constructing the full freeway between Loop 202 and Loop 303, including interchanges at SR-303L and SR-202L, (2) constructing a full freeway between SR-202L and I-17, including I-17 interchange with direct HOV ramps, and (3) constructing a phase 1 roadway between Loop 303 and SR-85 (with right of way protection for a full freeway) and ultimate conversion to a full freeway, including the SR-85 system interchange.

State Route 51/Piestawa Freeway

- Overview - The Piestawa Freeway extends from the I-10/Loop 202 interchange to Loop 101/Pima. It serves the Phoenix central business core, providing an important commuter route to the north and one of the few means of access through the Phoenix Mountains. It also provides access to the rest of the regional freeway system for these areas, particularly to the Red Mountain Freeway and the Maricopa Freeway.
- Development Outlook -
 - No projects have been identified for the RTP planning period.

US-60/Grand Avenue

- Overview - US-60 extends diagonally on Grand Avenue from the core of the urban area to the northwest corner of the MAG Region, providing a direct connection to communities in the northwest area. It also provides important connectivity to regional freeway system elements, including Loop 303, Loop 101, I-17 and I-10. Grand Avenue presents a number of traffic and design engineering challenges because it is aligned diagonally across the regional grid and it runs parallel to an active railroad track.
- Development Outlook -
 - Group 2 projects include: Rebuilding the Indian School Road/35th Avenue traffic interchange.
 - Group 3 projects include: Constructing two grade separation projects (to be determined) between Loop 101/Agua Fria and Van Buren Street.

US-60 Superstition Freeway

- Overview - The Superstition Freeway is an east-west freeway route, extending through the East Valley of the MAG area, and continuing into Pinal County and eastern Arizona as US-60. It is the spine of the freeway system in the East Valley, directly serving Tempe, Mesa, Gilbert and Apache Junction, and connecting to I-10 on the west and Loop 202 on the east. It provides access to a broad range of residential, commercial, and industrial activities, both in established and developing areas.
- Development Outlook -
 - Group 3 projects include: (1) Constructing HOV and general purpose lanes between Crismon and Meridian roads, and (2) upgrading US-60 between Mountain Road and the Renaissance Festival to an Arizona Parkway. The latter project is not a part of the FLCP as it is located outside of Maricopa County.

State Route 74

- Overview - State Route 74 travels in an east-west direction through the Northwest Valley, extending from I-17 at Carefree Highway to US-60 at Morristown. The two-lane facility is primarily a rural route, and it provides access to the Lake Pleasant recreational area, which is approximately 10 miles west of I-17. State Route 74 passes through areas that will undergo development in the future, in particular, along the eastern third of the route.
- Development Outlook -
 - Group 3 projects include: Protecting right of way along the SR-74 corridor for a potential future freeway facility.

State Route 85

- Overview - State Route 85 travels in a north-south direction through the Southwest Valley, extending from I-10 in Buckeye to I-8 at Gila Bend. The facility continues south of I-8 to the Maricopa County Line and eventually to the Mexico border, but experiences relatively low volumes of traffic along the southern portion. State Route 85 is a major connector route between I-10 and I-8 and serves as a by-pass truck route for the metropolitan area.
- Development Outlook -
 - Group 1 projects include: Constructing a grade-separated crossing at Warner Street.

State Route 87

- Overview - State Route 87 connects the MAG Region to the recreational areas in the eastern mountains, extending east along the Beeline Highway from Country Club Drive as a four-lane divided facility. State Route 87 extends south along Country Club Road/Arizona Avenue and into Pinal County.
- Development Outlook -
 - No projects have been identified for the RTP planning period.

State Route 88

- Overview - This two-lane highway provides access to Canyon Lake in eastern Maricopa County and eventually to Lake Roosevelt in Gila County.

- Development Outlook -
 - No projects have been identified for the RTP planning period.

US-93

- Overview - US-93 extends northward from US-60 in Wickenburg, continuing to the northwest part of Arizona and providing a link to Las Vegas, Nevada. The proposed Interstate 11 falls along US-93 between the Arizona/Nevada border and Wickenburg.
- Development Outlook -
 - Group 1 projects include: Constructing general purpose lanes from Tegner Street to SR-89.

Loop 101/Agua Fria Freeway/Pima Freeway/Price Freeway

Overview - Loop 101 is a circumferential freeway that loops around the northern part of the MAG area. It is divided into three segments: (1) the Agua Fria Freeway, which extends from I-10 to I-17, (2) the Pima Freeway, which extends from I-17 to Loop 202/Red Mountain, (3) and the Price Freeway, which extends from Loop 202/Red Mountain to Loop 202/Santan. Loop 101 directly links 10 of MAG's cities and towns, plus unincorporated areas of Maricopa County, and provides connectivity among a broad range of key activity centers in the Region.

- Development Outlook -
 - Group 1 projects include: (1) Constructing general purpose lanes between I-17 and Pima Road, (2) constructing general purpose lanes between Pima Road and Shea Boulevard.
 - Group 2 projects include: (1) constructing interchange improvements at the I-10 system interchange, and (2) constructing general purpose lanes between 75th Avenue and I-17.
 - Group 3 projects include: (1) constructing general purpose lanes between I-10 and US-60, (2) constructing general purpose lanes between US-60 and 75th Avenue.

SR-143/Hohokam Expressway

- Overview - The Hohokam Expressway links I-10 and Loop 202/Red Mountain, and terminates at McDowell Road. It provides access to the Sky Harbor Airport as well as greater connectivity for the freeway network.

- Development Outlook -
 - No projects have been identified for the RTP planning period.

Loop 202/Red Mountain Freeway/Santan Freeway/South Mountain Freeway

- Overview - Loop 202 is a 78-mile circumferential freeway, serving the southern part of the metropolitan region. It is divided into three segments: (1) the Red Mountain Freeway, which extends from I-10/Papago to US-60, (2) the Santan Freeway, which extends from US-60 to I-10/Maricopa, and (3) the South Mountain Freeway, which extends from I-10/Maricopa to I-10/Papago. The Red Mountain and Santan freeways loop around Tempe, Mesa, Queen Creek, Gilbert and Chandler, providing connectivity among these jurisdictions and mobility throughout the East Valley area. The Red Mountain Freeway also links the East Valley to Central Phoenix. The South Mountain segment of the Loop 202 is a vital component in the freeway system, linking the southwestern and southeastern areas of the Region, and providing an alternative route to the highly congested I-10/Papago Freeway. The new South Mountain Freeway will be open to traffic in 2019.
- Development Outlook -
 - Group 1 projects include: (1) Public-private-partnership capitalized maintenance for the Loop 202/South Mountain Freeway, and (2) constructing a new traffic interchange at Lindsay Road on the Santan Freeway.
 - Group 2 projects include: constructing general purpose lanes from Val Vista Drive to SR-101L on the Santan Freeway.
 - Groups 3 projects include: (1) constructing HOV lanes between Broadway Road (Red Mountain Freeway) and Gilbert Road (Santan Freeway), (2) constructing general purpose lanes from Higley Road on the Red Mountain Freeway to Val Vista Drive on the Santan Freeway, (3) constructing direct HOV ramps at the US-60/Red Mountain/Santan system interchange, and (4) constructing general purpose lanes between SR-101L and I-10 on the Santan Freeway.

Loop 303 Freeway

- Overview - Loop 303 is planned as a six-lane freeway facility extending west from I-17 at Lone Mountain Road, swinging southwest to Grand Avenue, running south in the vicinity of Cotton Lane to I-10, and then to SR-30. Loop 303 will provide service to West Valley communities, which collectively represent a large area of growth in the Region. In addition, the facility offers an alternative route to I-17 for trips destined to the West Valley. Loop 303 has been completed as a six-lane freeway from I-10 to Happy Valley Road and an interim four-lane divided roadway between I-17 and Grand Avenue.

- Development Outlook -
 - Group 1 projects include: constructing general purpose lanes between Happy Valley Road and Lake Pleasant Parkway.
 - Group 3 projects include: (1) Protecting right of way for a future extension of Loop 303 from SR-30 to Riggs Road, (2) constructing a freeway facility from Van Buren Street to MC-85, (3) constructing interchange improvements at US-60 and Northern Parkway, and (4) constructing ultimate freeway cross-section from Lake Pleasant Parkway to I-17, including construction of a system interchange at I-17.

Pinal County Area Routes

- Overview - The expansion of the MAG (MPA) into Pinal County in 2013 resulted in the addition of significant new mileage onto the regional freeway/highway system. This additional mileage corresponds to the Pinal County extensions of routes already in the MAG freeway/highway network, as well as the addition of totally new routes. The added mileage provides service throughout the Pinal County area and is an important element of the regional transportation network. These routes include: I-8, I-10, US-60, SR-79, SR-84, SR-87, SR-187, SR-238, SR-287, SR-387, SR-587, and SR-347.
- Development Outlook - The following improvements to the freeway/highway network are included in the RTP in the Pinal County area of the MAG MPA. None of these projects would be a part of the FLCP.
 - Group 3: (1) constructing general purpose lanes on I-10 from Riggs Road to the MAG MPA boundary, (2) constructing an Arizona Parkway along US-60 from Mountain Road to the Renaissance Festival, (3) constructing general purpose lanes on SR-79 from Butte Avenue to the Central Arizona Project (CAP), (4) constructing general purpose lanes on SR-238 from SR-347 to Warren Road, (5) constructing general purpose lanes on SR-287 from SR-79 to SR-87, (6) constructing general purpose lanes on SR-347 from I-10 to SR-238, and (7) protecting right of way for the future North-South Freeway Corridor (including SR-24).

Program Support and Other Improvements

- Program Support - The highway development process involves steps that are necessary to prepare projects for eventual construction. Key elements that are included in this area are as follows: (1) Preliminary Engineering - preparation of preliminary plans defining facility design concepts, right of way requirements and environmental factors; (2) Advance right of way acquisition - acquisition of right of way to respond to development pressures in a corridor; (3) Property Management/Plans and Titles - procedures to acquire property and manage it until needed for construction; and (4) Risk Management

- programs to minimize the risk of litigation. Funding is identified throughout the planning period to address these program support areas.

- Other Improvements - In addition, some funding has been projected to be available above and beyond that currently estimated as being required for the freeway/highway projects and programs specifically identified in the RTP. These financial resources would be present in the last few years of the RTP planning period, when uncertainties regarding costs and revenues are at their maximum. In addition, a comprehensive update of the RTP is anticipated within the next few years. In view of these factors, identifying projects and programs in addition to those already included in the RTP was not pursued as part of the 2040 RTP update process.

System Operations, Maintenance and Preservation

One of the key goals of the RTP is to operate and maintain a high-quality transportation network, and preserve the investments made in transportation facilities through the MAG area. For the freeway/highway system, this translates into actions to ensure not only the physical integrity and safety of the system, but also measures to address its visual impacts on motorists and surrounding neighborhoods. The amount identified in the RTP for the planning period (FY 2020 - FY 2040 for operation and maintenance of the freeway/highway system totals \$3.0 billion (YOE \$'s), including, routine roadway and right of way maintenance, pavement preservation, quiet pavement rehabilitation, and litter pick-up, sweeping and landscape maintenance.

Regionally Funded Programs

The RTP includes regional funding for maintenance and operation of the regional freeway system in the MAG area. These regional resources are dedicated specific programs, as described below. The goal of this funding is to supplement, not supplant, the state-level revenues that ADOT dedicates to maintenance and preservation in the MAG area. As a result of the regional funding, ADOT is providing improved operations and maintenance on existing freeways in the Valley and will expand this effort as additional RTP projects are constructed.

The RTP includes number of system-wide programs that are critical to the proper functioning of the regional freeway/highway system. These programs include projects to: (1) help keep traffic flowing as smoothly as possible, (2) pick-up litter and maintain landscaping, and (3) mitigate noise from the freeway system.

- Freeway Management System - Funding for the freeway management system (FMS) has been identified for the MAG area. This includes projects to enhance FMS on existing facilities, as well as to expand the system to new corridors. FMS covers items such as ramp metering, changeable message signs, and other measures to facilitate traffic flow. Funding will be directed to both the development of new FMS projects, as well as preservation and maintenance of existing equipment. A function related to freeway system management, the Freeway Service Patrol, has been allocated funding in the RTP.

- Litter Pick-up, Sweeping, and Landscaping Maintenance - Regional funding for the freeway system in the MAG area has been dedicated to litter pick-up, litter education, sweeping, landscaping maintenance, and landscaping restoration. The use of MAG regional funds to supplement ADOT funds has allowed ADOT to provide a level of landscaping, litter pick-up, and sweeping maintenance on the freeway system that would not have been possible without this funding.
- Quiet Pavement - A block of funding was previously identified for noise mitigation projects on the freeway system in the MAG area. This funding was used for mitigation projects such as rubberized asphalt overlays on existing freeways (quiet pavement) and noise walls. While Group 3 includes projects for future rehabilitation of rubberized asphalt overlays, the amount of funding identified is not sufficient for system-wide quiet pavement rehabilitation.

Other Operations, Maintenance and Preservation

Operation and maintenance (O&M) of the regional freeway/highway network in the MAG area is accomplished by ADOT through its maintenance districts. These districts are organized to provide services in five key functional areas, addressing roadway maintenance, landscape maintenance, electrical operations, traffic engineering, and administrative services. Funding for these districts is provided through ADOT's annual state budgeting process, which draws from state and federal revenue sources. As noted previously, in the MAG area this funding is supplemented by the regional funds.

Example O&M activities include maintenance of pavement, guard rails and median cable barriers, drainage channels, canals, tunnels, retention basins, and sound walls, as well as maintenance and restoration of landscaping. In addition, traffic operations are addressed, including roadway lighting, traffic signals, signing and striping, and freeway management system support. Other functions cover utility locating services, encroachment permits, crash clearing and repairing damaged safety features.

The ADOT organization also includes a Pavement Management Section, which is charged with the responsibility to develop and provide a cost-effective pavement rehabilitation construction program. The pavement preservation program receives a high priority within ADOT, to preserve the investment in the freeway/highway system and enhance transportation safety and efficiency. The program is accomplished by performing a yearly inventory of the pavements in the system, with attention to smoothness of ride, amount of cracking, bleeding, patching, ruts, and the friction characteristics. As part of this process, a large relational database is used to help prioritize the work needed to keep the system performing within predetermined service levels.

Freeways/highways constructed from concrete have a longer initial life and overlay life than facilities that are constructed using asphalt. In this regard, the predominance of concrete pavements on MAG urban freeways is a definite advantage. As a result, pavement projects have focused on I-10 to the west, I-17 to the north, and the portion of US-60 falling along Grand

Avenue. As noted previously, a small amount of funding is identified in the RTP for future rehabilitation of rubberized asphalt overlays on freeway facilities.

Funding and Expenditure Summary

Table 9-2 provides an overview of the funding and expenditures for the freeway/highway element of the RTP. This table lists the reasonably available funding sources for the planning period and the uses of those funds. The revenue sources included in Table 9-2 are reasonably available throughout the planning period, having had a long history of providing funding for the RTP. As indicated in Table 9-2, projected future funding is in balance with estimated future program expenditures, indicating that the freeway/highway element can be accomplished using reasonably available funding sources over the planning period.

Funding Sources

Funding sources shown in Table 9-2 for the freeway/highway element include the half-cent sales tax (\$10.0 billion); MAG area ADOT funds (\$10.6 billion); ADOT statewide funding (\$1.8 billion); other funding (\$285 million); bond proceeds (\$240 million); federal and state discretionary funding (\$3.2 billion); and an estimated available beginning cash balance of \$789.7 million. Debt service and other expenses totaling \$1.4 billion are deducted from these sources, yielding a net total of \$25.5 billion (YOE \$'s) for use on freeway/highway construction projects and programs.

The following revenue sources (Table 9-2) have been major funding elements for transportation facilities in the MAG area for decades and are reasonably available to the Region throughout the planning period. Projects of state or interstate significance are assumed to be funded accordingly.

Program Expenditures

Table 9-2 also lists estimated future costs for the freeway/highway element of the RTP, expressed in YOE \$'s. Expected expenditures during the planning period also total \$25.5 billion. This includes: \$12.7 billion for construction of new corridors; \$9.3 billion for construction of additional lanes and new interchanges on existing freeways; and \$401 million for system-wide programs, such as preliminary engineering, right-of-way administration, and freeway system traffic management. A total of \$3.0 billion is identified for roadway operations and maintenance functions, including routine roadway and right of way maintenance, pavement preservation, quiet pavement rehabilitation, and litter pick-up, sweeping and landscape maintenance. The remainder of \$137 million in funding was not allocated to additional projects and programs as part of the 2040 RTP update process, since a comprehensive update of the RTP is anticipated in the next few years.

TABLE 9-2
FREEWAY/HIGHWAY FUNDING PLAN FY 2020 - 2040

FUNDING (Year of Expenditure \$'s in Millions)		Totals
Regional Funds		
MAG Half-Cent Sales Tax	10,039.7	
MAG Area ADOT Funds	10,618.8	
Other Income	284.9	
Beginning Available Cash	789.7	
Bond Proceeds	240.0	
Allowance for Debt Service and Other Expenses	(1,427.4)	
Total Regional Funds		20,545.7
Other Funding		
ADOT Statewide Funding	1,788.6	
Federal and State Discretionary	3,214.5	
Total Other Funding		5,003.1
Total Funding		25,548.8
EXPENDITURES (Year of Expenditure \$'s in Millions)		Totals
Regionally Funded Projects		
New Corridors	12,681.7	
Improve Existing Facilities: General Lanes, HOV Lanes, Interchanges	9,284.9	
Freeway Management System, Freeway Safety Patrol	84.1	
Preliminary Engr., Risk Mgmt., ROW Management, Adv. ROW Acquis.	317.0	
Quiet Pavement Rehab.	241.25	
Litter Pick-Up, Sweeping, Landscaping	427.77	
Other Maintenance Programs	586.67	
Other Regionally Funded Projects	136.8	
Total Regionally Funded Projects		23,760.2
Other Funded Projects		
System Operation, Maintenance and Preservation		1,788.6
Total Expenditures		25,548.8

CHAPTER TEN

ARTERIAL STREETS

The arterial street grid system is a major component of the regional transportation system in the MAG area and is a key element of the Regional Transportation Plan (RTP). The development of this system is accomplished through regionally funded projects, as well as projects constructed through a combination of local government and private sources. Local jurisdictions are responsible for the maintenance of these facilities.

Current Arterial Street System

The arterial street system is a critical element of the regional transportation network and consists primarily of roadways with four or more lanes on a mile grid. This system provides the region with a high level of accessibility and mobility, complementing the regional freeway system, and serving automobiles, transit, bicycle, and pedestrian traffic. The arterial system carries over half of the total vehicle miles traveled (VMT) in the region. Figure 10-1 presents the existing arterial grid system, as modeled for the year 2020.

In addition to the arterial street system, the region is served by non-arterial streets, which include local and collector streets. Non-arterial streets carry a relatively small amount of the total traffic in the region, primarily providing access to businesses and residences. The development of local and collector street mileage is closely associated with the growth in population and employment.

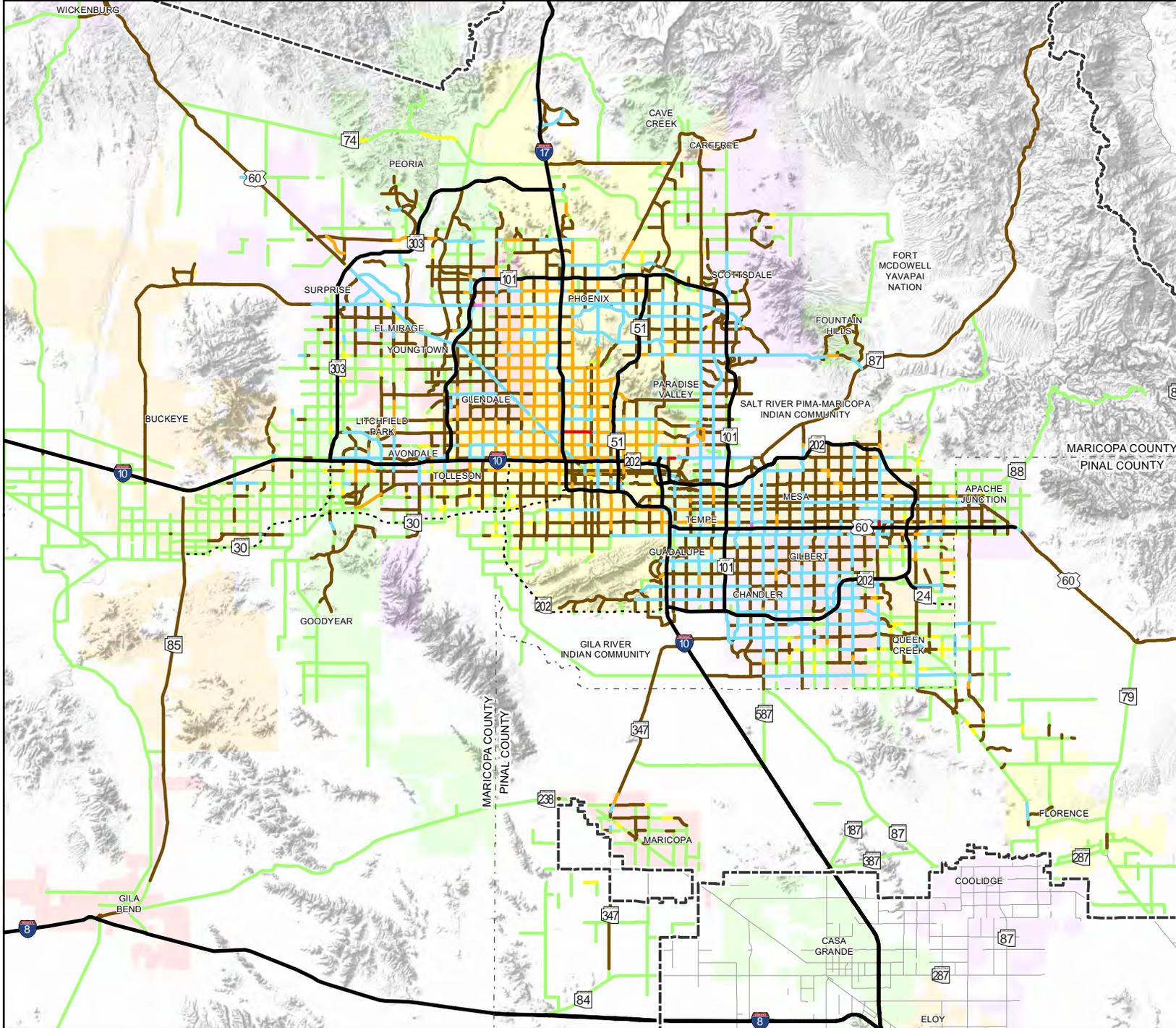
Future Arterial Facilities and Improvements

As the MAG area grows in the future, the continued expansion and improvement of the arterial street system will be vital to the functioning of the regional transportation system. The RTP identifies a long-range regional arterial grid system that provides access to existing and newly developing areas in the region. This system is characterized by a one-mile grid network of streets and will be developed through a combination of public and private funding sources.

The future arterial network anticipated in the MAG Region by 2040 is depicted in Figure 10-2. (Figure 10-1 and 10-2 are conceptual and do not represent a formal functional classification of roadways or precise roadway alignments.) This network was determined from the results of sub-regional studies conducted by MAG, along with ongoing consultation with local agencies. System improvements are staged to accommodate growth in traffic, as well as residential and commercial development of surrounding areas. In general, the future arterial network extends the current one-mile arterial grid system concurrent with new development, and closes gaps and improves connectivity in both developed and developing areas. In addition, considerable existing arterial mileage receives capacity improvements.

Figure 10-1: 2020 Arterial Street System Total Through Lanes

2040 Regional Transportation Plan Update



Arterial 2020 Lanes

- 2 Lanes
- 3 Lanes
- 4 Lanes
- 5 Lanes
- 6 Lanes
- 7 Lanes
- 8 Lanes

Other Features

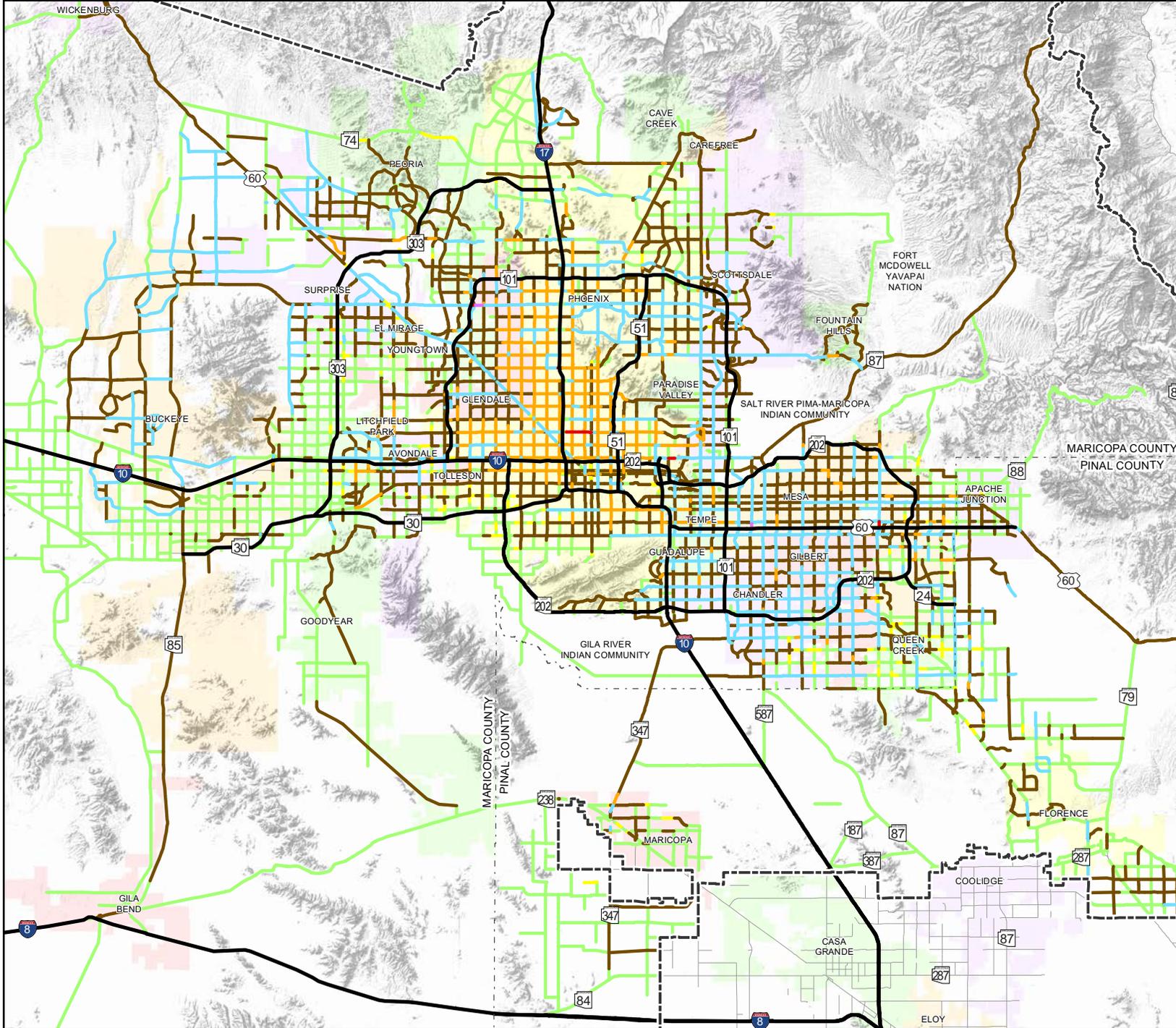
- Existing Freeway
- - - - Planned Freeway/Highway
- Other Roads
- Metropolitan Planning Area
- County Boundary

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Figure 10-2: 2040 Arterial Street System Total Through Lanes

2040 Regional Transportation Plan Update



Arterial 2040 Lanes

- 2 Lanes
- 3 Lanes
- 4 Lanes
- 5 Lanes
- 6 Lanes
- 7 Lanes
- 8 Lanes

Other Features

- Freeways
- Other Roads
- Metropolitan Planning Area
- County Boundary

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MAG anticipates that the overall arterial street network will expand through the construction of new roadway alignments, upgrading of roads that lie along the mile-arterial grid to arterial street standards, and widening of existing arterial streets. In some areas natural features, such as mountains and steep terrain, will preclude the extension of the one-mile arterial grid system.

The amount identified in the RTP for the planning period (FY 2020 - FY 2040) for expansion, widening, and maintenance of the arterial grid system totals \$27.6 billion (YOE \$'s), as indicated in Table 10-1. This includes regionally funded projects, as well as those constructed through local government and private financial resources.

Regional Arterial Street Projects

The package of regional arterial projects provides for the construction of new arterial linkages, widening of existing streets, and improvement of intersections. In addition, implementation of dust control and other air quality control measures and projects on the regional Intelligent Transportation System (ITS) Plan are included. Regional sources provide a total of \$3.4 billion (YOE \$'s) in funding. An additional \$1.8 billion (YOE \$'s) is added to the regional projects from local matching funds, for a total of \$5.2 billion (YOE \$'s).

- Arterial Capacity/Intersection Improvements - These improvements vary in nature, including the widening or major upgrading of existing arterial streets, construction of new facilities on new alignments, and improvements at individual intersections. These improvements are planned for the system through the MAG Arterial Life Cycle Program (ALCP) (Figure 10-3). Figure 10-4 depicts how regionally funded reimbursements from the ALCP for arterial street projects will be phased over the planning period, with group designations indicating the period in which actual project construction is finished. The total regional funding for these improvements is \$936.4 million (YOE \$'s). The local match for these projects provides an additional \$899.7 million (YOE \$'s) for a total of \$1.8 billion (YOE \$'s). A detailed listing of specific regional arterial projects is provided in Appendix D.
- Intelligent Transportation Systems (ITS) – An allocation of funding through the MAG ALCP was established to assist in the implementation of projects identified in the regional ITS Plan. These projects smooth traffic flow and help the transportation system to operate more efficiently. The allocation of funding through the MAG ALCP ended in 2019. Funding for ITS improvements after 2020 has been established through the MAG Systems Management and Operation Plan (SM&O). The funding is allocated and managed outside the ALCP and includes projects across modes.
- Implementation Studies - As established in the RTP approved in 2003, 3.65 percent of the half-cent funding for arterial streets is allocated to planning implementation studies for the region. These implementation studies are conducted by MAG, with total funding of \$12.7 million (YOE \$'s) for the planning period (FY 2020 through FY 2026). No local match is required for these studies.

Figure 10-3: Regional Arterial Street Projects

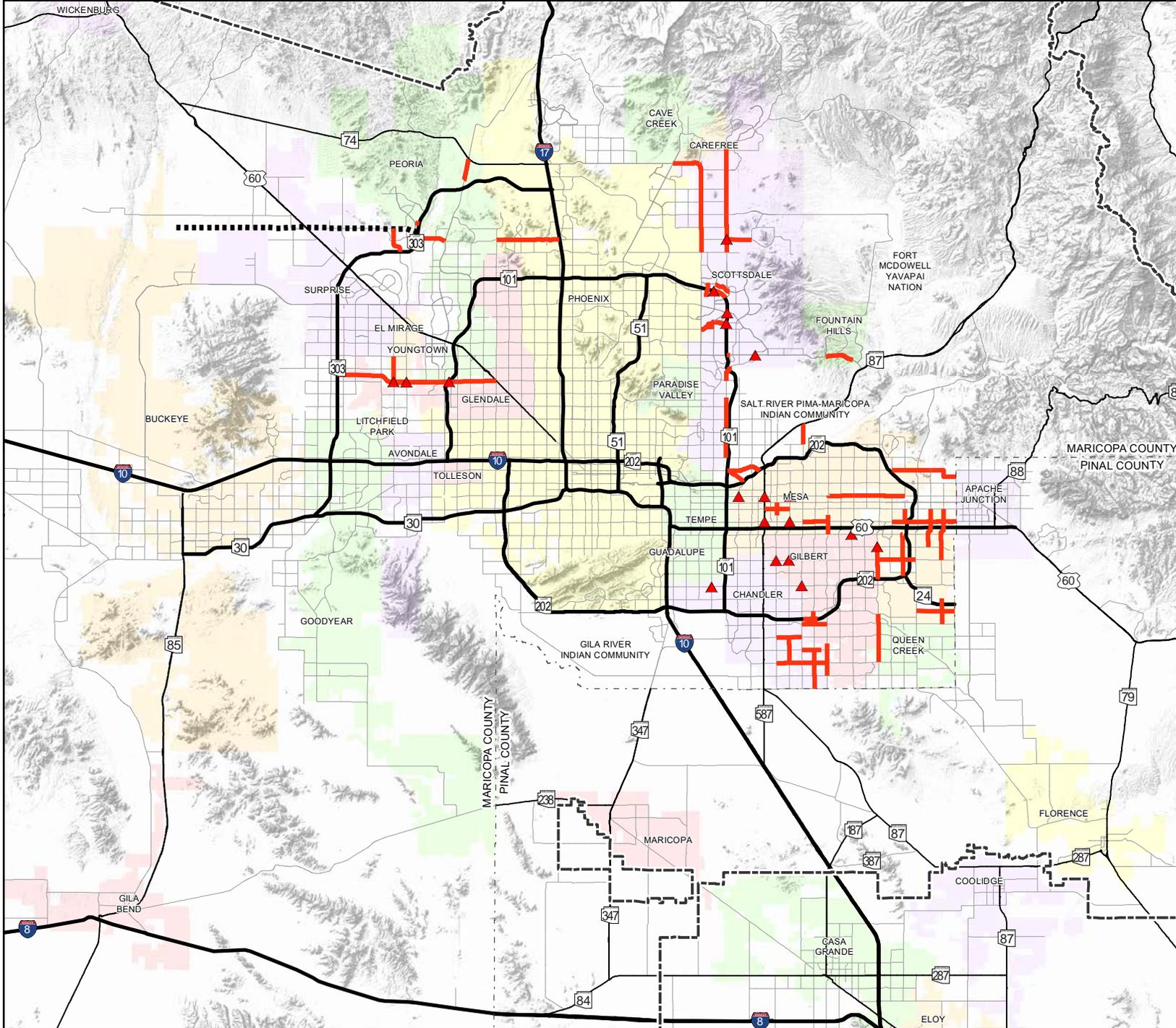
2040 Regional Transportation Plan Update

Regional Arterial Street Projects

- Improved Intersections
- New/Improved Arterials
- Right of Way Preservation

Other Features

- Freeways
- Highways
- Metropolitan Planning Area
- County Boundary



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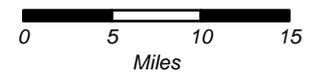
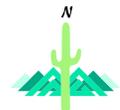
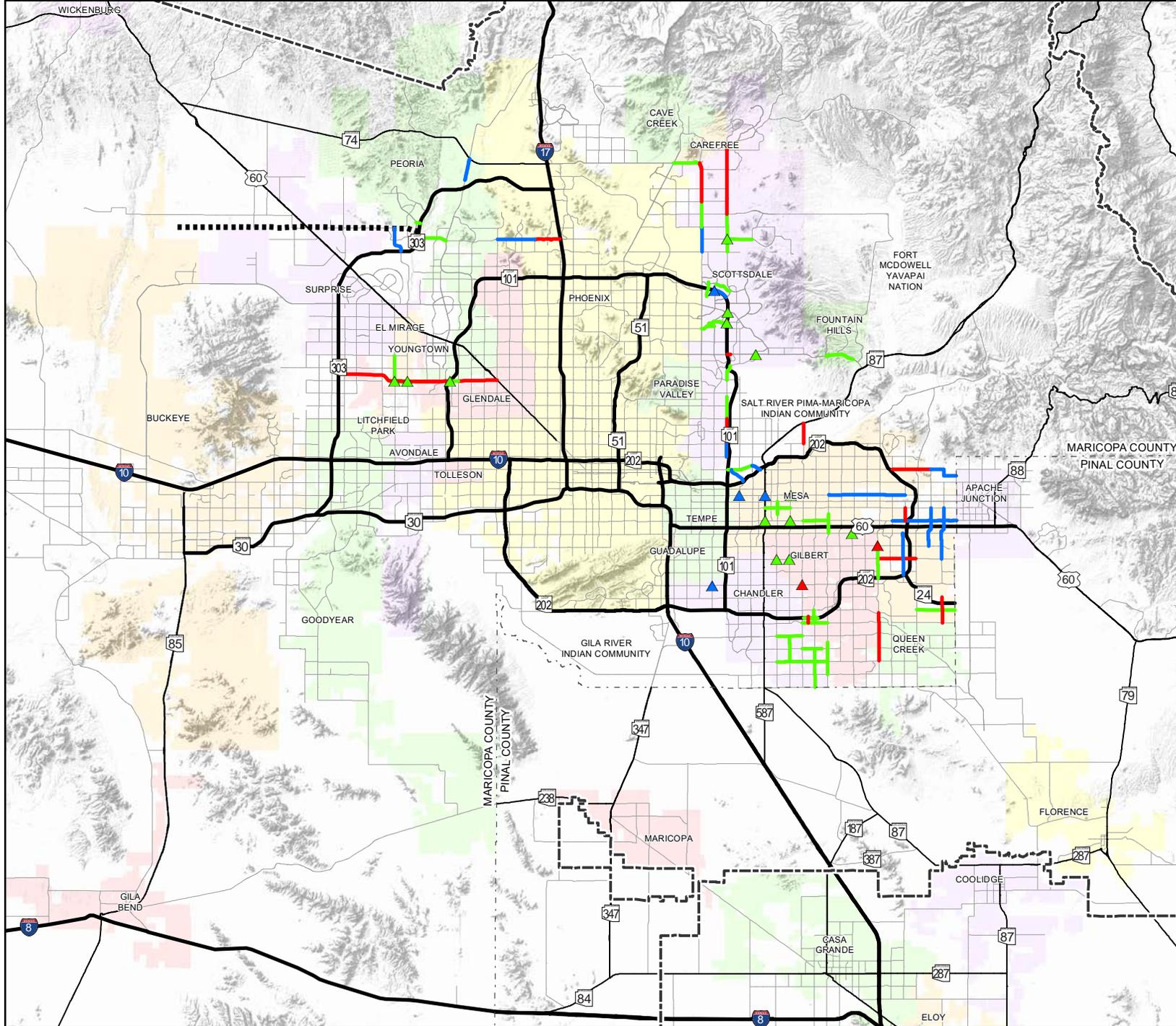


Figure 10-4: Regional Arterial Street Projects - Phasing

**2040
Regional Transportation Plan
Update**

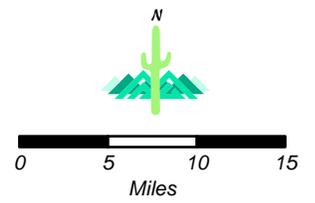


- Regional Arterial Street Projects**
- ▲ Group 1 (FY 2020 - FY 2024)
 - ▲ Group 2 (FY 2025 - FY 2026)
 - ▲ Group 3 (FY 2027 - FY 2040)

- New/Improved Arterials**
- Group 1 (FY 2020 - FY 2024)
 - Group 2 (FY 2025 - FY 2026)
 - Group 3 (FY 2027 - FY 2040)
 - ⋯⋯ Right of Way Preservation

- Other Features**
- Freeways
 - Highways
 - ⋯⋯ Metropolitan Planning Area
 - ⋯⋯ County Boundary

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- Dust Control and Other Air Quality Control Measures - The RTP incorporates funding for measures to reduce particulate matter (PM-10) emissions generated by vehicle travel. Approximately \$6.8 million (YOE \$'s) in CMAQ funding is programmed to purchase PM-10 certified sweepers in fiscal years 2020 through 2024 of the FY 2020-2024 MAG Transportation Improvement Program (TIP). After FY 2024, MAG anticipates local governments will continue to purchase five PM-10 certified sweepers each year to replace older PM-10 certified sweepers, expand the area swept, and increase the frequency of sweeping. In the RTP, the paving of dirt roads by local jurisdictions reflects a continuation of the commitment to reduce fugitive dust on unpaved roads with high traffic volumes; eliminate dirt roads in areas of new development; and to pave dirt alleys, shoulders, and access points. Consistent with past trends, the RTP assumes that 10 centerline miles of high Average Daily Traffic (ADT) unpaved roads will continue to be paved each year. The funding and expenditures for purchasing PM-10 certified street sweepers and paving dirt roads are reflected in the FY 2020 to FY 2040 arterial funding estimates. Long-term implementation of these dust control measures will be financed with the resources shown in Table 10-1.
- Other Arterial Street Grid Extensions, Widening, and Improvements - It is estimated that an additional \$2.3 billion (YOE \$'s) may be provided from reasonably available regional funding sources not currently identified in terms of specific regional projects in the RTP. These resources would be used to construct additional arterial system improvements or applied to other arterial-related programs. This funding would be matched by \$918.1 million (YOE \$'s) in local funding for a total of \$3.2 billion (YOE \$'s). In addition, a total of \$191.8 million (YOE \$'s) in regional CMAQ funding, plus \$11.6 million (YOE \$'s) in matching monies, is identified for PM-10 and other air quality programs for the FY 2020-2040 planning period.

Local Government and Private Developer Projects

In addition to the regionally funded projects with local match discussed above, other new street or street improvement projects that accompany new development will be funded entirely from local government and private developer sources. It is estimated that these projects represent a total of approximately \$8.2 billion (YOE \$'s) in new street construction and other street improvements. These improvements were identified during the review of future arterial street networks during ongoing consultation with local agencies.

System Operations, Maintenance and Preservation

MAG member agencies seek to maintain and operate the arterial street system in a way that preserves past investments and obtains the maximum capacity from existing facilities. To achieve this goal, agencies apply local funds and their share of State Highway User Revenue Funds (HURF) to a range of expenditures, including street lighting, street sweeping, landscaping, sign maintenance, lane markings, pavement maintenance, storm drains, the operation of traffic

signals, and other recurring costs necessary to maintain the arterial street network. The amount identified in the RTP for the planning period for operation, maintenance, and preservation totals \$14.2 billion (YOE \$'s). This estimate includes costs on the arterial system, as well as the associated feeder collector and local streets.

An important part of maintenance involves the application of pavement management systems (PMS). PMS are systematic processes that provide information for use in implementing cost-effective pavement reconstruction, rehabilitation, and preventative maintenance programs, which result in pavements capable of accommodating current and forecasted traffic in a safe, durable, and cost-effective manner. MAG member agencies have developed PMS programs for roads within their jurisdictions. Table 10-2 lists key characteristics of existing PMS programs.

Funding and Expenditure Summary

Table 10-1 provides a summary of the funding scenario for the street element of the RTP. This table lists the reasonably available funding sources for the planning period and the uses of those funds. The balance between the available funds and the potential expenditures indicates that the arterial element of the RTP can be accomplished by using reasonably available funding sources over the planning period.

Funding Sources

Regional funding sources for the arterial streets element of the RTP are shown in Table 10-1 in terms of YOE \$'s, and include the half-cent sales tax (\$1.9 billion); Federal Surface Transportation Program funds (\$1.4 billion); Federal Highway Congestion Mitigation/Air Quality funds (\$176 million); and an estimated cash balance of \$99.5 million in regional funds at the beginning of FY 2020. These regional funds are complemented by local/other sources, which include city/county highway user revenues (\$14.7 billion); other local funding sources (\$5.0 billion); and private funds (\$4.2 billion). This represents a total of \$27.6 billion available for use on arterial street projects and programs. These revenue sources have been major funding elements for transportation facilities in the MAG area for decades and are considered to be reasonably available to the region throughout the planning period.

Program Expenditures

Table 10-1 also lists estimated future costs for the arterial street element of the RTP in terms of YOE \$'s. Estimated expenditures during the planning period total \$27.6 billion. This includes \$5.2 billion for regionally funded arterial street improvements, including the accompanying local match; \$8.2 billion for locally and privately funded improvements and extension of the arterial grid; and \$14.2 billion in local funding for operations, maintenance and preservation.

**TABLE 10-1
ARTERIAL STREET FUNDING PLAN FY 2020 - 2040**

FUNDING (Year of Expenditure \$'s in Millions)		Totals
Regional Funds		
MAG Half-Cent Sales Tax	1,875.8	
MAG Federal STP	1,360.8	
MAG Federal CMAQ (For arterial improvements)	176.0	
MAG Federal CMAQ (For PM-10 and other air quality programs)	191.8	
Beginning Balance (Regional Funds)	99.5	
Total Regional Funds		3,703.8
Local/Other Funds		
City/County Highway User Revenue Funds and County VLT	14,672.1	
Local Sources (General Funds, Local Sales Taxes, etc.)	5,023.2	
Private Funds (PAD Improvements, Developer Contributions, etc.)	4,230.9	
Total Local/Other Funds		23,926.2
Total Funding		27,630.0
EXPENDITURES (Year of Expenditure \$'s in Millions)		Totals
Regionally Funded Projects		
Capacity/Intersection Improvements (ALCP)	936.4	
MAG Implementation Studies (ALCP)	12.7	
PM-10 and Other Air Quality Programs	191.8	
Other Arterial Grid Improvements	2,263.0	
Total Regionally Funded Projects		3,403.9
Local/Other Funded Projects		
Match for Regionally Funded Projects	1,829.4	
Future Arterial Grid Extensions, Widening and Improvements	8,208.1	
System Operation, Maintenance and Preservation	14,188.6	
Total Local/Other Funded Projects		24,226.1
Total Expenditures		27,630.0

TABLE 10-2 PAVEMENT MANAGEMENT SUMMARY

Agency	Software	Assessment Frequency	Rating System/Approach	Additional Comments
ADOT	Deighton	Annual	International Roughness Index (IRI) Present Serviceability Rating (PSR)	Newly purchased system currently being implemented.
Apache Junction	iWorQ	Annual	Remaining Service Life (RSL)	Five main distresses are measured: fatigue, transverse cracking, longitudinal cracking, patches, and edge of pavement cracking. Raveling and other indices are also monitored. Inspectors use a guide to rate pavement. Software is used to recommend maintenance activities based on ratings. Pavement preservation measures are prioritized and coordinated with crack sealing.
Avondale	iWorQ	2 years probably closer to 1	Not Available	Experience has indicated that past patterns of pavement maintenance have had a significant effect on current pavement conditions.
Buckeye	Microsoft Excel	Continuously check, update informally	Pavement Surface Evaluation and Rating (PASER)	The roadway maintenance approach is focused on obtaining grant funding for major arterials, while maintaining the highest traffic volume residential roadways. Pavement maintenance program focuses on keeping the greatest number of residents satisfied.
Carefree	Microsoft Word & Microsoft Excel	4-5 years	Modified Version of the Transportation Research Board Process	Through field inspection, 10 categories of pavement defects are scored. Defects are weighted based on severity and importance. Unique roadway and pavement conditions are noted. A three step approach to the operations and maintenance program is used; (1) identify defects, (2) prioritize needs, and (3) assess program options versus budget funding.

TABLE 10-2: PAVEMENT MANAGEMENT SUMMARY (CONT'D)

Agency	Software	Assessment Frequency	Rating System/Approach	Additional Comments
Cave Creek	Spreadsheet	Informal-routine	Informal system - Chip seal five miles of roads a year when funding is available. Other improvements are prioritized based upon available funding	Pavement management software is being researched and reviewed. Many of the available packages seem to be too complex to fit the pavement management needs of a small system. Segment condition tracked as assessments occur using a spreadsheet. Collaboration with GIS to store pavement data is under consideration
Chandler	Proprietary road matrix software by Stantec	3 years	Pavement Quality Index (PQI)	Developers provide a one year final inspection on new roadways, at which time the developer may be required to apply the first seal coat. Pavement life is targeted at 25-30 years before the first mill and overlay.
El Mirage	Microsoft Excel	Goal – 2 years Current – 4 years	Pavement Surface Evaluation and Rating (PASER)	Projects are planned in order to maximize use of available funding. In order to achieve economies of scale, larger projects are performed, limiting the variety of activities in a given year. For example, one year all available funding may go toward one arterial; the next year, crack sealing and fogging the network.
Fountain Hills	Infrastructure Management Services	5 years	Project approach, based on the PCI and rate of deterioration	The Town is working on establishing a new ten-year pavement management plan. The plan (after adopted) will include, re construction, mill and overlay, crack filling, slurry and or chip seal, micro surfacing and preservative seals. The majority of the Roads are about 40 years old, many of them have never received more the slurry seal coatings.
Gila Bend	No Formal System	Informal	Informal	Establishment of a formal system is under consideration.
Gilbert	CHEC software switching to GBA	3-4 years	Pavement Condition Index (PCI)	Pavement management program makes extensive use of the Pavement Condition Index. There is an ongoing effort to demonstrate to decision-makers how pavement preservation funding levels affect the Pavement Condition Index.

TABLE 10-2: PAVEMENT MANAGEMENT SUMMARY (CONT'D)

Agency	Software	Assessment Frequency	Rating System/Approach	Additional Comments
Glendale	Lucity	5 year goal	Pavement Condition Index (PCI)	Pavement preservation projects are included in the Capital Improvement Program, which utilizes General Obligation funds. The Structural Index (SI) is tracked on arterials to provide a basis for pavement management activities.
Goodyear	Lucity	3 year goal "2 year Arterial / Rural 4 year Residential/Coll ectors"	Pavement Condition Index (PCI)	Because the majority of roads are relatively new, they are typically in good condition, which tends to increase the system average Pavement Condition Index. Recent rapid growth in the size of the roadway system may result in increased future maintenance program funding needs that may not be apparent due to the high current average PCI.
Litchfield Park	None	As Needed	Informal	All roads in the network were assessed in 2006 and 10-year maintenance activities recommended. Roadway segments are reviewed annually to determine if recommended treatments are still warranted, or if a roadway's condition has worsened enough that it needs more than the original prescribed level of maintenance.
Maricopa	Microsoft Access	Informal	Pavement Condition Index (PCI)	All roads were assessed by ASU in 2019.
MCDOT	Proprietary Software - Roadway Management System (RMS)	Arterials-annual / Others-Biannual	Pavement Condition Rating (PCR) and International Roughness Index (IRI)	The pavement management process focuses predominantly on roadways classified as arterials. The roadway maintenance program does not maintain or manage landscape features.
Mesa	Modified MicroPAVER	Annual	Pavement Condition Index (PCI)	An activity-based budget process is used, tying pavement maintenance activities to strategic goals. Roadway operations and maintenance funding is kept separate from the Capital Improvement Program and major pavement projects are prioritized depending on funding levels. Typically a 20-30 year pavement life is experienced.

TABLE 10-2: PAVEMENT MANAGEMENT SUMMARY (CONT'D)

Agency	Software	Assessment Frequency	Rating System/Approach	Additional Comments
Paradise Valley	Lucity	5 years	Pavement Condition Rating (PCR)	The town is divided up into 15 maintenance districts, each district is on the same maintenance schedule. When a maintenance districts receives an asphalt mill and overlay, three years later it is crack sealed and an application of a High-Density Mineral Bond, Polymer Modified Masterseal (PMM) is applied. Every five years after that another surface treatment is applied. The Town's goal is to reach a twenty-five-year service life out of our roadways before another asphalt mill and overlay is applied.
Peoria	Hansen Asset Management Software,	3YR Cycle	Pavement Condition Index (PCI)	To maximize benefits from available funding, maintenance activities focus on early preventive treatment efforts.
Phoenix	Deighton Total Infrastructure Management System (dTIMS)	Bi-annual	Pavement Condition Index (PCI)	"Specially equipped van is used in the pavement assessment process to measure and record roadway Pavement Condition Index data. Reconstruction of pavements is not programmed, placing an emphasis on preservation and rehabilitation activities to preserve pavement quality over the long term.
Queen Creek	MicroPAVER and Microsoft Excel	Biannual	Pavement Condition Index (PCI)	Arterial roads are crack sealed every 2-3 years, with preventative maintenance seal coats applied on a 3-10 year cycle, type of material depending on pavement condition
Scottsdale	Lucity	4 years	Pavement Condition Index (PCI)	Pavements are rated using the Pavement Condition Index, with intersections assessed separately. Data is recorded and tracked using GIS polygons rather than lane mile units, which is aimed at providing a more precise measurement of pavement areas.
Surprise	Hansen Pavement Management software	4 years	Overall Condition Index (OCI)	While most of the roads in the network are relatively new, efforts are aimed at adequate maintenance to continue high levels of pavement quality in the future. Typically roads are assessed every four years, using the time in between to perform improvements. The pavement management system is continually updated as improvements are performed, but new defects may not be documented until the next periodic assessment.

TABLE 10-2: PAVEMENT MANAGEMENT SUMMARY (CONT'D)

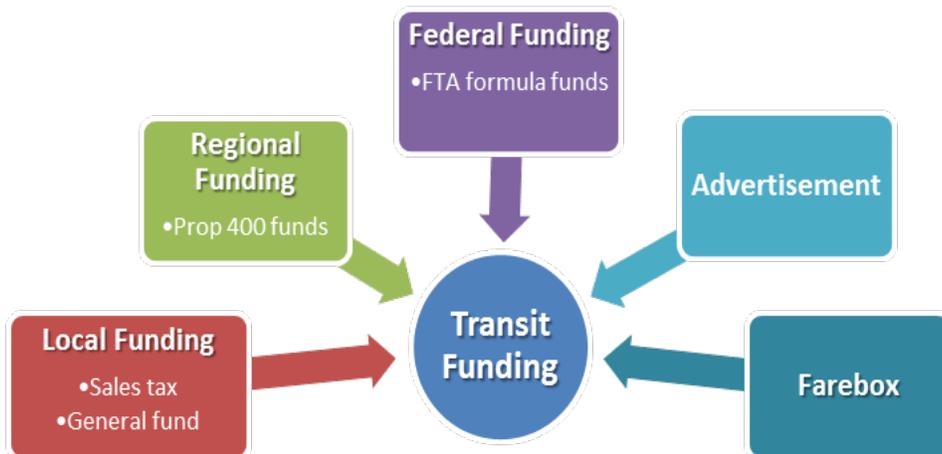
Agency	Software	Assessment Frequency	Rating System/Approach	Additional Comments
Tempe	Roadmatrix	3 years	Pavement Quality Index (PQI)	Avoiding a "worst first" repair prioritization approach, pavement maintenance strategies focus on consistent minor maintenance to preserve pavements, deferring the need for major maintenance projects. High standards are targeted, but if a road falls into poor condition, maintenance may be stopped and the road is later reconstructed. Predictable funding sources are being sought to maintain a strong pavement management program, instead of bonding or reliance on State shared revenues.
Tolleson	No Formal System	Ongoing	(Pavement Condition Index (PCI)) Unknown	A ten-year pavement maintenance plan is still being formalized. Streets Maintenance currently mainly operates using work orders and customer complaints
Wickenburg	Vueworks	Informal	Informal, need based prioritization	Projects are identified through an informal pavement condition assessment. Currently, \$200,000 was available for roadway maintenance in HURF.
Youngtown	No Formal System	Informal	Informal, need based prioritization	A slurry seal was done on all roads In 2004. A specific annual roadway operation and maintenance program is not part of the budget process. Community Development Block Grant funding, or other funding, has been used as it becomes available in the past for roadway maintenance projects. HURF funds typically cover costs to fix vandalism or matching for grants.

CHAPTER ELEVEN

PUBLIC TRANSIT

The 2040 Regional Transportation Plan Update (RTP) includes a transit network that encompasses various transit modes in the region. The regional transit system is supported by federal, regional, and local funding sources. Federal funds are directed to the transit system in the region by way of formula and competitive programs from the Federal Transit Administration (FTA) and Federal Highway Administration (FHWA). Regional funding sources include the Public Transportation Fund (PTF), also known as Proposition 400, which dedicates approximately one-third of the regional half-cent sales tax for transportation to mass transit. Local funding sources include dedicated transit or transportation sales taxes, municipal general funds, Arizona Lottery funds, revenue from transit fares, advertisement sales, and other funding sources. Figure 11-1 depicts the primary financial resources for transit in the region.

**FIGURE 11-1
TRANSIT SYSTEM FUNDING RESOURCES**



Current Transit Network

The transit network currently serving the MAG region regardless of funding source consists of multiple components, including bus operations, paratransit, and high capacity transit, including light rail transit (LRT). In addition to these services, capital investments (e.g., facilities, fleet, and infrastructure) make up the regional transit network. Figure 11-2 shows how these components are layered to make up the total transit network.

Bus Operations

The region has four bus service operators (three local cities and one regional agency). Currently, the local agencies support approximately 70 percent of the bus transit services provided in Maricopa County. The existing bus network is depicted in Figure 11-3 and consists of local bus service, circulators, RAPID/Express bus, limited and rural bus service (as coded for the Winter 2019 base network). These services operate on local and arterial streets and in freeway high occupancy vehicle (HOV) lanes. They serve a range of trip needs, including work, shopping, medical appointments and school trips.

The service design emphasis is on system efficiency and effectiveness in order to provide a high level of transit service that is reliable and affordable for users in the region. Service levels on particular routes are dictated by the demand for transit along those routes as well as by availability of funding. Routes typically operate seven days a week, 18-20 hours per day; in some cases, higher levels of service are provided during peak travel hours. Express/RAPID and limited services are oriented around peak periods of demand. The network is complemented with Americans with Disabilities Act (ADA) required paratransit service and, in some local areas, with Non-ADA paratransit service and subsidized taxi programs.

**FIGURE 11-2
REGIONAL TRANSIT NETWORK COMPONENTS**

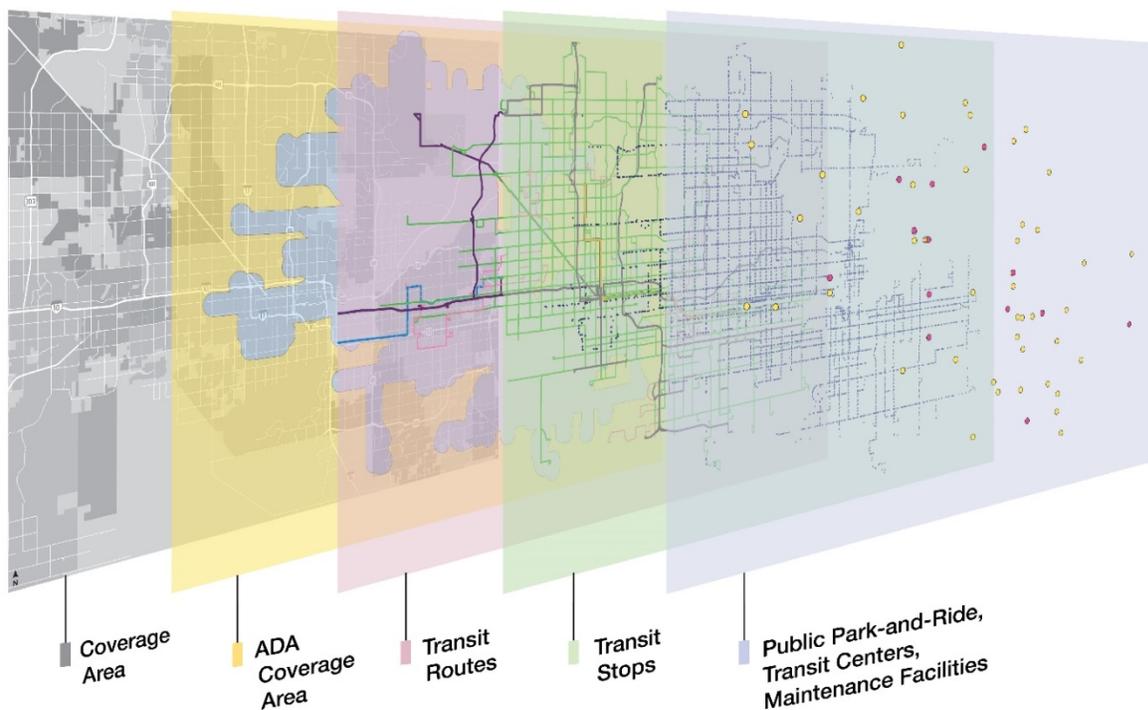
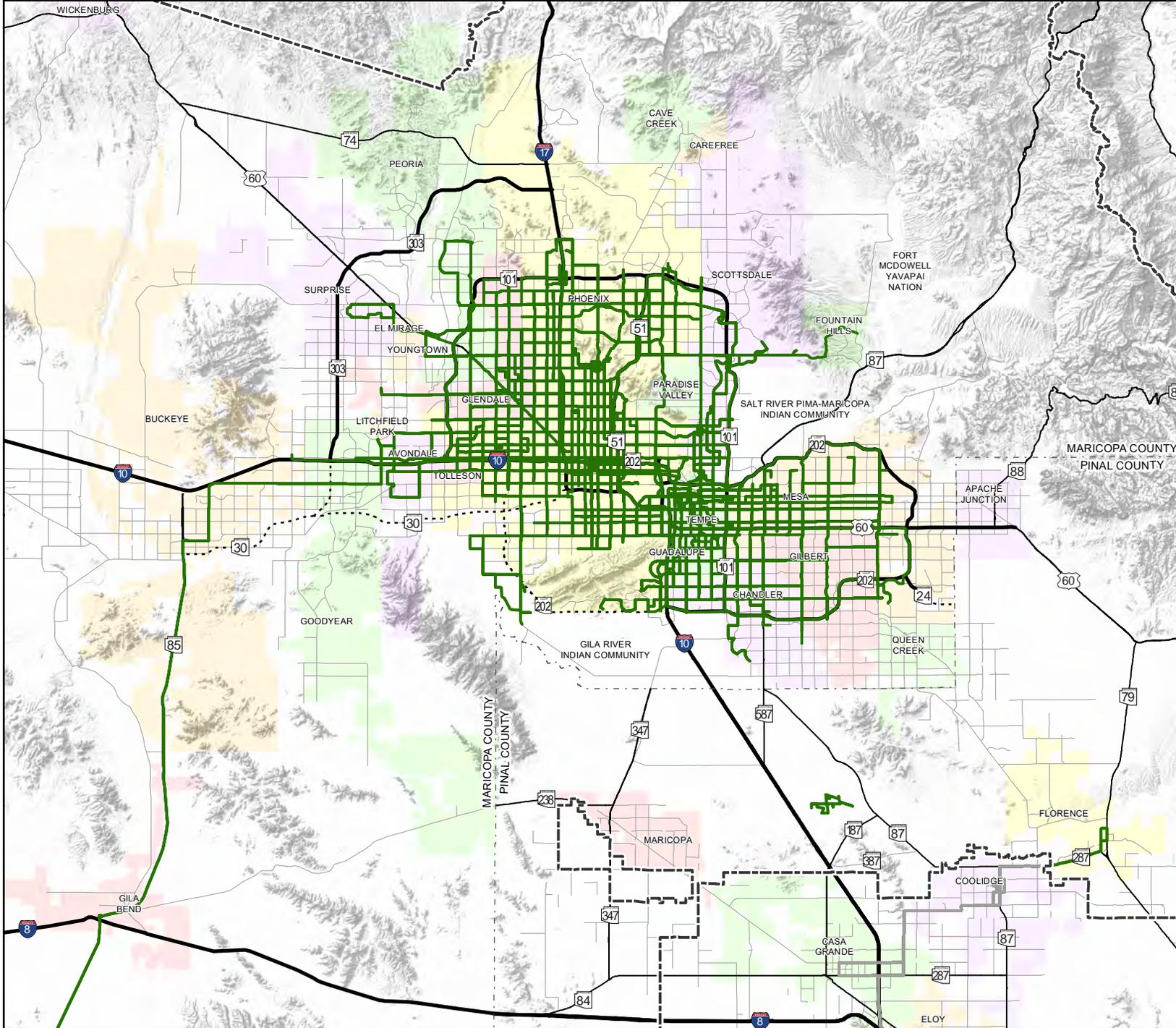


Figure 11-3: 2020 Bus Service Network

2040 Regional Transportation Plan Update



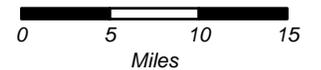
Bus Network

— 2020 Bus Network

Other Features

- Existing Freeway
- - - - Planned Freeway/Highway
- Highways
- Other Roads
- ⎓ Metropolitan Planning Area
- ⎓ County Boundary

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As previously noted, local and regional sales taxes and other revenue sources fund transit services in the region. The regional sales tax helps fund a regional bus network as part of the RTP. This network ensures that reliable service is available on a continuing basis:

- Circulators/Shuttles - Circulator service operates within a specific locale, such as a neighborhood or downtown area, and connects to major traffic corridors. There are currently 21 circulator routes in the region operating in Phoenix, Tempe, Avondale, Tolleson, Goodyear, Scottsdale, Mesa, Glendale, and Peoria.
- Local Routes - Scheduled bus service operates on a fixed route that involves frequent stops and lower travel speeds, the purpose is to deliver and pick up transit passengers close to their destinations or origins. In addition, local routes are transit routes in a city or its immediate vicinity, distinguishing them from regional transit service or interurban lines. Local routes are 100 percent locally funded.
- Regional Supergrid - Regional grid bus routes, which are also commonly referred to as "supergrid routes," are routes that follow the alignment of major roads of the regional arterial grid network. Regional funding of bus operations along the arterial grid network ensures a degree of consistency in service levels across jurisdictions, which may not otherwise be possible due to varying funding limitations at the local level.
- Rural/Flex Routes - This service type addresses the need to provide connections between the urban and rural communities of the county, serving a range of trip needs including medical, work, shopping, education, and access to various community services. The current bus system identifies one rural/flex route to Gila Bend.
- Limited Routes - Limited route bus service operates on a fixed route, typically major arterials, and provides higher speeds and fewer stops than found on other portions of the bus system or on the same route in local service. There is one limited route in the region: the Grand Avenue Limited.
- RAPID/Express Routes - Express bus provides enhanced-speed, moderate-volume commuter or regional access in the MAG region and is designed to operate primarily on the region's freeway system, including HOV lanes. Express bus service typically operates from park-and-ride locations to employment centers throughout the region. These routes provide service Monday through Friday during the morning and evening peak time periods. Express bus service usually operates one-way in the peak direction. All RAPID/Express routes have Downtown Phoenix as their final inbound destination. The term RAPID is express service that operates solely within the boundaries of the City of Phoenix.

The Great Recession negatively impacted the region's ability to provide transit service as originally proposed. The system was impacted by service decreases and elimination or postponement of some planned new service. However, recent economic conditions and local tax initiatives have the

potential to mitigate some of the previous reductions. An increase in projected revenues led to a rebalance of balance of the Transit Life Cycle Program in the fall of 2019.

In August 2015 Phoenix voters approved Proposition 104, also known as T2050, a 35-year citywide transportation plan aimed at dramatically expanding investment in Phoenix for bus service, light rail construction and street improvements. The previous transit plan, known as T2000, was a voter-approved tax that primarily funded transit service in Phoenix. Now broader and more comprehensive, the T2050 transit plan entails additional emphasis on street needs, including street maintenance to new pavement, bike lanes, and sidewalks, as well as ADA accessibility to compliment an increase in transit services. The T2050 plan was developed by the Citizens Committee on the Future of Phoenix Transportation.

Paratransit

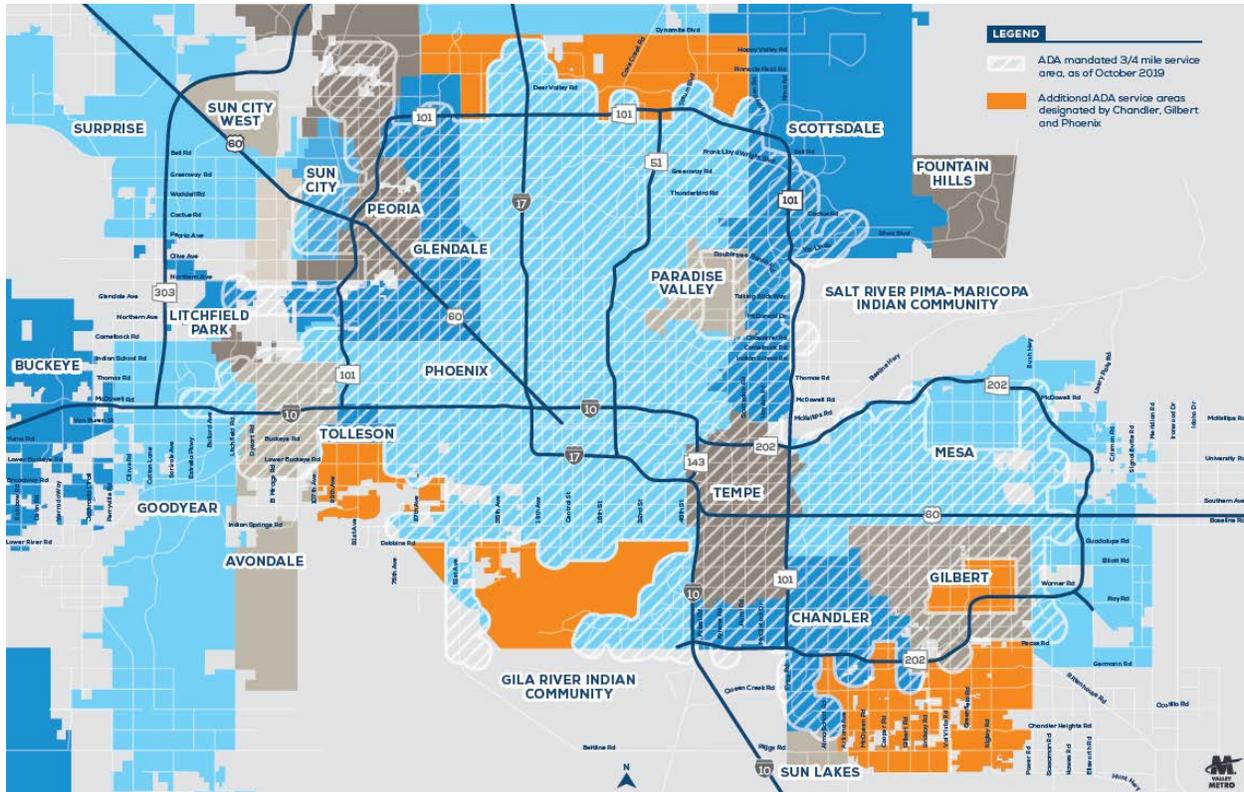
The Americans with Disabilities Act (ADA) requires transit agencies to provide alternative transportation called “paratransit” that mirrors available public transit for people with disabilities who are unable, because of a disability or disabilities, to independently use conventional public transit. Generally, paratransit service includes various types of passenger transportation that is more flexible than conventional fixed-route transit but more structured than the use of private automobiles. Paratransit includes dial-a-ride/demand response transportation services, shared-ride taxis, taxi subsidy programs, car-pooling and vanpooling. Under the RTP, ADA paratransit service is regionally funded, while senior and non-ADA paratransit service continues to be locally funded. Figure 11-4 depicts Dial-a-Ride (DAR) service areas in the MAG region.

In addition to ADA mandated service, several communities offer additional non-ADA paratransit services, including service for seniors, taxi subsidy programs, and service in areas where no public transit exists. The rules for these services vary by community, but most require any person with a disability who is not 65 years of age or greater to obtain ADA certification before using local non-ADA services. Some cities in Maricopa County have elected to provide paratransit services for seniors age 65 and above. Rules for these services vary by community, but most require the completion of an application and proof of age and residency.

- Dial-a-Ride - Dial-a-Ride (DAR) is a regional curb-to-curb or shared-ride origin to destination service that provides transportation for passengers unable to access fixed route local bus service. It is a public transportation service provided for three distinct groups of customers: ADA certified, non-ADA service, and Seniors age 65+. The ADA/DAR service is that service which is required to be provided according to ADA federal regulations as an alternative form of transit when and where local fixed route bus service is running. The federally mandated service area is three-fourths of a mile adjacent to/on each side of each transit stop. All origins and destinations within that area would be served. A certification process determines a user’s eligibility for ADA/DAR service. Some cities in the region have elected to provide DAR and other paratransit services beyond the federal

requirements. In most cases, passengers may travel within a DAR service area without transferring to another vehicle. In July 2016, Valley Metro began providing ADA paratransit service between the five DAR service areas without transfers. For a full description of paratransit services offered to seniors and people with disabilities in various jurisdictions in Maricopa County, check Valley Metro’s website <https://www.valleymetro.org/dial-ride>.

**FIGURE 11-4
DIAL-A-RIDE SERVICE AREAS**



- Other Paratransit Programs for seniors and people with disabilities - Several communities provide paratransit programs other than DAR, such as taxi subsidy programs.
- Carpool Matching Service – Valley Metro allows people to register online for carpool matching services through programs such as Share The Ride. Individuals making similar trips are matched up with each other to enable them to form their own private carpools under whatever terms they find mutually agreeable.
- Vanpools - Commuter vanpools allow groups of employees to self-organize and lease a vehicle from Valley Metro to use to operate a carpool service, providing a flexible transit solution for those trips not well served by more conventional fixed route service. The vanpool program is managed by Valley Metro through its complementary rideshare

program. In FY 2018, vanpool service logged 1,035,502 boardings. The current fleet is comprised of 377 vehicles and seating capacity per vehicle varies from six to 15 passengers. RPTA is also able to provide a wheelchair-accessible vehicle, if requested.

High Capacity Transit Operations

High capacity transit (HCT) is categorized into two categories: HCT/all day and HCT/peak period. HCT/all day provides high-capacity regional access and introduces a time-saving element by operating solely in an exclusive guideway. HCT/peak period provides higher-speed, high-volume commuter or regional access, when compared with express bus. HCT/peak period service can utilize either buses or rail vehicles. HCT service is best complimented by local bus service connections as well as adequate land uses and population/employment densities. The MAG region currently provides only HCT/all day service.

- High Capacity Transit/All Day - HCT/All Day typically operates two-way service, seven days a week. Fixed route bus or rail vehicles (e.g., light rail, streetcar) are used for this service, operating in an exclusive guideway or mixed traffic. Passenger access is available at stations located approximately every half-mile to one mile. Supergrid services in the MAG region generally operate in mixed traffic and lack the time-saving element of an exclusive guideway. In addition to addressing transportation needs, HCT/All Day services have demonstrated the ability to provide significant economic development benefits.
- *Light Rail Transit (LRT)*: On the weekdays, this service operates approximately 20 hours a day with 12-minute peak and midday service and 20-minute early morning and evening service. On Fridays and Saturdays, this service operates approximately 23 hours a day. Saturday frequency is 15-minute during the peak and midday and 20-minute in early morning and evening. On Sunday, this service operates approximately 19.5 hours a day with 20-minute all day service. Figure 11-9 includes the existing system within the planned LRT system.
- *Arterial Bus Rapid Transit (BRT)*: BRT is a two-way service that operates at higher speeds than local or regional grid bus service by taking advantage of limited stops and other time saving enhancements. BRT typically operates in a separated and dedicated right-of-way for public transit use during peak periods. This type of service is not currently provided in the MAG region.
- *PHX Sky Train*: The PHX Sky Train is a fully automated, nearly 2.5 mile grade- separated transit system that connects several major facilities at Sky Harbor International Airport with the Valley Metro bus and light rail system. The Sky Train operates 24 hours a day and arrives at stations every three to five minutes during peak periods and delivers passengers to their stops within minutes of boarding. The Sky Train is paid for with airport revenues and passenger fees.

- High Capacity Transit/Peak Period - HCT/Peak Period provides higher-speed, high-volume commuter or regional access, when compared with express bus. While express bus sometimes operates in mixed traffic, HCT/Peak Period generally operates in an exclusive guideway, providing service between park-and-ride locations and major employment centers. This service typically operates Monday through Friday during the morning and evening peak time periods traveling in the peak direction using bus or rail vehicles (e.g., conceptual commuter rail). HCT/Peak Period service can utilize either buses or rail vehicles. This type of service is not currently provided in the MAG region.

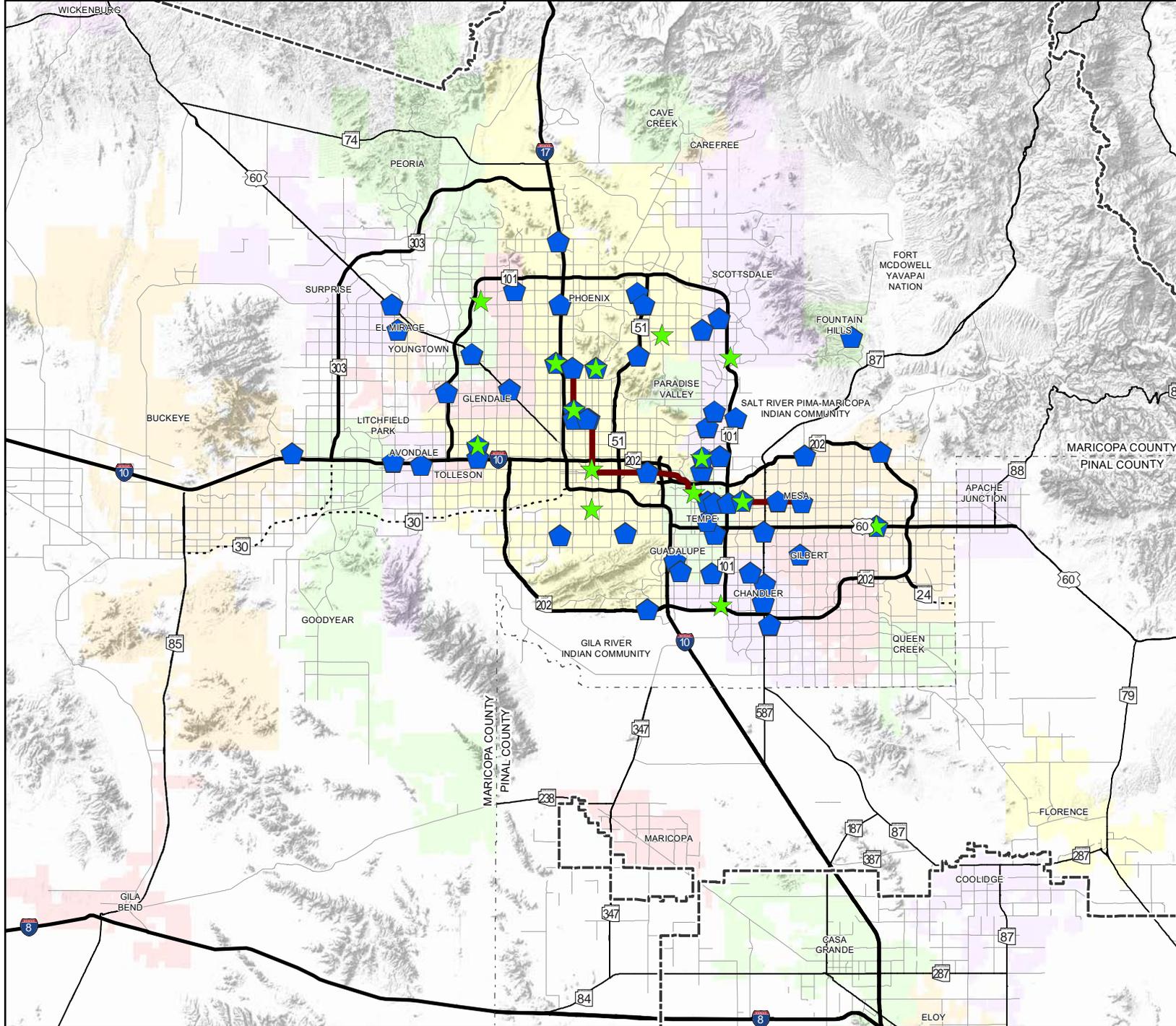
Facilities, Fleet, and Infrastructure

Transit operations are made possible by the capital facilities, fleet and infrastructure that carry passengers to their destinations. This covers not only the vehicles, tracks, stations, bus terminals, and bus stops that are directly used by passengers, but also includes the support facilities that are needed to facilitate vehicle maintenance, training, and customer service support.

- Facilities - The facilities that support the current transit system include 13 transit centers and 72 park-and-ride lots, one light rail line, and eight feeder bus operations, some of which are publicly owned, while others are in partnership with commercial establishments. Facilities also include eight bus and one light rail operations and maintenance facilities and over 7,400 bus stops. Finally, there is also the Valley Metro Mobility Center in East Phoenix, which houses regional customer service and where the ADA in-person assessments are conducted. These facilities are shown in Figure 11-5.
- Fleet - The current fleet in the transit system include: 777 buses, 108 shuttles/circulators, 167 dial-a-ride vehicles, 432 vans, 50 light rail vehicles, and nine regional connectors. These totals do not include the contractor-provided fleet of sedans, vans, and wheelchair-accessible vans, which operate DAR services in the East and Northwest Valley sub-regions and for regional paratransit services.
- Infrastructure - The LRT system has two, bidirectional tracks, light rail trains are comprised of one to three light rail vehicles. Important elements of the LRT system include park-and-ride lots at various locations along the alignment and signal priority strategies that improve speed. Passenger stations are generally located about a mile apart, but closer (1/2 mile apart) in urban centers. Half-cent sales tax funds from Proposition 400, from City of Phoenix' Transit 2000 Plan, and City of Tempe's 1996 Transit Plan along with funds from the City of Mesa were utilized to pay for route construction of the minimum operating segment (MOS) (Montebello Avenue/19th Avenue in Phoenix to Sycamore/Main Street in Mesa). Funds were also allocated toward certain elements of the support infrastructure (e.g. vehicles, bridges, park-and-rides, and the operations and maintenance facility). In addition to LRT infrastructure, the transit network also utilizes direct HOV ramps and busways to support the Express/Rapid routes.

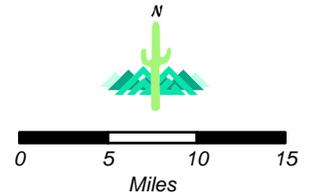
Figure 11-5: Transit Center and Park-and-Ride Facilities (2020)

2040 Regional Transportation Plan Update



- Transit Facilities**
- ★ Transit Centers
 - ◆ Park & Ride
 - Completed LRT
- Other Features**
- Existing Freeway
 - - - - Planned Freeway/Highway
 - Highways
 - Other Roads
 - ⊠ Metropolitan Planning Area
 - ⊠ County Boundary

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Future Transit Network

The 2040 RTP Update includes a broad vision for future transit facilities and services in the Region. Future bus service in the MAG Region will be a critical component of the planned regional transportation network. Paratransit services will also be essential, providing transportation for passengers unable to access conventional transit services. High capacity transit, which typically operates in an exclusive guideway, addresses higher volume transit needs and has demonstrated the ability to provide significant economic development benefits. In addition, investments in capital facilities, fleet and infrastructure are necessary to provide the vehicles, tracks, stations, bus terminals, and bus stops that are directly used by passengers, as well the support facilities that are needed for vehicle maintenance, provide training, and house customer services. The emergence of new technologies, such as autonomous vehicles, connected vehicles and Transit Network Companies (TNCs), must also be considered as advancement in such technologies is fast paced with implications sure to impact mobility planning and design.

Planned Bus Service

The future bus service in the MAG Region is an important component of the planned regional transportation network. Over time, new routes will be added to the existing transit system. Helping to guide the addition of new routes to the system is the recently completed Transit Standards and Performance Measures (TSPM) effort, as well as the new Short-Range Transit Program (SRTP) facilitated by Valley Metro. The performance-based transportation system is emphasized and required as part of the federal government's Moving Ahead for Progress in the 21st Century Act (MAP-21), and in the subsequent Fixing America's Surface Transportation Act (FAST Act). In addition, the Arizona State Legislature, in its legislation leading to Proposition 400 in 2004, stressed performance based transportation planning and programming, requiring audits every five years to verify operational performance and to address potential changes to the plan to improve performance.

In October 2012, Valley Metro initiated the TSPM effort. Phase I of the TSPM effort established service delivery goals, a definition of service types and associated service standards (days of operation, span, frequency), passenger stop spacing standards, and modifications to the regional transit service change process; it was approved by the Valley Metro Board in November 2013. Phase II included the identification of regional transit performance measures and associated planning tools, transit service performance thresholds, standards for implementing and prioritizing new transit services, and principles for the application of regional transit standards and performance measures; it was approved in December 2014. Phase III included service design standards for local and key local bus routes and a regional fleet prioritization process; it was approved in June 2016.

The SRTP identifies transit service improvements needed during the next five years. The SRTP identifies regional and local transit service improvements programmed in the TLCP as well as those local operating budgets. The SRTP is based on input submitted by member agencies as well as concepts developed by Valley Metro in conjunction with TSPM. The SRTP serves as input for

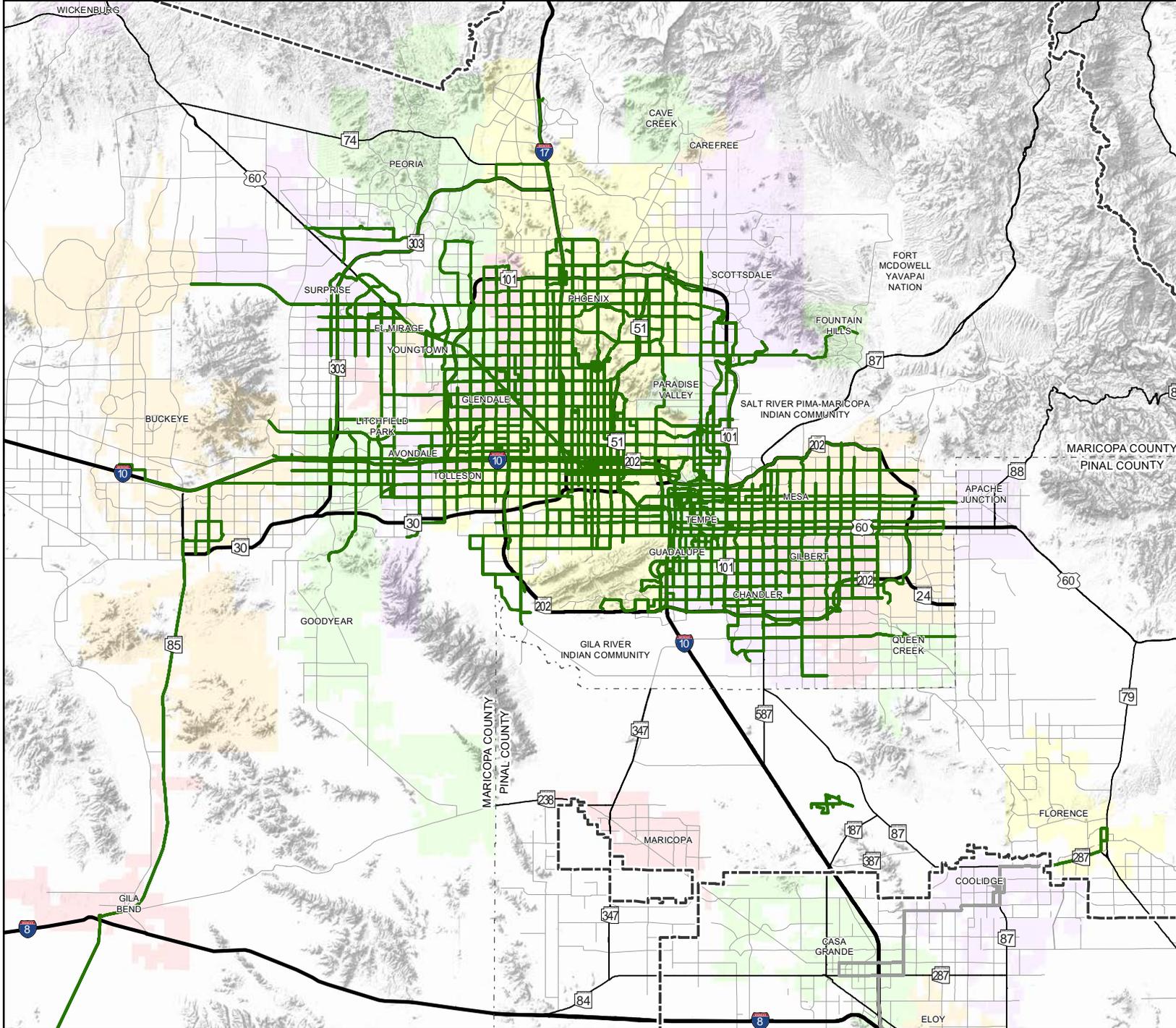
the TLCP, Fleet Management Plan, bi-annual service changes and the region's Transportation Improvement Program. Both the TSPM and SRTP processes are completed in close consultation with member agencies.

Funding for the additional transit service will be provided by revenue from federal, Proposition 400, and local sources. Based on the interest to implement transit services, it is reasonable to assume that other cities will also fund transit service beyond what is identified in Proposition 400 and current local sales taxes. Figure 11-6 depicts the 2040 fixed route bus network. This figure covers regionally and locally funded services. The amount identified in the long-range plan for bus facilities and services, which also includes vanpool, dial-a-ride, and passenger support services, totals approximately \$13.4 billion (YOE \$'s) from all funding sources. A detailed listing of the timing and cost of planned bus service and capital improvements that are regionally funded are provided in Appendix E.

- Circulators/Shuttles - It is anticipated that local agencies throughout the region will continue to add local circulators/shuttles to their transit operations in parallel with available resources during the planning period.
- Local Routes - Consistent with population growth and development patterns, it is anticipated that locally funded routes will incrementally be extended to meet demand within individual jurisdictions. Furthermore, current routes are expected to be modified in order to best meet ridership demand and effectively and efficiently use available resources. It is also anticipated that several local routes will transition to regional supergrid routes.
- Regional Supergrid - It is anticipated that by FY 2040, the remaining regionally funded transit routes outlined in the TLCP will be operational. Regionally funded bus routes are phased in during the planning period to allow for the acquisition of transit fleet and the construction of supporting infrastructure (i.e., operations and maintenance facilities, passenger facilities, road improvements, etc.). Figure 11-7 indicates how these services will be phased in over the planning period.
- Rural/Flex Routes - It is anticipated that the Rural/Flex route will continue operating and be regionally funded. Determining whether to develop, reinstate or extend a Rural/Flex route in the future will depend on ridership demand and available funding.
- Limited Routes - It is anticipated that the current limited route on Grand Avenue will continue operating and be regionally funded. Determining whether to reinstate or extend limited routes in the future will depend on ridership demand and available funding.
- RAPID/Express Routes - The proposed RAPID/Express routes as identified in the RTP are intended to operate using HOV facilities to connect park-and-ride lots with major activity centers including core downtown areas. Regional funding has been allocated for express operations throughout the RTP planning period. Figure 11-8 indicates how these services will be phased in over the planning period.

Figure 11-6: 2040 Bus Service Network

2040 Regional Transportation Plan Update



Bus Network

— 2040 Bus Network

Other Features

— Freeways

— Highways

— Other Roads

--- Metropolitan Planning Area

... County Boundary

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Planned Paratransit Services

Paratransit service includes various types of passenger transportation that offers a shared-ride origin to destination service that provides transportation for passengers unable to access fixed route local bus service. It can also allow groups of employees to self-organize and operate a carpool service, providing a flexible transit solution for those trips not well served by more conventional fixed route service. Paratransit includes dial-a-ride/demand response transportation services, shared-ride taxis, taxi subsidy programs, car-pooling and vanpooling.

- Dial-A-Ride (DAR) - It is anticipated that DAR service facilitated by the Americans with Disabilities Act (ADA) will grow commensurate to the number of fixed route bus miles expanded on per-year basis.
- Other Paratransit Programs for Seniors and People with Disabilities - As taxi subsidy programs and other innovative services prove to be both efficient and effective in serving seniors and people with disabilities, it is anticipated these programs will be introduced and expanded.
- Vanpools - The future of the regional vanpool program is expected to grow due to its level of convenience and ease of customization to meet user's needs. Federal sources fund 100 percent of the capital purchase of the vans, while the operations (e.g., fuel, insurance, maintenance, etc.) for this program are recovered 100 percent from passenger use/fares.

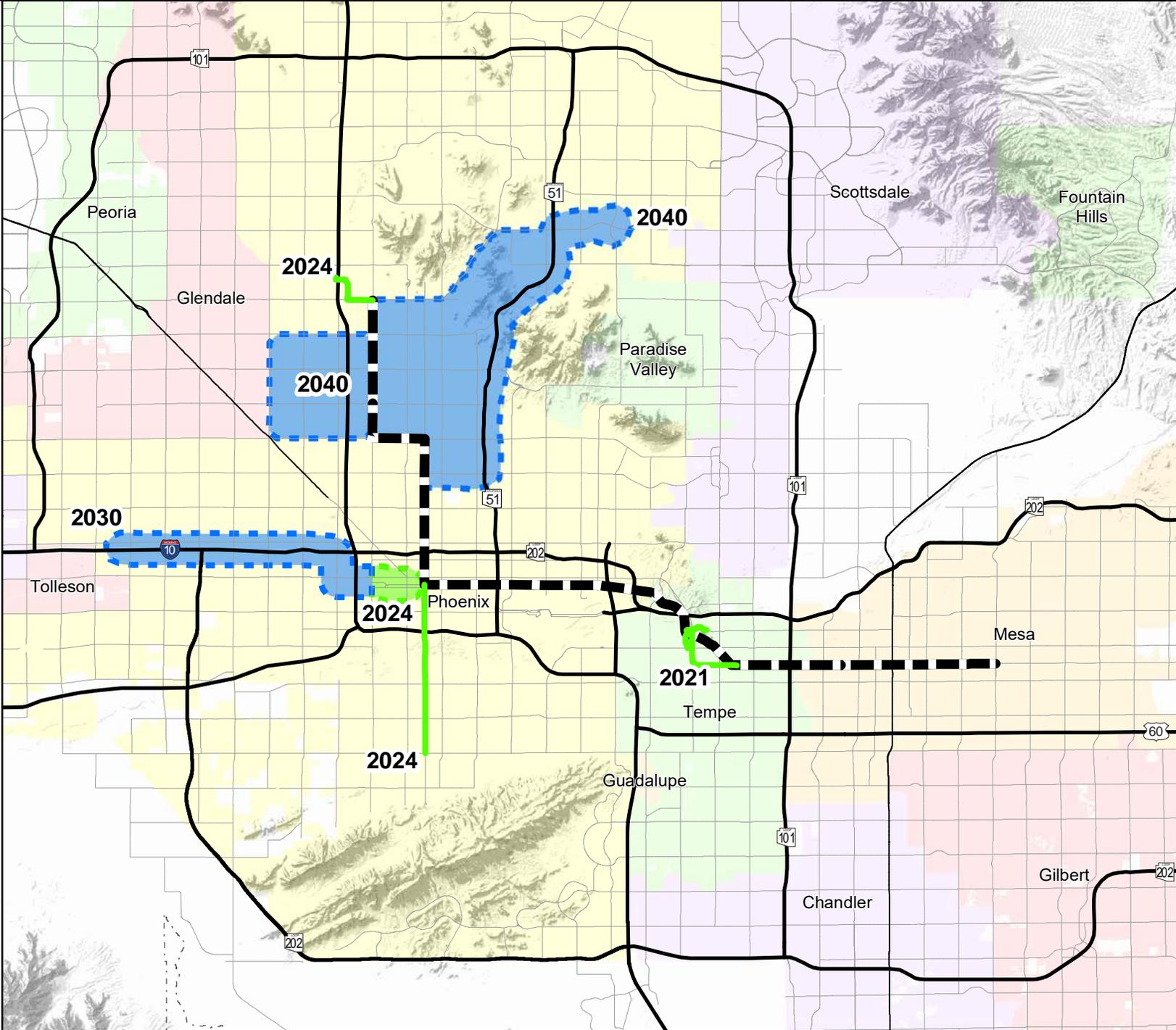
Planned High Capacity Transit

High Capacity Transit/Peak Period - HCT/Peak Period provides higher-speed, high-volume commuter or regional access, when compared with express bus. While express bus sometimes operates in mixed traffic, HCT/Peak Period generally operates in an exclusive guideway, providing service between park-and-ride locations and major employment centers. This service typically operates Monday through Friday during the morning and evening peak time periods traveling in the peak direction using bus or rail vehicles (e.g., conceptual commuter rail). HCT/Peak Period service can utilize either buses or rail vehicles. This type of service is not currently provided in the MAG region. A detailed listing of the timing and cost of planned high capacity service and capital improvements is provided in Appendix E.

- HCT/All Day - Fixed route bus or rail vehicles (e.g., light rail, streetcar) are used for this service, operating solely in an exclusive guideway. Passenger access is available at stations located approximately every half-mile to one mile.
 - *Light Rail Transit/High Capacity Transit (LRT/HCT)*: The RTP includes a 66-mile HCT system: the existing 28-mile system and seven planned extensions. The amount identified in the RTP from all funding sources for LRT/HCT expenditures during the planning period totals \$9.8 billion (YOE \$'s). Proposition 400 half-cent sales tax funding will not be used for operating expenses on any part of the LRT/HCT system.

Figure 11-9: Regional Light Rail Transit (LRT)/High Capacity Transit Extensions

**2040
Regional Transportation Plan
Update**



- LRT/HTC Corridors**
- Completed
 - Group 1 (FY 2020 - FY 2024)
 - Group 2 (FY 2025 - FY 2026)
 - Group 3 (FY 2027 - FY 2040)
- Other Features**
- Freeways
 - Highways
 - Metropolitan Planning Area
 - County Boundary

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- Operating funds, which include farebox receipts, will be provided by participating jurisdictions. In addition, provisions are made to fund regional LRT/HCT support infrastructure. Table 11-1 lists the LRT/HCT extensions and attributes. Figure 11-9 indicates how services will be phased in over the 21-year planning period.

**TABLE 11-1
HIGH CAPACITY TRANSIT/LIGHT RAIL - EXTENSIONS**

Extension Route Name (1)	Technology	Length (mi.)	Year Open
Tempe Streetcar, Tempe	Modern Streetcar	3.0	2021
Northwest Phoenix - Phase II, Phoenix	Light Rail Transit	1.7	2024
South Central, Phoenix	Light Rail Transit	5.0	2024
Capitol/I-10 West - Phase I (to 17th Ave./Jefferson), Phoenix	Light Rail Transit	1.4	2024
Capitol/I-10 West - Phase II (to 79th Ave./I-10), Phoenix	Light Rail Transit	9.6	2030
Northeast, Phoenix (3)	TBD (3)	12.0	2040
West Phoenix, Phoenix (2)	Light Rail Transit	3.0	2040

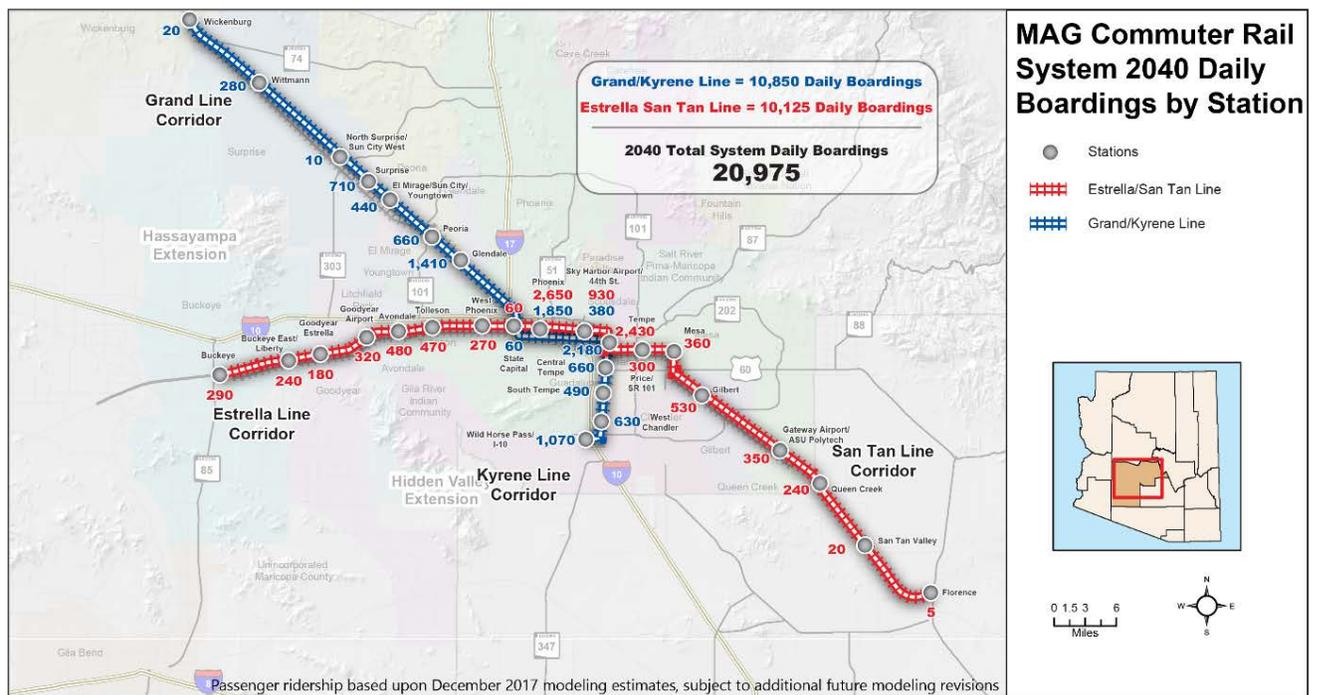
- (1) Projects programmed after calendar year 2026 are outside of the Transit Life Cycle Program. Priority of projects for new future funding is yet to be determined.
- (2) Locally preferred alternative corridor under study.
- (3) Technology to be determined.

- *PHX Sky Train*: The PHX Sky Train is a fully automated, nearly 2.5 mile grade-separated transit system that connects several major facilities at Sky Harbor International Airport with the Valley Metro bus and light rail system. On April 22, 2009, the MAG Regional Council approved inclusion of Stage Two as an illustrative project in the RTP, with the City of Phoenix approving full funding in October 2016. Stage Two, will extend the SkyTrain an additional 1.8 miles to serve the Phoenix Sky Harbor Rental Car Center by 2021. The Sky Train is paid for with airport revenues and passenger fees.
- HCT/Peak Period - High Capacity Transit/Peak Period - HCT/Peak Period provides higher-speed, high-volume commuter or regional access, when compared with express bus. While express bus sometimes operates in mixed traffic, HCT/Peak Period generally operates in an exclusive guideway, providing service between park-and-ride locations and major employment centers.
- *MAG Regional Transit Framework Study*: This transportation framework study identified over 129 miles of potential HCT/Peak Period/commuter rail corridors in the region. The RTP recognizes that these corridors may potentially serve a vital function in addressing future travel needs in the region, and has included them as illustrative corridors (see Chapter 17). An update of the MAG Regional Transit Framework Study was accepted

by Regional Council in December 2019. Its focus was a technically-based identification of corridors with the highest potential to support all-day, high capacity transit (i.e., light rail transit, bus rapid transit, and enhanced bus). Corridors identified require further feasibility analysis and study, and may result in revisions to corridors identified in the RTP.

- *Commuter Rail:* MAG was directed by Regional Council to develop a Commuter Rail Strategic Plan in 2009. Accordingly, also at the direction of member agencies, MAG commissioned three additional planning studies: Systems Study, Grand Avenue Corridor Study and Yuma West Corridor Study. These three studies were completed in spring 2010. In the fall of 2018, MAG completed the Regional Commuter Rail System Study Update. The purpose was to update the data included in the original, 110-mile MAG 2010 Commuter Rail System Study (specifically new regional socioeconomic forecasts, revised ridership, cost estimates, corridor rankings) and information from other relevant passenger rail studies and technical content. Governance and indemnity/liability issues related to passenger rail implementation were studied, as these elements must be addressed prior to any agreement between the owner railroads and the eventual commuter rail governing/operating agency. Increased mobility to jobs, housing alternatives, and connectivity to downtowns, airports and entertainment centers, travel and tourism options, and traffic mitigation were also evaluated. There are currently no funds identified for implementing commuter rail in the next 21 years (Figure 11-10).

**FIGURE 11-10
CONCEPT MAP OF REGIONAL COMMUTER RAIL SYSTEM**



Planned Facilities, Fleet, and Infrastructure

Future transit operations will depend on the capital facilities, fleet and infrastructure that are necessary to carry passengers to their destinations. This covers not only the vehicles, tracks, stations, bus terminals, and bus stops that are directly used by passengers, but also includes the support facilities that are needed for vehicle maintenance, provide training, and house customer services. These costs are included in the planning period cost estimates identified previously for bus and light rail/high capacity transit.

- Facilities - Associated with the expansion of transit service will be the need for additional maintenance and passenger facilities. The identification of specific locations that will host these facilities will occur as the result of ongoing capital planning efforts. The current Operations and Maintenance Center has planned expansion to accommodate future LRT and streetcar extensions in 2021.
- Fleet - Over the duration of the planning period, buses and LRT/HCT and streetcar vehicles will be purchased for fixed route networks, and rural routes. Dial-a-Ride (DAR) vans for paratransit purposes and vanpool vans will also be acquired. These procurements reflect both replacement and expansion vehicles.
- Infrastructure - The RTP includes funding toward the completion of support infrastructure affiliated with the LRT/HCT extensions. This includes infrastructure for the rail, right of way purchase, park-and-rides, Intelligent Transportation System (ITS) equipment, etc.

Funding and Expenditure Summary

Table 11-2 has been prepared to provide a summary of the funding profile for the transit element of the RTP. This table lists the reasonably available funding sources for the planning period and the uses of those funds. Sources include a variety of federal, regional, and local funding sources, including farebox receipts, while uses cover both operating and capital costs. The balance between funds available and expenditures indicates that the transit element can be accomplished with reasonably available funding sources over the planning period.

Funding Sources

Regional funding sources for transit in terms of YOE \$'s are shown in Table 11-2 for the period FY 2020-2040. These sources include the half-cent sales tax (\$5.9 billion); federal transit funds (\$4.5 billion) and federal Congestion and Air Quality Mitigation funds (\$554 million); local/other funding sources, including farebox receipts, (\$12.6 billion); and an estimated cash balance of \$68 million in regional funds at the beginning of FY 2020. Debt service expenses totaling \$248 million are deducted from these sources. This yields a net total of \$23.3 billion (YOE \$'s) for use on transit services and projects. These revenue sources have been major funding elements for transportation facilities in the MAG area for decades and are considered to be reasonably available to the region throughout the planning period.

**TABLE 11-2
TRANSIT FUNDING PLAN: FY 2020 THROUGH FY 2040**

FUNDING (Year of Expenditure \$'s in Millions)		Totals
Regional Funds		
MAG Half-Cent Sales Tax		5,948.8
MAG Federal Transit Funds		4,464.7
MAG Federal CMAQ		553.7
Beginning Balance (Regional Funds)		67.9
Bond Proceeds		0.0
Allowance for Debt Service and Other Expenses		(247.8)
	Total Regional Funds	10,787.3
Local / Other		
Fixed Route Bus Fares		1,593.8
Light Rail Transit/High Capacity Transit Fare Collections		653.3
Paratransit Vehicle Fares		110.6
Vanpool Fares		26.8
ALF Revenues		16.8
Local Funds		10,150.1
	Total Local/Other Funds	12,551.4
	Total Funding	23,338.6
EXPENDITURES (Year of Expenditure \$'s in Millions)		Totals
Regionally Funded Projects		
<i>Capital</i>		
Regional Bus Fleet		1,215.0
Bus Maintenance and Passenger Facilities		419.2
Light Rail Transit/High Capacity Transit Regional Infrastructure		1,133.2
Light Rail Transit/High Capacity Transit Extensions		4,080.1
Paratransit (Americans with Disabilities Act, or ADA, compliant)		101.2
Vanpool		113.0
Rural/Non-Fixed Route Transit		10.7
	Total Capital - Regionally Funded Projects	7,072.3
<i>Operating</i>		
Supergrid		1,516.2
Freeway Rapid Bus and Express Bus		278.8
LINK Service		58.2
Regional Passenger Support Services		213.2
Paratransit (ADA-compliant)		1,017.9
Light Rail Transit/High Capacity Transit		0.0
Rural/Non-Fixed Route Transit		11.5
Vanpool		26.8
Planning, Programming and Other Support		154.9
	Total Operating - Regionally Funded Projects	3,277.5
FTA Funds Forecast Contingency		437.4
	Total Regionally Funded Projects	10,787.3
Locally / Other Funded Projects		
<i>Capital</i>		
Fixed Route Bus Service		1,153.7
Paratransit		97.8
Light Rail Transit/High Capacity Transit		1,537.1
	Total Capital - Locally/Other Funded Projects	2,788.5
<i>Operating Costs</i>		
Fixed Route Bus Service		6,103.1
Paratransit		772.3
Light Rail Transit/High Capacity Transit		3,096.5
Planning, Programming and Other Support		228.5
	Total Operating - Locally/Other Funded Projects	10,200.3
FTA Funds Forecast Contingency		(437.4)
	Total Locally/Other Funded Projects	12,551.4
	Total Expenditures	23,338.6

Local/other funding contributions to transit services in the region have been significant in the past and are anticipated to continue to play an important funding role in the future. Based on the "Valley Metro Transit Services Inventory Report, 2019", it was projected that local funding sources had the potential to provide approximately \$10.2 billion for transit services during the planning period, taking into account population growth over the planning period. This represents a major portion of the \$12.5 billion identified above.

Program Expenditures

Table 11-2 lists estimated future costs for the transit element of the RTP, expressed in YOE \$'s. Expected expenditures during the planning period total \$23.3 billion. This includes: (1) \$11.4 billion for fixed route bus capital and operating, including maintenance facilities and support services, (2) \$2.1 billion for paratransit capital and operating, including vanpools, and (3) \$9.8 billion for light rail transit/high capacity transit capital and operating.

CHAPTER TWELVE

AVIATION

The Maricopa Association of Governments (MAG) region includes 16 airports, including:

- One major commercial facility, Phoenix Sky Harbor International Airport;
- One non-hub commercial airport that supplements Phoenix Sky Harbor, Phoenix-Mesa Gateway Airport;
- One Air Force Base;
- Seven general aviation reliever airports; and
- Six general aviation airports.

A map of airports within the MAG region is shown in Figure 12-1.

The MAG Regional Aviation System Plan (RASP) Update and the aviation planning program were completed in 2006. The MAG RASP Policy Committee and the MAG RASP Technical Advisory Committee oversaw the program and guided the preparation of the plan. After the work was completed, both committees were dissolved. The aviation program examined the region's future air transportation needs to maximize transportation and economic benefits of airports while minimizing adverse impacts related to congestion, the environment, and airspace. The Federal Aviation Administration (FAA) is responsible for the planning and management of airspace.

The support for Phoenix Sky Harbor, Phoenix-Mesa Gateway Airport, and Luke Air Force Base was an important element of the planning process. In 2018, Sky Harbor served more than 45 million passengers and Phoenix-Mesa Gateway served 1.5 million. Luke Air Force Base is the largest F-16 and F-35 training base in the world. The facilities fulfill air transportation and national defense needs and contribute billions of dollars to the regional economy annually.

Future planning efforts will focus on managing ground access to airports for highway and transit facilities, interacting with airport personnel, and exploring opportunities for improving the regional aviation system. In addition, the agency is working towards developing an aviation database that will support the MAG airport model, which develops air pollutant emissions inventory for airports in Maricopa County.

CHAPTER THIRTEEN

ACTIVE TRANSPORTATION

The Maricopa Association of Governments (MAG) maintains an active role in promoting the establishment of improved travel opportunities for bicyclists and pedestrians. MAG is a leader in promoting improvement in the Valley's street-side environments to better accommodate pedestrian travel. Past pedestrian planning efforts conducted by MAG and its member agencies have led to pedestrian-oriented policies, programs, and roadway improvements. The MAG Regional Bicycle Task Force was responsible for assisting in the development of the original MAG Bicycle Plan in 1992. In 1994, MAG formed the Pedestrian Working Group to promote increased awareness of walking as an alternative mode of travel and to improve facilities for people who walk. In 2001, MAG combined the groups to form the MAG Bicycle and Pedestrian Committee. In 2016, the committee was renamed the MAG Active Transportation Committee.

Regional Bicycle and Pedestrian Plans

MAG's bicycle and pedestrian planning efforts cover regional planning activities, including the development of regional bicycle plans, regional pedestrian plans, and multimodal corridor plans. In addition, MAG developed bicycle and pedestrian design guidelines and design assistance programs. In 2017, MAG also developed a three-year Bicycle and Pedestrian Master Plans pilot program that provides member agencies the opportunity to develop comprehensive bicycle and pedestrian master plans for their communities.

MAG Regional Bikeway Master Plan

In February 1992, the MAG Regional Council adopted the MAG Regional Bicycle Plan to address the needs and concerns of bicyclists in the Region, and to encourage bicycling to alleviate traffic congestion and air pollution. The MAG Regional Council adopted a Bicycle Plan Update in March of 1999. MAG followed the 1999 Bicycle Plan Update with the Regional Off-Street System (ROSS) Plan, which was adopted by the MAG Regional Council in February 2001.

In 2007, MAG developed the MAG Regional Bikeway Master Plan, which incorporated the 1999 MAG Regional Bicycle Plan, the Alternative Solutions to Pedestrian Mid-block Crossings at Canals, and the 2001 ROSS Plan. The goal of the MAG Regional Bikeway Master Plan is to update and integrate all three documents into one master plan, in order to develop an interconnected bikeway system of on-street and off-street facilities. The MAG Regional Bikeway Master Plan provides a guide for the development of a convenient and efficient transportation system where people can bike safely to all destinations. This plan recognizes the growing needs of the bicycling public and seeks to encourage more bicycling for transportation and health reasons. Bicycling, as a transportation mode, improves air quality and reduces traffic congestion and is less costly than operating a motorized vehicle. In addition, bicyclists benefit from improved health and fitness.

Regional Pedestrian Plan

The 2000 MAG Pedestrian Plan identified and recommended programs and actions to guide and encourage the development of pedestrian areas and pedestrian facilities. The update incorporates flexible design tools (Roadside Performance Guidelines) to assist MAG member agencies in creating better walking environments within the existing or new roadway network. A stakeholders group was directly involved in the development of the plan update, which was overseen by the Pedestrian Working Group, and adopted by the MAG Regional Council on December 8, 1999.

The plan contains five goals that are vital to creating a mode shift towards greater pedestrian mobility. The five goals are: land use compatibility, public awareness, funding, design, and intermodal linkages. One of the major regional initiatives reflected throughout the goals and objectives of the Pedestrian Plan 2000 is to establish performance guidelines for pedestrian facilities within road right of way. Establishing region-wide performance guidelines, as opposed to rigid roadway cross-sections, provides design flexibility to MAG member agencies. Providing this flexibility within performance guidelines, as opposed to prescriptive cross-sectional standards, will ensure that roadways meet the needs of other travel modes while simultaneously encouraging pedestrian travel throughout the MAG Region.

West Valley Multimodal Transportation Corridor Plan

The MAG West Valley Multimodal Transportation Corridor Plan and accompanying action plan were adopted by the MAG Regional Council on October 3, 2001. This plan created a master and action plan to implement a 42-mile trail network for pedestrians, equestrians, bicyclists and other non-motorized trail users for the New River and lower Agua Fria River areas. The plan provides for regional consistency in the development of non-motorized transportation facilities along the corridor by establishing consistent and uniform design for the development of a safe and comfortable multimodal trail system.

MAG Pedestrian Policies and Design Guidelines

In 2005, MAG updated the MAG Pedestrian Policies and Design Guidelines, which were originally written in 1995. The Guidelines are intended to provide information and design assistance to support walking as an alternative transportation mode. Through application of the policies and design guidance in the document, jurisdictions, neighborhoods, land planners, and other entities will be able to: (1) better recognize opportunities to enhance the built environment for pedestrians; (2) better create and redevelop pedestrian areas throughout the Region that integrate facilities for walking with other transportation modes; (3) support the development of areas where walking is the preferred transportation mode; and (4) encourage the development of other independent pedestrian-focused transportation facilities. The updated document includes information on elder mobility, Safe Routes to School, and discusses changes in the Americans with Disabilities Act Accessibility Guidelines. The Pedestrian Policies and Design Guidelines can be downloaded from the MAG website.

Complete Streets Guide

MAG authored a Complete Streets Guide in 2011. The purpose of the Guide is to ensure that bicycle and pedestrian facilities are included in all street designs, to the greatest extent possible, and are ultimately being considered as integral to a street as a fundamental component of community mobility, health, and safety. The Guide contains Complete Streets goals, strategies and a planning process. Complete Streets contribute to the overall capacity of a street, increase in property values, enhance the health of individuals, and create a sense of place.

MAG Regional Bikeways Map and Regional Activity and Destination Viewer

Every three years MAG develops and prints a regional bikeway map indicating bike lanes, shared use paths, off-street trails, and canals. The map also presents bike education information including the Arizona State Law and information on taking a bike on the bus and on the light rail. The map also includes photographs of desirable bicycling locations. In 2012, MAG expanded the print version to include an online version for the smart phone. The online version is updated frequently to ensure the best user experience possible. The most recent version of the MAG Regional Bikeways Map was completed in FY 2019. The Regional Activity and Destination (RAD) Viewer is an additional online option for bicyclists, pedestrians and other interested parties that includes bikeways, transit routes and stops, as well as a variety of destination points and other amenities across the Region.

Bicycle and Pedestrian Design Assistance Program

The FY 2021 MAG Unified Planning Work Program and Annual Budget included \$500,000 for the Bicycle and Pedestrian Design Assistance program. The program allows MAG member agencies to apply for funding for the preliminary engineering portion of a bicycle or pedestrian project including shared-use pathways.

The MAG program was initiated in 1996 as the Pedestrian Design Assistance Program to encourage the development of designs for pedestrian facilities according to the MAG Pedestrian Policies and Design Guidelines. The intent of the program is to encourage integration of pedestrian facilities into the planning and design of all types of infrastructure and development. Through the program, the design of pedestrian facilities that are compatible with existing land use and transportation practices is promoted. MAG anticipates that through this program, MAG members and private sector professionals involved in transportation and land use design will become familiar with the MAG Pedestrian Policies and Design Guidelines and the opportunities for integrating facilities that support walking into land use and transportation planning. Creating areas where people choose to walk instead of using a private vehicle assists in managing congestion and improving air quality.

In 2006, MAG initiated the Bicycle Facilities Design Program encouraging MAG members and private sector professionals involved in transportation and land use design to utilize the American Association of State Highway Transportation Officials Guide for the Development of

Bicycle Facilities. Bicycle and pedestrian projects consider the needs of seniors as recommended in the Federal Highway Administration Guidelines and Recommendations to Accommodate Older Drivers and Pedestrians.

MAG Bicycle Counts Program

In 2013, MAG piloted a regional bicycle counts program, coordinating with member jurisdictions to identify locations for counters. Consultant services were acquired to install and maintain counting equipment, and MAG staff monitored and collected count data. Data was distributed to cities and towns for review; the program ended in 2016. In FY 2020, MAG will embark on a more comprehensive count program conducted through its Transportation and Technologies Services Division. The counts will be used to form the Region's first valid bicycle model.

MAG Bicycle and Pedestrian Master Plans and First Time Updates

In response to an inquiry about available funding for MAG member agencies in the Region to develop bicycle and pedestrian master plans, the MAG Bicycle and Pedestrian Committee formed a working group to examine the issue in 2017. The Committee recommended that funding be set aside to assist in the development of local plans. The group stipulated that applications requesting Transportation Alternatives (TA) funding for Bicycle/Pedestrian Master Plans will be limited to first time bicycle and pedestrian master plans or first-time updates of existing plans. This was a three-year pilot program and will sunset after FY 2020.

MAG Active Transportation Plan

The MAG Active Transportation Plan will be developed as a comprehensive regional bicycle and pedestrian plan that will inform the development of the next Regional Transportation Plan. The Active Transportation Plan will serve as a guide for developing the Regional bicycle and pedestrian network and its connections to the Regional transit system to provide a more complete active transportation system. The plan's focus is on identifying potential facilities that will provide high quality active transportation options. This planning effort was initiated during FY 2017 and will be completed in FY 2020.

Funding for Bicycle and Pedestrian Projects

The MAG Regional Transportation Plan and MAG Transportation Improvement Program include a strong commitment to implement bicycle facility improvements. Funding specifically for bicycle and pedestrian projects from regional sources totals approximately \$340 million (year of expenditure, YOE \$s). This funding is provided from MAG Congestion Mitigation Air Quality and Transportation Alternatives funds and requires a 5.7 percent local match.

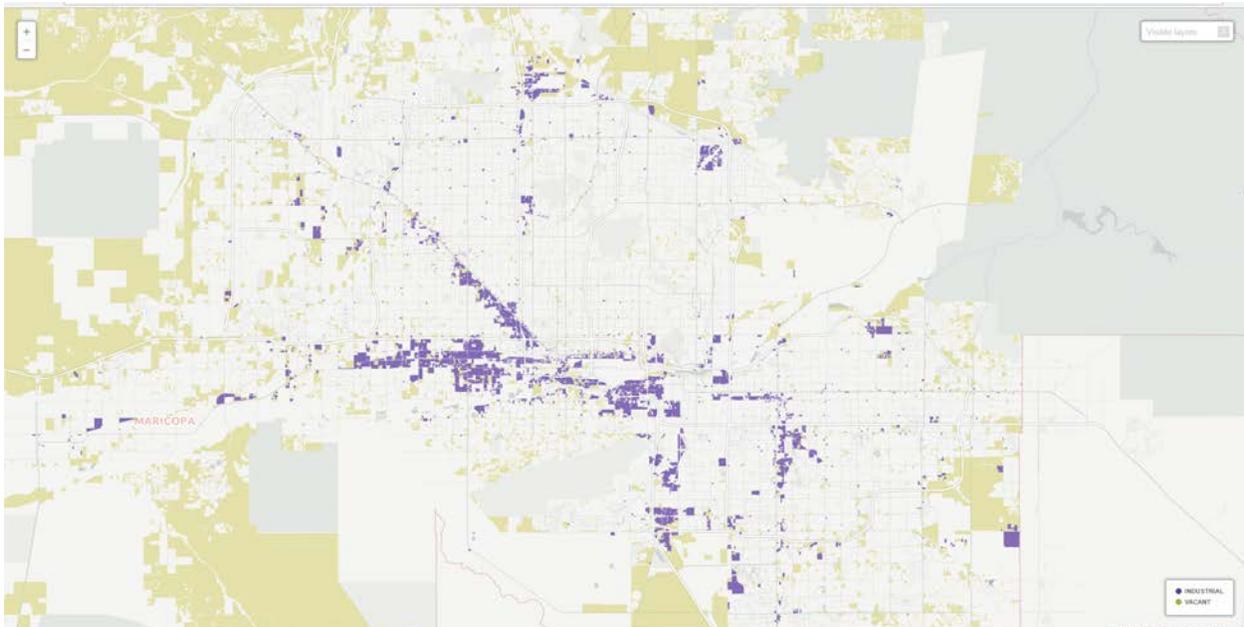
CHAPTER FOURTEEN

FREIGHT PLANNING

Freight transport involves a complex network of methods, modes, and equipment to move raw materials and processed goods through regional, national, and international markets for commerce. The movement of goods is conducted through multiple modes of transport, such as air, pipeline, water, truck, rail, and other non-traditional means. Freight issues are complex and often cross county or state borders. Supply chains, market demand, and competitive transportation corridors are continually changing. Therefore, neighboring regions and countries can benefit from the collaboration of plans to move freight efficiently and keep the Region globally competitive.

The movement of goods into, within, and out of the Region is vital to the regional economy. In 2010, the Maricopa Association of Governments (MAG), Central Arizona Association of Governments (CAG), and the Pima Association of Governments (PAG) formed the Joint Planning Advisory Council (JPAC) to coordinate long-range planning efforts for the three contiguous Counties. In 2012, MAG completed the Freight Transportation Framework Study in cooperation with the JPAC. In 2018, the MAG Freight Transportation Plan designated a core roadway freight network for long-term protection and investment. Current studies underway include the Southwest Freight Subarea Project Assessment and the MAG Truck Parking Study.

**FIGURE 14-1
INDUSTRIAL AREAS IN MAG REGION**



Manufacturing and Logistics Clusters

Robust industrial clusters drive the economic prosperity of the MAG Region. A cluster is defined as a geographic concentration of industrial and logistics establishments where business is conducted, jobs are located, and freight is generated or consumed. These establishments produce and distribute goods, and account for the principal freight-dependent sectors of the regional economy, except retail trade.

Underlying the location of industries is an ecosystem of interrelations between firms. A major function of the freight network is to support this ecosystem, and a strong ecosystem tends to attract new firms and create growth. Related firms that co-locate in advantageous areas can leverage strengths in the existing infrastructure, businesses, and services to increase their competitiveness. Often this occurs through regional specializations, where firms pool knowledge and resources to achieve a competitive advantage relative to isolated firms.

Figure 14-1 shows the distribution of industrial land in the MAG Region. Industrial uses are primarily located along regional highways and interstates. The freight network should prioritize roads that provide access to these industrial lands, especially industrial clusters.

Commodity Flow Overview

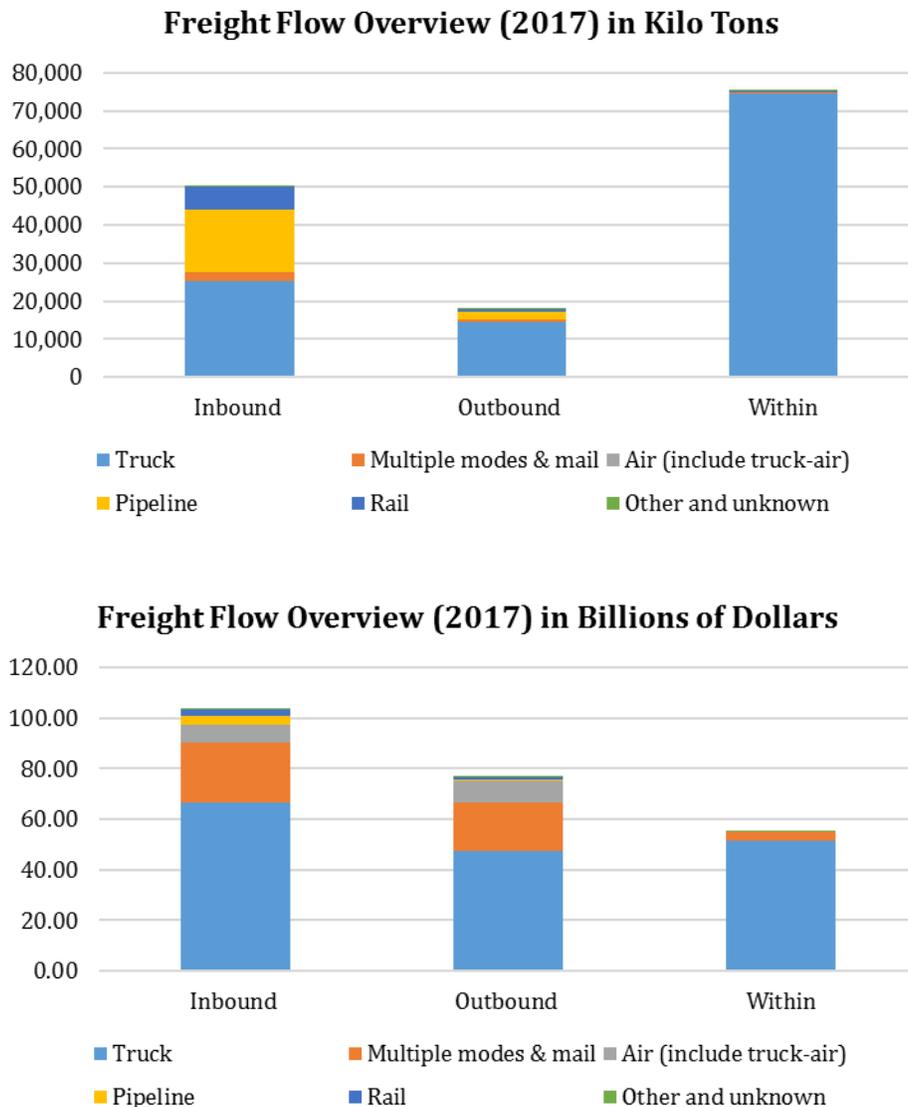
In 2017, the MAG Region originated and received 143.4 million tons of freight valued at \$235.96 billion (Figure 14-2). Figure 14-3 displays the modal split of freight movement. Most freight was moved by truck, which accounts for 80 percent of tons and 70 percent of total value. Rail accounted for 6.2 million tons of imports in 2017 (out of 7.2 million tons of overall movements by rail). The majority of these tonnages were metallic ores. Rail moved 5 percent of all tonnages and 1.6 percent of the total freight value. Even though the air mode did not carry a large number of tons, it moves higher value commodities important to the Region.¹ In the Freight Analysis Framework (FAF) the “air mode” data incorporates both travel by aircraft and truck drayage (truck connections) on the ground. Multiple modes and rail accounted for \$45.9 billion, representing 19.5 percent of total freight value. However, this modal category in FAF includes both intermodal rail shipments and small package shipments, such as UPS and United States Postal Service. The pipeline mode is particularly important for the MAG Region, moving 18.4 million tons in the FAF commodity group called coal-nec, which contains liquid energy products.

Defining a freight network requires an understating of the main commodities moved. A breakdown of the major regional commodity flows in terms of physical volume (tonnage) is presented in Figure 14-4. The main commodity flows consist of: 35.7 million tons of gravel; 17.1 million tons of coal-nec; 2.7 million tons of other foodstuffs; 8.4 million tons of nonmetallic mineral products; and, 6.5 million tons of waste and scrap. Commodities such as gravel,

¹ For domestic shipments the air mode considers movements of cargo by air with truck drayage, however for international shipments, it considers the air moves separately from truck drays. Truck drays in these shipments are included in the truck mode.

nonmetallic minerals, waste and scrap, natural sands and fuel oils primarily have origins and destinations within the Region. Electronics, manufactured products, motorized vehicles, machinery, and other foodstuffs were shipped primarily into the Region, while pharmaceuticals, electronics, mixed freight, transportation equipment, machinery, and plastics and rubber were shipped mostly to destinations outside of the Region.

**FIGURE 14-2
FREIGHT FLOW OVERVIEW - 2017**

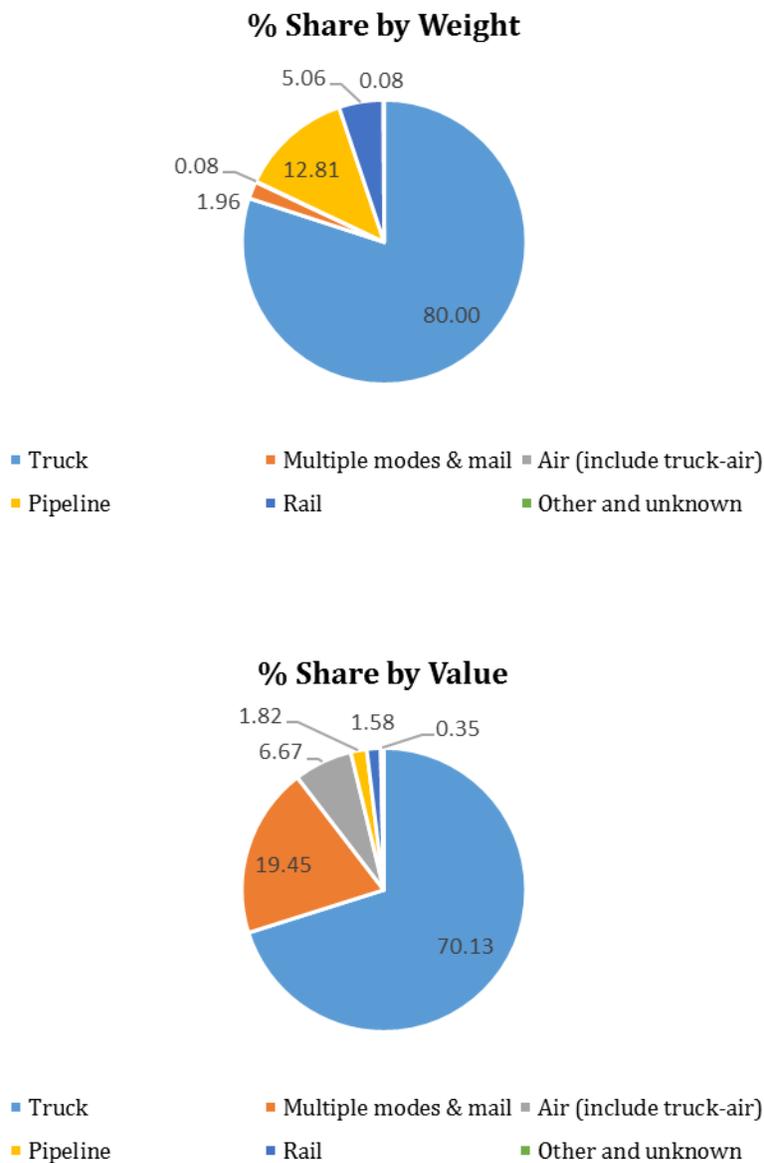


Source: BTS and FHWA, Freight Analysis Framework, versions 4.5, 2019.

Figure 14-4 displays several high-value commodities produced within the MAG Region. Pharmaceuticals and transportation equipment are two commodities for which the Region originated more shipments in terms of dollar value than it received. Electronics, machinery,

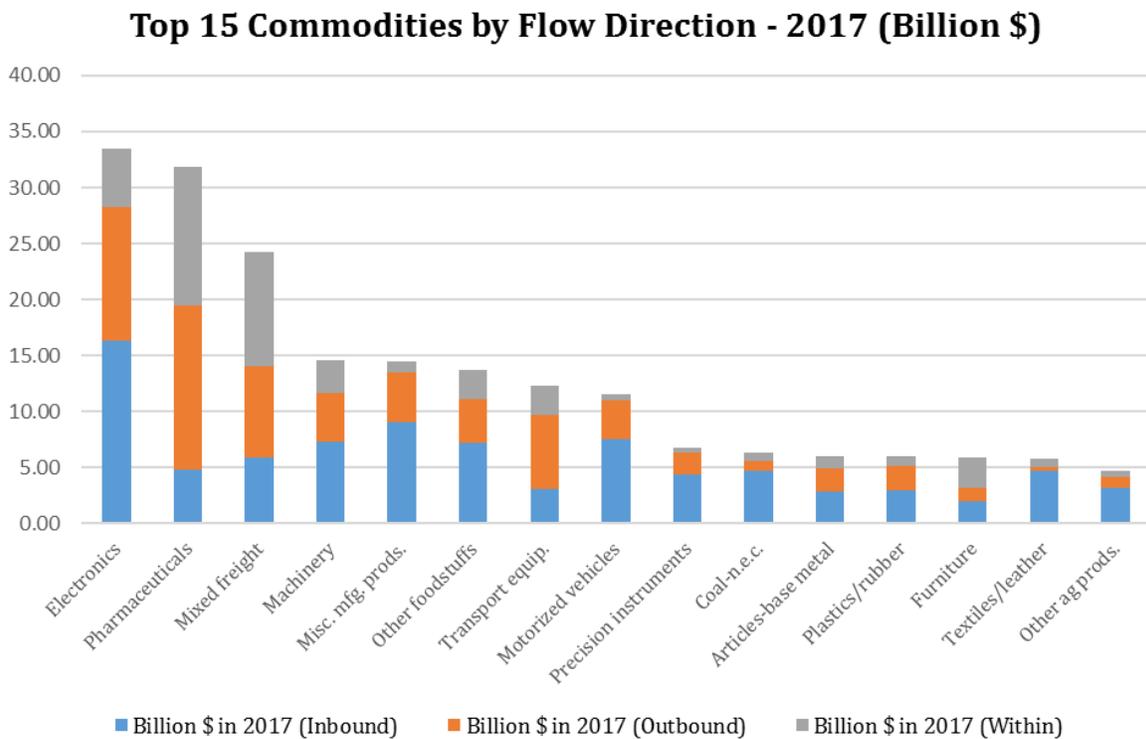
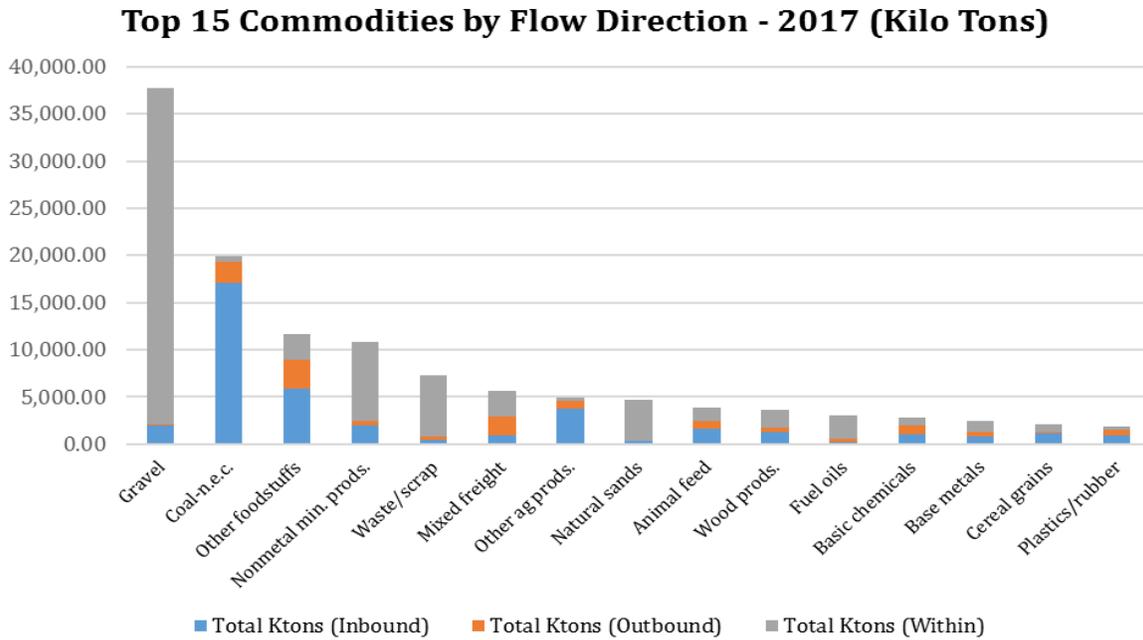
textiles and leather, plastics and rubber, miscellaneous manufacturing products, motorized vehicles, and precision instruments are commodities in which more shipments were delivered to the Region. This information should be considered when designating critical routes to connect to industry clusters. These industries may not generate high amounts of tonnage, and therefore truck trips, but are responsible for a high proportion of shipment value. The value of shipments can be interpreted as relating to the value of the goods to the broader economy and consumers. These shipments are especially costly to hinder with congestion and unreliability in the freight transportation network.

**FIGURE 14-3
FREIGHT MODE SHARE – 2017**



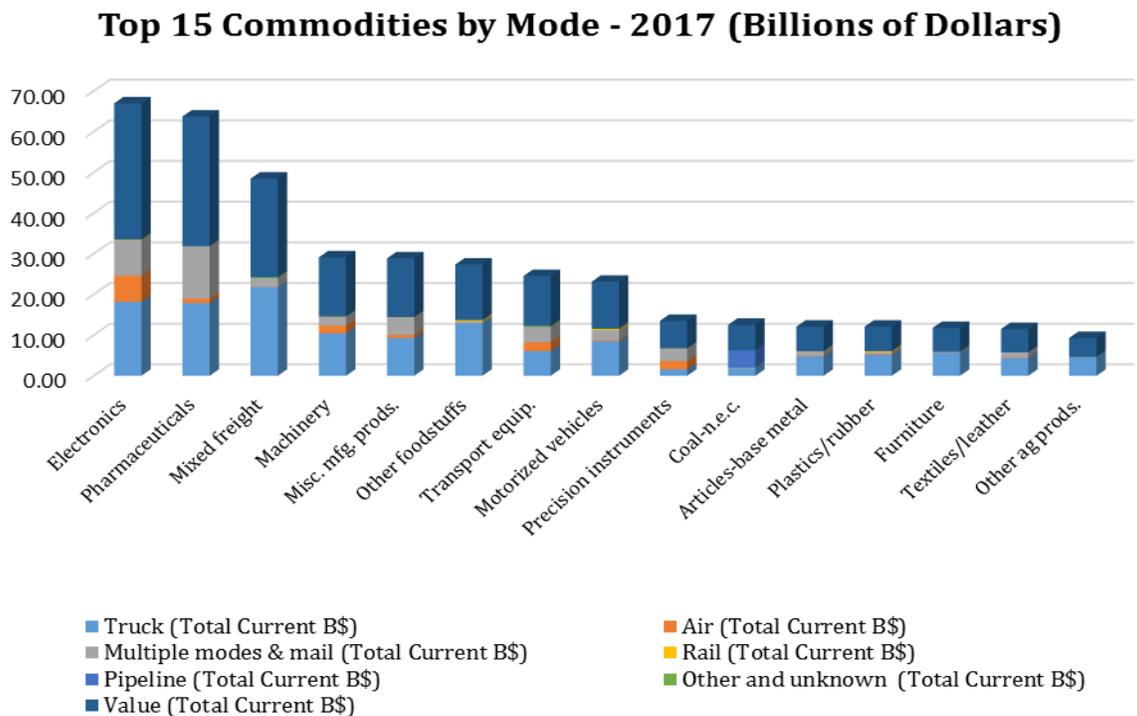
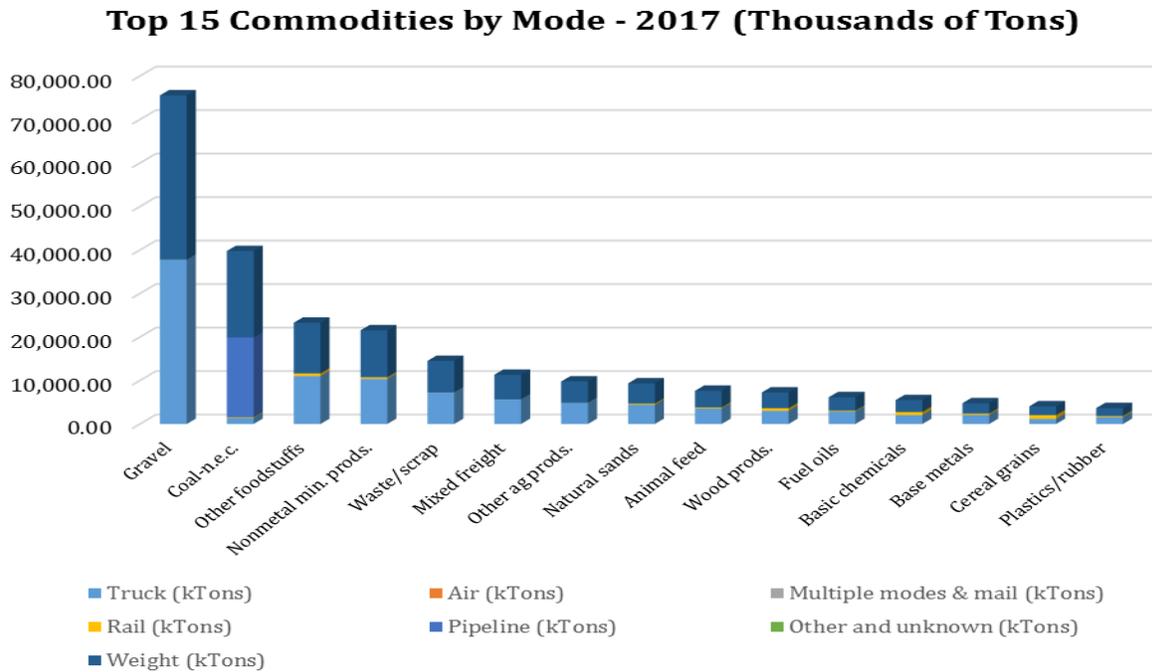
Source: BTS and FHWA, Freight Analysis Framework, versions 4.5, 2019.

**FIGURE 14-4
TOP 15 COMMODITIES BY FLOW DIRECTION- 2017**



Source: BTS and FHWA, Freight Analysis Framework, versions 4.5, 2019.

**FIGURE 14-5
TOP 15 COMMODITIES BY MODE - 2017**



Source: BTS and FHWA, Freight Analysis Framework, versions 4.5, 2019.

Figure 14-5 shows the breakdown of the top 15 commodity flows by mode. In terms of tonnage, trucking is the dominant mode, except for coal-nec which is transported by pipeline, and metallic ores which are transported by rail. In terms of value, other modes play a greater role. Multiple modes are used in the transportation of pharmaceuticals, electronics, miscellaneous manufacturing products, and precision instruments. Air and the related truck drayage, was used primarily for electronics, precision instruments, and higher value machinery.

The majority of inbound goods movement into the MAG Region is comprised of domestic cargo. Accounting for 50.2 million tons and an aggregate value of \$103.8 billion in 2017, the major commodities are high-value manufactured goods, such as motorized vehicles, transportation equipment, pharmaceuticals, electronics, plastics and rubber, and textiles and leather. This commodity flow is typical of a strong consumer-based regional economy.

Arizona has historically served as a conduit for imported goods moving through the ports of Los Angeles and Long Beach to other U.S. destinations. Southern California is a major gateway for international trade, especially with China. International imports move from the ports to Southern California's Inland Empire for trans-loading, value-added services, or later distribution. The imports move through Arizona primarily by rail or truck. Over the last decade, China's share of imports has increased, and Mexico's share has declined. While Arizona is not likely to become the new Inland Empire (a region in Southern California), possible shifts in U.S. sourcing (e.g., back to Mexico) could change the dynamics of value and supply chains for certain industries and products. Mexico is the United States' third biggest trading partner in import value and second in exports. The Arizona Sun Corridor imports less than one-half percent of consumer-oriented goods brought in via Arizona ports of entry from Mexico, indicating opportunities for modifying distribution networks, especially if imports sourced from Mexico into the U.S. increases.

Regional Freight Infrastructure

Within the MAG Region, the regional highway network, arterial network, railroads, airports, pipelines, freight terminals, warehouses, and intermodal facilities comprise the Region's overall freight infrastructure. Figure 14-6 displays the freight infrastructure system that handles the movement of goods to, from, and within the MAG Region. Warehouses, trucking companies, freight terminals, manufacturers, wholesale facilities, air couriers, and the local postal system represent the primary freight generators located throughout the MAG Region. Other freight generators of significance are the Region's intermodal facilities and air cargo airports, Sky Harbor International Airport, and Phoenix-Mesa Gateway Airport.

- There are approximately 55,000 total road miles within Arizona. Interstate Highways comprise 2.1 percent of the total state system mileage but carry 25.5 percent of total travel volumes. The highest volumes of truck travel within the state are on Interstate Highways 10, 17, 19, and 40. Several factors affect the movement of truck freight on the highway system, including the number of roadway lanes, areas of traffic congestion, locations of steep grades, and connectivity between major traffic generators, such as adjacent metropolitan areas.

Railroads

The railroad industry plays a major role in the national and regional economy by transporting goods throughout the country that would not be cost-effective or feasible by other freight modes, such as truck, air, or pipeline. Railroads in the United States transport bulk quantity goods hauled by multiple train carloads over long distances. Trains are often the mode of choice for low value, bulk commodities that are not time sensitive.

At present, there are a total of three operational railroads in the MAG Region. These railroads include the BNSF, the Union Pacific Railroad (UP), and the Arizona and California Railroad (ARZC). The BNSF and the UP are Class I carriers, whereas the ARZC is an active Short Line or Line Haul railroad. As of 2019, the BNSF maintained approximately 70 miles of active track in the MAG Region, the UP maintained approximately 180 miles of active track, and the ARZC maintained about 27 miles of active track.

Train inbound frequencies are higher than outbound frequencies. This imbalance in rail service frequencies reflects the MAG Region's economic status as predominately a consumption center. This imbalance also increases the cost of shipping goods to versus from Maricopa County, because the railroad companies incur an additional cost to "deadhead" equipment back to the service origins after delivery to Arizona.

- BNSF Rail Network - BNSF's "Transcon" line moves across northern Arizona connecting Chicago to Los Angeles. This double-track route serves Kingman, Williams, Flagstaff, Winslow, Holbrook, and other northern Arizona communities. BNSF has access to Phoenix through the Phoenix Subdivision, or the Peavine, a 209-mile line that connects with the Transcon at Williams Junction west of Flagstaff. The line is single track with a maximum train speed of 49 mph due to the condition of the track. The restricted speed and single track limits the capacity of the line. In addition to providing direct service to rail customers in the Phoenix metropolitan region, BNSF operates modal transfer facilities, such as the intermodal container and trailer terminal in Glendale, with an annual lift capacity of approximately 150,000 units. The terminal principally serves the domestic market with scheduled container and trailer services between Phoenix and Chicago, Kansas City, and Alliance, Texas.
- Union Pacific – The Union Pacific (UP) "Sunset Corridor" connects Southern California to El Paso, Texas, through the State of Texas and Midwest to Chicago. The Sunset Corridor is UP's principal corridor connecting the Los Angeles Basin, including the Ports of Los Angeles and Long Beach, with markets in the Midwest and East. The line serves communities and economic centers in the southern part of Arizona. The UP has access to markets in Mexico through the Nogales Subdivision that connects Tucson to Nogales. At the US/Mexico border near Nogales, UP connects with Ferrocarril Mexicano (Ferromex) providing access to the maquiladora industry and Mexico's industrial centers. Ferromex also serves the Port of Guaymas. The majority of UP's Mexico traffic flows through the U.S. Ports of Entry at Laredo, Texas (37 percent), and Eagle Pass, Texas (32 percent).

Nogales is UP's third-largest border crossing with 12 percent of traffic. While UP serves Tucson and Pinal County through the Sunset Corridor, UP (like BNSF) accesses the MAG Region via a lesser-used line, the Phoenix Subdivision. This 125-mile route connects to the Sunset Corridor near Eloy and terminates west of Arlington, west of Phoenix. Maximum operating speed on the line is 60 mph, with train activity at less than 10 trains per day. Union Pacific serves three transload facilities in the Sun Corridor.

- UP Wellton Branch Line - The UP Phoenix subdivision includes the Wellton Branch line segment, which provides another linkage between Phoenix and the Sunset Corridor, connecting at Wellton Junction, Arizona. Amtrak at one time operated over this line. Currently, the Wellton branch is inactive between Roll and Arlington, although the line is still in place. That portion of the line was removed from operation in 1997 when UP modified its operations to serve Phoenix over the east leg of the Phoenix subdivision. With the closure of the Wellton branch, freight traffic destined for the Phoenix area is delivered to UP's yard in Tucson by a mainline train. There it is consolidated with other traffic into a train for delivery to Phoenix. The opposite occurs for traffic originating from Phoenix. A proposed new Red Rock, Arizona yard will improve and expedite the classification process.

Air Cargo

While only one percent (by weight) of freight is moved by air through Arizona (Arizona Forward, 2012), there is a growing demand for air cargo. Phoenix Sky Harbor International Airport (PHX) is the main freight airport in Maricopa County. It is conveniently located near Interstate 10, which facilitates the movement of cargo between the airport and the Region's businesses and logistics facilities. The airport is about three miles east from downtown Phoenix, a central location that reduces drayage distances and allows goods to be easily moved from the Region and shipped to far locations, and vice versa. For example, Arizona produce can go from harvesting to a market in Europe within 48 hours.

In 2015, PHX reported that 143,000 tons of air cargo originated from Phoenix and 121,000 tons of air cargo was received, for a total of 264,000 tons. The Phoenix Regional Air Cargo planning study, conducted by InterVISTAS Consulting group, noted 256,000 tons of freight and mail air cargo in 2012, and projected an increase up to 460,000 tons by 2033. Based on data from 2012, FedEx and UPS represented about 65 percent of the total air cargo moving through PHX; other air cargo carriers included commercial airlines and DHL, which handle mainly international shipments. As air cargo to and from PHX increases, it is expected that truck drayage traffic along Interstate 10 will increase proportionately, and other interstate corridors will see increased truck traffic to a lesser degree. These corridors include Interstates 8, 19, 17, and 40.

Air cargo operations are also present at the Phoenix-Mesa Gateway Airport (AZA), which is located in southeastern Mesa, 20 miles southeast of Phoenix. AZA has three long runways that can accommodate any cargo aircraft, is located within a Foreign Trade Zone, and has 24-hour airport operations.

Pipelines

The El Paso Corporation and the Southwest Gas Corporation are the only companies involved in the regional distribution of natural gas products for residential and commercial use. In addition to these companies, there is a primary metropolitan pipeline terminal facility located on the west side of the City of Phoenix. This facility is near I-10 and provides refined oil and gasoline products that are transferred to trucks. It contains major pipelines that connect with the States of California and New Mexico, and a series of smaller pipelines that connect to Phoenix Sky Harbor International Airport, Luke Air Force Base, and a small line that extends south to the Tucson area.

Regional Freight Planning

Figure 14-7 illustrates supply chain opportunities for the Sun Corridor. The corridor is strategically located to serve as an import distribution gateway for nearshored products imported from Mexico, and as a mixing center to pool international goods with products from points of origin in the southeastern U.S., including the maritime ports along the Gulf Coast. As the only major anchor market in the 1,500 miles between Southern California and Houston, the Sun Corridor could serve as a local warehouse and distribution center. Furthermore, existing and proposed transportation connectivity to Southern California and other West Coast, Intermountain West, and Northwest markets make the Sun Corridor a convenient candidate for serving as a major forward distribution hub.

**FIGURE 14-7
SUN CORRIDOR SUPPLY CHAIN OPPORTUNITIES**



MAG Freight Transportation Framework Study

In 2012, MAG completed the Freight Transportation Framework Study in cooperation with JPAC. The goal of the study was to identify freight-related economic development opportunities in the Arizona Sun Corridor. The framework study included an extensive freight survey of 2,500 shippers and carriers across the United States. MAG also conducted phone and in-person interviews with local freight stakeholders; evaluated commodity flows and truck rates; identified 16 freight focus areas; analyzed the industry real estate market; and completed a detailed assessment of four emerging focus areas that included the evaluation of the industry market, land use plans (existing and future), inventory of existing businesses, education, travel times, commodities, transportation infrastructure, and economic development incentives.

The Freight Framework study also presents the results of a detailed evaluation of commodity flows affecting the Sun Corridor, with a focus on goods movement between Mexico, sources in the southeast United States, and markets along the West Coast. Screening of potential freight focus areas led to the determination of freight-related opportunities within the Region, including the designation and evaluation of area typologies representing differing relevant majority use types that would support an enhanced role for the Sun Corridor in the global supply chain.

MAG Freight Transportation Plan

In 2016, MAG completed the MAG Freight Transportation Plan, which designated a forward-looking core roadway freight network for long-term protection and investment, to attract industry and support household needs through better performance in speed, reliability, cost, productivity, and safety. This network will be readily accessible, within approximately fifteen minutes, to major existing and future clusters of freight generation and consumption. It will facilitate cross-town travel, so clusters and multimodal facilities are well connected and benefit from route redundancy, reducing risks from delay and disruption. This freight network was used to establish the MAG Critical Urban Freight Corridor (Figure 14-8), as required by the FAST Act, which calls for the designation of critical urban and rural freight corridors around the nation. Responsibilities for the latter rests with state departments of transportation.

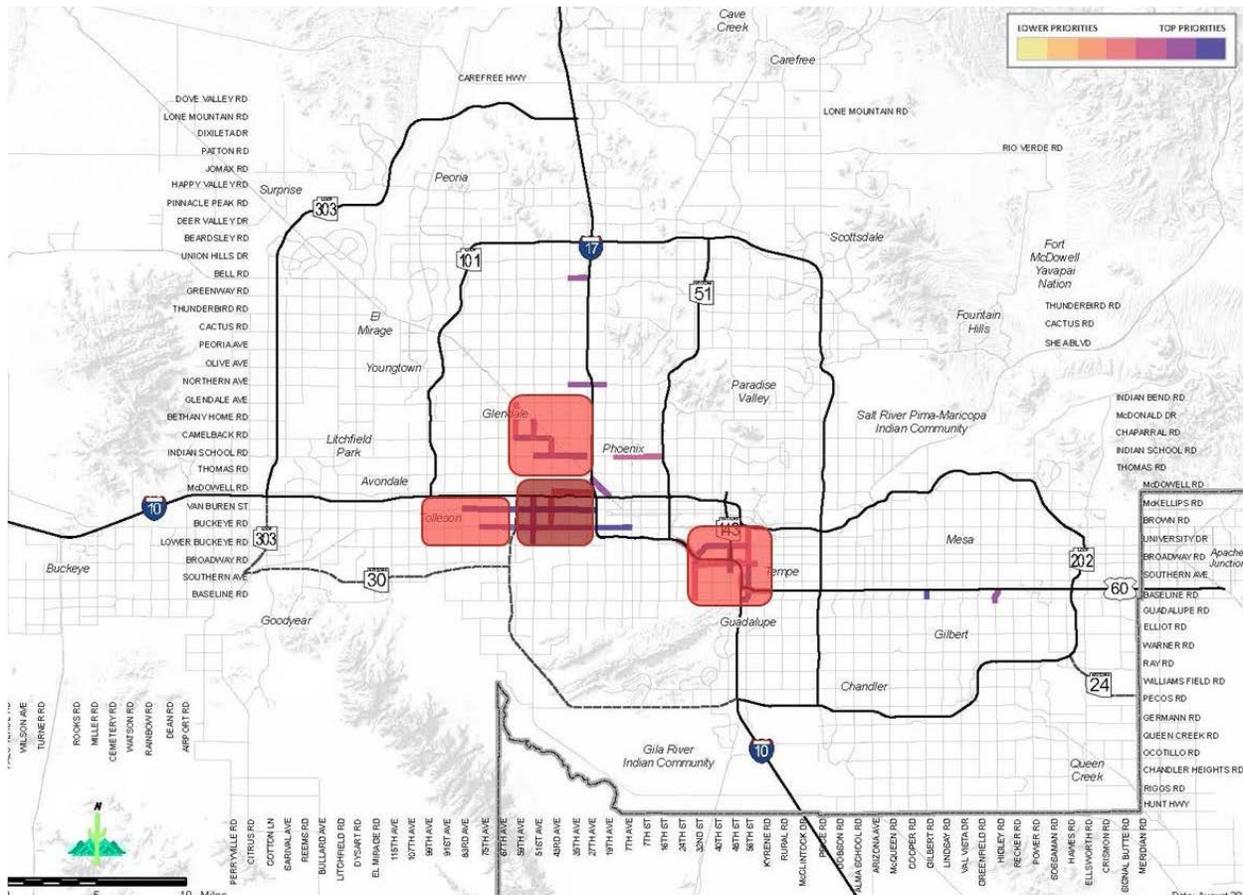
MAG Southwest Freight Subarea Project Assessment

Based on recommendations from the MAG Freight Transportation Plan, the Freight Subarea Project Assessments (SPAs) will identify solutions for the federally approved MAG Critical Urban Freight Corridor. The SPAs will focus on commercial truck freight operations and provide information about how freight interacts with other modes of transportation such as passenger cars, rail, transit, bicycles, and pedestrians.

The Southwest Freight Subarea Project Assessment is the first of its kind conducted by MAG. The subarea study area is located in the cities of Phoenix, Tolleson, and Avondale, and portions of Maricopa County. The subarea is a major warehousing and manufacturing industrial cluster,

with high levels of commercial vehicles and traffic generated by shift worker commutes. The study will recommend projects and policies to move goods more efficiently and safely through existing industrial clusters, fostering the development of a diverse and economically thriving place to work and live. MAG anticipates completion of the Southwest Freight Subarea Project Assessment in the fall of 2019, and will conduct three additional freight subarea project assessments in FY 2020.

**FIGURE 14-8
MAG CRITICAL URBAN FREIGHT CORRIDORS**



MAG Truck Parking Study

In 2018, the U.S. DOT Federal Motor Carrier Safety Administration (FMCSA) entered into compliance with mandated hours of service regulations for commercial vehicle operators. Commercial truck drivers are required to rest after operating a vehicle for more than 11 consecutive hours, or face fines and penalties. When drivers near the regulated service limit, it can be a challenge to find safe truck parking locations. Drivers often park on the shoulder of a road, on an off-ramp, along a residential street close to their delivery/pick up location, or in a vacant lot. This creates safety issues not only for the truck drivers but also for passing motorists and the surrounding community.

In the summer of 2017, the Arizona Department of Transportation (ADOT) initiated the State of Arizona Truck Parking Study. The study evaluated existing truck parking supply and demand throughout the State, including private and public parking facilities, and rest area locations outside major metropolitan areas. ADOT stakeholder meetings identified rural and urban truck parking issues that needed to be addressed.

The MAG Truck Parking Study, initiated in September of 2019, will evaluate truck parking supply and demand, with a specific emphasis on industrial clusters in the MAG Region. The study will provide information on the impact of the U.S. DOT FMCSA hours of service regulations on regional truck parking trends and the logistics market in the MAG Region. The study builds upon the recommendations identified in the ADOT Truck Parking Study, which was completed in July of 2019. MAG anticipates this project to be completed in the spring of 2021.

CHAPTER FIFTEEN

SPECIAL NEEDS TRANSPORTATION

The Maricopa Association of Governments (MAG) recognizes that the transportation needs of special populations are of regional concern and importance. Limitations caused by age or disability complicate the process of accessing and securing transportation for a portion of our community members. Those with limited financial resources may find transportation options to employment or training activities out of their reach. In the MAG Region, human services transportation faces an increasing demand for services due to the estimated growth in population. Maricopa County is estimated to grow to 5.1 million by 2030 and 5.7 million by 2040. This population growth increases strain on services already at capacity.

As the Region continues to grow, the need for transportation assistance also increases, placing a greater burden on these services. With the addition of the Town of Florence, the City of Maricopa, and the Gila River Indian Community to MAG's planning area, service needs now include more rural interests. Individuals request more assistance as they struggle to maintain jobs and access medical care. At the same time, available funding is not keeping pace with the increase in demand for services. Agencies have experienced funding reductions that have forced the reduction or elimination of services. Several providers merged programs to consolidate costs and resources, but this creates gaps in transportation services. MAG, in partnership with regional stakeholders, is taking steps to meet the needs of our most vulnerable populations.

Older Adults, People with Disabilities and Low-Income Individuals

Older Adults

According to the 2018 U.S. Census Bureau estimates, 15.2 percent of Maricopa County residents are aged 65 and over. By the year 2030, approximately 19 percent of residents will be aged 65 and over; of this number, approximately 45 percent will be 75 years or older. Although older adults of the future will be healthier, better educated, and more financially secure than past cohorts, many will experience physical, financial, emotional, and mental barriers when using various modes of transport. Older adults living alone may have disabilities that prevent them from driving, lack family members in proximity to provide assistance, or have limited financial means which can lead them to face more difficult or life-threatening transportation challenges.

People with Disabilities

A disability may be defined within the context of a person's level of ability, as well as by society's ability to accommodate their needs. Disabilities include physical limitations, cognitive impairments, and visual impairments. The 2013-2017 U.S. Census Bureau American Community Survey (ACS) 5-year Estimates report that 11 percent of people in Maricopa County live with a disability of some kind. Human services transportation solutions for people with disabilities

often benefit all people. Accessible transportation enables community members of all abilities to reach services and employment opportunities.

Low-Income Individuals

The U.S. Census Bureau's, 2013-2017 ACS 5-year estimates report that 15.7 percent of people in Maricopa County live below the poverty level. Income affects access to resources, including transportation. People with low incomes are more likely to utilize transit services and to work second or third shifts when transit services may not be available. Out of necessity, the low-income population will live in affordable housing, which may not be located near employment centers. Previous federal grants that addressed job access and reverse commute issues have been rescinded. Accessibility challenges are further exacerbated for older adults and individuals with disabilities who fall within the low-income bracket. According to the ACS 2017 5-year Estimates, 8.4 percent of the population aged 65 and older live below the poverty level, while 19.3 percent of the population that reported a disability live below the poverty level. It is more cost-effective to provide low-income people access to transportation so they may maintain self-sufficiency and access preventative health care services.

Resources for Transportation Disadvantaged Populations

Regional Action Plan on Aging and Mobility

MAG developed a *Regional Action Plan on Aging and Mobility* to address the mobility needs of older adults. The agency brought together experts and concerned citizens to form the Elderly Mobility Stakeholder Working Group. The group studied and then developed 25 recommendations for an action plan based on infrastructure and land use, alternative transportation modes, driver competency, and education and training needs. The plan provided a comprehensive overview of mobility issues of older adults and was adopted by the MAG Regional Council on October 3, 2001. MAG continues to use the 25 recommendations to guide regional planning on aging and mobility.

The MAG Municipal Aging Services Project also addressed the transportation needs of older adults in the Region. MAG engaged community stakeholders to determine current and projected transportation needs, preferred transportation modes, and provide other input to MAG and local governments. The information gathered was used to develop a toolkit of best practices and resources for addressing the transportation needs of older adults. The work from these projects help people lead more social, active lives and allow greater opportunity for aging in place.

Age Friendly Arizona

Age Friendly Arizona is a coordinated effort in partnership with Virginia G. Piper Charitable Trust, municipalities, nonprofit agencies, faith-based entities, community groups, residents, and MAG. The program develops a network of resources to identify opportunities for integrating older

adults into their communities, promote their well-being, and encourage community involvement. Age Friendly Arizona sponsored the Intersection of Aging and Transportation Conference in 2019. The conference brought national speakers to share information about the impact of aging on transportation services and the role transportation plays in keeping older adults and communities healthy. Age Friendly Arizona launched a two-year Rural Transportation Incubator (RTI) project in 2019 with support from the Harry and Jeanette Weinberg Foundation. The purpose of RTI is to improve the quality of life for older adults by strengthening transportation services. The goals of RTI are to launch new or expanded transportation services in rural communities, utilize technology to make transportation services more efficient and affordable, and to develop a toolkit to share with other communities.

MAG Transportation Ambassador Program

The MAG Transportation Ambassador Program (TAP) is a community initiative designed to connect stakeholders with resources and incorporate feedback from the public into the human services transportation planning process. The goal of the program is to create a network of partners informed on the most current developments in human services transportation. Increasing communication among providers and the public can lead to better coordination and identify opportunities and strategies to improve transportation for older adults and individuals with disabilities.

TAP meetings are held quarterly and provide community members with the opportunity to participate in coordination activities. The program supports more than 560 individuals from nonprofit agencies, for-profit businesses, faith-based organizations, and private citizens. In a survey conducted following each TAP meeting, on average, 95 percent of participants indicated they are satisfied with the program, 93 percent indicated satisfaction with the information and resources provided, and 91 percent of participants indicated they would share the information they received through the program with their respective agencies and communities.

Funding

The Federal Transit Association (FTA) Section 5310 Enhanced Mobility of Seniors and Individuals with Disabilities Transportation Program, referred to hereafter as "Section 5310", provides funding to support capital projects planned, designed, and carried out to meet the special needs of seniors and individuals with disabilities. Funding is available for other capital and operating expenses that support public transportation services beyond those required by the Americans with Disabilities Act (ADA). MAG coordinates the Section 5310 application process for the Region. The MAG Elderly and Persons with Disabilities Transportation Ad Hoc Committee includes regional members representing a diverse section of the Region and serves in the capacity of evaluating Section 5310 applications.

Section 5310 apportionments were once distributed to the state. In 2012 under the MAP-21 legislation, large urbanized areas with populations over 200,000 began to receive apportionments directly along with the opportunity to choose a Designated Recipient to

administer the Section 5310 program. In 2013, at the request of the Region, then-Governor Jan Brewer approved the City of Phoenix Public Transit Department as the Section 5310 Designated Recipient for the Phoenix-Mesa Urbanized Area (UZA). In 2015, the funding programming responsibilities moved to MAG. Since 2014, the Region has received and expended over \$18 million to support transportation projects that meet the special needs of seniors and individuals with disabilities, when public transportation is insufficient, unavailable, or inappropriate.

Human Services Transportation Coordination Planning

As a condition for receiving formula funding under the FTA Section 5310 Program, proposed projects must be included in a locally developed Public Transit/Human Services Transportation Plan. Under the Fixing America's Surface Transportation (FAST) Act, federal regulations require short-term strategies for Section 5310 applicants. While an agency applying for funding is required to comply with these strategies, all agencies that provide human services transportation are encouraged to utilize these concepts.

Public Transit/Human Services Transportation Plans - Each plan contains an extensive inventory of the human services transportation providers. The inventory has continued to grow, and MAG efforts to sustain the inventory are important as other agencies that kept track of similar information in the past have ceased doing so due to reductions in funding. The plans contain a gaps analysis based on the provider inventory, population demographics, and strategies for addressing the gaps analysis; these strategies are then tracked in each plan, building upon the success of the previous.

In 2007, MAG developed the first Human Services Coordination Transportation Plan consistent with the goals of the United We Ride initiative. Goals include: simplifying customer access to transportation, reducing duplication of transportation services, streamlining federal rules and regulations that impede the coordinated delivery of services, and improving the efficiency of existing services to provide more rides for the same or lower cost. Following these guidelines, the Human Services Coordination Transportation plans ensure the transportation needs of vulnerable populations, including older adults, people with disabilities, and people with low-income, are met. The plans are developed through a process that includes representatives of the public and private sectors, non-profit transportation and human services providers, and members of the general public. The MAG Regional Council approved the first plan in 2007; subsequent updates were approved through 2019. In March 2009, the FTA bestowed the United We Ride Leadership Award for major UZAs to the MAG Human Services Coordination Transportation Planning Program.

More recent updates are outlined below:

- FY 2014 Plan – The FY 2014 Plan focused on maximizing the capacity of regional stakeholders to support opportunities for improving the coordination of human services transportation. These opportunities included: the coordination of stakeholder workgroups to explore solutions to maximize the use of federally required vehicle

inventories; the development of Passenger Safety and Securement training to ensure requirements and standards are universally met for providers of transportation for older adults and people with disabilities; and the utilization of Sub-regional Mobility Managers as community liaisons to engage providers in coordination planning efforts. Subregional Mobility Managers participated in designated workgroups, provided feedback on brown bag training, and reported on coordination efforts at the quarterly MAG Transportation Ambassador Program meetings. Additionally, the Plan supported the facilitation of a One-Call Center or Northwest Valley Connect's Call-Click-Connect Mobility Center. The Center connects residents in the West Valley to local transportation resources in an area with limited transportation options.

- FY 2017 Plan - The FY 2017 Plan focused on maximizing the capacity of regional stakeholders to identify, establish, and support opportunities to improve coordination of human services transportation. The Plan expanded Brown Bag trainings to assist regional stakeholder providers in adhering to federal training requirements. Planning efforts explored ways to maximize the capacity of existing vehicles as an effective and efficient way to support the use of federal funds. The Plan also addressed the inclusion of new regional stakeholders in the rural MAG planning area by examining gaps in services and available resources.
- FY 2019 Plan Update – The FY 2019 Plan Update continues to build upon strategies outlined in previous plans. Rural agencies in the MAG planning area have been included to ensure the needs of all regional stakeholders are recognized, and agencies meet federal coordination requirements when applying for Section 5310 funding. Strategies are being developed to meet the diverse needs of the population. Training activities expanded to include a Passenger Assistance Safety and Sensitivity Training program to assist regional stakeholders who provide transportation services to underserved populations in meeting federal driver safety requirements. Subregional Mobility Managers assisted in the development of workshops, including a Vehicle Sharing workshop designed to navigate the complexities of agency-to-agency sharing of vehicles. The Amazing Volunteer workshop offers information and resources to increase staffing capacity through volunteers. The human services transportation provider inventory was built into a webpage, MAG Connect-a-Ride, and increases the visibility of resources in the Region.

CHAPTER SIXTEEN

TRANSPORTATION ENHANCEMENT ACTIVITIES

The Transportation Enhancement Program is designed to strengthen the aesthetic, cultural, and environmental aspects of the Region's intermodal transportation system. The Maricopa Association of Governments (MAG) enhancement projects have focused on the provision of facilities for pedestrians, bicycles, and related elements. Many of these projects also have strong intermodal ties to regional transit activities. MAG is working closely with the Arizona Department of Transportation (ADOT) and the transit designated and direct recipients to identify procedures for integrating enhancement projects into FAST Act (Fixing America's Surface Transportation Act) programs.

Transportation Enhancement Projects

Within the MAG Region, most enhancement projects have focused on traditional uses of enhancement fund categories, which include items that are focused on the provision of facilities for pedestrians, bicycles, and landscaping. Some enhancement projects are incorporated into larger construction projects, and some are completed as stand-alone projects that add to, improve, and expand the existing bicycle and pedestrian network. Since 1993, most projects in the MAG Region have received funding to complete multi-use pathways, sidewalks, and bike-share facilities to support pedestrians and bicyclists. Since the inception of the bicycle and pedestrian program in the MAG Region, funding has been awarded for multi-use or shared use pathways along existing routes and canals, including projects for sidewalks and pedestrian crossings, as well as projects directly related to bike routes and bike facilities.

Many enhancement projects occur near transit centers, rail facilities, and bus stops, and provide safer pedestrian access through the construction of new paths and sidewalks, including ADA-compliant curb cuts and marked pedestrian walkways. In many cases, they also provide an aesthetic upgrade to adjacent transit facilities by providing landscaping, shade, artwork, signs, lighting, benches and trash receptacles.

The MAG Transit and Active Transportation (formerly Bicycle and Pedestrian) committees review transit-related projects for funding consideration. Such items have included shade for bus stops and requests to provide enhancements to areas containing existing transit stops along bus routes connecting to the regional bus system.

Intercity bus services (those provided between the metropolitan areas of Phoenix, Tucson, and cities outside the MAG Region) are provided solely by private sector carriers. MAG's role is limited to transit services within the MAG Region. Rural Connectors in the MAG Region operate similarly to intercity buses but link passengers from rural communities to the urbanized areas. At present, a Rural Connector provides transit service from West Phoenix to Ajo. Other rural connectors are being evaluated for future implementation.

The State of Arizona, through ADOT, does not currently have a program for the operations or subsidization of state-managed intercity bus. ADOT has analyzed the potential for dedicated bus service between downtown Phoenix and downtown Tucson as a precursor to future commuter/intercity passenger rail. As a component of the Tier 1 Environmental Impact Statement (EIS) commissioned within ADOT's Passenger Rail Study, an intercity bus alternative was evaluated using existing HOV lanes on I-10 within Maricopa County, with a conceptual dedicated busway on I-10 from Chandler to Tucson.

Funding of Transportation Enhancement Projects

The Transportation Enhancement Program was originally enacted by the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 and was created to improve surface transportation activities by developing projects that go "above and beyond" normal or routine transportation activities and funding. Subsequent efforts such as the SAFETEA-LU (Safe Accountable Flexible Efficient Transportation Equity Act – A Legacy for Users), MAP-21 (Moving Ahead for Progress in the 21st Century), and the FAST Act fund enhancements through the Federal Highway Administration's (FHWA) Transportation Alternatives as a sub-allocation of the Surface Transportation Block Grant Program.

Eligible activities for the Transportation Block Grant Program include:

- Transportation Alternatives.
- Recreational trails program.
- Safe routes to school activities.
- Planning, designing, or constructing roadways within the right of way of former Interstate routes or other divided highways.

Transportation Alternatives encompass a variety of smaller-scale transportation projects such as pedestrian and bicycle facilities, recreational trails, safe routes to school projects, community improvements such as historic preservation and vegetation management, and environmental mitigation related to stormwater and habitat connectivity. Fifty percent of Transportation Alternatives funds are distributed to areas based on population (sub-allocated). States and MPOs for urbanized areas with more than 200,000 people conduct a competitive application process for use of the sub-allocated funds. Eligible applicants include tribal governments, local governments, transit agencies, and school districts. Options are included to allow states flexibility in the use of these funds. Approximately \$134 million year of expenditure (YOE \$'s) in FHWA monies has been projected to be available for TA projects during the RTP planning period (FY 2018 - FY 2040) for the MAG Region. Congestion Mitigation and Air Quality Improvement program (CMAQ) funding of approximately \$236 million (FY 2018-2040) is also available for bicycle and pedestrian facilities in the RTP. Including a local match of 5.7 percent, these two funding sources total approximately \$393 million (YOE \$'s).

Enhancement Project Selection and Programming

MAG is working closely with ADOT to interpret the TA program guidance and identify procedures for transitioning enhancement project funding from SAFETEA-LU and MAP-21 to the FAST Act. This includes determining the amount of funding available for enhancement projects, addressing enhancement projects already in the pipeline, and developing revised procedures for prioritizing, selecting, and reporting on enhancement projects in the future.

Current project evaluation and programming include an evaluation of projects for funding with CMAQ improvement program funding and TA funding. Projects are submitted through a competitive call-for-projects and are ranked and selected based on quantitative and qualitative criteria defined in the MAG Programming Guidelines published annually. The MAG Active Transportation Committee begins the technical review of applications submitted and the recommendations move through the MAG approval process. Typically, a call-for-projects occurs every other year for FHWA funded projects.

Additionally, as Federal Transit Administration (FTA) Section 5307 funds become available through the transit programming priorities, enhancement projects may be directly included as part of capital improvements or may be submitted as stand-alone projects through a transit call-for-projects. Projects are technically evaluated beginning at the MAG Transit Committee and follow the MAG approval process. During FY 2016, the MAG Region made a one-time approval to allocate \$2.5 million of FTA funding for local bus stop improvements. Availability of transit funding for enhancement projects varies greatly from year to year, with most transit-related enhancement projects being included during larger capital facility construction projects.

CHAPTER SEVENTEEN

EXTENDED REGIONAL TRANSPORTATION PLANNING OUTLOOK

In 2003, the Maricopa Association of Governments (MAG) Regional Transportation Plan (RTP) was updated through a comprehensive review, which resulted in the adoption of a major revision of the RTP by the MAG Regional Council. Since 2003, the RTP has been updated periodically to reflect new information and changing conditions in the Region. MAG continues to look to the future to assess regional trends that affect transportation demand and assess the need for new or improved facilities and services. Three important aspects of this ongoing effort are inter-regional cooperation and coordination, modal and area transportation studies, and illustrative corridors/projects.

Inter-Regional Cooperation and Coordination

One of the key factors affecting future transportation needs in the MAG Region has been the emergence of individual regional growth patterns in central Arizona into a multi-county matrix of development. This pattern has made inter-regional coordination among planning agencies increasingly important. MAG has pursued inter-regional coordination of its planning programs for many years and will continue to emphasize this effort in the future.

Interagency Coordination

The projected population growth throughout the Maricopa County, central Arizona, and other areas of the state necessitates effective, ongoing cooperation and coordination among Councils of Government (COG) and Arizona Counties.

Since the formation of MAG in 1967, the agency has maintained a dialogue with other agencies, counties, and communities throughout Arizona. Beginning in the early 1980s, the MAG Executive Director has served as an active member of the Arizona COG/Metropolitan Planning Organization (MPO) Directors Association, which was established to foster communication and ensure coordinated planning efforts among Arizona's COGs. MAG has used this association, as well as individual one-on-one sessions, to coordinate with other regions on regional, state, and federal programs, including human services, land use, environmental, and transportation planning issues. MAG also maintains discussions with other COGs, MPOs, and similar entities throughout the United States concerning common transportation issues and federal policies.

This interagency dialogue has been crucial to effectively assess congestion issues, evaluate key transportation needs, and identify funding options for the construction of future transportation corridors to address regional and statewide connectivity. As part of this effort, MAG developed transportation study partnerships with Central Arizona Governments (CAG), the Pima Association of Governments (PAG), and their member agencies. These three core Counties of Arizona are often referred to as the "Sun Corridor" (Figure 17-1).

Joint Planning Advisory Council

On December 17, 2009, MAG, PAG, and CAG signed a resolution to coordinate planning efforts in the Sun Corridor, creating the Joint Planning Advisory Council (JPAC). These three agencies are located adjacent to one another, with linked economies, and acknowledge regional planning issues transcend jurisdictional boundaries. On May 9, 2013, the Governor of Arizona approved an expanded metropolitan planning area (MPA) boundary for MAG that includes areas in Pinal County: the City of Maricopa, Town of Florence, and unincorporated portions of the County (Figure I-1). In addition, a new MPO was formed in Pinal County (Sun Corridor MPO or SCMPO), encompassing the incorporated communities of Casa Grande, Coolidge, Eloy, and surrounding unincorporated areas in Pinal County. SCMPO now also participates in JPAC activities.

In the past, MAG, CAG, and Pinal County have participated in cooperative planning studies, such as the Southeast Maricopa/Northern Pinal County Study, the Commuter Rail Strategic Plan, the Interstate 8 (I-8) & Interstate 10 (I-10)/Hidden Valley Transportation Framework Study, and the Freight Transportation Framework Study. To further demonstrate regionalism, MAG and CAG have six member agencies in common (Apache Junction, Florence, Gila River Indian Community, City of Maricopa, Pinal County, and Queen Creek), and PAG and CAG share one member agency in common (Marana). In addition, MAG coordinates with CAG and SCMPO to conduct required transportation air quality conformity analyses and public involvement activities.

JPAC was established to identify mutually agreed upon goals and interests, provide guidance on technical assistance and joint planning activities, and enhance the communication and cooperation among policymakers across regions. JPAC has a shared vision to coordinate planning efforts for the greater good of the Regions and the State of Arizona. MAG, PAG, SCMPO, and CAG coordinate their respective planning activities and work together to foster a successful and economically viable Sun Corridor in the State of Arizona.

Modal and Area Transportation Studies

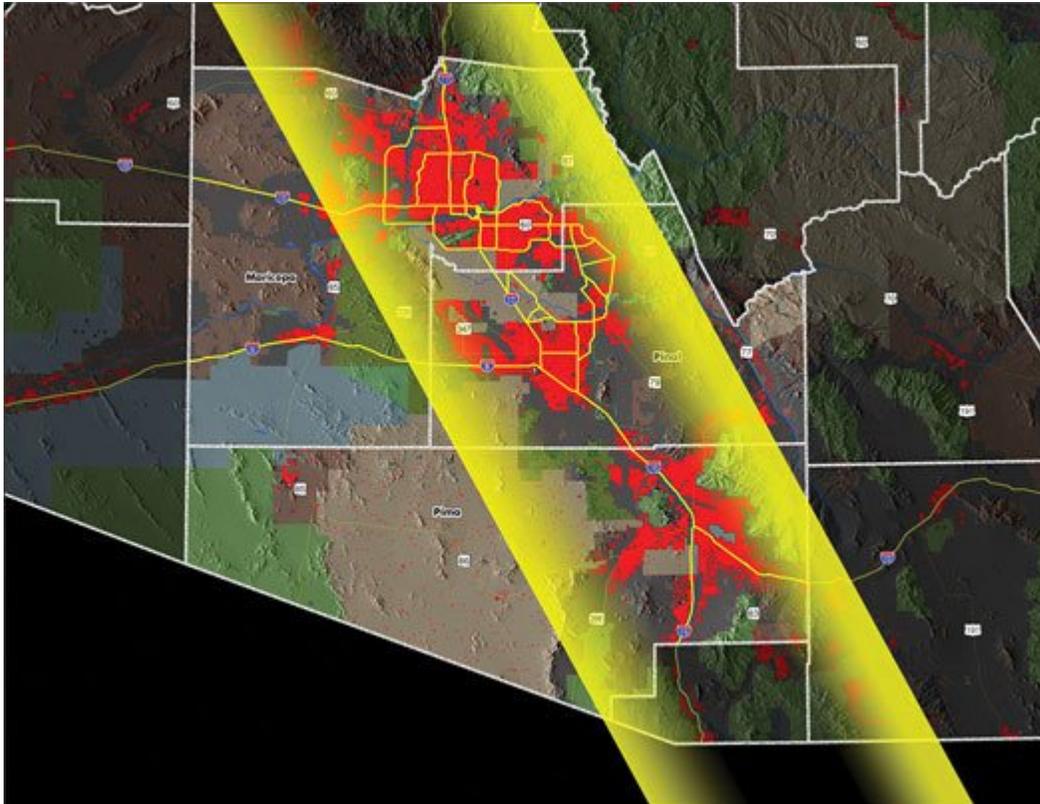
Modal and area transportation planning studies are a key piece of the MAG transportation planning process. These studies assess growth and the resulting transportation needs not identified in the current RTP. The study findings provide detailed information for a specified geographic area or modal facility system and identify potential new RTP elements for consideration. The studies often cover multi-county areas and include the participation of other COGs and agencies outside of Maricopa County, as well as state and federal agencies.

Southeast Maricopa/Northern Pinal County Area Transportation Study

Completed during 2002, the Southeast Maricopa/Northern Pinal County Area Transportation Study (SEMNPTS) was initiated to develop inter-county planning; document the transportation relationships and examine the long-range transportation needs between Maricopa and Pinal counties; and identify projects to address the primary transportation needs. The study was an opportunity for cooperation between Maricopa and Pinal counties and reinforced the dialogue

between both areas to identify shared regional transportation concerns. The findings and recommendations of the SEMNPTS were considered in the development of the MAG RTP, provided input for the Pinal County Transportation Plan, and identified the major corridors for the Arizona Department of Transportation (ADOT) Pinal County Corridor Definition Studies.

FIGURE 17-1
THE SUN CORRIDOR



Map: Joint Planning Advisory Council

ADOT Pinal Corridors Studies

As an outgrowth of the SEMNPTS, during September of 2004, ADOT initiated three corridor studies within Pinal County. These studies involved the U.S. 60 Corridor Definition Study, the Williams Gateway Corridor Definition Study, and the Pinal County Corridors Definition Study. The ADOT corridor studies assessed needs and feasibility and identified general locations for the development of high-capacity roadways within the study area. At its February 2006 meeting, the State Transportation Board approved the adoption of the recommendations of the three Corridor Definition Studies into the MoveAZ (Move Arizona) long-range statewide plan. While no funding was identified for the purchase of right of way or the construction of recommended corridors, inclusion in MoveAZ allowed for the funding of further studies to identify the actual alignments of the potential new roadways.

In 2009, ADOT initiated the study of a continuous north-south route through central Pinal County, covering the area between US-60 in Apache Junction and I-10 near Eloy and Picacho. While still ongoing, the North-South Corridor Study (NSCS) will result in a Location/Design Concept Report and an Environmental Impact Statement (EIS) for a proposed 45-mile-long transportation corridor in Pinal County. The purpose of the new corridor is to relieve traffic on I-10, improve access to future activity centers in Pinal County, enhance transportation system linkages, and create a more direct connection to the eastern portion of the Phoenix metropolitan area. In 2015, the extension of SR-24 (Gateway Freeway) was incorporated into the project. An existing study is being pursued by ADOT to extend SR-24 to Ironwood Road, and the NSCS will continue the study from Ironwood Road to the east. The Tier 1 EIS for the NSCS will be completed in 2020.

Interstate 10/Hassayampa Valley Transportation Framework Study

On February 27, 2008, the MAG Regional Council accepted the findings of the I-10/Hassayampa Valley Transportation Framework Study. MAG, together with ADOT, the Maricopa County Department of Transportation (MCDOT), and the cities of Buckeye, Goodyear, and Surprise, funded and developed the study. The study began in May 2006 for an area bounded by SR-74 on the north, SR-303L on the east, the Gila River on the south, and 459th Avenue on the west.

The action to accept the study included: (1) accept the findings of the I-10/Hassayampa Valley Transportation Framework Study as the surface and public transportation framework for the Hassayampa Valley; (2) adopt the traffic interchange locations for the I-10/Papago Freeway from SR-303L/Estrella Freeway to 459th Avenue; (3) adopt a two-mile traffic interchange spacing policy for new freeway facilities within the Hassayampa Valley with appropriate planning for non-access crossings of the freeway facilities to facilitate local transportation movements; (4) adopt a new functional classification as a parkway, recognizing the Arizona Parkway as a type of parkway with unique operating characteristics for congestion and air quality planning purposes; (5) accept the findings and implementation strategies as described in the study for inclusion as illustrative corridors in the RTP; and (6) recommend the affected jurisdictions within the Hassayampa Valley study area incorporate this study's recommendations into future updates of their general plans.

While the study provides a significant milestone in transportation planning for the Hassayampa Valley, the recommendations are not funded. Therefore, the MAG Regional Council was requested to accept the study's findings versus adopting them. In taking this action, the planning process can move forward in an illustrative manner, providing guidance to MAG and affected agencies in the Hassayampa Valley for future activities, including updates to the RTP.

Interstates 8 and 10/Hidden Valley Transportation Framework Study

On September 30, 2009, the MAG Regional Council accepted the findings of the Interstates 8 & 10/Hidden Valley Transportation Framework Study. This joint study included MAG, CAG, county and local jurisdictions in Maricopa and Pinal counties, ADOT and the Federal Highway

Administration (FHWA). The study began in 2006, and was bounded by: Overfield Road on the east, I-8 on the south, 459th Avenue on the west, and the Gila River and/or the north boundary of the Gila River Indian Community on the north.

The action to accept the study included: (1) accept the findings of the Interstates 8 and 10/Hidden Valley Transportation Framework Study as the surface and public transportation framework for the Hidden Valley area of the MAG Region, bounded by the Gila River on the north, SR-87 and Pinal County on the east, the Tohono O’Odham Indian Community and the Barry M. Goldwater Air Force Range on the south, and 459th Avenue on the west; (2) adopt a two-mile traffic interchange spacing policy for new freeway facilities within the Hidden Valley area with appropriate planning for non-access crossings of the freeway facilities to facilitate local transportation movements; (3) accept the findings and implementation strategies as described in the study for inclusion as long-range unfunded illustrative corridors in the RTP; (4) recommend the affected jurisdictions within the Hidden Valley study area incorporate this study's recommendations into future updates of their general plans; and (5) coordinate this acceptance with the councils of the Gila River and Ak-Chin Indian Communities.

As with the Hassayampa Valley Study, the study recommendations are not funded, therefore, the MAG Regional Council accepted the study’s findings versus adopting them. In taking this action, the planning process can move forward in an illustrative manner, providing transportation planning guidance to MAG, ADOT, CAG, Maricopa County, Pinal County, the cities of Buckeye, Goodyear, Maricopa, and Casa Grande, and the FHWA.

Hassayampa Transportation Framework Study for the Wickenburg Area

The Hassayampa Transportation Framework Study for the Wickenburg Area covers the northwest part of Maricopa County, from approximately the SR-74/Carefree Highway alignment to the south, encompassing the Town of Wickenburg planning area, north to the US-93/SR-71 junction, 459th Avenue to the west, and to the extension of the proposed Turner Parkway (267th Avenue) to the east. The study area includes the northern planning area of the City of Buckeye, the Town of Wickenburg planning area, the portions of the City of Surprise, and unincorporated areas in Maricopa and Yavapai counties. This study developed a transportation framework for the study area that will be implemented at multiple jurisdictional levels. The Town of Wickenburg accepted the study findings on November 15, 2010.

Central Phoenix Transportation Framework Study

The Central Phoenix Transportation Framework Study developed a multimodal transportation framework for the area bounded by Northern Avenue on the north, the SR-143/Hohokam Expressway (projected northward) on the east, the Loop 202 (South Mountain Freeway) on the south, and 75th Avenue on the west. The study established a blueprint for future transportation investment decisions to improve mobility along I-10, Interstate 17 (I-17), SR-51, Loop 202, key arterial streets, and proposed corridors in the RTP. While the major beneficiary of the study effort was the core Phoenix urban area, the framework resulting from the study enhances

transportation in and out of the Region's primary economic center and guide decisions affecting the entire MAG area. The final work products and findings of the study were provided to the MAG Regional Council for information and discussion on October 22, 2014.

Southeast Corridor Major Investment Study

The Southeast Corridor Major Investment Study was originated to investigate alternate transportation strategies in response to the growing travel demand between the East Valley and central Phoenix. This included identifying member agency needs and developing a multimodal approach to address the anticipated traffic volume on I-10, including the US-60/Superstition Freeway and the I-17/Black Canyon Freeway traffic interchanges.

Beginning in 2001, ADOT and FHWA launched an EIS for the I-10 corridor between SR-51 and SR-202L/Santan-South Mountain Freeways. The purpose of this EIS was to consider expansion options for I-10. As this effort was underway, MAG member agencies wanted other transportation options in the Southeast Corridor and congestion pricing along I-10 to meet future travel demand to be considered. The Southeast Corridor Major Investment Study was developed to examine these options in this portion of the Valley.

The Southeast Corridor Major Investment Study produced corridor alternatives in the form of high-capacity transit on exclusive right of way, improved local transit access via ramps directly accessing HOV lanes, additional freeway general purpose lanes, increasing HOV capacity, interconnectivity with the existing light rail system, potential commuter rail options, and managed lanes concepts. The study found managed lanes along I-10 and I-17, including direct high occupancy vehicle (DHOV) ramps, would provide the highest level of performance and accommodate increased traffic volumes in the freeway corridor. A strategically focused network of high-capacity transit services featuring exclusive guideway transit offers the most productive transit investment in the corridor. The final work products and findings of the study were provided to the MAG Regional Council for information and discussion on September 26, 2012.

MAG Managed Lanes Development Strategy

MAG, in cooperation with ADOT, FHWA, Valley Metro, and member agencies, explored a regional managed lanes system in the Phoenix Metro area. This effort was a response to Arizona House Bill 2396, which enables ADOT to consider Public-Private-Partnerships (P3) as a tool for financing transportation infrastructure in Arizona. The study entails determining future needs for HOV lanes and evaluating the potential introduction of high-occupancy toll (HOT) lanes and active traffic management strategies.

Study efforts included establishing goals and objectives for managed lanes in the Region, exploring management strategies and operations policies, and evaluating the existing regional freeway network for managed lanes potential in terms of constructability, traffic performance, facility cost, and revenue potential. The results of the Phase I study determined that implementing a system of managed lanes in the MAG Region is feasible. Results reveal that a

system of managed lanes is constructible, improves overall highway system performance, efficiency, and traffic operations, provides additional reliable travel options for system users, and generates net positive cash flow. Based on the Phase I study, it was recommended that MAG and its key transportation partners endorse and actively pursue the implementation of a broad array of enhanced mobility options, including the use of managed lanes, congestion pricing, active traffic management, and other similar innovative transportation solutions.

Based upon the Phase I study findings, on May 1, 2013, the MAG Regional Council approved moving on to Phase II of the MAG Managed Lanes Network Development Strategy project. In Phase II, the project work focused on developing a unified branding strategy, identifying demonstration projects as an initial proof of concept, and assessing methods for enhancing existing HOV operations on the regional freeway system.

US-60/Grand Avenue Corridor Optimization, Access Management Plan, and System Study (COMPASS)

The US-60/Grand Avenue COMPASS project identified a long-term transportation vision for the regional West Valley corridor. The project examined the route between the SR-303L/Estrella Freeway in Surprise and Willetta Street in central Phoenix. A key component of this study was the establishment of a "Charter Partners" group representing the elected leadership in the corridor. Upon study completion, this group presented a recommendation, a vision for the US-60/Grand Avenue corridor, to the MAG Regional Council for incorporation into a future RTP.

Options under study ranged from roadway improvements, to traffic operations strategies, to transit possibilities for US-60. These options were grouped into four concepts:

- Continuing with planned improvements from the MAG RTP as a benchmark for measuring the next three concepts.
- Reconsidering the US-60/Grand Avenue Expressway option originally envisioned for the corridor recommended in Proposition 300.
- Planning for commuter rail in the US-60 corridor with operational highway improvements to meet the demands for this new mode.
- Identifying other high-capacity transit options for Grand Avenue with improvements for accommodating future US-60 travel demand.

On January 27, 2016, the MAG Regional Council received an informational update on the final recommendations of the COMPASS Study. Staff reported that neither the expressway option nor the other high-capacity transit options met the criteria as alternatives for the corridor. The study recommended establishing a corridor access management system; continuing with improvements in the RTP; addressing remaining bottlenecks and congestion points; and planning for commuter rail with operational improvements. A key change could be consolidating approximately 430 driveways along the corridor to only 230 access points. The recommendations are only concepts, and design and environmental clearances would be necessary next steps with required local, state, and federal agency approvals.

Interstate 11 Corridor/CANAMEX Corridor

The Phoenix and Las Vegas metropolitan areas are the largest in the nation not linked by an Interstate Highway corridor. The combined population of the Phoenix, Tucson, Las Vegas, and Reno areas was less than 700,000 when the Federal Aid Highway Act of 1956 was enacted. Today, the combined population of these cities is 8 million and is expected to grow, prompting the need for better surface transportation connections to accommodate not only the travel demand between these metropolitan areas, but also improved mobility for freight shipments throughout the Intermountain West and inland portions of the West Coast.

An Interstate 11 (I-11) corridor to address this need was designated as part of the federal transportation bill, Moving Ahead for Progress in the 21st Century Act (MAP-21), which was signed into law by President Obama on July 6, 2012. The move makes the corridor eligible for federal funds; however, funding to construct a potential I-11 corridor has not been identified. Subsequently, I-11 was officially designated by the United States Congress in the 2015 Fixing America's Surface Transportation (FAST) Act. It is planned to run from Nogales, Arizona to Reno, Nevada with the potential to extend north to the Canadian border and become the new CANAMEX corridor through the Intermountain West. This corridor would connect communities, national and international economies, existing and future domestic and international deep-water ports, and would intersect with transcontinental roadways and railroad corridors.

In November 2014, the Arizona and Nevada departments of transportation completed the two-year I-11 & Intermountain West Corridor Study. The study included detailed corridor planning of a high priority Interstate Highway link between Phoenix and Las Vegas and high-level visioning for potentially extending the corridor north to Canada and south to Mexico. In December 2015, ADOT began a Tier I EIS and Conceptual Engineering Document structured to select a preferred corridor alignment and preferred transportation mode choice for accommodating future traffic needs from Nogales to Wickenburg, as recommended in the Final I-11 & Intermountain West Corridor Study. The study is expected to be completed in 2020.

Construction in a segment of the I-11 corridor in Nevada started in the summer of 2015 on the north side of the Mike O'Callaghan-Pat Tillman Memorial Bridge over the Colorado River at Boulder City, Nevada. The \$318 million, 15-mile segment of divided highway will bypass Boulder City and connect with U.S. 93 near Henderson, Nevada. The Nevada Department of Transportation broke ground on two segments: a 2.5-mile portion bypassing Boulder City for \$83 million; and a \$235 million, 12.5-mile segment funded by the regional Transportation Commission of Southern Nevada. On September 27, 2017, the MAG Regional Council approved a Major Amendment to the MAG 2040 RTP to add the I-11 corridor from I-10 to US-93.

Interstate 10/Interstate 17 Corridor Master Plan Study

The MAG, in partnership with the FHWA and ADOT, launched a study in 2014 to develop a corridor master plan for the I-10 and I-17 corridor. This corridor is referred to as the "Spine" because it serves as the backbone for transportation in the metropolitan Phoenix area. The

corridor handles more than 40 percent of all daily freeway traffic in the Region. The 35-mile "Spine Study" corridor begins at the I-17/Loop 101 "North Stack" interchange and continues south and east to the I-10/I-17 "Split" interchange. The corridor continues east and south along I-10 to the interchange with Loop 202 "Pecos Stack".

The Spine Study analyzed long-term strategies to improve mobility in the corridor. The study evaluated a range of transportation modes and concepts, including cars, transit, freight, bicycling, and walking, to identify the best multimodal solutions. These long-term solutions are envisioned as a combination of traditional methods, new technology, and increased use of transit. The key outcome of the Spine Study was a detailed strategy to manage traffic in the I-10 and I-17 corridors through 2040. In addition to the Master Plan development, the study team identified near-term improvements along I-10 and I-17. The study looked at traffic operations on the street and transit networks around the freeways.

The MAG 2040 RTP Update allocates funding for identified near-term improvements, in addition to long-range improvements. The Spine Study identified how to best use these funds to achieve the greatest benefit to the Region. It also defined funding shortfalls of the preferred corridor improvement approach so additional funding allocations can be considered in the future. In recent years, ADOT and FHWA developed design concept reports and EIS as part of the I-10 Corridor I-17 Corridor Improvement Studies. These studies looked at ways to add capacity, such as general-purpose lanes, to both I-10 and I-17 in the Phoenix area. The two previous studies identified long-term improvements that would have required more funding than was available in the RTP for either corridor. ADOT and MAG agreed on, and FHWA accepted the decision to rescind the studies in 2012 after it was determined that separate studies may not result in the best overall plan for the corridor. However, much of the planning, engineering, and environmental information from those studies was folded into the new Corridor Master Plan. In addition, the studies identified near-term improvements that will be carried forward and implemented by ADOT through a separate but parallel effort.

Stakeholder coordination and public involvement was a critical component of the Spine Study. Diverse groups of stakeholders and members of the public provided suggestions on potential corridor improvements, which were used to develop a unified corridor vision. Multiple rounds of public engagement, including public meetings and online surveys, were conducted during the study. On May 24, 2017, the MAG Regional Council approved the recommendations of the "Spine" Corridor Study into the 2040 RTP. This included improvements for operations and safety for the traveling public. Key components of the Corridor Master Plan Recommendations include the concept of additional managed lanes (such as HOV), modernization of 24 traffic interchanges, safer pedestrian and bicycle crossings at 20 different locations (including nine separate structures) and coordinated crossings of light rail transit at four locations.

SR-30 (Tres Rios Freeway), SR-202L to I-17 Scoping Study

In partnership with FHWA and ADOT, MAG is facilitating a scoping study for the section of the proposed SR-30 that would connect the Loop 202 (South Mountain Freeway) near 59th Avenue

to I-17 near the Durango Curve. The SR-30 scoping study is following the Planning and Environmental Linkages (PEL) process developed by FHWA and adopted by ADOT. The goal is to integrate early planning efforts with the National Environmental Policy Act (NEPA) process and ultimately be included in the RTP and TIP. The study will be complete in the summer of 2021.

SR-347, Peters and Nall Road to I-10/Maricopa Scoping Study

In partnership with FHWA and ADOT, MAG is facilitating a scoping study for SR-347 to identify potential improvements related to rapid development and changes in land uses through the corridor. Facilitated with the partnership of the City of Maricopa, Pinal and Maricopa counties, the Gila River Indian Community and Ak-Chin Indian Community, the study will also develop a PEL Statement to assist a future environmental study. The study will be complete in early 2020.

Freight Transportation Network Study

In 2012, MAG, in cooperation with the JPAC, completed the Freight Transportation Framework Study. The goal of the Freight Transportation Framework Study was to identify freight related economic development opportunities in the Arizona Sun Corridor. The framework study completed an extensive freight survey that: (1) included 2,500 shippers and carriers across the United States, (2) conducted phone and in-person interviews with local freight stakeholders, (3) evaluated commodity flows and truck rates, (4) identified 16 freight focus areas, (5) analyzed the industry real estate market, and (6) completed a detailed assessment of four emerging focus areas that included the evaluation of the industry market, land use plans (existing and future), inventory of existing businesses, education, travel times, commodities, transportation infrastructure and economic development incentives.

The Freight Transportation Framework Study presented the results of a detailed evaluation of commodity flows affecting the Sun Corridor, with a focus on goods movements between Mexico, sources in the southeast United States, and markets along the West Coast. Screening of potential freight focus areas led to the determination of freight related opportunities within the Region, including the designation and evaluation of area typologies representing differing relevant majority use types that would support an enhanced role for the Sun Corridor in the global supply chain.

As a follow-up to the Freight Framework Study, in 2015, MAG began work on the MAG Freight Transportation Plan. This study builds upon the recommendations identified in the Freight Transportation Framework Study, with the goal of identifying a strategic network for the movement of goods in the MAG area. The project team worked with MAG member agencies to identify freight clusters, model the flow of goods, and locate bottlenecks and other potential barriers to the efficient flow of freight. The plan included an infrastructure assessment along existing and proposed freight corridors that estimate bridge and roadway life cycle costs, evaluates the impact of overweight vehicles on transportation infrastructure, and analyzes overall traffic operations. A major goal of the study was to identify freight and logistic clusters and ensure these regional economic generators are protected from non-compatible uses, are

served by corridors that will move goods and commuters safely and efficiently, and that will remain competitive and continue to attract companies to the MAG Region. The results of the study identify projects that will enhance the flow of goods in the MAG Region and complement the projects identified in the RTP. While the study was completed in FY 2019, it recommended several subarea assessments to better evaluate specific strategies to address freight movements.

MAG Commuter Rail Studies

While the RTP does not include funding to build and operate commuter rail in the MAG Region, regional forecasts indicate that population densities and market demand are sufficient to warrant an investment in commuter rail in the future. Recognizing that population growth, economic conditions, travel demand, and public opinion are constantly changing, the RTP allocates funding to continue developing illustrative, commuter rail concepts for the Region.

- Commuter Rail Planning – MAG staff was directed by the regional Council to develop a Commuter Rail Strategic Plan in 2008. Three additional rail passenger planning studies were commissioned: System Study, Grand Avenue Corridor Study, and Yuma West Corridor Study. These three studies were subsequently completed, and Regional Council accepted the findings and recommendations in May 2010.
- Commuter Rail Strategic Plan - On April 23, 2008, the MAG Regional Council accepted the findings of the MAG Commuter Rail Strategic Plan. Subsequently, MAG launched the commuter rail strategic planning process and completed the efforts in February 2009. The purpose of the planning process was to develop an implementation strategy for commuter rail service in Maricopa County and northern Pinal County. The strategic plan builds upon technical information from the high-capacity transit study and ongoing passenger rail planning by the ADOT to provide a framework for implementing commuter rail service in the MAG Region.

The action by the regional Council included accepting the findings of the Commuter Rail Strategic Plan as the guiding implementation framework for commuter rail, and for MAG to proceed with the first four implementation steps identified on page nine of the executive summary: (1) ongoing coordination; (2) Union Pacific (UP) passenger rail coordination; (3) BNSF Railway coordination; and (4) regional transit planning.

- MAG Commuter Rail System Plan - This study evaluated commuter rail options and potential connecting routes for the MAG Region. It established priorities for implementing commuter rail service through an evaluation of ridership potential, operating strategies, and associated capital and operating costs. All existing freight corridors and possible rail extension areas identified in the Commuter Rail Strategic Plan were evaluated as part of the study. This system plan included a review of existing documentation, ongoing public involvement, an inventory of the existing BNSF and UP rail lines, potential extension corridors, development of a conceptual commuter rail operating plan, identification of infrastructure improvements necessary for the

implementation of commuter rail service, development of capital cost estimates, and the development of annual operating cost estimates for commuter rail service. The MAG Regional Council accepted the study findings on May 12, 2010.

- BNSF/Grand Avenue Commuter Rail Corridor Development Plan - This study determined the feasibility of implementing commuter rail service along the BNSF Railway Phoenix Subdivision between Phoenix and Wickenburg, approximately 54 miles. The final product provided a Corridor Development Plan that describes the elements necessary to successfully implement commuter rail transit service in the Grand Avenue Corridor. This corridor development plan includes a review of existing documentation, ongoing public involvement, an inventory of the existing BNSF Northwest rail line, development of a conceptual commuter rail operating plan, identification of infrastructure improvements necessary for the implementation of commuter rail service, development of capital cost estimates, and the development of annual operating cost estimates for commuter rail service. The MAG Regional Council accepted the study findings on May 12, 2010.
- Union Pacific/Yuma West Commuter Rail Corridor Development Plan - This study determined the feasibility of implementing commuter rail service along the UP Yuma West line between Buckeye in the west and Union Station in downtown Phoenix. The final product is a Corridor Development Plan that describes the elements necessary to implement commuter rail transit service along this corridor successfully. The project also addresses opportunities for connections with other high-capacity transit corridors, including the I-10 West AA/EIS currently being studied in the MAG Region. This corridor development plan provides a review of existing documentation, ongoing public involvement, an inventory of the existing UP West rail line, development of a conceptual commuter rail operating plan, identification of infrastructure improvements necessary for the implementation of commuter rail service, development of capital cost estimates, and the development of annual operating cost estimates for commuter rail service. The MAG Regional Council accepted the study findings on May 12, 2010.
- MAG Regional Commuter Rail System Study Update - In FY 2017, MAG initiated the regional Commuter Rail System Study Update. The study updated the data included in the original, 110-mile MAG 2010 Commuter Rail System Study, including new regional socioeconomic forecasts, revised ridership, and cost estimates. Governance and indemnity/liability issues related to passenger rail implementation were studied, as these elements must be addressed prior to any agreement between the owner railroads and the eventual commuter rail governing/operating agency. Figure 11-10 in Chapter 11 depicts a concept map for a regional commuter rail system. While the regional Commuter Rail System Study Update was completed in October 2018, there are currently no funds identified for implementing commuter rail through 2040.
- Phoenix-Tucson Commuter Rail Study - In addition to the MAG studies described previously, MAG participated in the Tucson-Phoenix Regional Passenger Rail (and Commuter Rail Service) Study conducted by ADOT. From 2011 to 2016, this thorough,

joint Federal Railroad Administration (FRA)-Federal Transit Administration (FTA) project study assessed the potential for passenger rail service between Phoenix and Tucson, with a focus on: (1) connecting downtown Phoenix to downtown Tucson, and (2) ensuring system connectivity, including commuter rail extensions to Buckeye and Surprise. Two corridor alternatives and a no-build alternative for implementing a passenger rail system were evaluated as a part of the study process. A Draft Tier One EIS was completed in the spring of 2016, and a Record of Decision (ROD) from the FRA issued December 19, 2016. There is currently no construction schedule and no capital or operating funding source identified for a passenger rail system between Tucson and Phoenix.

MAG Regional Transit Framework Study

The initial MAG Regional Transit Framework Study (RTFS) began in 2008 to provide a needs-based planning process for identifying and prioritizing regional transit improvements through year 2030, with consideration for long-range transportation needs through year 2050. The planning process included a technical approach to identify future travel demand and travel markets through an analysis of future growth patterns. Specific markets were identified through technical evaluation of high-demand travel markets and an understanding of traveler behavior. It included the technical analyses of land use, socioeconomic conditions, existing and planned transit service, and infrastructure, along with the stated customer preference attributes, identified public transit needs, deficiencies, opportunities, and constraints within the Region. On March 31, 2010, the MAG Regional Council accepted the Illustrative Transit Corridors map in the RTFS for inclusion as unfunded regional transit illustrative corridors in the RTP.

In FY 2017, the regional Transit Framework Study Update (RTFSU) was initiated to update the 2010 RTFS to guide future transit investments and decisions. The RTFSU served to formalize regional high-capacity transit system corridors by updating the work completed in the 2010 RTFS through a planning horizon of 2040. The 2017 RTFSU addressed factors such as: (1) changes in transportation conditions since the completion of the 2010 RTFS, (2) role transit plays in meeting regional transportation needs now and into the future, (3) composition of the transit system in 2040, and (4) advancements in existing and future transportation technologies and their impact on modal choice and long-term transit planning. The Update focused singularly on the high-capacity modes of light rail, bus rapid transit, and enhanced bus. The MAG Regional Council accepted the key findings report on December 4, 2019, outlining the most viable high-capacity corridors for future study.

Other Transit Studies

Several local transit system studies have been conducted to investigate the transit service needs to be brought about by extended periods of rapid population and employment growth in certain areas of the MAG Region. Many communities saw their populations double or triple in size in less than a decade. Not surprisingly, with such increases in growth comes an increased demand for transit service. While these areas have experienced rapid growth in the past, the

recent economic downturn has impacted the outlook for current and future transit services. The purpose of the studies was to identify opportunities and strategies for improving existing transit services, and to develop short-, mid-, and long-range local transit plans that effectively provide circulation within the study areas, as well as connections to the regional transit system.

- Southwest Valley Local Transit System Study - The purpose of the Southwest Valley Local Transit System Study was to develop a three-phased plan that identifies short-, mid-, and long-range strategies for local transit. This study included the communities of Phoenix, Avondale, Goodyear, Tolleson, Litchfield Park, Buckeye, and surrounding unincorporated portions of Maricopa County. Ultimately, the recommendations arising from these studies will serve as a blueprint for local communities for a sustainable and market-based local transit system, which ties into the regional transit network. Recommendations also included creating a regional partnership among cities and identifying funding sources. Regional Council accepted this study on May 10, 2013.
- Northwest Valley Local Transit System Study - The purpose of the Northwest Valley Local Transit System Study was to develop a three-phased plan that identifies short-, mid-, and long-range strategies for local transit. The plan from this study will serve as a blueprint for a sustainable and market-based local transit system that ties into the regional transit network. The study area included the communities of El Mirage, Surprise, and Youngtown, and portions of Glendale, Peoria, and unincorporated Maricopa County, as well as the unincorporated communities of Sun City, Sun City West, and Sun City Festival. Additional recommendations included creating a local volunteer drive program in Sun City, modifying existing Glendale and Peoria transit routes to better align with a consolidated express route, extend Valley Metro service into Sun City, and increasing frequency on a route serving Banner Boswell Medical Center. Recommendations also included creating a regional partnership among cities and identifying funding sources. Regional Council accepted this study on October 23, 2013.
- Southeast Valley Transit System Study - The Southeast Valley Transit System Study (SEVTSS) analyzed transit services and ridership demand in transit-established and transit-aspiring communities within the southeast subarea of the MAG Region. MAG and Valley Metro conducted the study over an 18-month period, which concluded in July 2015. The study area encompassed Apache Junction, Chandler, Florence, Gilbert, Guadalupe, Maricopa, Mesa, Tempe, Queen Creek, as well as parts of the Gila River Indian Community, Phoenix, and Maricopa and Pinal counties. Through a process that was both data-driven and collaborative, this study resulted in the identification of recommendations for optimizing the existing transit system, and mid-term and long-term improvements to enhance a performance-based transit system throughout the Southeast Valley. Regional Council accepted this study on October 28, 2015.
- Sustainable Transportation and Land Use Integration Study (ST-LUIS) - This transit-related study highlights the potential to move the Region towards greater use of sustainable transportation modes – transit, walking, and biking. The study provides a

fresh look at ideas for transit investments and services that have been under previous consideration and supports the creation of walkable and transit-oriented communities. The uniqueness of the ST-LUIS is the holistic approach taken to investigating transit's potential by integrating real estate market analysis with transit corridor assessment and ridership modeling. The focus on transit and supportive land use is joined with recommendations for creating compact, walkable places throughout the Region. The findings of this study were distributed in the fall of 2013.

- Multimodal Level of Service Study - This study assessed how well an urban street serves the needs of all users, including pedestrians, bicyclists, and transit users. It includes a tool that demonstrates the applicability of a multimodal level of service analysis, and how engineers can utilize it, development review staff, city planners, and transit planners to better understand the impact of geometry, design, and traffic on all users of the urban street. This study was completed in January 2017.
- Achieving Transit Accessibility Now (ATAN) - The MAG Regional Council approved the use of \$2.5 million of transit funding to improve the accessibility at transit stops in the MAG Region. MAG staff worked with Valley Metro, City of Phoenix Transit, and the MAG Transit Committee to develop an implementation program for these funds. This interim program addresses immediate needs while Valley Metro completed the Bus Stop Inventory and Accessibility Study in May 2018. The proposed short-term transit accessibility program, ATAN, was recommended for approval by MAG in late 2016, and its final round of funding was awarded in 2019.
- Bus Stop Inventory and Accessibility Study - The purpose of this joint Valley Metro, City of Phoenix and MAG project was to conduct a regional inventory of transit stops for ADA compliance and accessibility, to house the survey findings in the regional transit stop database, and to adopt a regional transit stop standard. The project provided the Region with valuable information about ADA compliance at bus stops. The inventory was completed in May of 2018. A previous related study, the Designing Transit Accessible Communities Study (DTAC), focused on challenges faced by pedestrians and bicyclists as they access transit at the stop level. The study furnishes member agencies with additional tools and guidance to promote and sustain better planning associated with improving existing deficiencies and deploying future stops that are more accessible and supportive of adjacent neighborhood needs. It was also completed and accepted by MAG on February 26, 2014.
- Rural Paratransit Needs Assessment - The purpose of the MAG Rural Paratransit Needs Assessment Study was to address the mobility needs of disadvantaged (i.e., older adults and persons with disabilities) and regional paratransit service levels necessary to address those needs within the rural areas of the MAG Region. The six-month study analyzed a variety of tasks that can build a case for transit improvements and may lead to future opportunities to secure local, regional, state, and/or FTA funding. Valley Metro,

Maricopa County, Pinal County, and ADOT were included as partnering agencies. The assessment was completed in July of 2017.

- City of Maricopa Rural Transit Demand Study - This study determined the market for new services that would link rural communities such as City of Maricopa with its residents as well as with other communities. The study evaluated the potential to expand transit service via SR-347 to better connect Maricopa with Phoenix, Tempe, and Chandler. It also analyzed the enhancement of intra-Maricopa transit service for local demand as the city is trying to transition from demand response to fixed service. The study was completed in October of 2018.
- Northwest Sun Cities Transit Implementation Study - Valley Metro and MAG initiated in March 2019 the Northwest Sun Cities Transit Implementation Study to develop a comprehensive understanding of the transportation needs of the unincorporated communities of Sun City and Sun City West. The product of visionary developer Del E. Webb, Sun City and Sun City West are Census Designated Places (CDP) and retirement communities designed for active adults 55 years and older. Located approximately 20 miles northwest of downtown Phoenix, the communities have a combined population of 64,085 as of 2017. This plan will determine the demand for transit services in the Northwest Sun Cities and identify service concepts that meet the unique needs of the community. The study will be completed in early 2020.
- Regional Bus Rapid Transit Study - A recommendation of the regional Transit Framework Study Update, the regional Bus Rapid Transit (BRT) Study was initiated in late 2019 to coordinate with similar BRT study efforts of the City of Phoenix. This regional study is largely intended to gauge the interest in and feasibility of implementing BRT in the communities surrounding Phoenix. The results of this study will serve as a springboard for surrounding communities to begin their discussions about implementing BRT. This study and associated outreach process will give member agencies a head start in future implementation through an enhanced understanding of BRT opportunities, challenges, and feasibility. Based on associated tasks, this study is also intended to recommend a preliminary set of locations where a regional BRT network could connect to planned City of Phoenix investments, and ultimately, inform future updates of the RTP. The study will be completed in early 2021.
- Regional Commuter Bus Feasibility Study - In the fall of 2019, MAG initiated a study to evaluate the demand for commuter bus throughout the Region. A recommended study from the RTFSU, the purpose of the study was to evaluate where demand exists for new commuter bus service and the viability for those services. While the Region currently operates commuter bus service (i.e., RAPID service in Phoenix, Express Bus outside of Phoenix), all routes end in downtown Phoenix. Analysis of the viability of this service to other destinations today and in the future is desired to inform future transit investments. The study will be completed by the end of FY 2020.

Illustrative Corridors/Projects

The transportation studies discussed in the previous sections represent collaborative efforts between MAG and other agencies, communities, counties, and regions, and have implications for the extended planning effort beyond the currently adopted MAG RTP. Given the current and expected population growth in the MAG Region, these studies provide a perspective on future transportation needs, which is essential for effective long-range planning. Their findings and recommendations identify potential new corridors or other transportation improvements that can be considered in future updates of the RTP. One approach to identifying potential new corridors/projects or other transportation improvements that might be considered for inclusion in future updates of the RTP is the concept of illustrative projects.

Illustrative Corridor/Project Concept

Federal regulations for metropolitan transportation planning identify the concept of “illustrative projects” as an element of the planning process. These are projects that could potentially be included in the plan if additional resources beyond the reasonably available financial resources identified in the plan were available. They are discussed in the metropolitan transportation plan for illustrative purposes only and are not included in the financial plan or air quality conformity determination. There is no requirement to select a project from an illustrative list of projects from a metropolitan transportation plan at a future date when funding becomes available. In addition, no priorities are stated or implied by inclusion as an illustrative corridor.

An illustrative project may not be needed until after the planning horizon of the RTP. However, illustrative projects can help guide transportation and land use planning efforts at both the regional and local level, even though funding for the projects has not yet been identified. This is applicable to making provisions for the development of potential future transportation facilities in municipal general plans. In addition, including an illustrative regional transportation project provides project sponsors with support in seeking funding from other sources, since the project was vetted through a planning study or process and through MAG. An illustrative project must be identified through a transportation planning process such as a framework study, corridor or modal analysis. The illustrative project must be for a regionally significant project and is a corridor or link in the regional transportation system that enhances mobility in the Region. The inclusion of an illustrative project in the RTP does not imply in any way that the project has priority for future funding over other illustrative projects in the RTP or future projects yet to be identified. The MAG Regional Council, acting on a recommendation from the Transportation Policy Committee, can add or delete an illustrative project in the MAG RTP.

The illustrative corridors/projects included in the RTP are discussed below.

Interstate 10/Hassayampa Valley Transportation Framework Study

On February 27, 2008, the MAG Regional Council accepted the findings of the I-10/Hassayampa Valley Transportation Framework Study. A key aspect of this action was to accept the findings

and implementation strategies, as described in the study for inclusion as illustrative corridors in the RTP. In taking this action, it was recognized that the study recommendations are not funded. Figure 17-2 depicts the illustrative corridors recommended by this study, which includes potential freeway facilities, parkway facilities, interchanges, and high-capacity transit corridors.

Interstates 8 and 10/Hidden Valley Transportation Framework Study

On September 30, 2009, the MAG Regional Council accepted the findings of the I-8 and I-10/Hidden Valley Transportation Framework Study. A key action was accepting the findings and implementation strategies, as described in the study for inclusion as illustrative corridors in the RTP. The Council recognized that the study recommendations are largely unfunded. Figure 17-3 depicts the illustrative corridors recommended by this study, which includes potential freeway facilities, parkway facilities, interchanges, and high-capacity transit corridors.

New River Corridor

On November 25, 2003, the MAG Regional Council approved a connection between Loop 303 and I-17 in the vicinity of New River Road as a corridor for further study. At that time, funding for the New River Corridor was not included in the RTP. In August 2005, ADOT completed an Alignment Selection Report, which identified an alignment for a potential future freeway facility in the corridor. The status of this corridor as an illustrative corridor was formalized in the 2010 Update of the RTP and is depicted in Figure 17-4.

Sky Harbor Automated Train System

On April 22, 2009, the MAG Regional Council approved the inclusion of Stage Two of the Sky Harbor Automated Train System (Sky Train) as an illustrative project in the RTP. Since the City of Phoenix approved funding for Stage Two in October 2016, the project is included in the 2040 RTP Update and is no longer an illustrative project. The Sky Train system is paid for by airport revenues and passenger fees (not local tax dollars). The Sky Train is a fully automated, 2.5-mile grade-separated transit system that connects several major facilities at Sky Harbor International Airport with the Valley Metro bus and light rail system. Stage One was completed in early 2013 and extends from the light rail station at 44th Street to Airport Terminal 4. Stage One-A, which continues from Terminal 4 to Terminal 3 for 0.7 miles with a short walkway to Terminal 2, opened in December 2014. On April 22, 2009, the MAG Regional Council approved the inclusion of Stage Two of the Sky Harbor Automated Train System (Sky Train) as an illustrative project in the RTP, with the City of Phoenix approving full funding in October 2016. Stage Two, a \$740 million, 2.5-mile extension will link Terminal 4 with the Rental Car Center by 2022. The entire project cost is paid for with airport revenues and passenger fees (not local tax dollars).

Regional Transit Framework Study

On March 31, 2010, the MAG Regional Council accepted the Illustrative Transit Corridors map in the regional Transit Framework Study (RTFS) for inclusion as unfunded regional transit

illustrative corridors in the RTP. In addition, the future planning actions identified in the study were accepted for consideration through the MAG Unified Planning Work Program process. Figure 17-5 depicts the illustrative corridors recommended by this study, which include all-day and peak period high-capacity transit, and arterial bus rapid transit. Future, more detailed analysis on corridors recommended from the RTFS Update may result in revisions to the concepts approved in 2010, subject to Regional Council action.

Tempe South Alternatives Analysis

On December 8, 2010, the MAG Regional Council approved a recommendation for inclusion of a potential future phase of modern streetcar east along Southern Avenue to Rural Road, as an illustrative transit corridor in the RTP. This illustrative project was dropped from the 2040 RTP since it is no longer compatible with the routing subsequently approved for the Tempe Streetcar, as discussed below.

In June 2014, the Tempe City Council supported a recommendation for a three-mile Tempe Streetcar route on Rio Salado Parkway from the Marina Heights development west to Mill Avenue, downtown loop on Mill and Ash Avenues and south to Apache Boulevard, then east to Dorsey Lane. In spring 2015, the Tempe City Council approved the recommended stop locations, which was also approved by the Valley Metro Rail Board and MAG.

The project received a Finding of No Significant Impact (FONSI) from the FTA in October 2015, which indicates that the project will have no significant environmental effect on the neighboring communities. The FONSI comes following the project's Environmental Assessment (EA), which evaluates the potential impacts to the neighboring environment, including noise and vibration, traffic and parking, and historical and archaeological resources.

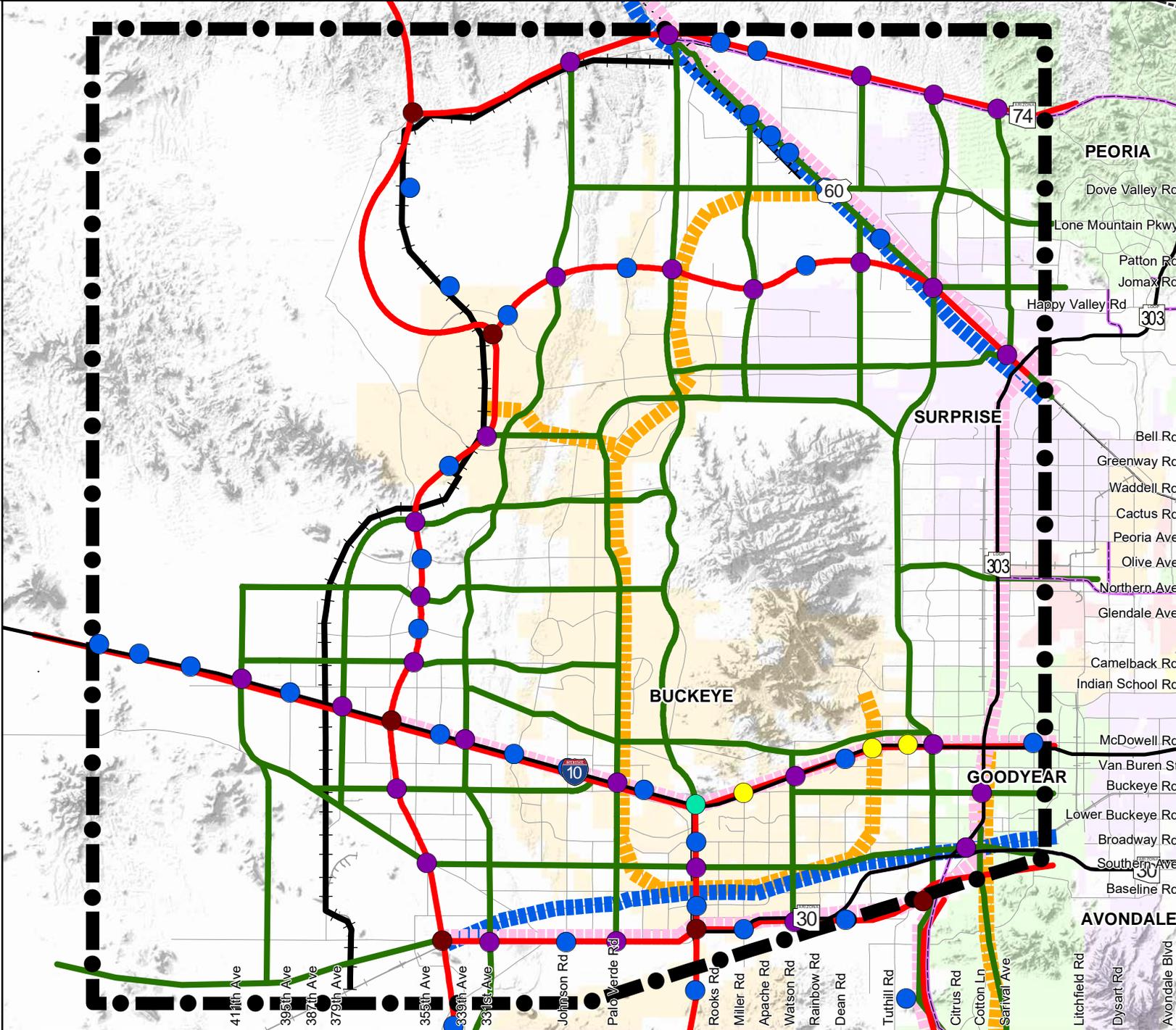
On February 9, 2016, planning for the Valley's first streetcar reached a significant funding milestone. Tempe Streetcar was included in President Obama's budget for Fiscal Year 2017, for \$75 million. The first \$50 million was received from the FTA in 2017 and the final \$25 million in November 2018. The Tempe Streetcar project capital costs are estimated at \$202 million and will be funded using regional Proposition 400 funds, local funds, and federal grant dollars. The project is due to open in 2021.

Potential Improvements to the Existing Freeway/Highway System

Certain additional projects to improve the existing freeway/highway system have been identified as a result of various ADOT corridor and design concept studies. These illustrative projects are:

- SR-85 (I-10 to I-8) - Upgrading SR-85 to a full freeway, including the construction of a fully directional interchange at I-8.
- I-10 / I-17 (System Interchange) - Possible enhancements to the I-10/I-17 "Stack".

Figure 17-2: Hassayampa Illustrative Corridors



2040 Regional Transportation Plan Update

- Hassayampa Illustrative Corridors**
- Study Area Boundary
 - Existing Traffic Interchanges
 - Illustrative Traffic Interchanges
 - Existing System Interchange
 - Illustrative System Interchanges
 - Illustrative Parkway Traffic Interchanges
 - Illustrative Freeways/Improvements
 - Illustrative Parkways
 - Adopted Regional Transportation Plan Facilities
 - Illustrative and Adopted Bus Rapid Transit
 - Illustrative High Capacity Transit (Peak Service)
 - Illustrative High Capacity Community Transit
 - Illustrative Freight Rail Connector
- Other Features**
- Existing Freeways
 - Highways
 - Other Roads
 - Existing Railroads
 - Metropolitan Planning Area
 - County Boundary

Alignments for new freeway, highway, arterial, and bridge facilities will be determined following the completion of appropriate design and environmental studies.

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Figure 17-3: Hidden Valley Illustrative Corridors

2040 Regional Transportation Plan Update

Hidden Valley Illustrative Corridors

- Study Area Boundary
 - Existing Traffic Interchange
 - Illustrative Traffic Interchange
 - Existing System Interchange
 - Illustrative System Interchange
 - ◆ Illustrative High Occupancy Vehicle Lane
 - Illustrative Freeways/Improvements
 - Illustrative Parkways
 - Adopted Regional Transportation Plan Facilities
 - Illustrative and Adopted Bus Rapid Transit
 - Illustrative High Capacity Community Transit
 - Illustrative High Capacity Transit (Peak Service)
 - Freight Connector
 - Enhanced Transit Corridor
 - Safety and Operational Improvements Corridor
- Other Features**
- Existing Freeways
 - Highways
 - Other Roads
 - Existing Railroads
 - Metropolitan Planning Area
 - County Boundary

Alignments for new freeway, highway, arterial, and bridge facilities will be determined following the completion of appropriate design and environmental studies.

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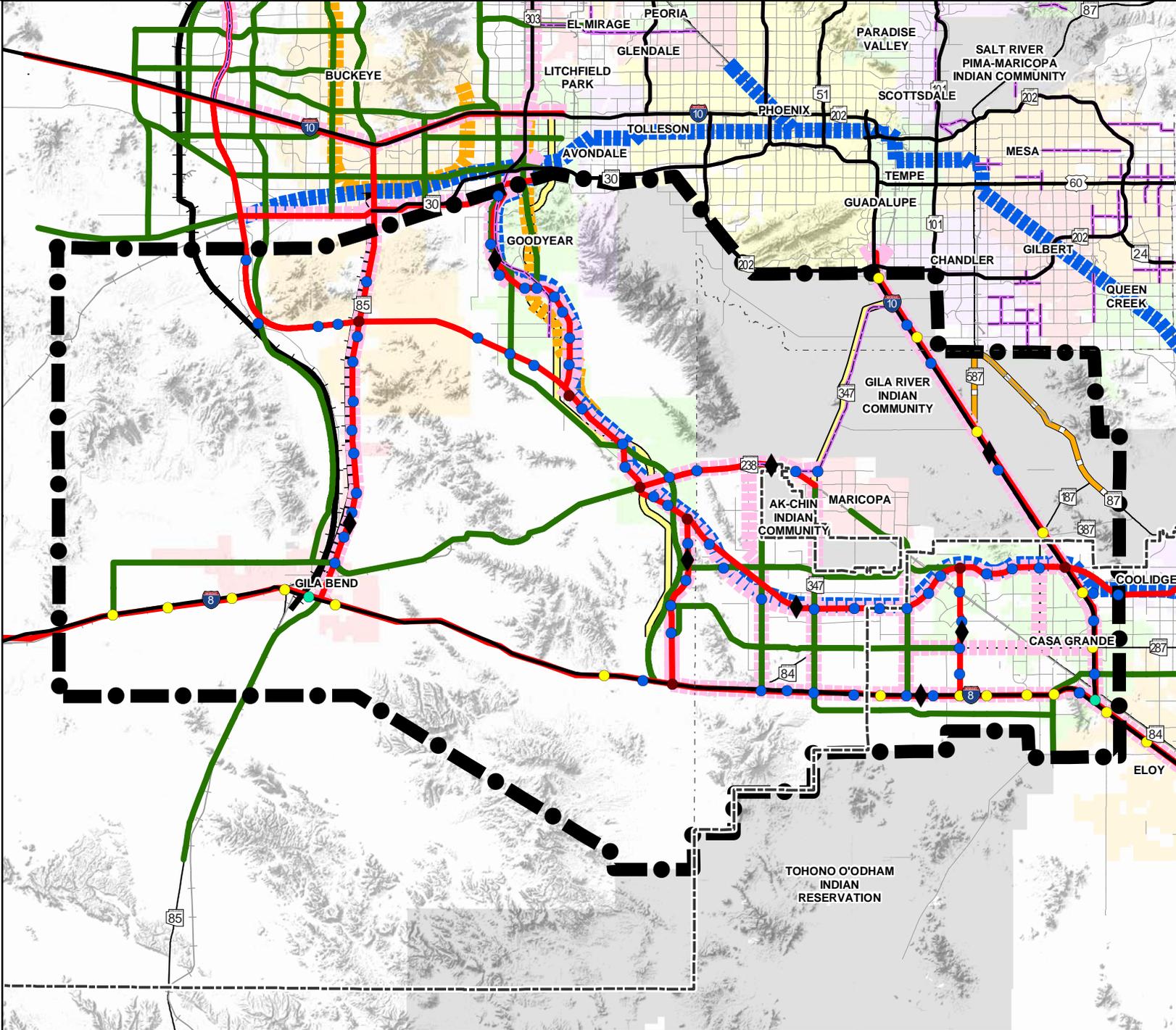
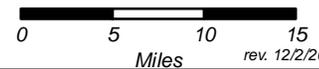
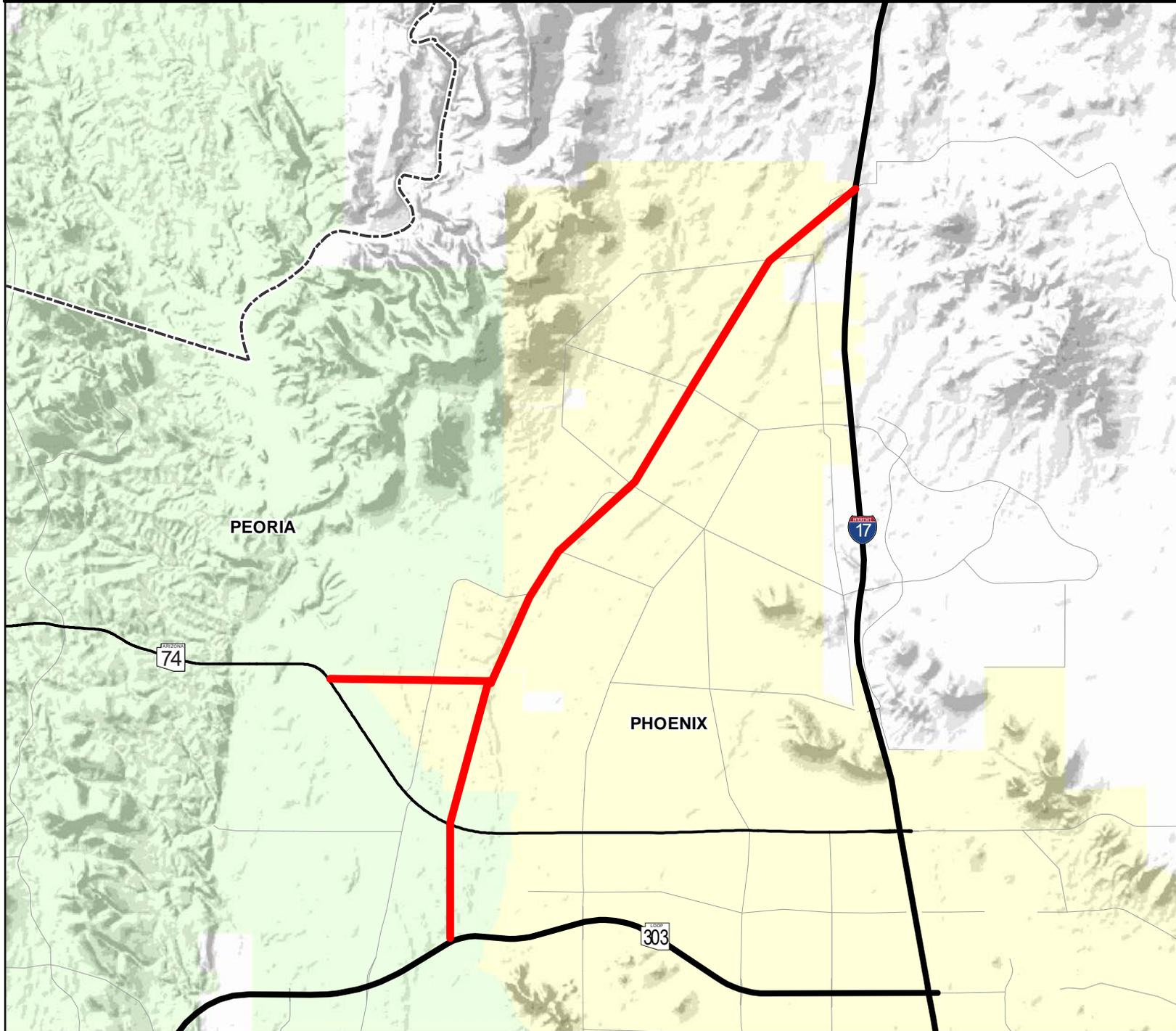


Figure 17-4: New River Illustrative Corridors

2040 Regional Transportation Plan Update

- New River Illustrative Corridors**
- Illustrative Freeway Corridor
- Other Features**
- Existing Freeways
 - Highways
 - Other Roads
 - Metropolitan Planning Area
 - County Boundary



Alignments for new freeway, highway, arterial, and bridge facilities will be determined following the completion of appropriate design and environmental studies.

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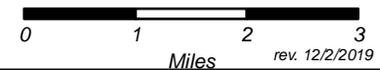
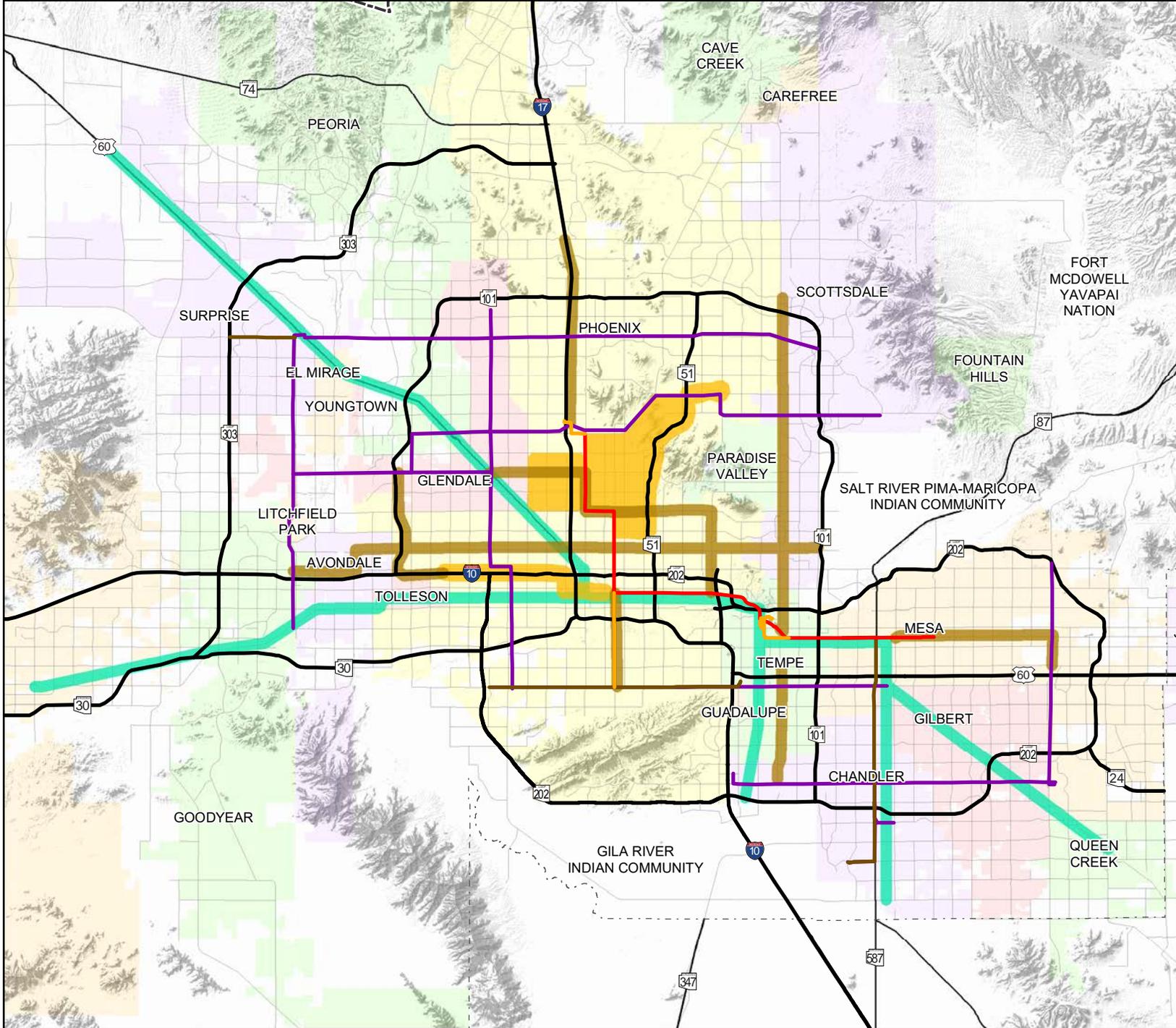


Figure 17-5: Illustrative Transit Corridors

2040 Regional Transportation Plan Update



- Illustrative Transit Corridors**
- Completed Light Rail Segment
 - Adopted High Capacity Transit Corridors (RTP Funded) *
 - Adopted High Capacity Transit Corridor Areas (RTP Funded)
 - Adopted Arterial Bus Rapid Transit (RTP Funded) *
 - Illustrative High Capacity Transit (All-day Service) **
 - Illustrative High Capacity Transit (Peak Service) **
 - Illustrative Arterial Bus Rapid Transit **
- Other Features**
- Freeways
 - Highways
 - Other Roads
 - Metropolitan Planning Area
 - County Boundary

* RTP funding based on estimates of reasonably available revenues (2020-2040)

** Illustrative corridors do not have funding identified in the RTP

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CHAPTER EIGHTEEN

SYSTEMS MANAGEMENT AND OPERATIONS

Planning for Systems Management and Operations (SM&O), in the context of surface transportation in large urban regions, refers to the regional approach for optimizing the operation and performance of the transportation system. This is accomplished through the coordination of multi-modal, cross-jurisdictional traffic management systems and related services that deliver positive outcomes for the region through improved safety and mobility. The full spectrum of transportation technology applications and related infrastructure, known as Intelligent Transportation Systems (ITS), together with effective practices in traffic management and operations, form the basis for all SM&O programs and services.

Intelligent Transportation Systems Infrastructure and Planning

Intelligent Transportation Systems, or ITS, involves the application of advanced sensors, surveillance cameras, computers, electronics, and wired or wireless communication technologies integrated with effective management strategies to improve the safety, efficiency, and reliability of the surface transportation system. The realization of full benefits from strategic investments in ITS applications and related infrastructure requires commitment, support, and resources for hiring and retaining skilled personnel. Automation is utilized in ITS applications owned and operated by public agencies, and these systems depend on skilled technical staff for conducting the management of day-to-day traffic operations and equipment maintenance.

Intelligent Transportation Systems Infrastructure

At the regional level, MAG is committed to supporting ITS applications and the solutions they provide to enhance the regional transportation system. The Regional Transportation Plan (RTP) has provided funds for systematic regional investments in ITS infrastructure, on both the freeway and arterial systems. Most regional investments in ITS are directed at new infrastructure or technology upgrades. A fully integrated system of ITS infrastructure was funded by the RTP and implemented on the urban freeway network. Referred to as the Freeway Management System (FMS), the system is utilized by the Arizona Department of Transportation (ADOT) and the Arizona Department of Public Safety (DPS) to ensure the safety and efficiency of freeway operations.

The operations and management of the arterial street system are based on jurisdictional boundaries and ownership. Each local agency owns and operates its traffic signal management system. Local agencies have utilized RTP funds to acquire such systems from different vendors. These systems are subject to federal requirements and are all compatible in operation. The region continues to make investments in expanding ITS infrastructure while delivering improved SM&O during periods of heaviest travel demand.

The products and services related to ITS infrastructure improve efficiency, safety, and travel time reliability by:

- Collecting and disseminating real-time information on traffic conditions and transit arrival times to aid travelers before and during their trips.
- Relieving traffic congestion by reducing traffic incidents and the associated impact through better traffic incident management response, traffic flow coordination, detecting and clearing incidents quickly, and efficiently rerouting traffic.
- Providing road condition information to drivers to help them better plan their trips and reach desired destinations safely and efficiently.
- Helping freight companies move goods safely and efficiently by utilizing real-time traffic information made available via ITS infrastructure.

National and Regional ITS Architectures

The U.S. Department of Transportation (USDOT) led a nationwide effort involving many stakeholder agencies in the development of the first version of the National ITS Architecture (NIA) in 1994. The main goal of the NIA is the development of nationally interoperable ITS infrastructure. A Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) policy issued in 2001 requires ITS projects funded by the Highway Trust Fund and the Mass Transit Account conform to the NIA. This was followed by the 2001 USDOT Rule 940 which stipulates that all federally funded regional ITS projects must: 1) be consistent with a Regional ITS Architecture (RIA); and 2) include a Systems Engineering Analysis.

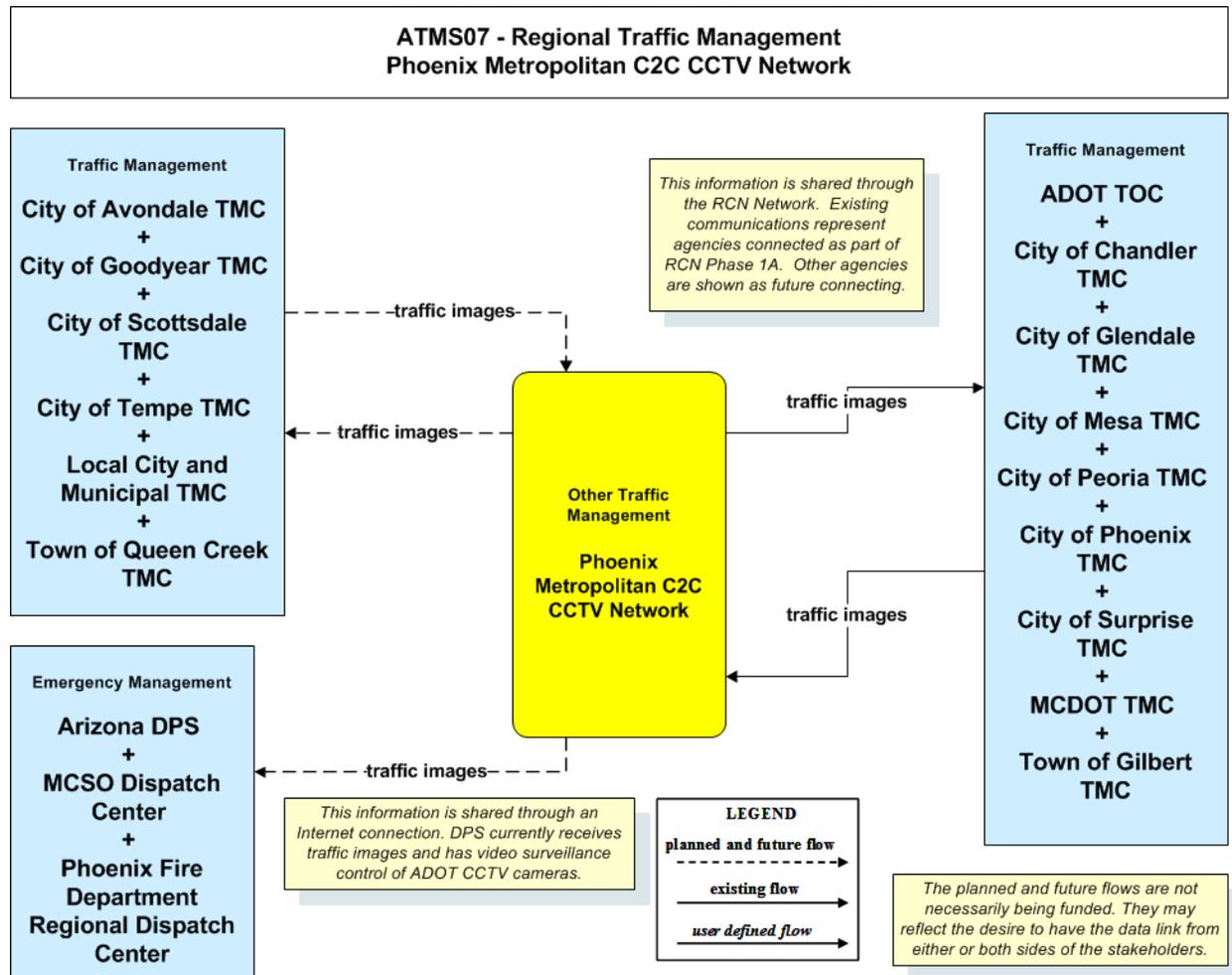
The MAG RIA is based on the NIA and provides a common framework for planning, defining, and integrating ITS across the region. It reflects the contributions of a broad cross-section of the ITS community (e.g., transportation practitioners, systems engineers, system developers, technology specialists, consultants, etc.). A comprehensive update of the RIA was performed through a project completed in 2009; it was further updated in 2011 to reflect all programmed ITS projects through 2014. The RIA was modified in 2013 to accurately reflect Version 7.0 of the National ITS Architecture released in 2011 and also to incorporate new ITS projects programmed in the Transportation Improvement Program (TIP) through FY 2017. The 2013 RIA update also incorporated all transit ITS applications implemented or planned by Valley Metro, thus enabling the regional transit planning agency to fully comply with FTA regulations related to RIA.

Since 2013, the USDOT released the new common National ITS Architecture standard, the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT). The 2019 Update to the MAG ITS Architecture provides comprehensive documentation of existing and future plans for ITS infrastructure and systems, and agency responsibilities for ITS functionality within the MAG region.

The MAG RIA is considered a national best practice in ITS planning and was presented to national audiences, including a webinar to FHWA staff nationwide. The RIA is posted on the MAG website as interactive webpages and depicts details that need to be considered when local agencies begin

designing programmed ITS projects (www.azmag.gov/ITS). Local agencies utilize the RIA information pertinent to their jurisdictions to better define planned ITS projects in development of Design Concept Reports to ensure regional compatibility and deliver integrated systems in the future. Figure 18-1 shows how the closed-circuit television (CCTV) camera component of ITS in the City of Phoenix is depicted in the RIA based on Version 7.0 of the National ITS Architecture.

**FIGURE 18-1
CITY OF PHOENIX CCTV CAMERAS**



All federally funded ITS projects implemented in the MAG region, by ADOT and local agencies, are required to include a Systems Engineering Analysis (SEA). While MAG is responsible for compliance with the USDOT Rule 940 stipulation on RIA, compliance with SEA requirements is overseen by the local office of FHWA and ADOT.

The Regional ITS Architecture defines:

- The stakeholders involved in the transportation system and their needs.
- The functions to fulfill the needs (e.g., gather traffic information).

- The physical entities or subsystems where these functions reside (e.g., the field or the vehicle).
- The information flows and data flows that connect the physical subsystems into an integrated system.
- The standards that govern the smooth functioning of subsystems and information flows (e.g., communication standards).
- The security of all ITS systems and information (e.g., controlled access to the signal system).
- The maintenance of ITS architecture itself.

ITS Strategic Planning

Since 1996, MAG has made progressive steps toward mainstreaming the development of regional ITS infrastructure within the transportation planning process. MAG coordinates all planning activities for public sector owned ITS infrastructure development on freeways and arterials in the region. In April 2001, MAG approved the first comprehensive ITS Strategic Plan for the region, which provided direction and guidance for ITS implementation for the next ten years.

In December 2012, a new ITS Strategic Plan was approved by MAG, which was limited in scope to guide arterial ITS infrastructure investments. The Plan recommended a shift from recommending specific future projects to identifying programs or emphasis areas. The programming of available RTP funds for arterial ITS infrastructure improvements through FY 2019 has been completed and was guided by the ITS Strategic Plan.

Other Regional ITS Initiatives

In recent years, other systems and initiatives have been pursued as part of the regional ITS planning process. These include:

- The regional 24-hour Dynus-T mesoscopic traffic simulation model with dynamic traffic assignment, which is utilized in planning for traffic management and operations.
- A Concept of Operations for the I-10 Integrated Corridor Management System aimed at mitigating the impact of a large regional freeway construction project.
- A Regional Traffic Signal Optimization Program that provides technical assistance to local agencies for improving traffic signal operations, including assistance in obtaining the required signal timing software and training for agency personnel.
- A Regional Archived Data Service (RADS), an archive of transportation system management data from ADOT and various agencies across the region. The RADS includes an array of computer servers located at the Maricopa County DOT and ADOT Traffic Operation Center (TOC) and is administered by Maricopa County. Information includes: freeway speed detector data; Phoenix Fire and Mesa Fire Computer-Aided Dispatch; freeway and arterial construction; traffic signal performance data; and traffic incident notifications to subscribed agencies.

System Management and Operations

In August 2016, MAG initiated a new study to develop an SM&O Plan to guide regional strategic investments to expand essential ITS infrastructure components and support a business model that addresses the staffing and resource needs for efficient management and operation of critical components of the regional transportation system. The SM&O Plan supersedes previous ITS strategic plans focused mostly on building infrastructure. The SM&O Plan identifies funding needs for a ten-year period (FY 2021 through FY 2030) with a focus on four priority areas: Integrated Corridor Management (ICM) freeways and adjacent arterials, regional priority arterial corridors, local arterial corridors, and enhanced operations and management. A key outcome from the SM&O Plan is the recommendation of an institutional framework and the funding support needed for the future management and operation of critical transportation facilities in the Region.

Management and Operation of the Urban Freeway System

ADOT utilizes an integrated package of ITS infrastructure and management strategies, commonly referred to as the Freeway Management System (FMS). The regional FMS first became operational in 1996, and it provides surveillance, incident management, travel time displays, traveler advisory, and performance monitoring functions. All FMS operations are centrally coordinated from the ADOT TOC, which is staffed 24 hours a day, 7 days a week. The TOC also serves as a statewide emergency coordination center for freeway emergencies through the co-location of the DPS troopers.

- Freeway Management System - A key function of the FMS is the dissemination of real-time information on freeway traffic conditions. This is accomplished via real-time traffic speed maps and camera images available on the internet at www.az511.gov. This website is heavily utilized by local television, radio traffic reporters, and members of the public. Information on freeway construction activities and major traffic incidents is also available via the telephone-based 5-1-1 traveler information system. In addition, a joint MAG-ADOT project, completed in June 2007, extended the availability of freeway condition information to the public via cellular phones with access to the internet. Real-time point-to-point estimated travel times are generated from traffic data gathered by sensors and displayed on dynamic message signs (DMS). In 2014, ADOT and MAG funded a pilot project to co-locate DPS troopers at the ADOT TOC for more efficient responses to and management of freeway incidents.

Based on a 2006 review of the FMS needs, funds were allocated for increased maintenance of field devices and the replacement of aging FMS devices. This was essential for improving the reliability of the system. A 2014 review of funding priorities for completion of the FMS resulted in the approval of RTP funds for adding new coverage through FY 2019.

The extent of coverage of the regional FMS, as of late 2016, is approximately 200 miles. The system includes a total of 144 DMSs, 257 cameras, and 225 metered entrance ramps. It is estimated that by 2020, the total FMS coverage on all regional freeways will be

approximately 290 miles including 35 miles of coverage on Loop 303, which was not included in the original Plan. The required FMS infrastructure on the Loop 202 (South Mountain Freeway) and State Route 24 (Gateway Freeway) is funded separately for each project.

Figure 18-2 shows the existing and projected expansion of the regional FMS based on resources allocated to this project in the RTP. MAG anticipates the planned FMS coverage to be completed by 2020.

Private sector agencies have also launched new traffic information services. The services utilize existing information sources, such as the FMS, and are supplemented by additional traffic data generated by private data providers. As a result, real-time freeway speed information beyond the current FMS coverage is available from third-party providers, such as Google, WAZE, INRIX, HERE, and SigAlert. Approximately 5 DMS' on the FMS are currently displaying travel times based on speed data purchased from private providers. The need for this data is expected to be eliminated when the FMS coverage is completed.

- Freeway Service Patrol Program** - The Freeway Service Patrol (FSP) Program is an important regional strategy that supports safe and efficient management and operation of the freeway system. This program is included in the RTP, with \$1 million per year in state funds for the FSP identified in the TIP. Services provided by the FSP include: (1) removing road debris and abandoned vehicles, (2) helping change tires, (3) providing emergency gasoline, and (4) transporting stranded motorists off the freeway system in a timely manner. The program is well used by the traveling public, with over 12,000 stranded motorists assisted during 2017. Table 18-1 provides a brief summary of the services provided by the FSP program in years 2013 through 2017.

**TABLE 18-1
SUMMARY OF FREEWAY SERVICE PATROL ASSISTANCE**

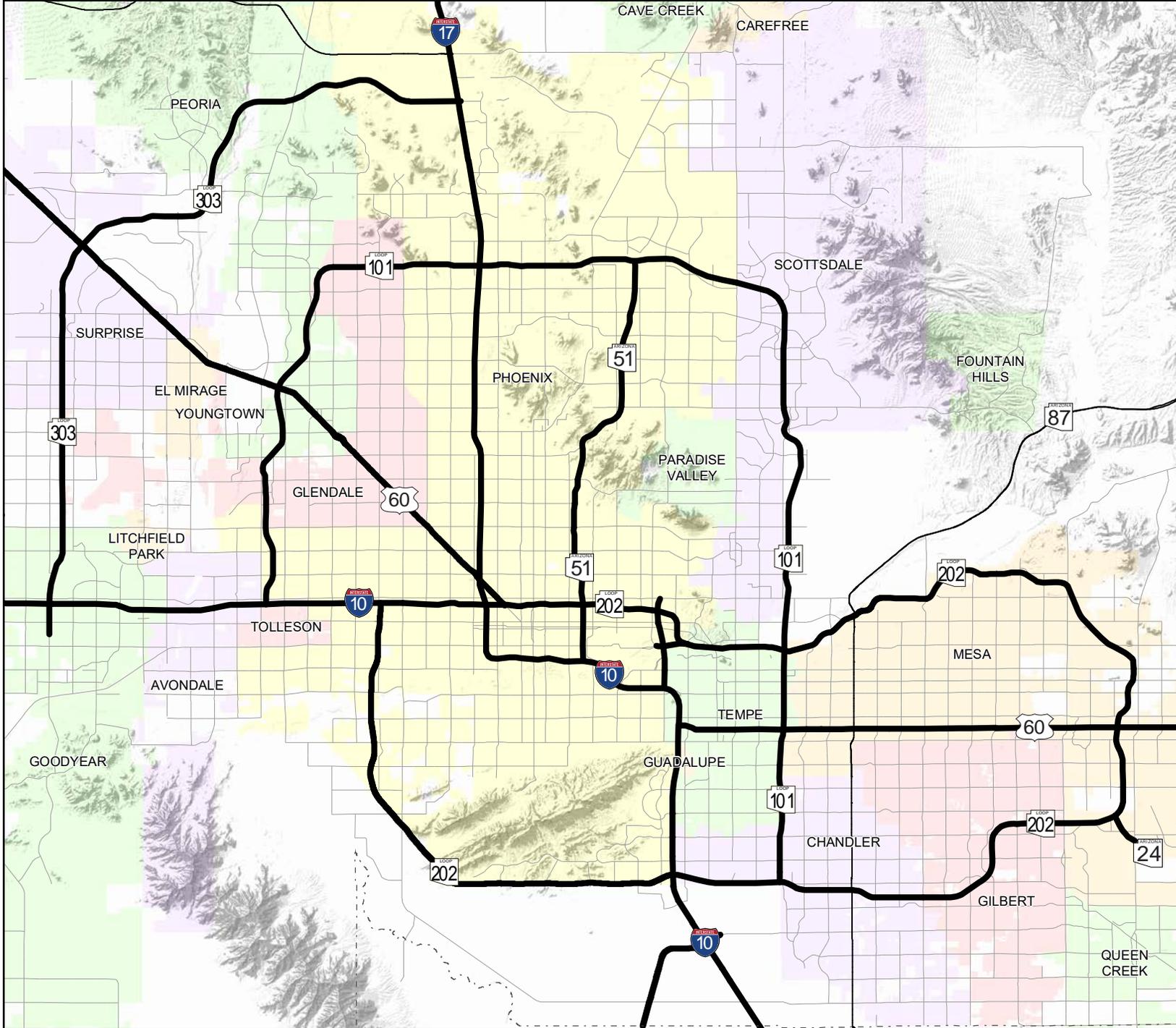
	2013	2014	2015	2016	2017
Miles Driven	303,174	353,201	501,075	415,153	440,769
Assistance at Crash Scenes	421	601	686	167	218
Motorists Assisted	9,145	10,374	14,532	12,468	12,330

Source: Freeway Service Patrol Quarterly Reports, Department of Public Safety

Figure 18-2: Freeway Management System

**2040
Regional Transportation Plan
Update**

- Freeway Management System**
- FMS Coverage by January 2020
- Other Features**
- Highways
 - Other Roads
 - Metropolitan Planning Area
 - County Boundary



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- Co-location of DPS Troopers at the TOC - In 2014, a three-year pilot project sponsored by ADOT and MAG helped co-locate DPS troopers at the ADOT TOC to improve the coordination and efficiency of traffic incident management activities. This resulted in significant improvements, with estimates showing the pilot project produced a benefit-to-cost ratio of 250 to 1. The annual benefit to the MAG region from reduced congestion alone is estimated at nearly \$112 million, while the annual cost of the program is about \$425,000. These results illustrate that co-location of DPS troopers at the ADOT TOC significantly improves traffic incident management and should be considered an essential function in the future, with benefits for both regional and statewide traffic operations.

Management and Operation of the Arterial Street System

The responsibility for management and operation of the arterial street system is based on jurisdictional boundaries and facility ownership. Each local agency owns and operates its respective traffic signals and related management systems, except for arterial traffic signals at freeway traffic interchanges, where the signals are owned by ADOT but may be operated by the local agency through an Inter-Governmental Agreement (IGA). Maricopa County and Pinal County are responsible for the management and operation of roads located within unincorporated county areas. Most of the larger cities and towns in the region have installed computerized traffic signal management systems, which are managed and operated from that jurisdiction's Traffic Management Center (TMC). The region has 13 TMCs; a few also house local law enforcement units and serve as local Emergency Operations Centers (EOC).

In 2011, MAG developed a comprehensive web-based summary of Regional Transportation Systems Management and Operations for the arterial street system. Tables 18-2 and 18-3 show updated summaries of the arterial ITS infrastructure and related operations in the region. The management and operation of traffic flow on arterial streets is the sole responsibility of individual MAG jurisdictions. The coordination of traffic operations across the jurisdictional boundaries is accomplished through ongoing regional dialogue among agency technical staff.

Planning for operations at the regional level is addressed by MAG through the ITS Committee, where infrastructure improvement needs, and operational issues are discussed. The committee provides recommendations for infrastructure improvements to be funded through the MAG TIP process. Special studies required for exploring complex issues related to traffic operations are carried out through the MAG Work Program. An example is the Emergency Vehicle Pre-emption (EVP) Study, a state of the practice report.

Discussions related to traffic operations on a more detailed technical level are coordinated and held under the AZTech banner. AZTech is a voluntary traffic management technical collaboration for public agencies in Maricopa County, co-chaired by ADOT and Maricopa County. ITS projects implemented by local agencies or ADOT that are funded by the RTP and MAG TIP process may be referred to as AZTech projects.

**TABLE 18-2
SIGNAL SYSTEM RESPONSIBILITIES**

Jurisdiction/Agency	# of Signals Owned	# of Signals Centrally Operated	# of Signals Maintained
Apache Junction, City of	32	N/A	32
Avondale, City of	47	10	63
Buckeye, City of	20	0	20
Carefree, Town of	2*	N/A	2*
Cave Creek, Town of	6*	0	6*
Chandler, City of	218	208	218
El Mirage, City of	12	N/A	12
Florence, Town of	7*	N/A	7*
Fort McDowell Yavapai Nation			
Fountain Hills, Town of	13	0	13
Gila Bend, Town of	1*	N/A	1*
Gila River IC	7	0	7
Gilbert, Town of	188	188	188
Glendale, City of	201	161	201
Goodyear, City of	88	51	88
Guadalupe, Town of	5*	N/A	5*
Litchfield Park, City of	7*	N/A	7*
Maricopa, City of	15	0	15
Maricopa County	143	120	158
Mesa, City of	422	455	455
Paradise Valley, Town of	12	12	12
Peoria, City of	118	116	118
Phoenix, City of	1138	1098	1138
Pinal County	29	0	29
Queen Creek, Town of	47	38	47
Salt River Pima Maricopa IC			
Scottsdale, City of	300	280	300
Surprise, City of	50	49	50
Tempe, City of	206	208	226
Tolleson, City of	13	0	13
Wickenburg, Town of	3*	N/A	3*
Youngtown, Town of	5*	N/A	5*
Total	3319	2994	3403

Note: * Identified from crash data

Management and Operation of the Public Transportation System

Advanced Public Transportation Systems (APTS) are defined as advanced technology based ITS applications in public transportation. These applications are relevant to fixed-route bus, paratransit, vanpool, and rail and can be used to improve passenger convenience, vehicle operations, and mechanical systems. Passenger convenience technologies benefit passengers through advanced traveler information, real-time schedule updates, and fare payment. Vehicle operations technologies are associated with dispatching vehicles and in-vehicle systems. Mechanical systems technologies are designed to monitor the electrical and mechanical infrastructure of transit vehicles remotely.

**TABLE 18-3
TRAFFIC MANAGEMENT AND OPERATIONS CENTERS**

Jurisdiction/Agency	Existing	Planned	Existing Traffic Management Center						
			Hours of Coverage				Square Footage		
			Peak	Business	Business+	24/7	<500	500-1000	>1000
Apache Junction, City of									
Avondale, City of	X				X		X		
Buckeye, City of		X							
Carefree, Town of									
Cave Creek, Town of									
Chandler, City of	X			X				X	
El Mirage, City of									
Florence, Town of									
Fort McDowell Yavapai Nation									
Fountain Hills, Town of									
Gila Bend, Town of									
Gila River IC									
Gilbert, Town of	X		X	X			X		
Glendale, City of	X				X			X	
Goodyear, City of	X				X		X		
Guadalupe, Town of									
Litchfield Park, City of									
Maricopa, City of		X							
Maricopa County	X				X				X
Mesa, City of	X				X				X
Paradise Valley, Town of									
Peoria, City of	X			X				X	X
Phoenix, City of	X				X			X	
Pinal County									
Queen Creek, Town of	X				X		X		
Salt River Pima Maricopa IC									
Scottsdale, City of	X				X				X
Surprise, City of	X		X					X	
Tempe, City of	X				X				X
Tolleson, City of									
Wickenburg, Town of									
Youngtown, Town of									

Over the years, Valley Metro’s Vehicle Management System (VMS) Master Plan has served as the guide for implementing APTS applications in the region. Full implementation of the VMS, which was completed in 2005, resulted in an integrated system with components on 750 fixed-route buses, 200 paratransit (Dial-A-Ride) vehicles, and 60 support vehicles. It includes a Computer Aided Dispatch system to track and manage the day-to-day operations of the region’s transit vehicle fleet. Other features and devices installed in transit vehicles include: a radio communication system; an Automatic Vehicle Location system which uses Global Positioning Satellite (GPS) receivers to track vehicle location; a next stop announcement system; and, an automatic passenger counting system installed on some transit vehicles. The VMS is engineered to be scalable to accommodate the future growth of Valley Metro operations.

In 2011, the region's first scheduled transit arrival information system, NextRide, was launched. NextRide provides information on the next scheduled bus or train arrival times at any bus or train stop in the region. This information can be received on a cell phone by sending a text message with the bus/train stop ID. All bus transit operations are centrally managed from the Transit Control Center (TCC). The control center dedicated to light rail transit operations is located immediately adjacent to the TCC.

Integrated Corridor Management

The development of fully integrated traffic operations between freeways and adjacent arterials has long been a regional goal. The 2003 Regional Concept of Transportation Operations created the goal of establishing up to three Integrated Corridor Management (ICM) corridors. The development of ICM corridors in the MAG region is complicated by the management of freeways and arterials by separate agencies, often with incompatible traffic management infrastructures. The primary goal of ICM is to coordinate the operation of freeways by ADOT with the operation of adjacent arterial streets by local jurisdictions. The focus of ICM initiatives is to address traffic incident management issues on heavily traveled corridors within the region through collaboration between MAG, DPS, ADOT, and affected local agencies. MAG developed the necessary tools and provides planning support through analysis, modeling, and simulation for evaluating ICM strategies and testing effective traffic management tools.

MAG works with ADOT and member agencies to develop incremental ICM solutions. The initial focus was on the I-10 corridor that runs through Central Phoenix, which is the busiest interstate segment in Arizona. Significant progress has been made in developing efficient traffic signal timing strategies that could be quickly implemented during major freeway closures. An ICM Playbook was developed to address all possible freeway closures on an eight-mile I-10 segment between I-17 and Loop 101. In 2015, the USDOT selected the MAG region as one of 13 sites to receive an ICM planning grant. This grant is being utilized to develop an ICM plan for the entire I-10 corridor (Figure 18-3). Similar efforts are underway to implement ICM strategies by ADOT and the City of Scottsdale in the Loop 101 corridor, and by MAG and the cities of Tempe and Mesa, and the Town of Gilbert in the US 60 corridor.

In 2018, ADOT and the Maricopa County Department of Transportation (MCDOT) were awarded the federal Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) grant for the Loop 101 Mobility Project. The grant will be used to improve safety and existing capacity on the Phoenix area's Loop 101 corridor by deploying technologies that support ICM systems, public transportation, and other real-time information technologies. Loop 101 connects several cities and towns including Phoenix, Tolleson, Glendale, Peoria, Scottsdale, Mesa, Tempe, and Chandler. The SM&O plan, completed in 2018, allocated funding for developing ICM strategies for seven corridors, in addition to the I-10 western segment and Loop 101 corridor.

**FIGURE 18-3
INTEGRATED CORRIDOR MANAGEMENT on I-10**



Funding for System Management and Operations

The 2003 RTP identified funds for ITS infrastructure on freeways and arterials over the life of Proposition 400 (through 2025). In 2006, to obligate CMAQ funds more efficiently, all arterial ITS funds were accelerated to the first ten years of the Plan. This accelerated the deployment of ITS infrastructure on the arterials and resulted in spending the planned funds faster. All funds that were identified for ITS infrastructure on arterials are fully programmed through FY 2019. It is anticipated that future discussions will lead to the identification of potential funds for arterial ITS infrastructure projects through FY 2025.

A MAG survey of member agencies conducted in 2014 identified arterial ITS infrastructure needs. Its results identified approximately \$10 million per year would be required to address those needs. In the annual distribution of CMAQ funds to the MAG region by the state, nearly \$8 million per year is identified for ITS infrastructure on freeways.

CHAPTER NINETEEN

DEMAND MANAGEMENT

Transportation Demand Management (TDM) reduces congestion by encouraging efficient use of the existing transportation infrastructure through alternatives to single-occupancy vehicles (SOVs). Reducing vehicle miles traveled improves air quality by decreasing vehicular emissions' contributions to total air pollutants. TDM activities in the MAG region are described below.

Transportation Demand Management Programs

Transportation Demand Management, or TDM, programs apply strategies and policies to reduce travel demand and encourage more efficient use of the transportation system. Strategies aim at increasing travel choices and providing incentives to reduce single occupancy vehicles (SOVs) and promote alternatives such as carpooling, vanpooling, transit, walking, and bicycling. The goal is to reduce commuter or student trips during peak travel periods. Policies that reduce commuter trips include alternative work schedules, such as teleworking and compressed workweeks. MAG provides funding for TDM programs, which are implemented by the Regional Public Transportation Authority (Valley Metro/RPTA), the Arizona Department of Administration, and the Maricopa County Air Quality Department.

Regional Rideshare and Telework Program (Commute Solutions)

Valley Metro/RPTA receives funding from the Arizona Department of Environmental Quality, MAG, and the Maricopa County Air Quality Department to encourage commuters and employers to use alternative transportation modes and work schedules. Valley Metro/RPTA promotes alternative transportation modes including carpooling, bicycling, walking, vanpools, teleworking, and compressed work schedules. Valley Metro offers a free ride-matching service (ShareTheRide.com) that provides outreach and education for employers in the Maricopa County Travel Reduction Program (TRP).

- Trip Matching - Valley Metro/RPTA operates ShareTheRide, an online ride-matching and commute tracking tool. The tool matches commuters based on proximity, destination and travel routes, schedules, and preferences. Users can explore carpool, vanpool, transit, and bicycle options, and calculate the pollution and gas savings associated with alternative travel choices. Valley Metro/RPTA provides assistance to those that do not have access to the internet to ensure that commute matching is accessible to all. ShareTheRide allows employers in the Maricopa County TRP to manage travel reduction programs by administering custom sub-sites, producing reports of employees, monitoring alternative modes use, creating applications for employees without internet access, providing online matching services, and facilitating contests as incentives. From FY 2016 to FY 2019, the number of companies using ShareTheRide to manage their TRP increased from 400 to 480, an increase of 20 percent. The ShareTheRide website is a single source for alternative transportation information and is the call-to-action for

Valley Metro Commute Solutions' marketing efforts. The website provides incentives for alternative mode use and includes High Pollution Advisory (HPA) information for the MAG region.

- SOV Alternatives Campaigns - Valley Metro/RPTA promotes SOV alternatives through campaigns, contests, and online resources, and by providing regional advocacy and developing educational materials for employers and commuters. A communications plan is developed annually to promote the use of alternative transportation modes. Every April, a phone survey is conducted to measure commuter mode choices, changes in SOV use, and to gauge opinions regarding transit, rideshare, air quality, and traffic issues. The survey helps staff determine marketing strategies and measure the effectiveness of programs and services.

In addition, Valley Metro/RPTA delivers campaigns to educate commuters and companies about commute solutions, including Rideshare Month and Valley Bike Month. Rideshare Month, held in October each year, aims to bring awareness to ridesharing options, such as carpool, vanpool, and transit. The public is directed to the ShareTheRide website to create an account, find a commute partner, explore bus and light rail travel options, and to log daily commute trips for chances to win prizes. Commuter challenges offer an additional opportunity for prizes when employees use an alternative mode of transportation one or more days during the week. Employers in the Maricopa County TRP hold events to inform staff and students about alternative modes and schedules.

Valley Bike Month, held in April each year, brings attention to bicycling as an alternative mode for commuting and other trip purposes. People are encouraged to participate in biking events throughout the Valley, such as family fun rides, bike expos, and safety events. Bicycle safety and education information is provided at over 30 events across the Valley. Events include Bike to Work and Bike to School days. Bicycle rodeos are hosted to teach safe bicycling behavior. Valley Bike Month is a regional effort that relies on the partnership of public and private organizations. Activities are promoted Valley-wide through cities and employers in the Maricopa County TRP.

The Valley Metro Annual Clean Air Campaign Awards and Luncheon is held to honor individuals and organizations that demonstrate outstanding efforts in support of clean air programs and alternative mode usage. Award recipients are nominated in one of 25 categories and recognized for their efforts.

- Employer/Employee Education and Partnerships - Valley Metro/RPTA creates brochures, informational materials, collateral materials, and promotional items that promote commute solutions. A communications plan is developed annually to inform the public and includes electronic newsletters, media, events, news releases that coincide with campaigns and annual survey results, and communication via social media, including Facebook and Twitter. A campaign is developed to educate and encourage Valley residents to use alternative modes, compressed work schedules, and other commute

solutions. Distribution includes print materials, paid and unpaid media, public and media relations, and special events.

Valley employers in the TRP promote carpooling, vanpooling, transit, telework, compressed workweek, biking, and walking to achieve TRP goals. Online training and on-site presentations are used to educate employers on the use of alternative commute modes. Valley Metro/RPTA partners with employers and community organizations to expand educational opportunities. Staff coordinates with organizations on measures that impact alternative mode use.

Valley Metro/RPTA also partners with major retailers and small businesses to provide transit fares. The program saves time for transit riders, provides access to Reduced Fares, and expands communication to businesses in areas with Title VI populations. Transit users may obtain a list of retail locations selling transit passes by visiting ValleyMetro.org. There are nearly 700 retail locations where passes can be purchased.

Trip Reduction Program

The Maricopa County TRP was mandated by Arizona legislation in 1988, and employers with 100 or more workers on site began participating in the program in 1989. Participating employers are required to conduct an annual survey of the commuting modes of employees and prepare and implement a travel reduction plan to reduce the rates of SOV trips or vehicle miles traveled. The program was amended in July 1994 to include employers with 50 to 100 employees. In the summer of 1996, a special session of the legislature passed an innovative enhancement to the TRP whereby employers would be allowed to implement several new "flexibility" strategies to meet TRP goals. Under these flexibility provisions, employers have an expanded menu of measures for implementation, including reduction of business-related vehicle trips, off-peak hour commuting, reduced use of other gasoline-powered equipment, and stationary source emission reductions. As of FY 2017, approximately 3,094 sites representing 1,209 employers with 787,183 employees and driving-age students participated in the TRP.

The Maricopa County TRP is overseen by the Maricopa County Air Quality Department. Valley Metro/RPTA receives funding from Maricopa County to provide: training and technical assistance; promotional and educational materials to TRP employers; training on the requirements of the law, including the survey process, plan writing, and documentation; and information on the types of alternative modes and trip reduction strategies that can achieve the prescribed reductions in SOV trips or miles traveled. Valley Metro/RPTA conducts a year-round campaign for employees that includes print and electronic materials, paid media, public and media relations, public affairs, and events that encourage weekly use of trip reduction solutions.

Capitol Rideshare

The Arizona Department of Administration Travel Reduction Program Office provides travel reduction services, branded as Capitol Rideshare, to state employees in Maricopa County as

required by law. Capitol Rideshare implements strategies to incentivize employees to use alternative modes of transportation for commuting to work. Incentives include transit subsidies, vanpool subsidies, preferential parking for carpools, telework agreements, and resources to assist employees who bike or use alternative modes to commute. The CapitolRideshare.AZ.gov website educates more than 20,000 employees about alternate modes. Staff works with Travel Reduction Coordinators from each state agency, board, and commission. Coordinators play an important role in helping agencies comply with the state's travel reduction law.

Vanpool Program

Valley Metro/RPTA has provided vanpool service since 1987. Vans are lent to qualifying groups of six to 15 commuters. The vans are driven by vanpool members and passengers share the cost of operating the van by paying a monthly fee. The fee includes insurance, roadside assistance, and vehicle maintenance costs. In FY 2018, more than 1 million passenger trips were made in approximately 360 vanpools. A Valley Metro/RPTA contractor, Enterprise, provides insurance, fleet services, billing, and federal reporting. Vanpooling is one of the TDM strategies implemented by employers as a Trip Reduction Program measure.

The Valley Metro/RPTA vanpool program has a 100 percent farebox recovery goal. Farebox recovery is the percentage of operating costs in a public transit system that are paid by users of the system. In FY 2018, the vanpool program had a 107.8 percent fare recovery. In FY 2012, staff introduced a pilot program to add bicycle racks to vanpool vehicles; approximately five percent of the vehicle fleet has bicycle racks. The program improves air quality by removing cold-start trips and short-distance SOV trips.

Teleconferencing / Videoconferencing Project

MAG established a teleconferencing program to link MAG and MAG member agencies via teleconferencing. The MAG Regional Videoconferencing System Project facilitates communication between agencies while reducing the need to travel to meetings. The MAG Regional Videoconferencing System has a central conferencing location at the MAG offices and satellite locations housed at each member agency. The system allows for communication between MAG and its member agencies as well as among member agencies without direct participation by MAG.

Funding Outlook

Transportation Demand Management programs will be funded by several revenue sources during the planning period. Regional funding sources and local transit funding sources contribute to rideshare, trip and travel reduction, and vanpool activities. During the planning period, MAG estimates that a total of \$139 million will fund vanpool programs, and approximately \$59 million will fund rideshare, trip reduction, and other travel demand management activities.

CHAPTER TWENTY

CONGESTION MANAGEMENT PROCESS

The Congestion Management Process (CMP) is an objectives-driven, performance-based systematic approach to addressing traffic congestion problems and their effects throughout the MAG Transportation Management Area. The CMP is a requirement of states and metropolitan planning organizations (MPOs) and addresses congestion through effective development, management, and operation of transportation facilities and services, and implements effective strategies and solutions to reduce mobility problems in the Region.

Information included in this chapter refers to congestion management applications, including strategies to address congestion, and the development and implementation of the CMP as mandated by The Moving Ahead for Progress in the 21st Century Act (MAP-21) and continued in the Fixing America's Surface Transportation (FAST) Act. This regulation mandates the establishment of an integrated CMP that is cooperatively developed, accepted, and implemented, resulting in a metropolitan-wide strategy for transportation facilities using travel demand reduction and operational management strategies.

Congestion Management Concepts

Congestion results when traffic demand approaches or exceeds the available capacity of the system and travel time becomes unreliable. Congestion can be grouped into two categories: recurring congestion and non-recurring congestion. Recurring congestion typically occurs during peak travel periods when traffic volumes are high, while non-recurring congestion (NRC) is a more random phenomenon. Traffic incidents, road closures, and road construction are the primary causes of NRC.

Throughout the nation, regions utilize roadway and transit improvement to reduce traffic congestion. These programs cover four major strategies: (1) managing the existing system, (2) expanding public transit service, (3) reducing peak-period travel demand, and (4) constructing additional roadway capacity. Methods may include coordinating traffic signals, using other intelligent transportation system approaches, promoting the use of buses, light rail and carpooling, implementing programs that reduce peak-hour travel demand, and constructing intersection and other road capacity additions.

Over the last two decades, among the primary factors responsible for increased traffic congestion within the MAG Region are an increase in population and a strong economy. These factors have resulted in high rates of urban metropolitan growth and brought significant levels of development to previously undeveloped lands on the urban fringe. Such internal and peripheral growth created greater travel demand throughout the Region, resulting in increased number and length of trips, higher traffic volumes, and congestion on the existing freeway and arterial roadway network. Transportation Network Companies (TNCs), such as Uber and Lyft, are widely used throughout the Region. Although the impact of TNCs on the intensity and duration

of congestion has not been quantified, TNCs are a suspected factor in the congestion and delay equation in the MAG Region.

The Great Recession during 2008-2009 interrupted past high growth rates. However, a decade later, observed data indicate that the employment base and most regional economic indicators have reached pre-recession figures. The accelerated pace of economic recovery during the last three years influenced the demand for additional transportation facilities in the MAG Region. Analysis of the regional system shows significantly higher travel times in the afternoon peak period on freeways and especially on arterials.

Federal Congestion Management Requirements

The planning and programming process used at MAG and other metropolitan planning organizations is driven by regulations put forth by the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), two of the modal administrations of the United States Department of Transportation (USDOT). FHWA and FTA issue regulations and policies that put into practice legislation that Congress passes authorizing federal funding for transportation.

Federal requirements state that regions with more than 200,000 people, known as Transportation Management Areas (TMAs), must maintain a CMP and use it to inform transportation planning and decision making. These requirements were initially introduced by the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, which established the need for a Congestion Management System, and were continued under the successor law, the Transportation Equity Act for the 21st Century (TEA-21). The Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) introduced a change to reporting format and content and required a CMP. The goal of SAFETEA-LU was to utilize a process that is an integral component of metropolitan transportation planning.

The latest federal transportation legislation continues congestion management requirements, as contained in the Moving Ahead for Progress in the 21st Century Act, (MAP-21) and the Fixing America's Surface Transportation (FAST) Act, signed into law by President Obama on July 6, 2012, and December 4, 2015, respectively. The legislation emphasizes the need for performance measurement in planning and programming activities at the national, state, and MPO levels. The performance and congestion management elements of MAP-21/FAST Act have been incorporated into the MAG transportation planning process.

The Congestion Management Process, or CMP, includes the following key features/focus areas:

- Methods to monitor and evaluate performance of the multimodal transportation system.
- Definition of congestion management objectives and performance measures.
- Establishment of a program for data collection and system performance monitoring.
- Identification and evaluation of anticipated performance and expected benefits of appropriate congestion management strategies.

- Identification of an implementation schedule, implementation responsibilities, and possible funding sources.
- Implementation of a process for periodic assessment of the effectiveness of implemented strategies.

Fixing America’s Surface Transportation Act (FAST)

Under the FAST Act, the USDOT established performance measures requiring state departments of transportation to develop performance targets in consultation with MPOs and others. The law requires states to make cost-effective and efficient transportation investments that progress toward these performance targets. MPOs must incorporate these performance measures and targets into their Transportation Improvement Programs (TIPs) and long-range transportation plans; additionally, MPOs are required to report on how these investments will make progress toward meeting those targets.

Performance measures under the FAST Act introduce significant modifications to the federal-aid highway program and provide a means to accomplish the most efficient investment of federal funds. This is done by refocusing on national transportation goals, increasing accountability and transparency, and improving project decision making through performance-based planning and programming. The FAST Act identifies seven thematic areas for which the Secretary of Transportation has determined performance measures. These areas include:

- (1) Safety
- (2) Infrastructure condition
- (3) Congestion reduction
- (4) System reliability
- (5) Freight movement and economic vitality
- (6) Environmental sustainability
- (7) Reduced project delivery delays

MAG Congestion Management Activities

MAG has pursued a broad range of programs in response to congestion issues in the Region. These include early efforts in travel demand reduction and operational strategies, as well as programs directed at system performance monitoring and assessment. Most recently, efforts have focused on the MAG CMP.

Travel Demand Reduction and Operational Strategies

The MAG Region benefits from a range of strategies for travel demand management, promotion of alternative modes, and optimization of operational procedures. During fiscal year 2018, MAG and its member agencies collaboratively developed a comprehensive System Management and Operations Plan (SM&O) that identified infrastructure needs in priority corridors and

recommended strategies needed to improve operations. This plan is a central component of the CMP encompassing infrastructure, road safety, and travel demand management, and solutions incorporating new technologies. Transportation Systems Management and Operations (TSMO) focuses on improvements that can restore and maintain the capacity of the existing transportation system without adding more lanes.

Initially, the identification and selection of travel demand reduction strategies was a function of the MAG Congestion Management System (CMS) Working Group, which was established under TEA-21 and ISTEA. Through this process, alternative transportation options were developed to reduce congestion throughout the greater metropolitan region. Programs included carpooling, vanpooling, walking, bicycling, alternative or compressed work schedules, and telework programs. To develop project priorities and implementation schedules, the CMS Working Group process considered the impact of each strategy on system performance and efficiencies, as well as available funding and geographic conditions.

Projects are generated from individual MAG modal committees, which consider regional needs and modal funding policies. This is the case for operations management strategies and improvements, which are identified and assessed by the MAG Intelligent Transportation Systems (ITS), TSMO Working Group, and Safety committees. Criteria and measures applied by the ITS Committee and TSMO Working Group include: corridor throughput, travel time reliability, safety, whether the project has leveraged partners of adjacent jurisdictions to have greater impact, and if it is integrated with the Regional ITS Architecture.

Performance Monitoring and Assessment

MAG has an ongoing program for data collection and system monitoring, which includes periodic surveys of travel characteristics such as traffic volumes, travel times, congestion levels, occupancy rates, vehicle classification, and public transit user factors. This information is used to assess current conditions and provide data to enhance the MAG travel demand modeling capability.

Continuing to emphasize performance-based planning, in 2007, MAG established an ongoing Transportation System Performance Monitoring and Assessment Program. This program developed reporting methodologies and web-based components, allowing policymakers, technical users, and the public easy access to performance data and visualization. As a starting point, in 2009, MAG developed a Performance Measures Framework and Regional Performance Report to illustrate the most important characteristics associated with the status of surface transportation in the MAG Region and document the status and quality of transportation related data sets. Measures captured in the data include vehicle miles traveled (VMT), throughput, speeds, spatial and temporal congestion, and travel times for the MAG modeling area, and are displayed on the MAG Performance Dashboard. The MAG Performance Dashboard is based only on observed data sets and constitutes a fundamental tool in CMP evaluation. The dashboard establishes benchmarks for evaluating current year performance and congestion levels and acts as a repository for historic data, which facilitates trend analysis.

MAG Congestion Management Process

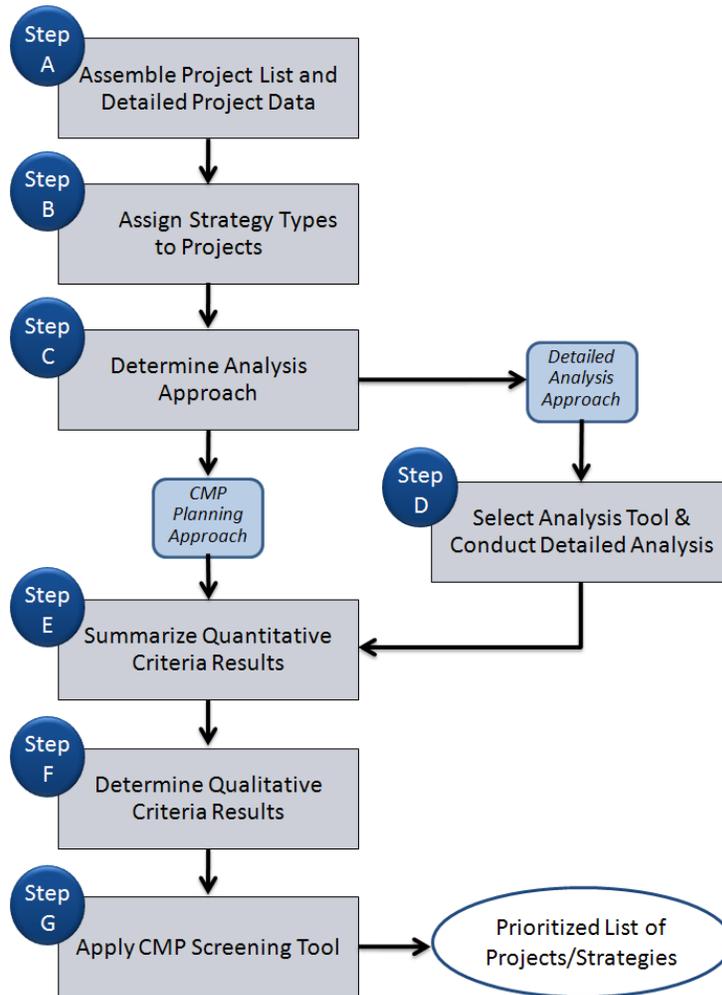
MAG updated the CMP in collaboration with the MAG CMP Working Group. This effort relied on historical and current traffic data analysis and culminated in a CMP Report published in December of 2009. The CMP comprises two main criteria: (1) the establishment of a series of strategies to address congestion, and (2) the development and implementation of a CMP evaluative Sketch Tool. The elements considered include performance measures, data collection, and system monitoring, the identification and evaluation of proposed strategies, the implementation of those strategies, and the evaluation of the effectiveness of those strategies.

- CMP Sketch Tool - The CMP Sketch Tool provides a step-by-step sketch planning approach that facilitates the analysis process for evaluating congestion management strategies or projects. The core of the tool is a spreadsheet that uses both quantitative and qualitative criteria to assess strategy and project effectiveness and assist in the assignment of ranks to projects for prioritization. The process and sketch planning tool are applied to sets of projects or congestion management strategies for which some quantitative data is available. Figure 20-1 depicts the structure of the CMP Sketch Tool. Target outcomes for the development of the CMP Sketch Tool included:
 - Assist in generating an evaluation and ranking of projects for programming during each application cycle.
 - Identify and document process in meeting the RTP goals.
 - Meet FHWA requirements.
 - Provide a tested and accepted practice for evaluating projects if funding is increased or decreased in the adopted TIP.
 - Determine data collection needs and propose methods to address gaps in data collection that strengthens the quantitative evaluation.

The CMP uses existing performance measurement systems that monitor and report on the status of the transportation network. These measures are an integral part of the MAG CMP sketch tool, which incorporates evaluative elements for each of the modes, including criteria developed by modal committees. The CMP tool provides input to the development of the TIP using quantitative and qualitative methods to assist MAG committees in considering the merits of proposed projects under consideration for competitive funding.

- CMP in the Programming Process - A key component of MAG's congestion management activities is the periodic updating of the TIP. This is the most important application of the updated CMP and tools. Considering quantitative and qualitative factors, MAG's congestion management strategies were implemented using the updated CMP model combined with the modal committee-based recommendations. This process has been applied in the development of the MAG TIP since 2009.

**FIGURE 20 -1
MAG CMP SKETCH TOOL STRUCTURE**



For projects funded through the Congestion Mitigation and Air Quality (CMAQ) Improvement program, a federally funded program, MAG developed methodologies for quantifying emission reductions and cost effectiveness. As part of the programming process, jurisdictions are requested to submit annual requests for federally funded projects through the MAG Management Committee, Transportation Review Committee (TRC), and modal committees. MAG evaluates CMAQ projects for possible inclusion in the TIP.

For the 2019 fiscal year cycle, the CMP update and tool were implemented at modal committees. Additionally, a modified CMP tool has been adapted to facilitate changes in the existing Arterial Life Cycle Program (ALCP), as well as the Surface Transportation Program (Pinal County portion) project evaluation process. MAG modal committees develop the Sketch Tool scores and rank the projects. Figure 20-2 depicts an example of project assessment results. These results are furnished with the CMAQ assessment for final project evaluation purposes.

Recommendations from the MAG modal committees are forwarded to the TRC for programming consideration. CMAQ guidance allows a qualitative evaluation to be made when a quantitative analysis is not possible. Although every effort is made to quantify the congestion reduction impact of each project, qualitative assessments may be based on a reasonable review of how a project or program will decrease congestion.

MAG has an established project application, programming schedule, project evaluation process, and project selection process. This process includes an evaluation of the expected emissions reductions and cost effectiveness, a CMP tool assisted project evaluation process at the modal committees, and project selection through the MAG committee process: TRC, Management Committee, and Transportation Policy Committee for review and recommendation, and then Regional Council for approval.

**FIGURE 20 -2
MAG CMP SCREENING TOOL – EXAMPLE RANKINGS SUMMARY**

			PROJECT NUMBERS:								
CRITERIA	Weight		1	2	3	4	5	6	7	8	9
<i>Quantitative Data</i>	VOLUME/AADT *	25%	7	7	9	4	4	3	4	1	2
	CRASH RATE	5%	1	1	1	1	1	1	1	9	1
	TRUCK VOLUME / AADT	5%	7	7	9	4	4	3	4	2	1
	CONGESTION / LOST PRODUCTIVITY GP	10%	5	5	3	7	7	4	7	2	1
	Total Weighted Score:		2.65	2.65	3.05	1.95	1.95	1.35	1.95	1.00	0.70
	Rank Order:		2	2	1	4	4	7	4	8	9
<i>Qualitative Data</i>	CMP OBJECTIVES	35%	3.33	2.60	2.57	3.29	2.14	3.29	3.57	3.43	3.29
	PROJECT/MODE SPECIFIC ASSESSMENT	20%	4	4	1	4	3	4	3	4	4
	Total Weighted Score:		1.37	1.11	1.70	1.35	1.15	1.35	1.65	1.40	1.35
	Rank Order:		4	9	1	5	8	5	2	3	5
<i>All Data</i>	Total Weighted Score:		4.02	3.76	5.75	3.30	3.10	2.70	3.60	2.40	2.05
	Rank Order:		2	3	1	5	6	7	4	8	9

* For ITS Projects:

- AADT can be replaced by VMT or VMT/lane
- Cost can be another quantitative factor expressed in VMT/\$ spent

The transportation project types and responsible technical advisory committees are detailed below:

- Bicycle and pedestrian projects are presented, reviewed, and ranked at the Active Transportation Committee, and then forwarded to the TRC.
- Intelligent transportation system (ITS) projects are presented, reviewed, and ranked at the ITS Committee then forwarded to the TRC.
- Paving of unpaved road projects are presented and reviewed at the Streets Committee, ranked at the Air Quality Technical Advisory Committee, and then forwarded to the TRC.
- PM-10 certified street sweeper projects are reviewed at the Streets Committee, ranked at the Air Quality Technical Advisory Committee, and then forwarded to the MAG Management Committee.

In addition, the Air Quality Technical Advisory Committee may forward a ranking of air quality projects to the TRC.

Future Congestion Management Efforts

The RTP, which covers a 20-year planning period, includes projects from three life cycle programs: the Freeway Program Life Cycle Program (FLCP), the ALCP, and the Transit Life Cycle Program (TLCP). Multimodal programs and projects included in the life cycle programs were determined at the RTP's inception in 2003 and are scheduled for inclusion in the MAG TIP following the regular update process. These life cycle programs establish a programming approach that forecasts and allocates funds through the full life of a major funding source (such as the Proposition 400 tax extension, local, and other federal funding sources), and reflect a fiscal balance between anticipated revenues and expenditures.

Pursuant to MAP-21 and FAST Act regulations, the CMP will play a role in the planning and programming of future transportation investments in the MAG Region. CMP strategies will be based on the same goals and objectives of the original 2003 RTP and will continue to use the same congestion mitigation criteria in the assessment and evaluation of the projects submitted for consideration. Following this principle, the future of CMP will evolve from its current role to become a further integral part of the planning process.

The MAG Performance Measurement Dashboard continues to be updated since its first edition in 2009 with charts, maps, and graphics available on the MAG website. These tools constitute a performance measuring and monitoring system for regional multimodal transportation planning, and an integral component for life-cycle programming and federally funded programs.

CHAPTER TWENTY-ONE

TRANSPORTATION SAFETY

In September 2004, the Maricopa Association of Governments (MAG) formed a Transportation Safety Committee, establishing the intent to incorporate safety considerations in the metropolitan planning process. In October 2005, MAG adopted the Region's first Strategic Transportation Safety Plan (STSP) developed and recommended by the committee. The STSP was updated in 2015 and a comprehensive update of the STSP is in the process for 2020; oversight of the plan's update is provided by the Transportation Safety Committee. All planning activities related to transportation safety are performed in coordination with the Transportation Safety Committee. Crash data analysis is performed in-house at MAG, and a range of safety studies are managed by MAG staff.

Transportation Safety Planning Process

Transportation safety planning, or planning for safer roads, is addressed through several activities within the MAG transportation planning process, as described in the following sections.

Safety Assessment of Transportation Alternatives

Road safety outcomes are used as criteria in long-range planning, such as the MAG Regional Transportation Plan (RTP), where decisions are made on large investments in regional transportation infrastructure. These planning decisions have a significant impact on the long-term road safety provided by the transportation system. These decisions are supported by an assessment of regional transportation alternatives from a safety viewpoint. The Regional travel demand model is used to forecast future travel demand on the transportation system.

The methodology used by MAG in the past for safety impact assessments of transportation alternatives utilized results from the travel demand forecasting model to estimate the total number of crashes in the system based on forecasted traffic volumes. Simplified models that utilized historical crash rates for different road types were then applied to estimate the number of crashes. The forecasting of road safety consequences of planning alternatives at the macroscopic or regional level is based on the stability of crash rates and their historical trends. Since 2010, MAG developed the ability to perform complex crash data analyses. In addition, MAG developed an Activity-Based Travel Demand Model that provides better information on future travel patterns and crash risk exposure. The model was deployed by MAG in early 2016. MAG anticipates that a more sophisticated safety forecasting methodology will be utilized in the next major update to the RTP.

Strategic Transportation Safety Plan

Planning for safer roads is addressed strategically and identifies short-to-medium term needs, as described in the 2015 STSP (Table 21-1). The Plan establishes the Regional vision, goals, objectives, strategies, countermeasures, and performance measures for making systematic improvements in

transportation safety. The STSP adopted the “Zero Deaths and Zero Injuries” vision for the MAG Region’s road safety. The STSP is a data-driven, multi-year comprehensive plan that integrates the four E’s of highway safety: engineering, education, enforcement, and Emergency Medical Services (EMS). A review of the most recent five-year crash data shows that over 50 percent of road deaths and nearly 75 percent of crashes in the state of Arizona occur in the MAG planning area. The STSP documented over 40 strategies (Table 21-1) that would help reach the goal of eliminating deaths and serious injuries. These strategies were identified based on detailed analyses of crash data.

Coordination with the State’s Strategic Highway Safety Plan

MAG transportation safety planning activities are coordinated with planning at the state level. In 2014, the Arizona Department of Transportation (ADOT) adopted an update to its Strategic Highway Safety Plan (SHSP). The 2015 update of the MAG Strategic Transportation Safety Plan occurred at the same time and the two efforts were closely coordinated. In the fall of 2018, ADOT began the process of updating the 2014 SHSP with MAG engagement. The 2019 State Strategic Traffic Safety Plan is the product of this update.

**TABLE 21-1
2015 STRATEGIC TRANSPORTATION SAFETY PLAN ACTION AREAS & STRATEGIES**

Education		
<p>Intersection Related</p> <p>Develop and distribute educational materials related to intersection safety.</p> <p>Partner with local professional societies to hold an annual workshop on safety tools available to assess and improve substantive safety.</p>	<p>Vulnerable Users</p> <p>Develop ongoing training and public information bicycle and pedestrian safety campaigns.</p> <p>Explore the development of a smartphone application to educate vulnerable users on road safety.</p>	<p>Impaired Driving</p> <p>Develop materials for educating target groups for impaired driving including mass-media campaigns on DUI dangers and penalties.</p> <p>Explore methods of educating young road users through Mass-media campaigns.</p> <p>Younger Drivers</p> <p>Partner with GOHS and ADOT to deploy distracted driver safety awareness campaigns.</p>
Enforcement		
<p>Intersection Related</p> <p>Explore the feasibility of using automated enforcement at intersections with high crash risk.</p> <p>Conduct targeted enforcement at high crash risk intersections.</p>	<p>Speeding & Aggressive Driving</p> <p>Utilize automated enforcement where appropriate to address speeding.</p> <p>Conduct enforcement in all work zones and increase enforcement in school zones.</p>	<p>Impaired Driving</p> <p>Conduct high visibility DUI saturation patrols.</p>

Engineering - Programs, Projects & Practices

Intersection Related	Vulnerable Users	Speeding & Aggressive Driving
<p>Include safety as explicit project evaluation criteria in the MAG processes for prioritizing projects for programming in the TIP.</p> <p>Implement systemic improvements based on the identification of specific characteristics of high risk intersections.</p> <p>Identify new practices or standards that integrate safety into planning and design.</p> <p>Prepare a "best practices" guide for Road Diet and Complete Streets projects for incorporating safety.</p> <p>Enhance the MAG RSA Program: (1) Data driven location nomination; (2) Design phase reviews; (3) Focus on bicyclist safety.</p> <p>Prioritize improvements based on screening for high crash risk.</p> <p>Prepare a technical resource that documents regional and national effectiveness of safety countermeasures for all E's.</p> <p>Emergency Medical Services Perform a comprehensive review of current Emergency Vehicle Priority (EVP) practices and develop a recommended EVP practice.</p>	<p>Promote Safe Routes to School studies in the MAG TA non-infrastructure program.</p> <p>Continue to support the Regional training program for school crossing guards.</p> <p>Promote practices that ensure safety and multimodal connectivity.</p> <p>Share best practices on getting to and from school.</p> <p>Develop a Complete Streets Implementation Guide that integrates safety analysis and design.</p> <p>Produce a white paper on wrong way bicycle crashes and local ordinances.</p> <p>Prepare a "best practices" guide for high exposure bicycle and pedestrian nodes.</p> <p>Develop an action program: (1) high transit activity stops, and (2) new routes that enhance transit safety.</p> <p>Install Pedestrian Hybrid Beacons (HAWKs), medians, and crossing islands at mid-block locations.</p> <p>Install bicycle detection at signalized intersections.</p>	<p>Develop best practices guidelines on using automated enforcement to improve road safety.</p> <p>Younger Drivers Identify best practices for promoting or implementing Safe Driving pledge campaigns.</p> <p>Impaired Driving Implement wrong-way detection system to prevent wrong-way driving crashes on the freeway system.</p> <p>Traffic Management Support and encourage the implementation of Intelligent Transportation Systems (ITS) technologies that show promise for reducing fatalities and serious injuries.</p> <p>Support Incident Management (IM) and Integrated Corridor Management (ICM) strategies that would help eliminate secondary crashes during major traffic incidents.</p>

Other Strategies - Improve Data Collection, Quality, Availability, Integration, and Analysis for Decision Making		
Enhance and expand the current MAG network screening methodology for intersections to include road segments.	Develop or purchase a comprehensive road safety assessment tool that utilizes HSM methodologies.	Develop local calibration factors for existing national HSM Safety Performance Functions (SPFs) specific to the MAG planning area.
Enhance the crash data analysis software, Regional Transportation Safety Information Management System (RTSIMS).	Develop a framework and tools to conduct benefit-cost analyses and develop crash reduction factors (CRFs) using local data.	

Tools, Solutions, and Activities for Improving Transportation Safety

Regional Traffic Safety Information Management System

The 2005 STSP identified a project to develop the Regional Traffic Safety Information Management System (RTSIMS). As a result, the RTSIMS was delivered in October 2010. The RTSIMS software has been through several updates and enhancements through 2018. Through a separate project, MAG developed a user’s manual for local agencies requesting access to RTSIMS. MAG provides training sessions as needed. This tool provides a useful crash analysis system for local agency staff wanting to run queries and provides a valuable tool for smaller agencies that may not have the resources to procure their own crash analysis software. Local agencies requesting access to the system are required to have a data access agreement in place with ADOT and may access data only for roadways in their jurisdiction.

Network Screening Methodology to Identify Intersection Crash Risk

In 2010, MAG developed a network screening methodology to identify and rank all intersections in the Region based on crash risk. The Network Screening Methodology for Intersections (NSM-I) screened over 20,000 intersection crash locations in the Region and ranked them by crash risk. The functionality of running a query utilizing NSM-I was added to the RTSIMS software. Utilizing the NSM-I functionality, MAG produces a high-level list of intersections for local agencies in a data-driven process to nominate road safety and project assessment locations. This crash risk screening functionality was a landmark accomplishment for the Region. It has helped local agencies obtain Highway Safety Improvement Program funds from the state for road safety projects.

MAG Road Safety Assessment Program

The 2005 STSP recommended Road Safety Assessments (RSA) at intersections ranked by crash risk. Enhancements to the RSA program were identified in the 2015 STSP update. In 2011, MAG developed and executed an RSA program with assistance from ADOT. Since there were few

examples available for establishing an urban RSA program, the MAG program was developed from fundamental principles of RSAs, including the addition of a human-factors expert to the RSA team. Following an RSA, Project Assessments (PA) are developed and result in a roadway safety improvement project designed up to 15 percent completion. Projects with completed PAs are better positioned to compete for federal road safety funds. A total of 70 RSAs and nine PAs have been completed. A data-driven methodology for the identification of RSA locations was implemented in 2017. The RSA program will continue to be funded by MAG with planning funds.

In 2017, the Local Agency Safety Studies (LASS) program was initiated in response to requests received by MAG for technical assistance with road safety studies. The selected studies examine specific road safety issues or concerns at locations that may not meet the criteria used to identify sites for the MAG RSA Program.

Annual School Crossing Guard Training Workshop

Until 2006, the City of Phoenix provided training to school crossing guards through a structured workshop for nearly 40 years. In 2006, staff from MAG, City of Phoenix, and other member agencies developed a regional training workshop for school crossing guards based on the workshops conducted by the City of Phoenix and the City's national award-winning school safety program. These regional workshops have been held annually since.

The school crossing guard training has become an annual road safety event sponsored by MAG. Starting in 2013, three training workshops were held across the Valley. Each year, nearly 400-500 crossing guards are provided basic safety training prior to each school year. MAG produced a road safety documentary titled "Guardians of the Future" explaining safety procedures at yellow crosswalks. The video is available in English and Spanish and is used in the training workshops. Copies of the video have been distributed to nearly 975 schools in Maricopa County, all public school districts in the Region, and to a number of agencies outside Arizona by request. The increased utilization of new traffic control technologies by local agencies at school crossings initiated an update to the documentary. The updated version includes instructions on operating these new technologies, such as crossings equipped with flashing beacons. The most recent update to the documentary, completed in 2015, is available online on the MAG Safe Routes to School Program (SRTS) webpage, as well as MAG's YouTube channel.

Administration of Safe Routes to School Studies

New programs and projects identified in the 2015 STSP are being implemented to support regional SRTS programs. These include: (1) sharing safety best practices for getting to and from school, (2) supporting a regional training program for school crossing guards, and (3) promoting and administering SRTS framework studies as a priority in the MAG Transportation Alternatives Non-Infrastructure Projects Program. Since 2018, MAG has administered 20 SRTS studies for schools in four local agency jurisdictions in the Region. Conducting SRTS studies is a proactive approach to identifying safety improvements for K-8 students who walk and bike to school. SRTS studies are requested by local agencies, in partnership with schools and school districts with the goal of encouraging walking and biking to school. Recommendations are developed in

partnership with stakeholders. The walking and biking boundary of each school area is assessed to incorporate infrastructure, enforcement, education, and encouragement programs into recommendations that are meaningful and offer effective solutions to address issues unique to each community. The comprehensive SRTS study scope includes data collection (e.g., vehicle, pedestrian, bicyclist, and crash data), pick-up and drop-off observations, parent and student surveys, assessment of pedestrian and bicyclist facilities, and development the SRTS report to include walking and biking route maps.

Status of Transportation Safety in the MAG Region

The MAG planning area is the most populous urban area in Arizona and crash patterns in this area are significantly different than statewide crash patterns. A review of crash data for the analysis period of 2008 through 2017 shows that nearly 51 percent of fatalities and nearly 74 percent of all crashes in the state occur in the MAG planning area. The area has a crash injury rate of 7.77 persons injured per 1,000 people. When comparing fatality rates for urban regions, the Phoenix metropolitan area has the second highest rate of deaths, 8.75 deaths per 100,000 persons, second to Houston, Texas.

The transportation safety program shares information on the road safety performance of the Region on the MAG website. Safety information is generated through analyses performed by MAG staff. The crash data used in these analyses are provided to MAG by ADOT. Road safety data, statistics, indicators, and trends for the Region are posted on the MAG website; this information is frequently quoted by news media and agencies interested in road safety.

Appendix F provides statistics on road safety in the MAG planning area. In 2017, the economic loss due to vehicular crashes in Maricopa County was estimated at nearly \$5.6 billion. A total of 504 lives were lost and nearly 40,400 persons were injured due to crashes in the Region. From 2013 to 2017, the total number of crashes, injuries, and deaths trended upwards; total crashes increased by 22 percent, total injury crashes increased by 12 percent, and the total number of fatal crashes increased by 19 percent. It is estimated that nearly 65 percent of the state's population lives in the MAG planning area in addition to 55 percent of the state's travel (measured in vehicle miles of travel or VMT). Proportionate with these levels, the MAG planning area represents about 70 percent of all injuries in the state due to motor vehicle crashes and over 50 percent of fatalities.

The State of Arizona was identified by the USDOT as an "opportunity state" for road safety improvements due to the state's poor road safety record. Crash statistics indicate that the poor road safety record could be attributed to the number and severity of crashes in the MAG Region. This points to the need for increased investment in the road safety resources within the Region.

Freeways

The urban freeway system consists of I-8, I-10, I-17, US-60, SR-51, SR-143, Loop 101, Loop 202, and Loop 303. Crash statistics indicate that the urban freeway system is a safer road environment in comparison to the arterial street network. The freeway system carried about 43 percent of the vehicle travel in the Region but experienced only 28 percent of all crashes and 17 percent of fatalities in 2017. Each freeway corridor in the Region has differences in attributes such as road

geometry, traffic demand, and vehicle composition. The I-10 corridor is a major national truck route and carries a high percentage of trucks. A comparison of road safety levels requires the consideration of total traffic flow or traffic exposure. A measure for traffic exposure is the number of vehicle miles traveled on a facility, expressed in millions of vehicle miles traveled (MVMT). Based on the crash rate per MVMT for the calendar year 2017, I-17 had the highest crash rate of 2.65, while I-8 had the second lowest with a rate near 0.64.

The overall safety on the Regional freeway system has been enhanced through MAG-sponsored safety projects, such as the implementation of cable median barriers, the Freeway Service Patrol Program, and the Freeway Management System (FMS), which is operated by ADOT. A pilot project launched in 2014 co-located DPS troopers at the ADOT Traffic Operations Center for improved coordination and response for clearing freeway crashes. ADOT now fully funds the co-location as a result of the pilot's success. Nearly all freeway traffic advisories broadcast on local radio stations, television channels, and the internet are based on information generated by the FMS; this information is made available to media at no cost. Expansion of the FMS to cover the entire urban freeway system, identified and funded as a regional priority through the RTP (Chapter 18), is expected to be completed by 2021.

Excessive speeding and incidents involving road rage and impaired driving continue to pose a threat to road safety on freeways. In 2015, there was an increase in wrong-way driver crashes. The Department of Public Safety receives over 26 reports a month of drivers entering or driving the wrong direction on the freeway. Crashes occur in a fraction of those incidences but have been on an increasing trend. In most cases, the crash reports indicate alcohol, medication, or controlled substance impairment. Through enforcement, the Department of Public Safety and local police departments continue to monitor and address threats to safety. The 2015 STSP identified a strategy to implement wrong-way detection systems and in 2017 ADOT advanced a first-in-the-nation thermal detection solution to reduce and prevent wrong-way driving on freeways.

Arterials and Local Streets

On the arterial street system, the most severe crashes occur at intersections mainly due to conflicting turning movements. The arterial street system carries nearly 60 percent of all travel in the Region but experiences nearly 74 percent of all crashes and 77 percent of crashes involving injuries or fatalities. In 2017, of the 71,172 crashes that occurred on the arterial system, 56 percent occurred at or near intersections; of these crashes, a total of 13,034, or 33 percent, resulted in either a fatality or serious injury. These statistics point to the need for improving safety at intersections on the arterial street system in the Region.

Crash statistics indicate that, following a declining trend for all crashes in the Region between 2006 and 2010, the total number of crashes has increased from a low of 71,071 in 2010 to 96,508 in 2017. This trend is also reflected in crashes on arterial streets. One area where the Region has improved is the trend of crashes for alcohol-impaired fatalities, which have decreased three percent from 2016 to 2017, compared to the statewide increase of 6 percent. Ride-hailing services such as Uber and Lyft available in many large metropolitan areas, including the MAG Region, may be contributing to the decrease in alcohol impaired crashes.

Bicycle Facilities

A stated goal of the 2007 Regional Bicycle Plan was making bicycling a viable option for daily travel trips. MAG is developing an Active Transportation Plan as an update to the Regional Bike Plan, which focuses more on developing safe bicycle facilities. In addition, more local agencies have been placing bicycle facilities and connectivity as a higher priority in their own planning efforts, which may increase bicycling activity in the Region. The 2015 MAG STSP identified a number of strategies and actions for improving bicyclist and/or pedestrian safety. A few key strategies are:

- Develop complete streets implementation guidelines that integrate safety analysis and design throughout the planning process.
- Promote practices that ensure safety and multimodal connectivity in planning and design.
- Produce a white paper on wrong way bicycle crashes and model ordinances to prevent crashes.
- Install pedestrian Hybrid Beacons (HAWKs).
- Install medians and pedestrian crossing islands.
- Prepare a "best practices" guide for high risk intersections and high exposure bicycle and pedestrian crossing nodes.
- Provide bicycle detection at signalized intersections.

Bicycle crash data is limited because data is available only for crashes on public roads that involve at least one motor vehicle. However, crash statistics for bicycles involved in fatal and injury crashes indicate a decrease of 30 percent between 2012 and 2015. There was an increase in bicycle crashes between 2015 and 2017 of nearly 12 percent, possibly due to an increase in persons utilizing bicycles for commutes, increasing the exposure of bicyclists to vehicle traffic. The MAG RSA program conducts bicyclist and pedestrian counts to capture more non-motorist volume data. The MAG bicycle counts program establishes much needed data on bicyclist exposure for screening candidate locations for implementing safety improvements. In 2018, MAG conducted a bicycle safety analysis. This study included an extensive review of crash reports for crashes involving bicyclists, a statistical review of crash types, locations, and crash characteristics and development of a guidance document to provide assistance to MAG member agencies for planning and design of new improvements to existing active transportation facilities. This study of crash reports provided insight into characteristics of bike crashes not available with traditional reviews of raw crash data. Ultimately, the analysis provided a better understanding of bicycle crashes for better decision-making and identification of appropriate bicycle safety infrastructure.

Pedestrian Facilities

Although the percentage of pedestrian crashes in the Region is relatively small, pedestrian safety is a primary area of concern due to high fatality rates and national studies have referenced the metropolitan area's notably high pedestrian fatality rates. The trends of crashes involving pedestrians indicate an increase of 36 percent between 2010 and 2017. The 2015 MAG STSP addresses both bicyclist and pedestrian safety, since many of the road safety issues are common to both modes of travel. Some of the goals identified in the Plan are: (1) incorporate safety

considerations in pedestrian facility planning, (2) promote safe multimodal access, and (3) reduce mid-block pedestrian crashes. MAG is exploring the use of new technologies utilizing video analytics to capture more information on potential pedestrian conflicts with vehicles. This information cannot be found in traditional data obtained from crash reports, specifically for near misses that are not captured by police officers. This information will help MAG and member agencies gain a better understanding of potential conflicts and how best to address similar conditions. Two projects providing analysis and recommendations were conducted through the LASS program at seven locations.

Younger and Older Drivers

Road safety research and literature have documented that younger drivers (under 25 years) and older drivers (over 65 years) are associated with elevated risk for vehicular crashes. The total number of younger drivers involved in crashes each year steadily decreased until 2012, but has increased since then. A similar trend is observable for crashes involving older drivers. Both of these trends seem to reflect the overall trend in crashes observable across all types of crashes.

The 2015 STSP update identified a predominance of younger driver crashes where both distracted driving and impaired driving was indicated. Three strategies were developed to address these crash types for younger drivers: (1) identify best practices for promoting or implementing Safe Driving Pledge campaigns, (2) explore methods of educating young road users through mass-media campaigns, and (3) partner with ADOT and local agencies to deploy distracted driver safety awareness campaigns.

The 2015 STSP did not show the predominance of crashes involving older drivers that was indicated for younger drivers. As a result, no specific strategies were identified in the 2015 STSP to address crashes involving older drivers. However, older drivers have been observed to be particularly susceptible to crashes at intersections. Older driver related issues are considered by local agencies when existing intersections are improved, such as the addition of a left-turn lane or a left-turn protected signal phase. Local agencies are exploring other initiatives to assist older drivers, such as installation of flashing yellow arrows at intersections.

Transit Riders and Operators

Valley Metro requires operators to be apprised of safety and security issues and to perform functions related to safety of capital equipment. Contract incentives are provided for preventable accidents. Future improvements to safety and security in transit vehicles are addressed through Valley Metro's Vehicle Management System Plan. The light rail transit (LRT) system, operated by Valley Metro, began service in December of 2008. The in-street system is currently 28.2 miles long, with multiple extensions either under construction or planned. Few crashes involving LRT have resulted in serious injuries to passengers or motor vehicle occupants. There were a total of eight crashes in the years of 2009, 2010, 2013, 2016, and 2017 resulting in serious injuries. There were four fatalities from collisions between 2009 and 2018. Several strategies were identified in the 2015 STSP, including enhancements to the MAG RSA program to include road safety assessments that focus on riders' access to transit. MAG conducted seven transit RSAs in the vicinity of light rail stations in coordination with Valley Metro to inform the integration of safety features into new

facilities or improvements to existing facilities. There are several overarching strategies under the vulnerable user action area of the STSP that address access to transit with the recognition that transit riders are bicyclists and pedestrians representing all ages and abilities.

MAG will be conducting a pedestrian and bicycle safety analysis project at 20 light rail station locations at major arterial intersections between 2020 and 2021. The analysis will include technologies utilizing video analytics to capture more information on pedestrian and bicyclist conflicts with vehicles at these locations. The video analytics and review of conflict characteristics will generate recommendations for meaningful safety improvements that can be implemented by local agencies in coordination with Valley Metro.

Availability of Funds for Improving Transportation Safety

The implementation of physical improvements that address existing road safety issues are carried out by MAG member agencies. The role of MAG is limited to recommending qualifying safety improvement projects using available funding sources. Two sources of federal aid funds are available to local agencies for implementing qualifying road safety improvements: (1) Federal Highway Safety Improvement Program (HSIP) funds; and (2) Transportation Alternatives/Safe Routes to School (TA-SRTS) program funds. During the project review process at MAG, all available information on project eligibility for federal funds is used to screen projects. However, the final determination of whether a candidate project qualifies for federal funds is made by the Arizona office of the Federal Highway Administration (FHWA) and ADOT.

In 2019, MAG initiated development of the MAG Roadway Safety Program (RSP). This funding program was proposed by MAG to supplement the state's HSIP program and provide additional funding in the short term. MAG will facilitate the Regional safety program to improve the safety conditions of roadways in all areas of the Region, whether rural or urban. MAG developed this program to address critical safety regional funding needs in the near term.

To address near term safety needs with more flexible and lower cost solutions, MAG identified approximately \$2 million a year of sub-allocated federal funds available for the FY 2020 to FY 2024 period. MAG will coordinate with ADOT to substitute MAG Sub-allocated Surface Transportation Block Grant program funds, noted as an equal return of MAG 2.6% funding Highway User Revenue Funds (HURF), that could then be used to fund a number of small safety projects throughout the Region. MAG issued a call for projects for utilizing RSP funds for the first time in October of 2019.

Programming of Highway Safety Improvement Program Funds

The national HSIP provided new guidelines and criteria to be considered when allocating safety resources to problem locations, giving consideration to the number of fatalities, the amount of travel, and the lane-miles of public roadway available. Responsibility for the process that allocates federal funds to the MAG Region for safety improvements lies with ADOT.

In May 2015, ADOT announced a new process for allocating HSIP resources across the state for qualifying road safety improvement projects. Previously, ADOT provided an annual sub-allocation

to the MAG Region in the amount of \$1.9 million that could be directed to qualifying, low-cost safety improvement projects at the discretion of MAG. These funds, or MAG-HSIP, were systematically programmed for qualifying road safety projects in FY 2010 through FY 2018.

Starting in FY 2019, under the new ADOT HSIP process, no sub-allocation will be provided by ADOT to any COG or MPO region. All roadway safety improvement candidate projects statewide will compete for Arizona's total allocation of federal HSIP funds, approximately \$42 million per year. Many types of low-cost systemic road safety improvements, such as pedestrian countdown timers that were previously recommended by MAG and implemented with MAG-HSIP funds, are no longer eligible for HSIP funds. This is due to the minimum cost of \$250,000 for all road safety projects, as established by ADOT under the new 2015 HSIP process. However, several strategies identified in the 2015 STSP could lead to the identification of region-wide systemic road safety projects that could qualify for HSIP funding, provided a suitable procurement method (a lead agency) is available to handle such a multi-agency project.

Programming of Transportation Alternatives Safe Routes to School (SRTS) Funds

Starting in 2012 following MAP-21 guidelines, ADOT began sub-allocating a portion of federal funds to the MAG Region for the Transportation Alternatives (TA) Program, with the flexibility to use a portion of these funds for Safe Routes to School (SRTS) projects since the statewide SRTS Program administered by state DOTs was no longer funded.

Currently, the MAG Region receives \$4.4 million in TA funds, and MAG has allocated \$400,000 per year to fund SRTS non-infrastructure projects. The MAG Transportation Safety Committee identified programming goals and objectives based on regional SRTS priorities. For the first programming cycle of TA-SRTS in 2013, two project priorities were established by MAG, guided by the FHWA Safe Routes to School eligibility criteria.

- Priority One - SRTS Framework Studies: These studies are based on the Regional desire to identify traffic safety issues within the walking and biking boundary of schools. It was anticipated that the development of SRTS framework studies would establish and foster partnerships and identify improvements that could be implemented either on the school site or in the public right of way. The main deliverable of such SRTS studies would be new or updated walking and biking route maps used by schools and parents.
- Priority Two - Support Activity Projects: These projects were established recognizing the importance of funding for ongoing SRTS activities that are administered by schools and local agencies. Support Activity Projects provide educational print and incentive materials, development of SRTS webpages, and bulk ordering of items such as yellow crossing roll-out signs, crossing guard stop paddles, and safety vests, among other items.

Since 2013, 44 projects have been programmed for the TA-SRTS funding by local agencies for nearly 700 schools. In addition, strategies identified in the 2015 STSP will be implemented to support encouragement of safe walking and biking for K-8 students.

The Future of Regional Road Safety Funding

The federal Fixing America's Surface Transportation (FAST) Act passed in 2015 covers funding only through fiscal year 2020 and maintains the HSIP funding source. Therefore, it is not feasible to develop a long-range federal funding projection for the safety program. Based on the crash history of the MAG planning area (in comparison to the entire state) and execution of the new HSIP process, about 50 percent of the state's annual HSIP allocation, or \$21 million, would need to be allocated to qualifying road safety projects in the MAG Region. Beginning in 2017 for the FY 2019 HSIP funding cycle, the MAG Region has seen a significant increase for projects funded when competing for the nearly \$40 million available statewide in each fiscal year cycle. The total amount of projects funded for the FY 2020-2021 HSIP funding cycle was \$4.2 million and increased to \$18.9 million in the FY 2023-2024 funding cycle.

Implementation of some safety improvement projects with federal aid funds can be inefficient from both a cost and time perspective. ADOT must meet federal mandates for safety performance, which requires stringent eligibility criteria. These challenges were the main impetus in developing the MAG RSP utilizing the HURF. This new program will fund low-cost, meaningful safety improvements through FY 2024. The new RSP is expected to demonstrate the need for establishing a dedicated regional funding source for road safety. Until then, the bulk of funds will continue to come from the HSIP federal aid source, with improvements funded entirely by local agencies and a smaller amount from the MAG RSP funding source. For larger projects, MAG member agency safety improvements would need to meet current HSIP eligibility criteria. The key elements of project eligibility focus on countermeasures that: (1) align with the State Highway Safety Plan (SHSP 2014) emphasis areas, (2) are to be implemented only at locations that experience fatal and serious injury crashes in the most recent five years, and (3) demonstrate a cost-benefit ratio of 2.5 or greater by using established crash reduction factors and historical data on fatal and serious injury crashes.

Road safety improvements in the MAG Region may be better realized by focusing on locations with a predominance of certain crash types (i.e., left-turn, angle, and rear end), which tend to cause more severe injuries and fatalities. The challenge in this will be that focusing on crash types and countermeasures with known safety benefits may not necessarily meet the current HSIP eligibility criteria, due to the low number of fatal and serious injury crashes experienced. The use of HURF funds in the RSP provides the flexibility to establish eligibility criteria more aligned with the MAG Region's safety goals and priorities. This will enable local agencies to focus on certain types of crashes by allowing the inclusion of all crash severities and types documented for the proposed safety countermeasure at the subject location. An alternate source of regional funding may enable implementation of safety projects that address the crash types experienced in the Region. The implementation of the programs and projects identified in the 2015 STSP will identify effective region-wide safety projects, as well as large projects at single intersection locations, with potential for competing for state-wide HSIP funding. Previously referenced MAG Transportation Safety Program projects and initiatives, such as the RSAs and SRTS Studies, will serve to feed projects for funding with RSP funds.

CHAPTER TWENTY-TWO

TRANSPORTATION SECURITY

This chapter provides an overview of transportation security, security-related issues, and ongoing efforts to protect transportation networks and facilities at the federal, state, and regional levels. This chapter considers responses to national security issues as they pertain to transportation and focuses on transportation security efforts at varying levels of government. The Maricopa Association of Governments (MAG) acknowledges that agencies, offices, consortiums, groups, and committees are committed to providing security. This chapter addresses the primary governmental and regional efforts that impact, assess, or implement measures to protect transportation facilities, systems, and networks.

Transportation Security Concepts

Immediately following the September 11, 2001, terrorist attacks on the United States, agencies began to develop and implement policies and programs to provide for the safety and security of the nation's transportation networks. Furthermore, attacks on foreign public transit systems have heightened the need for increased transit security. Although programs for transportation safety have existed for many years, the concept of planning for transportation security and implementing security procedures on different modes of transportation is relatively new. In some cases, the phrases "safety" and "security" are used simultaneously or interchangeably to describe the planning or programming of broader transportation programs or initiatives. However, the intent of the words "safety" and "security" are different from one another. Safety is defined as "freedom from danger," whereas security is "freedom from *intentional* danger." While implementing safety programs for transportation is intended to protect the public by reducing fatalities, injuries, and crashes, the implementation of security measures and programs identify and prevent attacks intended to harm people, facilities, or transportation infrastructure.

Transportation security efforts consist of programs, measures, or initiatives focused on transportation systems or networks that collectively comprise our means of travel. An important aspect of transportation security is maintaining the economy and allowing for the free flow of goods. Protecting free trade and allowing the safe movement of imports and exports is vital to the economy of the United States and involves providing a high level of security for the nation's freight system. Therefore, when considering transportation mobility and the movement of goods, the implementation or planning for transportation security measures or policies is crucial to protecting transportation infrastructure. Such infrastructure includes interstates, highways, and freeways; local and regional road networks; bridges; tunnels; emergency access roads; connector roads; railroads; ports; intermodal passenger facilities; intermodal cargo facilities; freight corridors; pedestrian and bicycling networks; airports; pipelines; public transit systems; and evacuation corridors.

Another aspect of providing for secure transportation is "emergency planning." While transportation security is directly related to preventing attacks that are intended to harm people,

facilities, or transportation infrastructure, emergency planning responds to unforeseen natural events and disasters. A security incident involves acts of terror, which result in regional, local, or location-specific attacks on people, sites, facilities, or transportation infrastructure whereas emergency response planning efforts maintain responsibility for preparedness, response, and recovery to natural disasters such as earthquakes, floods, hurricanes, violent weather, fires, and similar incidents. Several agencies coordinate on security and safety matters for homeland security. The term “homeland security” refers to domestic governmental actions designed to prevent, detect, respond to, and recover from acts of terrorism, and respond to natural disasters. Homeland security refers to a concerted, national effort to protect the homeland by all levels of government — federal, state, local, and Native nation — for the sole purpose of protecting the territory of the United States from internal and external hazards.

The following sections of this chapter address transportation security efforts at different levels of government and provide a summary of MAG’s role in regional transportation security efforts. The information in Table 22-1 identifies a list of federal and state agencies, as well as additional entities within the MAG Region that address transportation security concerns. Table 22-1 displays the agency responsible for addressing the respective primary transportation “sectors of concern” relating to roads, transit, air transportation facilities, cargo facilities and commodity movements, and transportation security planning. While efforts range from the active implementation of programs and measures to coordinating activities with other agencies, the role of each agency enhances security of the MAG regional transportation network. The agencies identified in Table 22-1 represent a multifaceted and layered approach to protecting and maintaining security and responding to potential incidents throughout the MAG Region.

Federal Programs

Several agencies are responsible for addressing security-related issues and protecting transportation networks and facilities from a national perspective. While there are federal government agencies that provide security, the discussion below focuses on the programs that impact, assess, or implement measures to protect transportation facilities.

U.S. Department of Transportation Programs

The U.S. Department of Transportation (USDOT) is responsible for ensuring a fast, safe, efficient, accessible, and convenient transportation system that meets national interests and enhances the quality of life for the nation’s citizens. The department consists of 11 administrations that are responsible for establishing national transportation policies pertaining to highway planning, development, and construction; mass transit; aviation; railroads; ports, waterways and pipelines; and transportation safety and security issues. Individual administrations coordinate with officials at the state, regional, and local levels on fiscal, regulatory, administrative and policy-related matters. Each administration within the USDOT is involved with different aspects of transportation security. The following information provides an overview of agencies that impact MAG’s regional transportation system.

**TABLE 22-1
AGENCIES AND TRANSPORTATION SECURITY EFFORTS
BY SECTOR OF CONCERN**

AGENCY	SECTOR OF CONCERN				
	Roads	Transit	Air Transportation Facilities	Cargo Facilities and Commodity Movements	Transportation Security Planning
U.S. DEPARTMENT OF TRANSPORTATION	•	•	•	•	•
Federal Highway Administration	•				•
Federal Transit Administration		•			•
Federal Railroad Administration		•			•
Federal Aviation Administration			•	•	•
U.S. DEPARTMENT OF HOMELAND SECURITY	•	•	•	•	•
Transportation Security Administration			•	•	•
U.S. Customs and Borders Protection			•	•	•
Federal Emergency Management Agency	•				
TRANSPORTATION RESEARCH BOARD					•
STATE OF ARIZONA					
Arizona Office of Homeland Security	•	•	•	•	•
Arizona Div. of Emergency Management	•	•	•	•	•
Arizona Department of Public Safety	•				•
Arizona Department of Transportation	•	•	•	•	•
REGIONAL EFFORTS					
Maricopa Co. Dept. of Emergency Mgmt.					•
MAG 911 – Emergency Telephone					•
RPTA/Valley Metro		•			•
Valley Metro Rail		•			•

- Federal Highway Administration (FHWA) - The FHWA is responsible for ensuring that the nation’s roads and highways are safe and efficient and have access to the most current forms of technology that allows for a high level of system performance. The FHWA provides technical and financial support to state, local, and tribal governments for the construction, improvement, and preservation of the National Highway System. The FHWA also provides aid for roads on federal lands, such as national parks and forests.

The National Highway System is a component of the nation's defense mobility. The FHWA coordinates with state officials and members of the U.S. military to address military deployment during times of natural disasters and national security emergencies. The FHWA works with the U.S. Department of Defense to maintain and strengthen deployment coordination and military mobilization during security emergencies by enhancing the conditions of the Strategic Highway Network and its connectors.

The FHWA works with state and local transportation agencies to increase the awareness and understanding of emergency planning and security operations. The FHWA has a team of engineers trained to identify terrorist threats, understand explosive phenomena, and identify risks to critical bridges and tunnels. The FHWA has developed workshops and training courses to educate bridge and tunnel owners and emergency responders. This training helps to identify vulnerable transportation facilities and disseminates best practices for deterring and mitigating potential attacks.

The FHWA Office of Operations maintains the Emergency Transportation Operations website. It provides tools, guidance, capacity building, and best practices that aid local and state Departments of Transportation (DOT) in improving transportation network efficiency and public/responder safety when a non-recurring event interrupts or overwhelms transportation operations. Emergency Transportation Operations uses the National Incident Management System (NIMS) to organize its content.

The NIMS is a systematic, proactive approach that guides departments and agencies at all levels of government, nongovernmental organizations, and the private sector to coordinate seamlessly and manage all threats and hazards—regardless of cause, size, and location. Homeland Security Presidential Directives require all Federal departments and agencies to adopt the NIMS for incident management programs and activities, as well as in support of all actions taken to assist state, tribal, and local governments.

- Federal Transit Administration (FTA) - The FTA provides financial assistance to develop new transit systems throughout the country and to improve and maintain existing transit systems. The FTA distributes grant funds to state and local transit providers for operating systems and programs in accordance with federal guidelines. The FTA oversees initiatives and programs related to transit, livable communities, financing, database maintenance, human services coordination, and Intelligent Transportation Systems (ITS). The FTA is involved in public transportation throughout the MAG Region, including buses, maintenance facilities, vanpools, paratransit vehicles, streetcar, and light rail.

A primary focus of the FTA is to integrate security into transit-provider programs, operations, and transit infrastructure to protect the general public from security threats. The FTA funds and aids local transit agencies throughout the country. The FTA developed a comprehensive, 20-point checklist of *Security Program Action Items* for transit agencies to incorporate into their System Security Program Plans. In September 2014, the FTA and the Transportation Security Administration (TSA) collaborated to

update and consolidate the FTA's Top 20 Action Items into 17 Action Items, which are aligned with TSA's National Terrorism Advisory System. The Action Items apply to all transit modes operated or contracted by transit agencies. Transit agencies are encouraged to include all Action Items in their security programs and scale them appropriately to risk environment and operation size.

In addition to the TSA, FTA coordinates security activities with the Department of Homeland Security (DHS), the Federal Emergency Management Agency (FEMA), the National Institute of Standards and Technology (NIST), the Transportation Research Board (TRB), the U.S. Coast Guard, the American Public Transit Association (APTA), and state and local agencies.

- Federal Railroad Administration (FRA) - The FRA enforces rail safety; provides rail assistance programs; addresses intermodal transportation issues; and conducts research for rail transportation policy and safety. The FRA is also responsible for addressing security-related issues. Through joint efforts with the DHS, the TSA, and the FTA, the FRA works to establish initiatives to enhance security efforts that address passenger and freight rail security issues. The FRA administers federal grants to the Amtrak rail system and is working toward an assessment of Amtrak's nationwide passenger rail system to evaluate the level of preparedness toward external security threats and acts of terrorism.

The FRA collaborates with the DHS to conduct comprehensive vulnerability assessments on passenger rail networks that operate in highly dense urban settings and implement security action items on the movement of hazardous materials. The FRA coordinates with the Association of American Railroads on identifying and protecting critical assets; the movement and transportation of hazardous materials; freight operations; and the intensification of inspections. A full-time operations center, the Railway Alert Network, monitors various levels of intelligence on potential threats to the national rail network.

The FRA's security mission includes public safety of freight and passenger railroad networks. Railroad security operational functions include uniformed police, special agents, state of the art security systems, high-speed redundant communications, and passenger train emergency preparedness. The FRA maintains a railroad security communications network to alert the railroad industry of potential security threats and to notify law enforcement of security-related incidents. The FRA receives information about potential security threats and disseminates that information to railroads, police, and other relevant security officials.

- Federal Aviation Administration (FAA) - The FAA is responsible for regulating civil aviation to promote safety, to develop civil aeronautics and new aviation technologies, and to oversee air traffic control and navigation for civil and military aircraft throughout the country. The FAA works to control aircraft noise, regulates commercial air transportation, and researches and develops the National Airspace System. In addition, the FAA maintains an Internal Security function to reduce and eliminate risks associated

with terrorism, sabotage, espionage, theft, vandalism, and other criminal acts. Although the FAA has an internal security function, it maintains a partnership with the TSA. The TSA is responsible for screening airline passengers, onboard airline baggage, and air cargo materials to minimize security threats, and ensures that commercial air activity is free from potential security risks.

U.S. Department of Homeland Security Programs

The DHS was established in the aftermath of the September 11, 2001, attacks on the United States. The agency is responsible for protecting the nation from external threats and terrorist attacks and responding to natural disasters and domestic emergencies. The Department was created from 22 existing federal agencies, and today consists of several directorates and departments. As part of the agency's mission, the DHS leverages resources at the federal, state, and local levels, and coordinates the transition of multiple agencies and layers of government into a single, integrated agency focused on protecting the security of the American people. The DHS coordination strategy maintains a complementary system that connects all levels of government and avoids duplicating efforts, resulting in a "national mission" of security.

The DHS is primarily concerned with border security, critical infrastructure protection, emergency preparedness and response, domestic intelligence activities, biodefense, researching and implementing security technologies, the detection of nuclear and radiological materials, and the provision of transportation security. Although DHS consists of many agencies that are responsible for national security issues, the agencies listed below have direct responsibility for overseeing cargo movements and aviation activities within the MAG Region.

- U.S. Customs and Border Protection (CBP) - The CBP agency is responsible for the protection of the country's borders, and for facilitating the flow of legal trade and travel. The CBP prevents terrorists and dangerous weapons from entering the country and enforces U.S. trade and immigration laws. The agency processes incoming and outgoing passengers, pedestrians, cargo, vehicles, and ships, and protects the nation's borders with Canada and Mexico. The CBP is also responsible for protecting the nation's shorelines and processing all incoming trade via truck, rail, ship, and sea containers, as well as managing the nation's more than 300 ports of entry. The CBP established the Container Security Initiative which uses technology to screen and identify high-risk containers at a faster pace; uses smarter, more secure, tamper-proof containers; and prescreens containers before shipping. This level of scrutiny is vital to national security because imported containers are shipped from American ports of entry to destinations throughout the country, including Arizona.

The CBP maintains security for incoming trade to Arizona's Foreign-Trade Zones. The CPB defines foreign-trade zones as secure areas under customs supervision that are outside the customs area, upon activation of the zone. Merchandise located in the zone can be shipped "duty-free" for storing, packing, repackaging, assembling, or manufacturing. Several Foreign-Trade Zones exist in Arizona, including at Phoenix Sky-

Harbor and Phoenix-Mesa Gateway airports. The CBP verifies and inspects incoming shipments at these facilities and offers a full range of cargo processing functions. As U.S. ports of entry, shipments coming into the Phoenix Sky Harbor and Phoenix-Mesa Gateway airports are subject to the same levels of scrutiny and enforcement procedures that are implemented at other Foreign-Trade Zones throughout the country.

- Transportation Security Administration (TSA) - The TSA was created on November 19, 2001, as part of the Aviation and Transportation Security Act. The agency was created to fill three separate mandates: to provide security on all modes of transportation; to recruit and train security officers for commercial airports at 450 locations; and, to screen all commercial luggage and packages for explosives and other threats. The TSA maintains the mission of protecting air passengers and has deployed federal air marshals aboard commercial air flights. Federal air marshals serve as the primary law enforcement entity within TSA and collaborate with other law enforcement agencies to provide security for airline passengers. The TSA maintains programs for law enforcement training teams, canine detection teams, deploying federal flight deck officers, hazardous materials training, crew member self-defense, a registered traveler program, and the implementation of transit and rail inspection pilot programs. The TSA also created an Air Cargo Program, which recommends enhancements to security requirements for cargo carried on commercial aircraft.
- Federal Emergency Management Agency (FEMA) - FEMA is responsible for preparing the nation for potential hazards and coordinating and managing a national response to disasters such as earthquakes, hurricanes, tornadoes, fires, floods, hazardous material spills, and terrorist threats. FEMA coordinates with other organizations and agencies that are part of the nation's emergency management system. FEMA's primary goals are focused on reducing the loss of life and property; minimizing the level of disruption and suffering affiliated with national disasters; serving as the nation's portal for emergency management information and services; and preparing the nation to address issues and consequences associated with terrorist activities. FEMA is the independent federal agency responsible for leading the nation's efforts to prepare for, prevent, respond to, and recover from disasters.

Under DHS, FEMA formed the internal Office of Protection and National Preparedness. The Office serves to implement terrorism incident management programs and coordinates efforts with state and local governments to manage natural disaster and terrorist-related emergencies. FEMA coordinates with other agencies to address transportation mobility and security at different levels of government during times of natural disasters and terrorist attacks.

Transportation Research Board

The TRB is one of seven program units of the National Academies of Sciences, Engineering, and Medicine and provides independent, objective analysis and advice to the federal government

and other entities on matters of national importance. The purpose of TRB is to promote innovation and progress through transportation research. TRB provides research on transportation system security and collaborates with all levels of the federal government and private sector. The TRB conducts studies on transportation policy issues and research items at the request of the United States Congress and government agencies.

The TRB maintains a Security and Emergencies webpage that highlights research reports, requests for proposals, and other announcements related to security and emergencies. It includes links to research-related activities taking place at the federal and state levels, and within the academic and international transportation communities. The page provides links to programs and activities, which are the source of most of TRB's security and emergencies-related research products.

State of Arizona Programs

Arizona Department of Homeland Security

Governor Janet Napolitano created the Arizona Office of Homeland Security in March of 2003 to coordinate activities of the DHS at all levels of government within the State of Arizona. In 2006, the Arizona Office of Homeland Security became the Arizona Department of Homeland Security (AZDOHS). The mission of the AZDOHS is to protect Arizona by providing strategic direction and access to resources that enable the state's homeland security stakeholders to achieve the collective goals of:

- Preventing terrorist attacks in Arizona.
- Enhancing border security.
- Heightening cybersecurity efforts.
- Reducing Arizona's vulnerability to all critical hazards.
- Enhancing the capacity and expertise to plan for, mitigate, respond to, and recover from all critical hazards that affect the safety, well-being, and economic security of Arizona.
- Building the resiliency of Arizona.

AZDOHS administers and manages federal homeland security grants for terrorism prevention and the protection of Arizona from all hazards.

Arizona Division of Emergency Management

The Arizona Division of Emergency Management is a unit within the Department of Emergency and Military Affairs (DEMA), which includes the Arizona National Guard (Air, Army, and Joint Task Force) and the Division of Administrative Services. The DEMA is structured into four sections: Grants Administration; Preparedness; Operations and Coordination; and Communications Technology and Assurance. Each section is divided into operational branches that coordinate to support the mission of providing emergency management services to citizens

of Arizona and the Nation. The State of Arizona was accredited by the Emergency Management Accreditation Program Commission in 2004 and was reaccredited in 2009 and 2015.

The State of Arizona Emergency Response and Recovery Plan (SERRP) is administered by the Arizona Division of Emergency Management (ADEM). The plan identifies state agency roles and responsibilities in times of emergency or disaster and is designed to coordinate preparedness, emergency response, and recovery efforts at the federal level, including the National Response Framework and National Disaster Recovery Framework. The plan does not prescribe agency-specific procedures but rather serves as guidance for the development of respective local, county, tribal, state, and non-governmental organizations' plans and procedures. The SERRP, the Division of Emergency Management's Continuity of Operations Plan, and the Arizona Hazard Mitigation plan collectively comprise the comprehensive foundation of hazards emergency planning for the State of Arizona.

Arizona Department of Public Safety

The Arizona Department of Public Safety's (AZDPS) mission is to protect human life and property by enforcing state laws, deterring criminal activity, and providing vital support to the State of Arizona and its citizens. The AZDPS is a multi-faceted state-level law enforcement agency, which works in close partnership with other agencies to protect the public. It is a service organization that provides scientific, technical, operational, and regulatory services to Arizona's citizens and the criminal justice community. The AZDPS participates in the Arizona Counter Terrorism Information Center, a joint effort with the Federal Bureau of Investigation, and other participating agencies. The Center operates on a 24-hour, 7 day a week basis, and provides intelligence, investigative, and technical support to state, local, Native nations, federal law enforcement agencies and other agencies critical to Arizona and the country's homeland security efforts.

Arizona Department of Transportation

The Arizona Department of Transportation (ADOT) coordinates activities with the USDOT to provide transportation security and work with state and local agencies on transportation security and emergency response. Ongoing security efforts by ADOT include the following:

- Utilization of Homeland Security Grant Funds to Support Internal Projects:
 - Continuity of Operations
 - Interoperable Communications
 - Cyber Security
 - Automated Vehicle Location Devices on Critical Vehicles
 - HAZMAT
 - Needs Assessment
 - Vulnerability Assessment
 - Energy Assurance

- Internal Programs:
 - Vulnerability Assessment of Highway/Interstate Structures (bridges, tunnels, etc.)
 - Employee Training and Exercises
 - Business Continuity/Disaster Recovery Planning
 - Emergency Operations Planning
- Continued Support and Distribution of Public Information via 511 and www.az511.com
- Situation Reporting for major incidents and responses shared through WebEOC to multiple state agencies and the Arizona Counterterrorism Information Center
- Support of State, Regional, and National Programs:
 - National Incident Management System Compliance
 - State Emergency Response and Recovery Plan
 - Participation in Local, Regional, and Statewide Exercises for Emergency Preparedness
 - Participation in Urban Area Security Infrastructure Efforts and Exercises
 - FHWA Traffic Incident Management Training
 - Distribution of TSA's Highway Infrastructure Counterterrorism Guide

MAG Area Programs

Maricopa County Department of Emergency Management

The Maricopa County Department of Emergency Management provides a comprehensive emergency management program for Maricopa County. The department coordinates response and recovery activities through the implementation of emergency response plans during and after emergencies. The emergency response process is implemented through coordination with and assistance from local cities and towns, volunteer agencies, and other agencies and county departments. In addition, through intergovernmental agreements, Maricopa County Department of Environmental Management staff members act as liaisons to incorporated cities and towns to assist in the preparation of local emergency plans and training programs.

Some of the departmental functions include:

- Hazard Mitigation – Hazard mitigation planning is documented in the Maricopa County Multi-Jurisdictional Hazard Mitigation Plan. As a part of this planning effort, hazard mitigation plans were developed for all 27 incorporated cities and towns in the county.
- Maricopa County Emergency Operations Plan - The Emergency Operations Plan closely follows the NIMS, which was established by the DHS to ensure a common disaster

response framework throughout the nation. The plan has been coordinated with the SERRP and the emergency operations plans of the cities and towns in Maricopa County.

- Homeland Security - Assists in the development of the Central Region's (Maricopa County) homeland security strategy and helps cities, towns, tribes, and independent fire districts integrate into the strategy. MAG assists in complying with the mandatory rules and procedures needed to receive the DHS grant funds critical to establishing and maintaining the capacity to prevent or respond to terrorist events.
- Disaster Planning - Provides assistance in disaster planning as well as mass casualty management exercises and drills for hospitals, nursing homes, and school districts in Maricopa County.
- Disaster Assistance – Provides support in the damage assessments that follow a disaster to determine eligibility for state and federal assistance. Affected county and city/town agencies are briefed, and Local Assistance Centers are opened, if necessary, to aid local jurisdictions and individuals in recovering from losses incurred during the disaster.

MAG 9-1-1 Emergency Telephone Number

In the late 1970s, MAG formed a committee to implement the 9-1-1 emergency telephone number system in Maricopa County. This system became operational on September 9, 1985. A MAG Committee comprised of public safety managers meets regularly to make recommendations on operational issues, and to guide the purchase of new equipment to ensure system compatibility. The City of Phoenix serves as the contract agent for the system.

In January 2003, MAG was awarded a contract by the Arizona Department of Environmental Quality to establish and operate the Community Emergency Notification System/Reverse-911, which allows emergency agencies within the MAG 9-1-1 service area to notify citizens by telephone (in English or Spanish) of evacuations, security threats, or other emergencies. The system became operational on January 1, 2004. In 2017, there were 3.1 million 9-1-1 calls processed in the MAG region. In April 2018, Text to 9-1-1 was made available to the MAG region. The launch of this service is the result of the collaborative efforts of MAG, Maricopa Region 9-1-1, and other public agencies working with members of the disability community, the Arizona Center for Disability Law, and the National Association of the Deaf. While voice calling is preferred, texting will provide another option to save lives. In the MAG Region, 9-1-1 utilizes multiple fiber networks, including the Regional Community Network owned by MAG member agencies. The Regional Community Network was initially utilized for transportation purposes but is now also used to provide redundancy for 9-1-1 calls to ensure public safety.

Valley Metro/Regional Public Transportation Authority

Valley Metro manages the safety and security of light rail, bus, paratransit, dial-a-ride, and vanpool customers. Valley Metro's Safety, Security, and Quality Assurance Division establish

requirements for the identification, evaluation, and minimization of safety and security risks during revenue transit operations. The division oversees the construction and testing of service, rail line extensions, and related facilities. They develop and administer provisions of the System Safety Program Plan, System Security Plan, Safety and Security Management Plan, and Security and Emergency Preparedness Plan. Valley Metro has increased security personnel presence and the use of modern security-related technologies that assist in securing the system and facilities. Valley Metro's light rail safety and security programs were developed in cooperation with the ADOT, the designated State Oversight Agency for light rail in Arizona.

The FTA and the DHS work with transit providers across the country to develop security measures to protect members of the transit public and transit system infrastructure. Valley Metro conducts periodic, project-related Transit Threat and Vulnerability Assessments. The assessments evaluate general threat conditions and potential vulnerabilities to attacks and include personnel interviews, site visits, and documentation review. System-wide Transit Threat and Vulnerability Assessments are conducted in conjunction with local law enforcement to address facilities and operational infrastructure and to enhance security practices, staffing, and technology. Additionally, Valley Metro partners with local, state, and federal law enforcement agencies to share information or intelligence that assist in the development of strategies and plans to keep passengers safe. Valley Metro conducts and participates in yearly and triennial audits to ensure plan effectiveness.

Future Security Program Efforts

This chapter provided an overview of agencies at the federal, state, and regional levels that address transportation security in the MAG Region. The United States, the federal government, the State of Arizona, and local governments coordinate to protect the nation's transportation networks, including roads, local and regional rail networks, passenger and freight terminals, port facilities, intermodal facilities, transportation infrastructure, and transit systems.

These agencies continue to refine transportation security measures and work toward closer cooperation, coordination, and integration of tasks to provide safe transportation networks and facilities throughout the United States. Although MAG does not currently have a direct role in federal and state transportation security policy decisions, MAG continues to maintain a supportive regional role for transportation security planning. As the regional Metropolitan Planning Organization, MAG provides a regional forum for security issues and continues to provide a high level of support for existing and ongoing transportation security measures.

CHAPTER TWENTY-THREE

TRANSPORTATION SYSTEM PERFORMANCE

The Fixing America's Surface Transportation (FAST) Act, signed into law on December 4, 2015, introduced transformative transportation regulations mandating a performance-based management approach of states and metropolitan planning organizations (MPOs) across the country. Consistent with federal rulemaking and state legislation, the development of the MAG Regional Transportation Plan (RTP) includes a performance-based planning and programming process. Since 2009, MAG has emphasized performance-based applications; initially establishing a Transportation System Performance Monitoring and Assessment Program and ongoing data collection, processing, and analysis. This program has developed reporting methodologies and web-based components, providing policymakers, technical users, and the public easy access to performance data and visualization tools.

Federal Performance Targets and Performance Reporting

The FAST Act provides the same transportation planning guidance contained in the Moving Ahead for Progress in the 21st Century (MAP-21). The Act increases funding by 11 percent over five years but maintains current program structures and funding shares between highway and transit, allowing state and local governments to plan and finance projects with greater certainty through 2020.

The FAST Act reforms federal transportation programs, streamlining the approval process for new transportation projects by providing additional safety tools and establishing new programs to advance critical freight projects. The requirements are: (1) coordination between states and metropolitan areas and between the public and private sectors, (2) linkages and connections between different forms of transportation, (3) recognition of environmental mitigation considerations, and (4) broad participation to ensure that decisions will be responsive to local needs. In addition, FAST emphasizes a performance-based approach to transportation decision-making, establishing performance targets, and integrating state departments of transportation (DOTs) and public transit operators' targets into the metropolitan planning process.

USDOT/FHWA Rulemaking

The U.S. DOT/Federal Highway Administration (FHWA) final rulemaking includes: The Highway Safety Improvement Program (HSIP), the Safety Performance Measures, and Statewide and Metropolitan Planning Rule, the Pavement and Bridge Condition Performance Measures, Asset Management, and the System Performance Freight Movement and Congestion Mitigation and Air Quality (CMAQ) Program Performance Measures Rules.

The Federal Transit Administration (FTA) and FHWA jointly published the final rule on Statewide and Metropolitan Transportation Planning on May 27, 2016.

USDOT/FTA Rulemaking

FTA published the final rule on Transit Asset Management (TAM), effective October 1, 2016, the Public Transportation Agency Safety Plan Rule was issued July 19, 2018, and the State Safety Oversight Final Rule in March 2016. These rules establish new requirements for MPOs to coordinate with transit providers, set or support performance targets, and integrate performance targets and plans into planning documents. MAG will continue to follow transportation planning concepts as included in the FAST Act, and coordinate with transit partners to follow performance based planning and programming criteria and principles.

MAG Target-Setting Activities

The Statewide and Metropolitan Planning Rule (Title 23 CFR Part 450.306(d)(3)) states: "each MPO shall establish the performance targets under paragraph (d)(2) of this section not later than 180 days after the date on which the relevant state or provider of public transportation establishes the performance targets." Targets must be established pursuant to rulemaking as described previously. Federal regulations also require that "the transportation plan shall include a transportation system performance report and subsequent report updates evaluating the condition and performance of the transportation system with respect to the performance targets described in 450.306(d)."

Safety Targets

In March 2016, FHWA announced the Final Rule for Road Safety Performance that specified five road safety performance measures. The Rule requires every state to establish and report on road safety performance measures and road safety targets for each of the measures. The first report for calendar year 2018, was due to FHWA by August 31, 2017, and is due annually thereafter.

The five safety performance measures specified by FHWA are: (1) number of fatalities, (2) rate of fatalities – fatalities per 100 million vehicle miles of travel, (3) number of serious injuries – all injuries classified as incapacitating/suspected serious injury, (4) rate of serious injuries – serious injuries per 100 million vehicle miles of travel, and (5) total of non-motorized fatalities and non-motorized serious injuries – total deaths and serious injuries involving pedestrians or bicyclists.

The Arizona Department of Transportation (ADOT) submitted the second report to FHWA for calendar year 2019, identifying statewide safety targets for each of the measures listed above. The Final Rule stipulates that each MPO must either (1) adopt statewide targets, or (2) establish similar measures and targets specific to their MPO planning area for the five performance measures within 180 days after the State establishes targets.

On September 26, 2017, and January 22, 2019 the MAG Transportation Safety Committee reviewed the proposed statewide safety performance targets for 2018 and 2019 (Table 23-1), unanimously recommending that MAG support them in compliance with FHWA rulemaking. The ADOT-developed Calendar Year 2018 statewide safety targets were approved on December 6,

2017, by the MAG Regional Council and the updated 2019 targets were approved on February 27, 2019. Respective letters to ADOT indicating support were submitted as required, meeting both FHWA deadlines.

**TABLE 23-1
STATEWIDE AND MAG MPO SAFETY TARGETS**

Safety Performance Measure	2018 Statewide Target	2018 MAG Target	2019 Statewide Target
Number of Fatalities	935	460	1,105.1
Rate of Fatalities per 100 Million VMT	1.41	1.28	1.507
Number of Serious Injuries	4,330	2,701	4,006
Rate of Serious Injuries per 100 VMT	6.55	7.18	5.610
Number of Non-motorized Fatalities + Non-motorized Serious Injuries	790	506	871

Asset Management Targets

On May 20, 2017, the FHWA’s final rules establishing performance measures for DOTs and MPOs took effect. The rule, published in the Federal Register on January 18, 2017 (82 Fed. Reg. 5886), establishes performance measures for pavement and bridges on the National Highway System (NHS) and requires the development of targets that support the management of this infrastructure in a state of good repair. The four pavement performance targets as specified by FHWA are: (1) percent of interstate pavements in good condition, (2) percent of interstate pavements in poor condition, (3) percent of non-interstate NHS pavements in good condition, and (4) percent of non-interstate NHS pavements in poor condition. The two bridge performance targets as specified by FHWA are: (1) percent of NHS bridges classified as in good condition (based on deck area), and (2) percent of NHS bridges classified as in poor condition (based on deck area).

ADOT established targets corresponding to the measures identified for interstate and non-interstate NHS pavement and bridge conditions throughout Arizona, including the locally owned NHS facilities in the MAG Region. Locally-owned NHS roads comprise about 3.4 percent of the State’s non-interstate NHS routes. Supporting ADOT’s performance targets eliminates the need to engage in a complex data normalization and target-setting effort for a small amount of roadway. ADOT’s performance targets maintain 96 percent of bridges, 98 percent of interstate pavements, and 94 percent of non-interstate pavements in good or fair condition. On November 28, 2018, MAG’s Regional Council supported the Statewide Bridge and Pavement Targets; a letter to ADOT indicating support was submitted as required, meeting the FHWA deadline.

**TABLE 23-2
STATEWIDE ASSET MANAGEMENT TARGETS**

Interstate Pavement	Statewide Current	ADOT 2- and 4-yr Target
Good Condition	52%	48%
Poor Condition	1%	2%
Non-Interstate Pavement	Statewide Current	ADOT 2- and 4-yr Target
Good Condition	37%	31%
Poor Condition	2%	6%
NHS Bridges	Statewide Current	ADOT 2- and 4-yr Target
Good Condition	56.4%	52%
Poor Condition	1.6%	4%

System Performance/Freight/CMAQ Targets

On May 20, 2017, the FHWA’s final rule established performance measures for DOTs and MPOs. This rule, published in the Federal Register on January 18, 2017 (82 Fed. Reg. 5970), establishes performance measures that DOTs and MPOs are required to report on: the system performance of the interstate and non-interstate NHS for the National Highway Performance Program (NHPP); freight movement on the Interstate system for the National Highway Freight Program (NHFP); and on-road mobile source emissions and traffic congestion for the CMAQ Program.

The joint establishment of the following unified targets is required from MPOs and DOTs: (1) percent non-single occupancy vehicle travel (Non-SOV), and (2) peak hours of excessive delay per capita (PHED). The non-unified targets, for which MPOs have the option of developing targets specific to the Metropolitan Planning Area (MPA) are: (1) system travel time reliability (TTRM) for interstate and non-interstate NHS, and (2) freight reliability (TTTR) for interstate.

MAG and ADOT developed collaborative methodologies to calculate targets and continue to integrate technical data sources and analytic procedures supporting target setting and annual reporting. In compliance with reporting requirements, target calculation results were submitted to FHWA. In addition, MAG is developing performance reporting tools for required plans and web-portals to comply with FAST Act regulations. The two unified recommended system performance targets for the MAG Region, the PHED and the percent non-SOV, are compatible with the statewide system targets established by MAG and ADOT. The TTRM, TTTR, and CMAQ proposed targets are specific to the MAG MPA, as well as the relevant nonattainment area, and meet all federal requirements.

MPOs, such as MAG, are required to set 2- and 4-year targets for the on-road mobile source emissions reduction measure. This requirement is imposed because it contains a portion or complete part of an area designated as nonattainment or maintenance for ozone, CO, or PM-10 and PM-2.5 National Ambient Air Quality Standards (NAAQS) that overlaps an urbanized area with a population of more than 1 million. The measures and targets reported in this chapter have been calculated using travel time data from the National Performance Management Research Data Set (NPMRDS), an annual national data set of average travel times, provided by the FHWA Office of Operations. Traffic, population, and air quality data sources are incorporated into the target setting analytical process.

**TABLE 23-3
STATEWIDE AND MAG SYSTEM PERFORMANCE/FREIGHT/NON-SOV TARGETS**

Measure	ADOT 2 Year Target	ADOT 4 Year Target	MAG 2 Year Target	MAG 4 Year Target
Truck Travel Time Reliability Index	1.21	1.23	1.50	1.55
Travel Time Reliability – Interstate System	86%	85.8%	65%	63%
Travel Time Reliability – Non-Interstate NHS	Not Required	74.90%	Not Required	59%
Peak Hour Excessive Delay Per Capita	Not Required	10.9 Hours	Unified Target	Unified Target
% Non-SOV Travel	22.9%	22.6%	Unified Target	Unified Target

**TABLE 23-4
STATEWIDE /MPO CMAQ EMISSION TARGETS**

Emission Targets (kg/day)	VOC	CO	NOx	PM-10	PM-2.5
2-Year Target (FY2018-2019)	210	3,720	418	873	69
4-Year Target (FY2018-2021)	385	6,985	761	1,399	112

Transit Targets - Valley Metro and the City of Phoenix

The MAG Region has two provider agencies required to identify performance measures and targets: the City of Phoenix and Valley Metro. Pursuant to the TAM Rule, FTA determined each

transit provider may define its own asset classes within an asset category reflecting their specific operating environments, if the transit agency is able to meet the performance measure target setting and the National Transit Database (NTD) reporting requirements of the final rule. This provision affords flexibility to transit providers to develop State of Good Repair (SGR) performance measures and targets. Nevertheless, the rule requires transit providers and sponsors to coordinate with states and MPO's to the maximum extent practicable in the selection of integrated State and MPO SGR performance targets to ensure consistency. ADOT, Valley Metro, and MAG cooperated in the establishment of local and regional targets. In June 2017, MAG reviewed reporting documents, including measures and targets from regional transit providers in compliance with the TAM Rule (Tables 23-A to 23-F). MAG policy committees reviewed and supported the performance targets as established by transit partner agencies.

**TABLE 23-A. RPTA
ROLLING STOCK – PERCENT OF REVENUE VEHICLES THAT HAVE MET THEIR USEFUL LIFE
BENCHMARK (ULB)***

<u>Performance Measure</u>	<u>2017 Target (%)</u>	<u>NA</u>
AB - Articulated Bus	0%	
BU - Bus	0%	
CU - Cutaway	0%	
VN - Vanpool vans	21%	
All others NA		X

*ULB is used to assess life cycles of capital assets based on expected service years, mileage, and/or condition.
Note: RPTA does not have any AB, BU or CU over 14yrs. 21% of VN are over 8 yrs.

**TABLE 23-B. VALLEY METRO RAIL
ROLLING STOCK – PERCENT OF REVENUE VEHICLES THAT HAVE MET/EXCEEDED THEIR
ULB**

<u>Performance Measure</u>	<u>2017 Target (%)</u>	<u>NA</u>
LR - Light Rail Vehicle (31 yrs)	0%	
OR - Other		X
SR - Streetcar Rail		X
VT - Vintage Trolley		X

Note: Zero of the LRVs exceed 31 years. Operations began in 2008

**TABLE 23-C. VALLEY METRO RAIL
EQUIPMENT - PERCENT OF SERVICE VEHICLES THAT HAVE MET/EXCEEDED THEIR ULB
(NON-REVENUE VEHICLES AND WORK TRUCKS) 8 YEARS**

<u>Performance Measure</u>	<u>2017 Target (%)</u>	<u>NA</u>
Automobiles		
Trucks and Other Rubber Tire Vehicles	14%	
Steel Wheel Vehicles		X

Note: 1 of 7 trucks has reached the useful life per TAM requirements.

**TABLE 23-D. VALLEY METRO RAIL
FACILITY - PERCENT OF FACILITIES RATED BELOW 3 (ADEQUATE) ON CONDITION**

<u>Performance Measure</u>	<u>2017 Target (%)</u>	<u>NA</u>
Passenger / Parking Facilities	2%	
Maintenance Facilities (OMC) 138,300 sq'	0%	

Note: There are 40 stations. Valley Metro Rail estimates they all will be maintained above a 3 on the TERM scale. Preventive maintenance activities keep the facilities above a 3.

**TABLE 23-E. VALLEY METRO RAIL
INFRASTRUCTURE - PERCENT OF TRUCK SEGMENTS WITH PERFORMANCE RESTRICTIONS**

<u>Performance Measure</u>	<u>2017 Target (%)</u>	<u>NA</u>
LR - Light Rail	10%	

Note: 14% of the guideway has had a performance restriction in the past 2 years. Estimated 10% performance restrictions for FY17. VMR anticipates it to be lower.

**TABLE 23-F. CITY OF PHOENIX TRANSIT
PERFORMANCE TARGETS BY ASSET CATEGORY**

Category	Class	Performance Measure	Performance Target	Performance Target Projections
Rolling Stock	Buses 40'	Age	0% of fleet exceeds default ULB of 14 years	9% of fleet exceeds default ULB of 14 years
	Buses 45" RAPID	Age	0% of fleet exceeds default ULB of 14 years	0% of fleet exceeds default ULB of 14 years
	Buses 60'	Age	0% of fleet exceeds default ULB of 14 years	0% of fleet exceeds default ULB of 14 years
	Cutaway Buses	Age	0% of fleet exceeds default ULB of 10 years	0% of fleet exceeds default ULB of 10 years
	Vans	Age	0% of fleet exceeds default ULB of 8 years	0% of fleet exceeds default ULB of 8 years
Equipment	Support Vehicles – PTD & TEU	Age	0% of non-revenue service vehicles* exceeds default FTA ULB of 8 years, 26.66% of non-revenue service vehicles exceeds default COP ULB of 10 years	76.66% of non-revenue service vehicles* exceeds default FTA ULB of 8 years, 26.66% of non-revenue service vehicles exceeds default COP ULB of 10 years
Facilities	Administration Facility (1)	Condition	0% of facilities rated under 3.0 on TERM scale	0% of facilities rated under 3.0 on TERM scale
	Maintenance Facility (GP-3)	Condition	0% of facilities rated under 3.0 on TERM scale	0% of facilities rated under 3.0 on TERM scale
	Passenger/Parking Facility (14)	Condition	0% of facilities rated under 3.0 on TERM scale	0% of facilities rated under 3.0 on TERM scale

Transit Targets - Arizona Department of Transportation

ADOT administers the FTA Sections 5305, 5307, 5310, 5311, and 5339 formula grant programs for the state. ADOT pools 5307 Urban Funds for areas of the state without transit services and makes the funding available through a competitive application process for all small urban areas in Arizona. Section 5339 Urban funds are also pooled and made available through a competitive application process. For 5310 funding, ADOT manages all funds apportioned to the state except

funds apportioned to the Phoenix-Mesa Urbanized Area. The City of Phoenix is the Direct Recipient of those funds. ADOT has assets in the Phoenix service area and inventories those assets until their useful life has been met and there is no federal interest remaining. The ADOT Multimodal Planning Division's Transit Group is responsible for ensuring the fair and equitable distribution of FTA funds; advertising the availability of funds; administering grant application processes and FTA funds; providing grant management guidance and technical assistance to applicants and grantees; administering and monitoring contracts; and, ensuring compliance with federal requirements by sub recipients. ADOT developed performance targets and measurements based on the transit assets held by sub recipients. The Transit Asset Management Group Plan is on the ADOT website at: www.azdot.gov/planning/transportation-planning.

Pursuant to FHWA/FTA rulemaking, MAG, ADOT, and regional providers of public transportation signed a Performance Measure Target Setting and Data Sharing Charter in June 2018, in compliance with the Statewide and Metropolitan Planning Rule (Title 23 CFR Part 450.306(d)(3)). MAG performance and environmental staff, in conjunction with ADOT's multimodal and performance measurement staff, was successful in meeting first generation target deadlines and submitted the results in FY 2018 to FHWA. To develop targets for the required measures, data processing, geographic network conflation, and system metrics and measures were developed and completed on schedule to meet MPO Baseline Period performance target reporting deadlines as required by FHWA. In addition, reporting of transit targets developed by grant recipients was successfully achieved working collaboratively with regional transit partners.

MAG Performance Monitoring Program

An extensive performance measurement and management program was developed with regional partner agencies and member jurisdictions. The program has been integral to the development of MAG's Unified Planning Work Program (UPWP). Based on robust data collection and processing, the program includes a series of analytic procedures, reporting methodologies, and web-based products, allowing policymakers, technical users, and the general public access to performance data and visualization.

In conjunction with the adoption of the MAG RTP in November 2003 and the passage of Proposition 400 in November 2004, the Arizona Legislature issued A.R.S. 28-6313, requiring the Auditor General to contract with a nationally recognized independent auditor to conduct a performance audit of the Regional transportation system beginning in 2010 and every five years thereafter. The second Performance Audit of the MAG RTP was initiated in April of 2016. The audit evaluated the RTP using data in table, chart, and map formats included in all of MAG's Performance Measurement Program products. MAG worked closely with the Auditor General's contractor providing all required information to comply with their requests. Recommendations included enhancements to existing web-based products, such as adding baseline budget and schedule information to the RTP Project Cards and linking transit performance measures to the MAGnitude Dashboard. A final RTP Performance Audit Report was published in November of

2016. A 10-month progress update was submitted to the auditing firm and in a final report to the Auditor General; the review concluded recommendations applicable to MAG were implemented, including the establishment of regional targets as mandated by the FAST Act.

Performance Applications in Planning

Proposition 400 legislation set forth factors to consider during the development of the MAG RTP, such as the impact of growth on transportation systems. Consistent with state legislation, the development of the MAG RTP includes a performance-based planning and programming process. The process establishes goals, objectives, and performance measures as a basis for evaluating potential scenarios for inclusion in the Plan. The goals and objectives adopted relate to the performance of the system as a whole and individual components of the multimodal system across freeway, arterial, and transit corridors.

The following are examples of MAG's goals with performance products that address them:

- **Goal:** "Provide a safe and secure environment for the traveling public, addressing roadway hazards, pedestrian and bicycle safety, and transit security."

Product: Tables and graphic analysis showing trends in total crashes for the major corridors of the urban freeway system in the MAG Region, as well as total injuries and fatalities on arterial facilities by mode. These data provide a reference for MAG programming activities involving member agencies as they factor safety into project prioritization and selection.

- **Goal:** "Maintain an acceptable and reliable level of service on transportation and mobility systems serving the Region, taking into account performance by mode and facility type."

Product: Tables, graphs, and interactive maps that allow the user to select a freeway or arterial corridor and choose a peak period to obtain results for measures of delay, congestion, or travel time index. The map is supported by companion charts, which track statistics through the day and a map depicting graphic gauges that compares percentage changes in performance between 2015 and 2017.

- **Goal:** "Provide the people of the Region with transportation modal options necessary to carry out their essential daily activities and support equitable access to the Region's opportunities."

Product: Regional maps and charts showing the location and extent of areas within walking distance of transit stops that provide high frequency service, and the population in those areas that fall below the poverty line.

MAG focuses on enhancing the Transportation System Performance Monitoring and Assessment Program by monitoring data sets, online tools, and publicly available information sources to provide quality products that meet or exceed industry standards.

Monitoring Current Conditions

The optimum combination of accuracy and detail for performance measurement is based on real-time observed data sources. This data provides information to assess the principal operating characteristics of the current transportation system and to establish a historical record that tracks performance trends over time. The parameters observed vary by transportation mode and must take into consideration the practicality and expense of collecting data on a continuing basis. A large amount of data is collected annually in the MAG Region related to the movement of people, goods, and services.

- Data Items - For roadway systems, data collected to assess current performance includes: vehicle counts at a sample of locations; vehicle densities along roadway segments; speeds and point-to-point travel times; delays; number and types of accidents; and, as a result of special studies, intersection queue lengths. For transit systems, common data items include: boardings and farebox revenues by route; on-board passenger loadings at points in the system; operating costs; and, service standards.
- Data Sources - Data from the ADOT Freeway Management System (FMS), which includes 158 centerline miles of the Regional freeway system, is collected in five-minute increments from loop and acoustic sensors that detect and record the movement of vehicles across a large portion of the MAG Region. Currently, the FMS instrumented portion covers approximately 56 percent of the freeway system. If the FMS system continues to grow, it will allow for future reliability performance calculations over the entire urban highway system. In the last two fiscal years, a significant number of sections of previously instrumented FMS freeway facilities have ceased to report data on a consistent basis. In addition, traffic count data is collected on arterial roadways through both permanent and temporary counting stations deployed by MAG member agencies as well as a MAG sponsored vehicle count program at select regional locations. Moreover, periodic studies are conducted to collect information such as the average number of people in cars, the proportion of trucks on the roadways, and levels of congestion on freeways and arterials.

MAG acquires traffic speed data for freeways and arterials from third party commercial sources. A major national private data provider is under contract with MAG to supply GPS-probe based speed data for all regional freeways and major arterials, thus supplementing the existing arterial and ADOT FMS freeway databases. Third party data allows the continuity and integrity of the data archive, enabling MAG to perform analysis on system and corridor performance from comprehensive data sources. Additionally, MAG established a partnership with the University of Maryland's Center for Advanced Transportation Technology Laboratory, which developed a data tool called The Regional Integrated Transportation Information System (RITIS).

- System-Wide Monitoring - Per capita freeway vehicle-miles of travel (VMT) is defined as the average number of freeway miles a vehicle in the Phoenix-Mesa Urbanized Area travels per day per person. This measure reflects vehicle travel trends for the Region. Table 23-1

lists the total number of freeway VMT each year during 2014 to 2017. Between 2014 and 2017, freeway VMT figures continue to trend upward, showing an increase of 5.8 percent; the level of VMT per capita in 2017 has also increased by 5.3 percent compared to 2016. Another system-wide monitoring result is displayed in Figure 23-1. The GPS-probe based speed data was used to depict the amount of time afternoon commuters may expect to lose, reflecting the difference between peak hour and free flow conditions.

**TABLE 23-5
PER CAPITA FREEWAY VMT for the PHOENIX/MESA URBANIZED AREA**

	2014	2015	2016	2017
Total Freeway VMT*	30,802,738	31,209,013	31,625,257	32,586,553
Population of Phoenix-Mesa Urbanized Area**	3,490,349	3,542,153	3,591,674	3,653,840
Per Capita Freeway VMT	8.83	8.81	8.81	8.92

*ADOT Highway Performance Monitoring System (HPMS) 2017 Draft

** ACS and Census 2010 (2017 Draft Estimate)

Roadway System Performance

A range of monitoring data on the performance of the roadway system in the MAG area have been collected over the years. Currently, traffic data is available for the MAG Region from studies and surveys completed within the last five years, as well as yearly ADOT FMS, private and public sector speed data. These data collection efforts have supported performance factors and have enabled analysis as well as historical comparisons.

Traffic Volume Data

The ADOT FMS provides count data on the mainline general purpose lanes and HOV lanes twenty-four seven and on ramps for the majority of the urbanized freeway system. Traffic counts are collected through 273 in-pavement loop detectors and 83 passive acoustic detectors (PADs). These feed directly to the Arizona AZ511 system, providing real-time traveler information. MAG’s performance programs and products do not include real-time data feeds as this data is generated at the ADOT’s Traffic Operations Center (TOC) and these data are more appropriate for traveler information than planning functions. For archive and analysis purposes, volume data are aggregated in periods from five minutes to 24 hours for weekdays and weekends. For the arterial system, MAG collects traffic data at over 770 stations using machine counts. Data are collected on weekdays every three to four years, over a 48-hour time period, and aggregated by 15-minute, hour, peak period, and 24-hour periods. Counts are conducted by direction at mid-block locations and approach locations throughout the Region. Data from the MAG count program undergoes data quality control checks; count data collected from other jurisdictions is subject to the same quality control checks. Since 2010, MAG has developed a web-based Traffic Data Management System, which is a repository of all available traffic counts, turning movement counts and travel time databases.

Figure 23-1: PM Peak Period Average Delay on Arterial Roadways

2040 Regional Transportation Plan

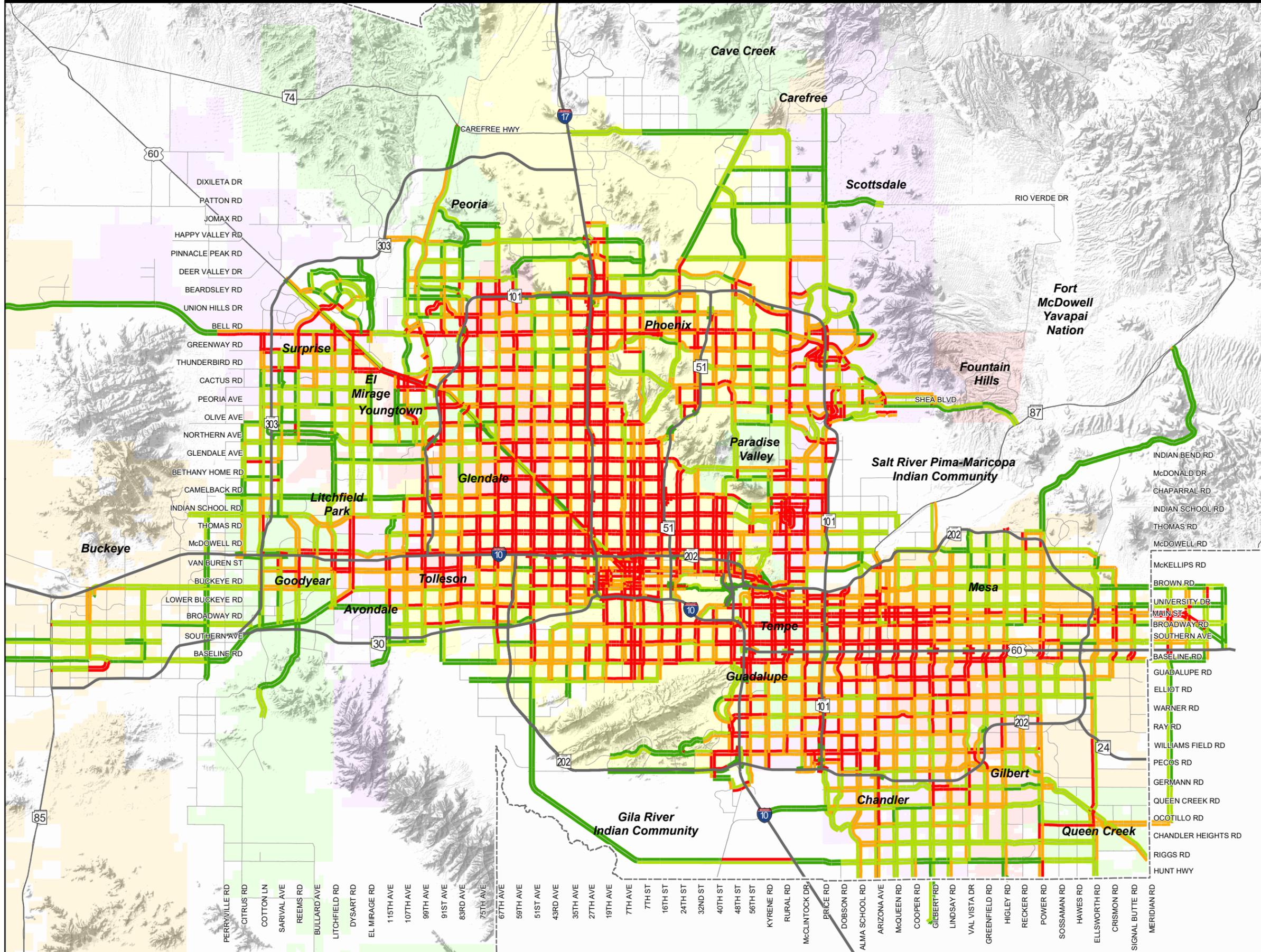
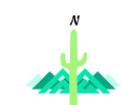
**Average Delay
(seconds per mile)
3PM - 7PM (2017)**

- 0 - 10
- 10 - 20
- 20 - 30
- 30+
- Freeways
- Highways
- Other Roads
- County Boundary

Delay calculated in seconds per mile relative to free flow speed, which can vary from year to year.

Alignments for new freeway, highway, arterial, and light rail/high capacity transit facilities will be determined following the completion of appropriate design and environmental studies.

Disclaimer: While every effort has been made to ensure the accuracy of this information, the Maricopa Association of Governments (MAG) makes no warranty, expressed or implied, as to its accuracy and expressly disclaims liability for the accuracy thereof.

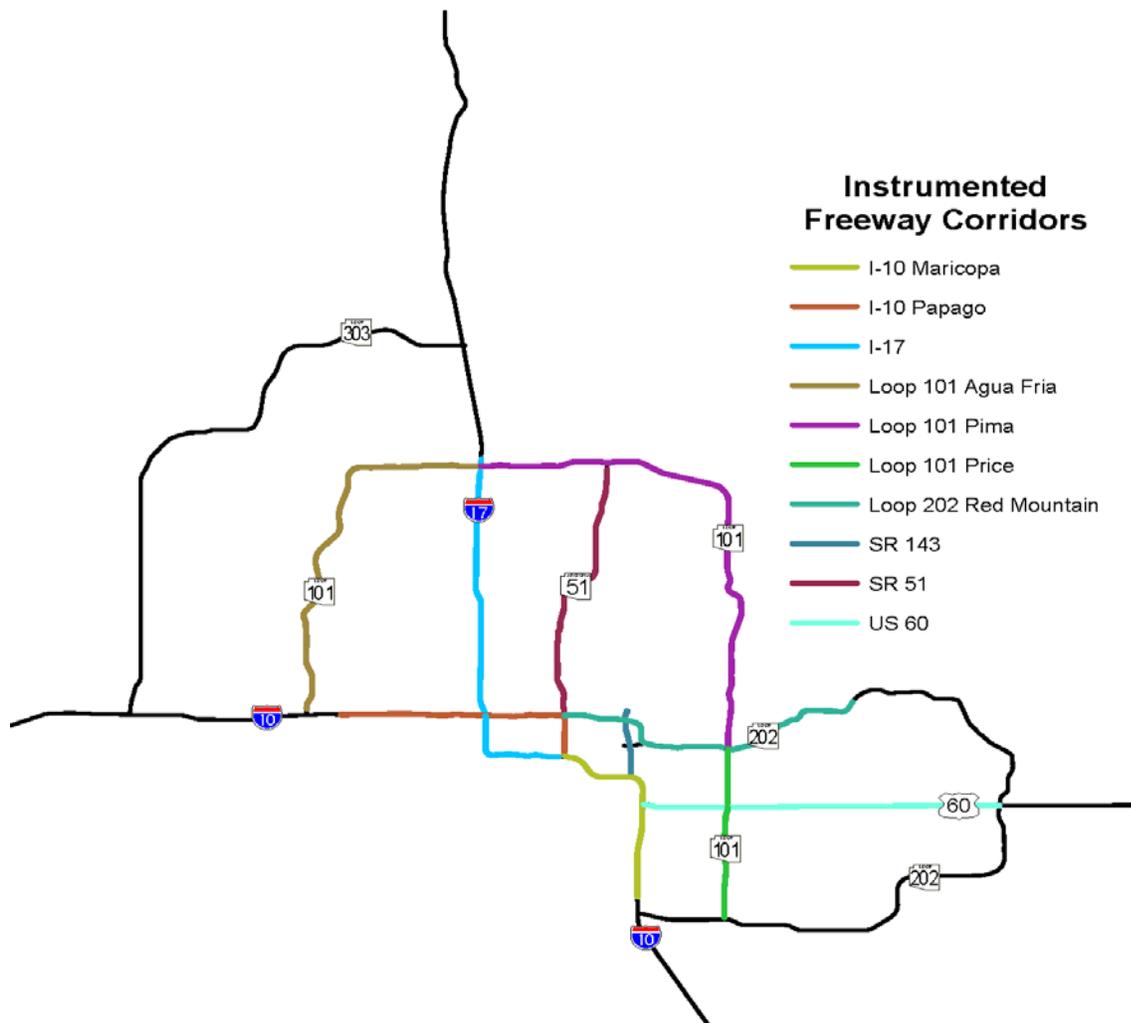


Travel Time Data

The Travel Time Index (TTI) is a measure of average travel times during congestion compared to during light traffic. For example, a value of 1.30 TTI means that a 20-minute trip at free flow speeds takes 30 percent longer, or 26 minutes in the peak hours.

Figure 23-2 depicts the location of the Regional freeway segments instrumented by ADOT with traffic detectors. These corridors are all within the NHS within the MAG Region. Speed and volume data collected from these segments is the basis for throughput and VMT calculations for measures and targets. Appendix Table G-1 provides a detailed listing of the calculated TTI's for the AM and PM commuting peak periods on the instrumented freeway corridors, based on 2016 and 2017 ADOT FMS data.

**FIGURE 23-2
SELECTED FREEWAY CORRIDORS**



The 2017 peak period TTI values generally are stable, with fluctuations of a few percentage points. There are some exceptions: an AM period on westbound I-10 between SR-202 Santan and US-60 experienced an increase of 3.8 percent, and an AM period on southbound SR-51 segment between Glendale Avenue and I-10 increased by 4.0 percent. An example of a segment that notably improved PM period travel times is westbound I-10 between SR-51 and I-10, registering a decrease of 6.0 percent. Another important AM period improvement has been observed on northbound SR-101 between SR-202 and Pima Road, with travel times decreasing by 7.0 percent, likely attributable to the capacity improvement project completed in FY 2017. On the northbound SR-101 Price between US-60 and SR-202 Red Mountain, AM period travel times increased by 6.7 percent. Overall, the highest percent changes in travel time indices between 2016 and 2017 are observed during the PM peak periods. Two corridors that experienced significant service level declines are: northbound SR-101 between Pima Road/90th Street and Pima Road/Princess Drive, experiencing increased travel times by 7.4 percent and eastbound SR-202 Santan between SR-101 Price and Lindsay Road registering a 6.1 percent decline. As a whole, the percent increases in travel times comparing 2016 and 2017 are moderate across the freeway system; the most significant differences are observed in the direction of central locations with higher concentrations of job destinations near the urban core.

Speed Data

The three principal, most comprehensive sources of speed data for the MAG Region are: the private sector databases (acquired by MAG starting in 2010), ADOT's FMS permanent count detector database, and the NPMRDS, made available to States and MPOs by the FHWA. The source for private sector and national traffic data is probe GPS-equipped vehicles and other mobile consumer devices. The significant benefit of these products is the consistency in reporting, as well as the full coverage of the MAG freeway and major arterial network. Speed data for the instrumented portions of the freeway system is also available through the ADOT Transportation Planning Division traffic detector stations.

Appendix Tables G-2 and G-3 depict changes in average speed for freeway corridors monitored by ADOT's FMS System between 2016 and 2017. General purpose lanes maintained morning peak period average speeds in 2017, with the exception of southbound I-17 between Peoria Avenue and I-10 and westbound US-60 between Val Vista Drive and SR-101, where speeds decreased 7.5 percent and 5.8 percent respectively compared to 2016. Conversely, the following segments have experienced increased morning period HOV lane speeds: northbound SR-51, between I-10/SR-202 and Glendale Avenue at 8.6 percent higher speeds and northbound I-17 between I-10 and Peoria Avenue at 6.4 percent improvement; both figures compare 2016 and 2017 data.

During the 2017 afternoon peak period, the freeway system maintained stable speed conditions compared to 2016. A few segments with general-purpose lanes located within the urban core corridors are the exception: southbound SR-101 between SR-202 Red Mountain and US-60 where speeds declined by 11.3 percent, and northbound SR-51 between I-10/SR-202 and Glendale Avenue experiencing declines of 14.5 percent. A significant improvement in HOV lane speeds was observed on southbound I-17 between Peoria Avenue and I-10, an increase of 5.2 percent.

Congestion Measures and Trends

Two of the most common measures of congestion are TTI and Planning Time Index (PTI). TTI is the measure of how long it will take to drive a segment of road, compared to how long it would take if there were no congestion. PTI is calculated on the 95th percentile travel time, indicating how much extra time to build in to be on time to work 95 percent of the time. PTI is the principal measure of the reliability of the travel time on a given roadway. Performing analysis over consecutive years makes it possible for decision makers to see year-to-year comparisons and evaluate trends.

FIGURE 23-3A
CONGESTION CHARTS - 2015 & 2017

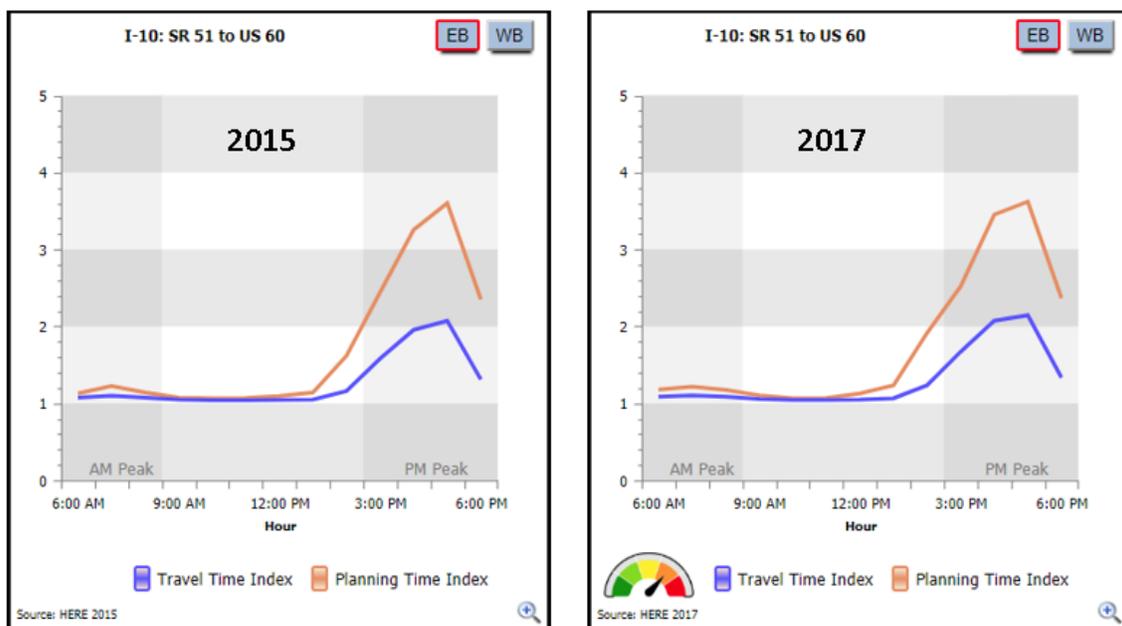


Figure 23-3A and 23-3B are examples of the TTI and PTI trend charts available on the MAG Performance Dashboard, comparing congestion changes over the period from 2015 to 2017. The 2017 chart includes a TTI dashboard gauge that communicates trends. These same measures are used system-wide to communicate how well capacity on freeways and arterials is keeping up with demand. Figure 23-5 shows system summary graphics comparing key measures for freeways and arterials.

The complete set of trend charts sampled in Figures 23-3A and 23-3B is available on the MAG Performance Dashboard, comparing congestion changes over the period from 2015 to 2017. Figure 23-3A shows a segment of eastbound I-10; the calculated TTI deteriorated for this segment experiencing a percent change of 4.1 for the PM peak period between 2015 to 2017; nevertheless, the PTI remained relatively stable at 3.6. Additional comparative information for the remainder of the freeway corridors can be found in MAGitude at <http://performance.azmag.gov/Default.aspx>.

**FIGURE 23-3B
CONGESTION CHARTS, 2015 & 2017**

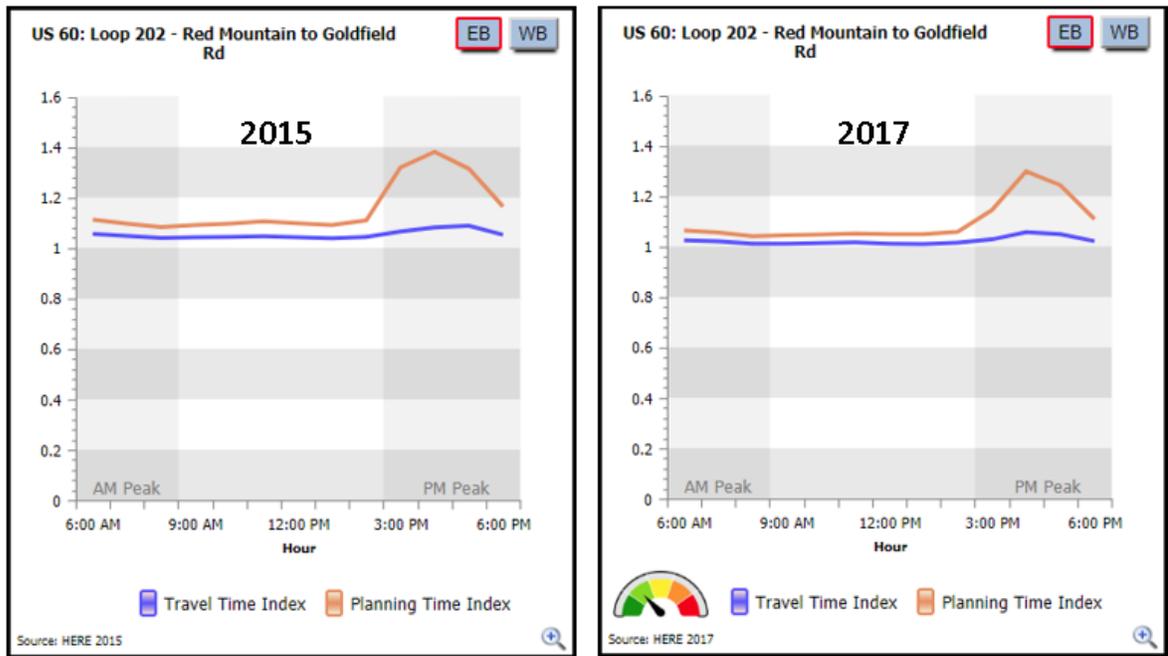


FIGURE 23-4 LEGEND

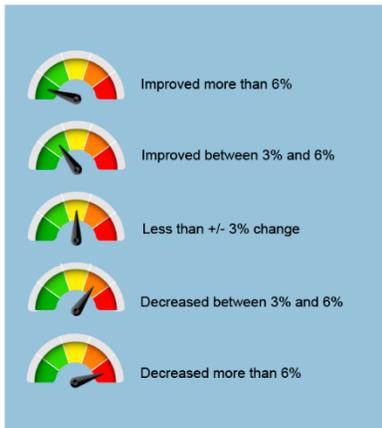


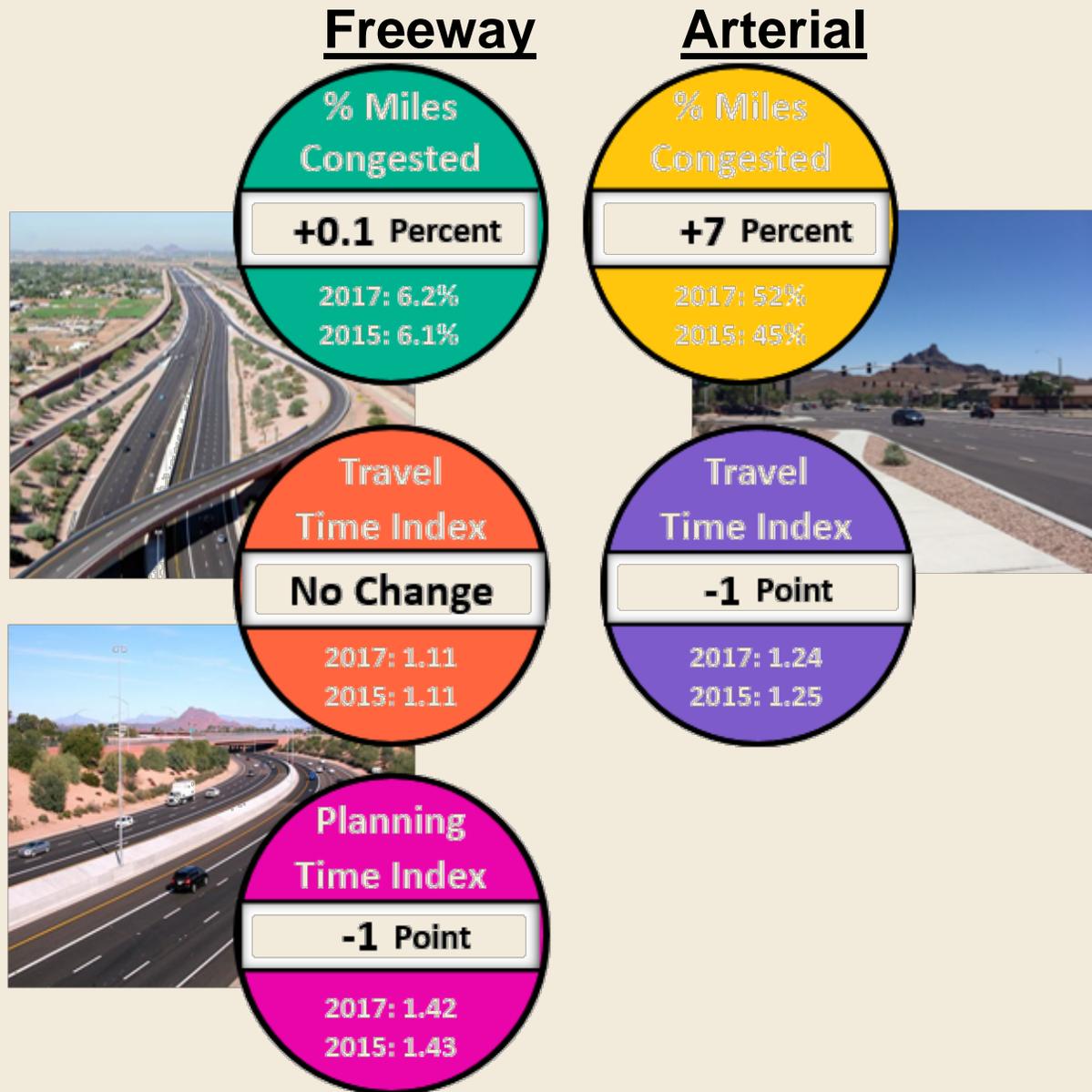
Figure 23-3B shows a segment of eastbound US-60 between SR-202 Red Mountain Freeway and Goldfield Road. The calculated TTI for the PM peak period remained stable for this particular segment; conversely, the PTI has significantly improved along this corridor since 2015, experiencing a reduction from 1.4 to 1.3, which represents a moderate savings of planning time on this 7.5 mile corridor. Figure 23-4 depicts a TTI dashboard gauge legend that graphically communicates trends.

Transit System Performance

MAP-21 and the FAST Act include new federal requirements for FTA grantees to prioritize investments in transit assets to bring their systems into an SGR. FTA issued a final TAM rule, 49 CFR parts 625 and 630, SGR on July 26, 2016, which implements regulations to establish a National Transit Asset Management system and became effective October 1, 2016. FTA grantees and their sub-recipients are required to develop and implement a TAM Plan within two years of the rules effective date that includes, at a minimum: capital asset inventories, condition assessments, and investment prioritization. Additionally, recipients of FTA formula funding are required to report on system condition, changes in condition since the last report, targets set using FTA performance measures, and progress towards meeting the targets.

FIGURE 23-5

System Wide Congestion Trends



Transit Asset Management System

A systematic process of administration, operating, maintaining, and improving transit capital assets effectively throughout the life cycles of those assets includes:

- Transit Asset Management Plan – A plan that includes an inventory of capital assets, describes the methodology for condition and risk assessments of each asset and provides guidance for each group of assets throughout their life-cycle. It identifies and provides strategies for implementing the business practices needed to maximize the value of having a TAM System. Additionally, the plan must contain the required elements as described in FTA’s 49 CFR part 625 Subpart C.
- Inventory - A record of an individual asset containing specific asset attributes such as description, cost, age, location, and other key information.
- State of Good Repair (SGR) – A condition during which an asset can provide its intended utility, within specifications, under normal operating conditions. FTA Rules require grantees to prioritize investments in transit assets to bring their systems into an SGR. The regulations define what it means to be in an SGR, set objective standards for measuring the conditions of capital assets, and establish performance targets to attain an SGR.
- State of Good Repair (SGR) Database – A consolidated, central location for asset tracking data. Initially populated with baseline conditions and then continually updated through the daily/weekly/monthly/annual workflows identified in the TAM.
- Decision Support Tool – A means to analyze the data within the SGR database to assist in transparent and fact-based decisions.

Valley Metro Performance Monitoring

Two key components to transit performance monitoring are the Transit Performance Report (TPR) and the Ridership Report prepared by Valley Metro, the Regional Public Transportation Agency (RPTA). The TPR is updated annually and developed using input from, member agencies and the RPTA Board. The TPR is an important information source for the MAG Regional transportation planning process. This report also updates the Valley Metro Short Range Transit Plan. Valley Metro publishes an annual ridership report, which covers transit passenger ridership for all the operating agencies in the Region. The report includes annual weekday, Saturday, and Sunday ridership figures by select transit modes (bus, circulator, rural, and light rail). Principal performance measures include total boardings, boardings per mile, total number of riders, and revenue miles by route and by city. The full Transit Performance Report and The Valley Metro ridership report can be accessed from the Valley Metro Website (www.valleymetro.org).

Service Standards and Performance Measures

In 2006, Valley Metro hired a consultant to conduct a Service Efficiency and Effectiveness Study (SEES) and develop a series of performance measures. The SEES developed initial performance targets that compare between performance expectations and actual performance. These performance measures are being incorporated into the TPR and reported on the Transit Ridership Report and Dashboard. The SEES framework established a baseline of performance expectations for fixed route bus system-wide; fixed route bus at the route level; paratransit; and, light rail transit. A key goal of the performance targets is to ensure consistent service levels throughout the Region.

A Technical Advisory Group (TAG) made up of Valley Metro member agencies and MAG was formed in November 2012 and tasked with the development of Regional Transit Service, Facility Standards, and Performance Measures. Phase I was completed with Valley Metro Board adoption in November of 2013, and included service standards and service delivery goals and objectives. It also developed transit standards, initiated a performance measures review, and developed a fully documented process for transit service changes. Phase II, which was built upon the effort initiated as part of Phase I, was completed in December 2014. Phase II focused on the development of transit service performance measures, transit service thresholds, application principles, and implementation standards for new service. Valley Metro Board of Directors approved Phase II recommendations in December 2014. Phase III was initiated in December 2014 to establish standards and performance measures for regionally funded transit vehicles such as buses, light rail vehicles, and transit facilities such as bus stops and park and ride lots. Phase III was approved by the Valley Metro Board of Directors on June 16, 2016.

Performance Measures and Operating Results

The original performance measures developed during the Service Efficiency and Effectiveness Study are listed in Tables 23-5 through 23-7. These tables include actual operating results from 2015, 2016, and 2017 TPRs. The annual TPR provides information to the Boards of Directors and member cities concerning ridership, operating costs, fare revenue, and performance indicators for region-wide transit services.

As seen in Table 23-5, Light Rail Transit Performance Measures for 2018 show an increase in farebox recovery ratio, operating cost per boarding, subsidy and operating cost per revenue mile. Total boarding numbers and boardings per revenue mile significantly decreased; ADA on-time performance remained relatively the same. Table 23-6 depicts Fixed Route Bus Performance Measures. In 2018, there was a continued drop in farebox recovery ratio, from 15.4 percent in 2017 to 14.1 percent, while operating cost per boarding and subsidy per boarding increased. Operating cost per revenue mile and total boardings increased in 2018. With respect to Paratransit Performance Measures, Table 23-7 shows the farebox recovery ratio, which increased from 6.2 percent in 2017 to 6.7% in 2018; while 2018 saw an increase in operating cost per boarding and subsidy per boarding, operating cost per revenue hour dropped significantly, from \$104.12 in 2017 to \$77.85 in 2018.

**TABLE 23-6
LIGHT RAIL TRANSIT (LRT) PERFORMANCE MEASURES**

Measure	2016 Results	2017 Results	2018 Results
Cost Efficiency/Effectiveness			
Farebox Recovery Ratio	38.0%	32.0%	37.7%
Operating Cost per Boarding	\$2.25	\$2.51	\$2.73
Subsidy (Net Operating Cost per Boarding)	\$1.39	\$1.70	\$1.97
Operating Cost per Revenue Mile	\$12.05	\$12.48	\$13.05
Service Effectiveness			
Annual Total Boardings	15,574,737	16,511,841	15,786,911
Boardings per Revenue Mile	5.35	4.97	4.79
ADA On-time Performance	93.4%	93.3%	93.3%

Source: FY 2016, 2017, and 2018 Valley Metro Transit Performance Report

**TABLE 23-7
FIXED ROUTE BUS PERFORMANCE MEASURES**

Measure	2016	2017	2018
Cost Efficiency/Effectiveness			
Farebox Recovery Ratio	17.3%	15.4%	14.1%
Operating Cost per Boarding	\$4.53	\$5.02	\$5.40
Subsidy (Net Operating Cost per Boarding)	\$3.74	\$4.25	\$4.64
Operating Cost per Revenue Mile	\$7.96	\$7.74	\$7.81
Average Fare	\$0.79	\$0.77	\$0.76
Service Effectiveness			
Annual Increase in Total Boardings	-8.3%	-4.5%	3.8%
Annual Increase in Average Boardings Weekday	-6.9%	-6.6%	1.8%
Saturday	-6.8%	-4.8%	9.7%
Sunday	-6.2%	-2.4%	9.7%
Average Boardings per Revenue Mile	1.76	1.54	1.45

Source: FY 2016, 2017, and 2018 Valley Metro Transit Performance Report

**TABLE 23-8
PARATRANSIT PERFORMANCE MEASURES**

Measure	2016	2017	2018
Cost Efficiency/Effectiveness			
Farebox Recovery Ratio	7.6%	6.2%	6.7%
Operating Cost per Boarding	\$35.64	\$43.64	\$44.12
Subsidy (Net Operating Cost per Boarding)	\$32.95	\$40.95	\$41.47
Operating Cost per Revenue Hour	\$89.19	\$104.12	\$77.86
Service Effectiveness			
ADA On-time Performance	96.6%	96.7%	92.6%

Source: FY 2016, 2017, and 2018 Valley Metro Transit Performance Report

The modes covered by the TPR include fixed route bus, paratransit, and light rail transit. Fixed route bus service includes local routes, super grid routes (major arterials), express bus, circulators, rural connector routes, and shuttles. Since the adoption of service provision goals and standards in December 2014, Valley Metro has developed transit service performance measures and thresholds to evaluate transit operations. Transit service performance measures are intended to assess the effectiveness of transit operations in achieving the adopted system goals.

Performance Monitoring Program Outlook

Non-Traditional and Socioeconomic Reporting

To foster and advance transportation infrastructure in the Region to support economic growth and vitality, MAG's vision is to maximize efficiency and innovation in the practice of planning and programming activities. At the transportation system level, this enables access to jobs and educational opportunities, along with cultural and social activities. Federal legislation requires performance analysis to inform development of the Regional Transportation Plan. At MAG, performance-based programming guides project selection and prioritization so that funds are allocated based on data and analysis.

In addition to all of the above measures of performance and congestion, MAG has started to explore non-traditional performance measures. The goal is to examine the extent to which the Regional transportation system provides access to employment and other regional activity centers for those who have the greatest need. For this purpose, the Performance Measurement Program utilizes US Census data and other national and regional databases that analyze accessibility and mobility for households with lower incomes and no vehicle availability.

The MAG Transportation System Performance Monitoring and Assessment Program was established to provide a framework for reporting performance at the system and corridor levels, and serves as a repository of historical, simulated, and observed data for the transportation system in the MAG Region. In light of MAP-21 and FAST Act legislation, this program has reached an important level of development and is poised to serve as the performance measurement and management component in the planning and programming activities at MAG. A major goal of the program is to continue communicating measures related to mobility and accessibility in the MAG Region and to provide the public with timely and relevant information on the performance of the multimodal transportation system.

CHAPTER TWENTY-FOUR

AIR QUALITY CONFORMITY

As required by the Clean Air Act, an air quality conformity analysis was conducted by MAG on the Draft FY 2020-2024 MAG Transportation Improvement Program (TIP) and the Draft 2040 MAG Regional Transportation Plan Update (RTP). The conformity analysis demonstrates that the TIP and RTP are in conformance with regional air quality plans and will not contribute to air quality violations. A description of the conformity requirements, conformity tests, and results of the 2020 MAG Conformity Analysis are summarized below. The 2020 MAG Conformity Analysis supports a finding of conformity for the FY 2020-2024 MAG TIP and 2040 MAG RTP Update.

Conformity Requirements

The federal transportation conformity rule (40 Code of Federal Regulations Parts 51 and 93) specifies criteria and procedures for conformity determinations for transportation plans, programs, and projects and their respective amendments. Under the federal transportation conformity rule, the principal criteria for a determination of conformity for transportation plans and programs are:

- The TIP and RTP must pass an emissions budget test with a budget that has been found to be adequate or approved by EPA for transportation conformity purposes, or interim emissions tests.
- The latest planning assumptions and emission models in force at the time the conformity analysis begins must be employed.
- The TIP and RTP must provide for the timely implementation of transportation control measures (TCMs) specified in the applicable air quality implementation plans.
- Consultation generally occurs at the beginning of the conformity analysis process; on the proposed models, associated methods, and assumptions for the upcoming analysis and the projects to be assessed; and at the end of the process, on the draft conformity analysis report. The final determination of conformity for the TIP and RTP is the responsibility of the Federal Highway Administration and the Federal Transit Administration.

The conformity tests specified in the federal transportation conformity rule are: (1) the emissions budget test, and (2) interim emissions tests. For the emissions budget test, projected emissions for the TIP and RTP must be less than or equal to the motor vehicle emissions budget specified in the approved air quality implementation plan or the emissions budget found by EPA to be adequate for transportation conformity purposes. If there is no approved air quality plan for a pollutant for which the region is in nonattainment or no emissions budget found to be adequate for transportation conformity purposes, interim emissions tests apply.

Maricopa Nonattainment and Maintenance Areas

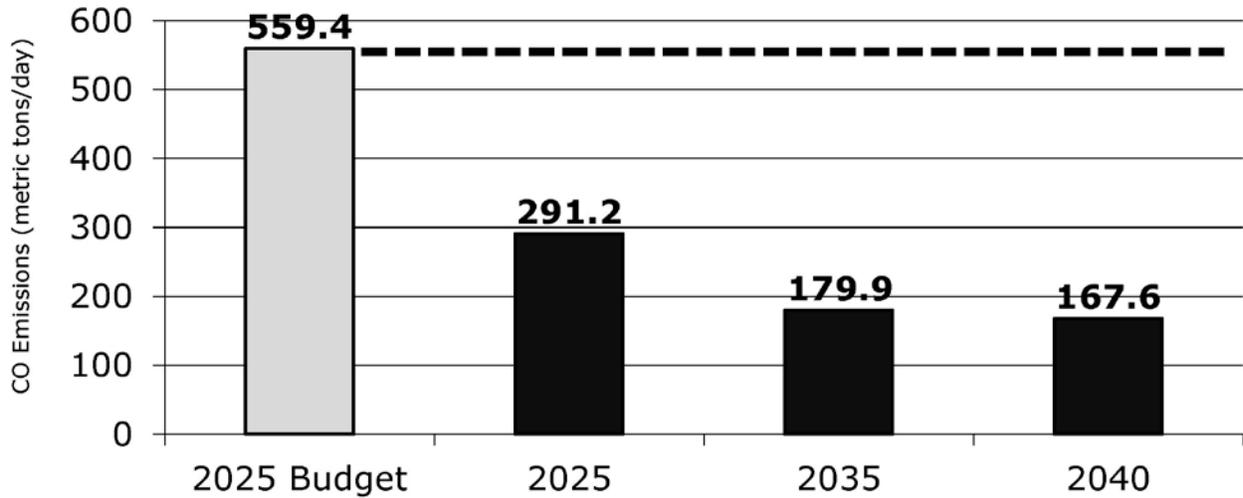
For the 2020 MAG Conformity Analysis, for carbon monoxide the emissions budget test was applied using the approved conformity budget from the MAG 2013 Carbon Monoxide Maintenance Plan. For eight-hour ozone, emission budget tests were applied using the approved conformity budgets from the MAG 2007 Eight-Hour Ozone Plan and MAG 2009 Eight-Hour Ozone Maintenance Plan. For PM-10, the emission budget test was applied using both the approved budget from the MAG 2012 Five Percent Plan for PM-10 and the approved budget from the Revised MAG 1999 Serious Area Particulate Plan for PM-10.

For the 2020 MAG Conformity Analysis, a regional emissions analysis was conducted for carbon monoxide and PM-10 for the years 2025, 2035, and 2040. For the eight-hour ozone precursors (volatile organic compounds and nitrogen oxides) a regional emissions analysis was conducted for the years 2020, 2025, 2035, and 2040. All analyses were conducted using the latest planning assumptions and emissions models in force at the time the conformity analysis started on October 23, 2019. The major conclusions of the 2020 MAG Conformity Analysis are:

- For carbon monoxide, the total vehicle-related emissions associated with implementation of the TIP and RTP for the analysis years 2025, 2035, and 2040 are projected to be less than the approved 2025 emissions budget. The applicable conformity test for carbon monoxide is therefore satisfied. The results of the regional emissions analysis for carbon monoxide are presented in Figure 24-1.
- For eight-hour ozone, the total vehicle-related volatile organic compound and nitrogen oxide emissions associated with implementation of the TIP and Regional Transportation Plan for the analysis year of 2020 are projected to be less than the approved 2008 emissions budgets, and the total vehicle-related volatile organic compound and nitrogen oxide emissions for the analysis years of 2025, 2035, and 2040 are projected to be less than the approved 2025 emissions budgets. The applicable conformity tests for eight-hour ozone are therefore satisfied. The results of the regional emissions analysis for eight-hour ozone are presented in Figures 24-2 and 24-3.
- For PM-10, the total vehicle-related emissions associated with implementation of the TIP and Regional Transportation Plan for the analysis years of 2025, 2035, and 2040 are projected to be less than the approved 2012 emissions budget and the approved 2006 emissions budget. The conformity test for PM-10 is therefore satisfied. The results of the regional emissions analysis for PM-10 are presented in Figure 24-4.
- A review of the implementation status of TCMs in applicable air quality plans has indicated the TIP and RTP will provide for the timely implementation of the TCMs and there are no obstacles to the implementation of any TCM.
- Consultation has been conducted in accordance with federal requirements.

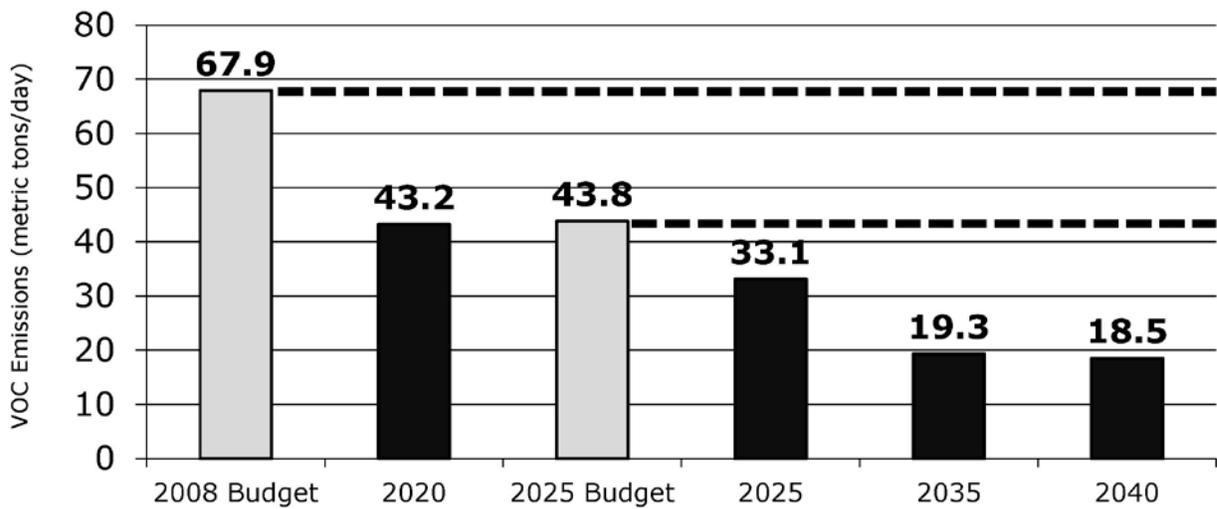
**FIGURE 24-1
CARBON MONOXIDE RESULTS FOR CONFORMITY BUDGET TEST
MARICOPA COUNTY NONATTAINMENT AND MAINTENANCE AREAS**

CO Season Average Weekday



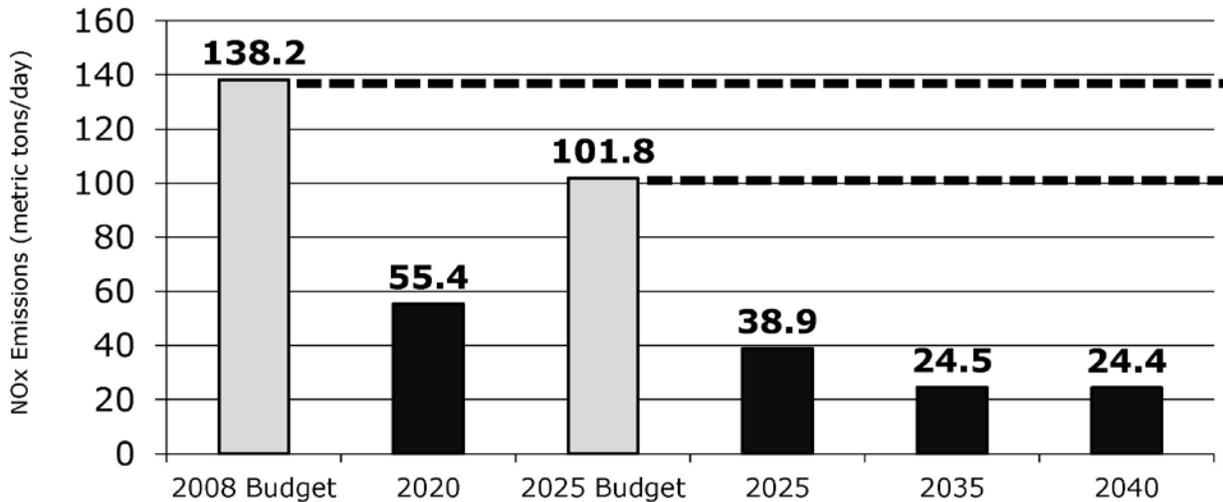
**FIGURE 24-2
8-HOUR OZONE: VOLATILE ORGANIC COMPOUNDS (VOC) RESULTS FOR CONFORMITY
BUDGET TEST, MARICOPA NONATTAINMENT AND MAINTENANCE AREAS**

Thursday in June: Episode Day Conditions



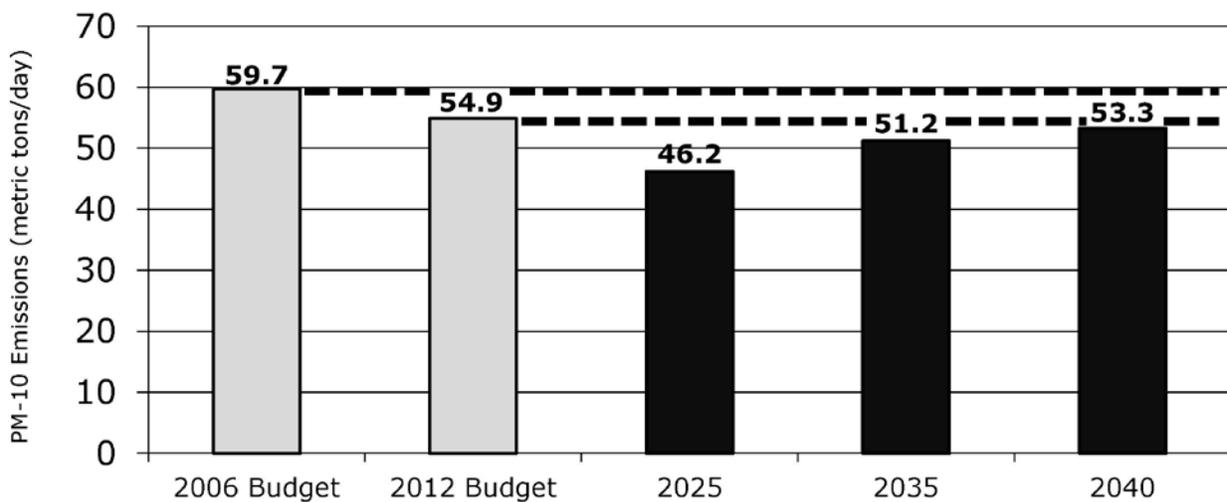
**FIGURE 24-3
EIGHT-HOUR OZONE: NITROGEN OXIDES (NOX) RESULTS FOR CONFORMITY
BUDGET TEST, MARICOPA NONATTAINMENT AND MAINTENANCE AREAS**

Thursday in June: Episode Day Conditions



**FIGURE 24-4
PM-10 RESULTS FOR CONFORMITY BUDGET TEST
MARICOPA COUNTY NONATTAINMENT AND MAINTENANCE AREAS**

Annual Average Day Conditions



The conformity results are shown compared with the 2006 budget from the Revised MAG 1999 Serious Area Particulate Plan for PM-10 approved by the EPA on July 25, 2002 and the 2012 budget from the MAG 2012 Five Percent Plan for PM-10 approved by the EPA on June 10, 2014.

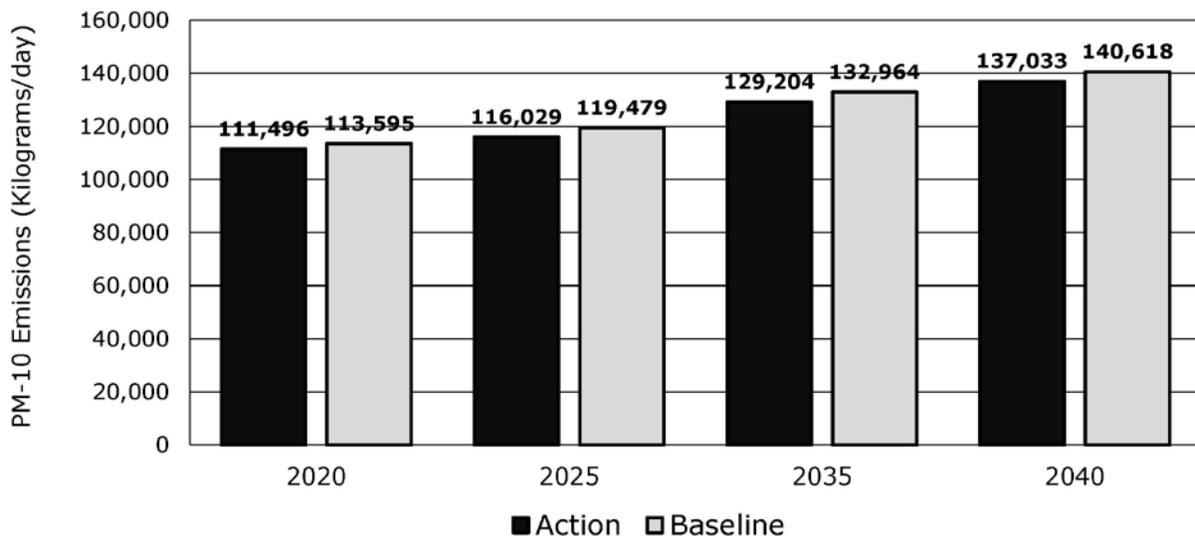
Pinal County Nonattainment Areas

For the Pinal County nonattainment areas, there are no adequate or approved motor vehicle emissions budgets for conformity. Therefore, the conformity interim emissions tests were applied. The action/baseline tests were conducted for PM-10 for the West Pinal PM-10 Nonattainment Area and for PM-2.5 and NOx for the West Central Pinal PM-2.5 Nonattainment Area for the analysis years of 2020, 2025, 2035, and 2040.

For PM-10 (Figure 24-5), for each analysis year the projected emissions for the action scenario are not greater than the projected emissions for the baseline scenario. Since the PM-10 emissions projected for the action scenarios are not greater than the PM-10 emissions projected for the baseline scenarios, the conformity interim emission test is satisfied. It is also reasonable to expect the action emissions would not exceed the baseline emissions for the time periods between the analysis years.

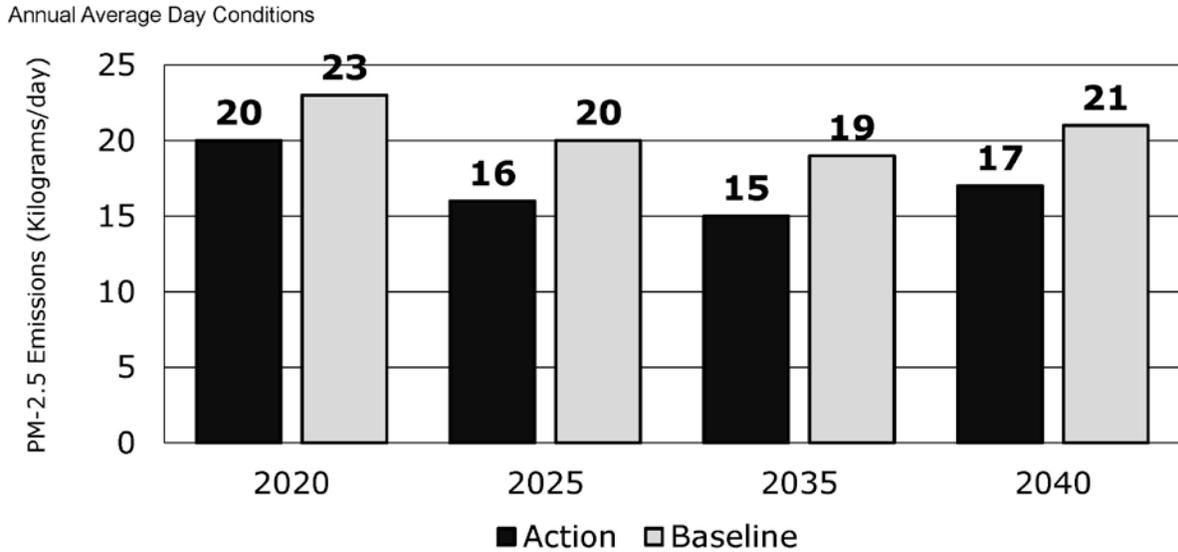
**FIGURE 24-5
PM-10 RESULTS FOR CONFORMITY INTERIM EMISSION (ACTION/BASELINE) TEST
PINAL COUNTY PM-10 NONATTAINMENT AREA**

Annual Average Day Conditions



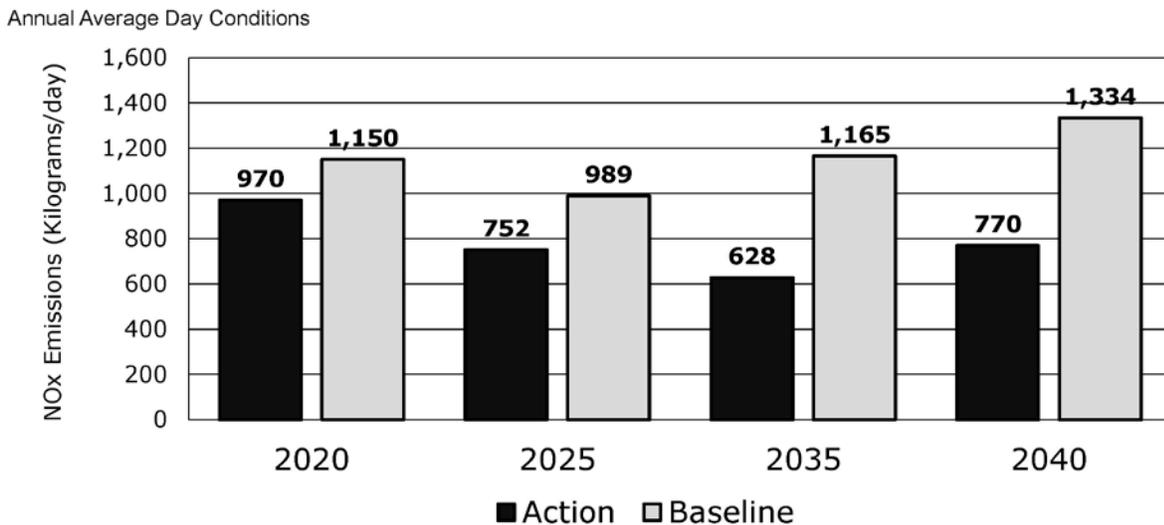
For PM-2.5 (Figure 24-6), for each analysis year the projected emissions for the action scenario are not greater than the projected emissions for the baseline scenario. Since the PM-2.5 emissions projected for the action scenarios are not greater than the PM-2.5 emissions projected for the baseline scenarios, the conformity interim emission tests are satisfied. It is also reasonable to expect the action emissions would not exceed the baseline emissions for the time periods between the analysis years.

**FIGURE 24-6
PM-2.5 RESULTS FOR CONFORMITY INTERIM EMISSION (ACTION/BASELINE) TEST
PINAL COUNTY PM-2.5 NONATTAINMENT AREA**



For NO_x (Figure 24-7), for each analysis year the projected emissions for the action scenario are not greater than the projected emissions for the baseline scenario. Since the NO_x emissions projected for the action scenarios are not greater than the NO_x emissions projected for the baseline scenarios, the conformity interim emission tests are satisfied. It is also reasonable to expect the action emissions would not exceed the baseline emissions for the time periods between the analysis years.

**FIGURE 24-7
NOX RESULTS FOR CONFORMITY INTERIM EMISSION (ACTION/BASELINE) TEST
PINAL COUNTY PM-2.5 NONATTAINMENT AREA**

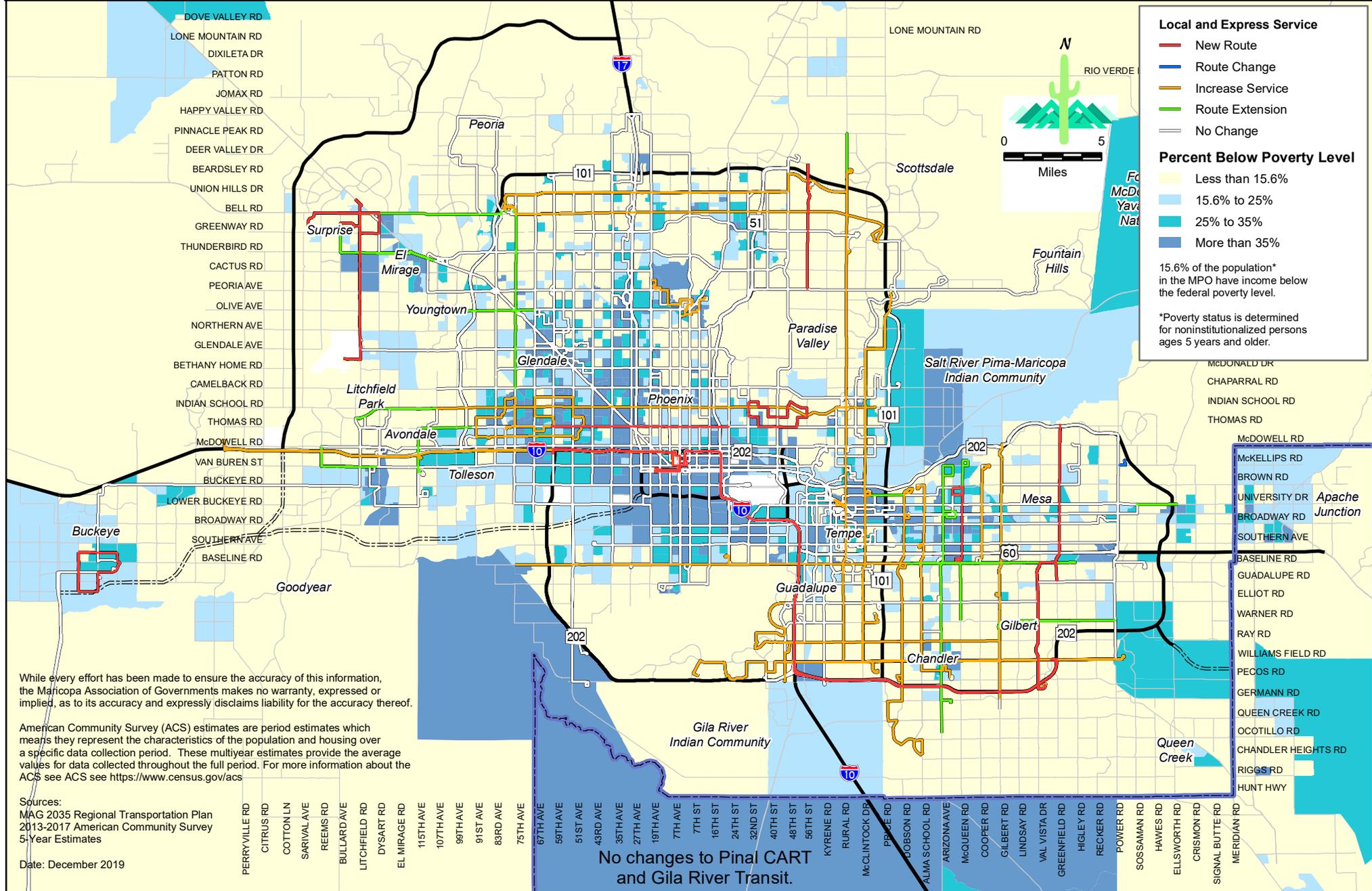


APPENDICES

Appendix A

Title VI and Environmental Justice Maps

Bus Route Changes, 2020-2024, and Population at or Below Poverty Level



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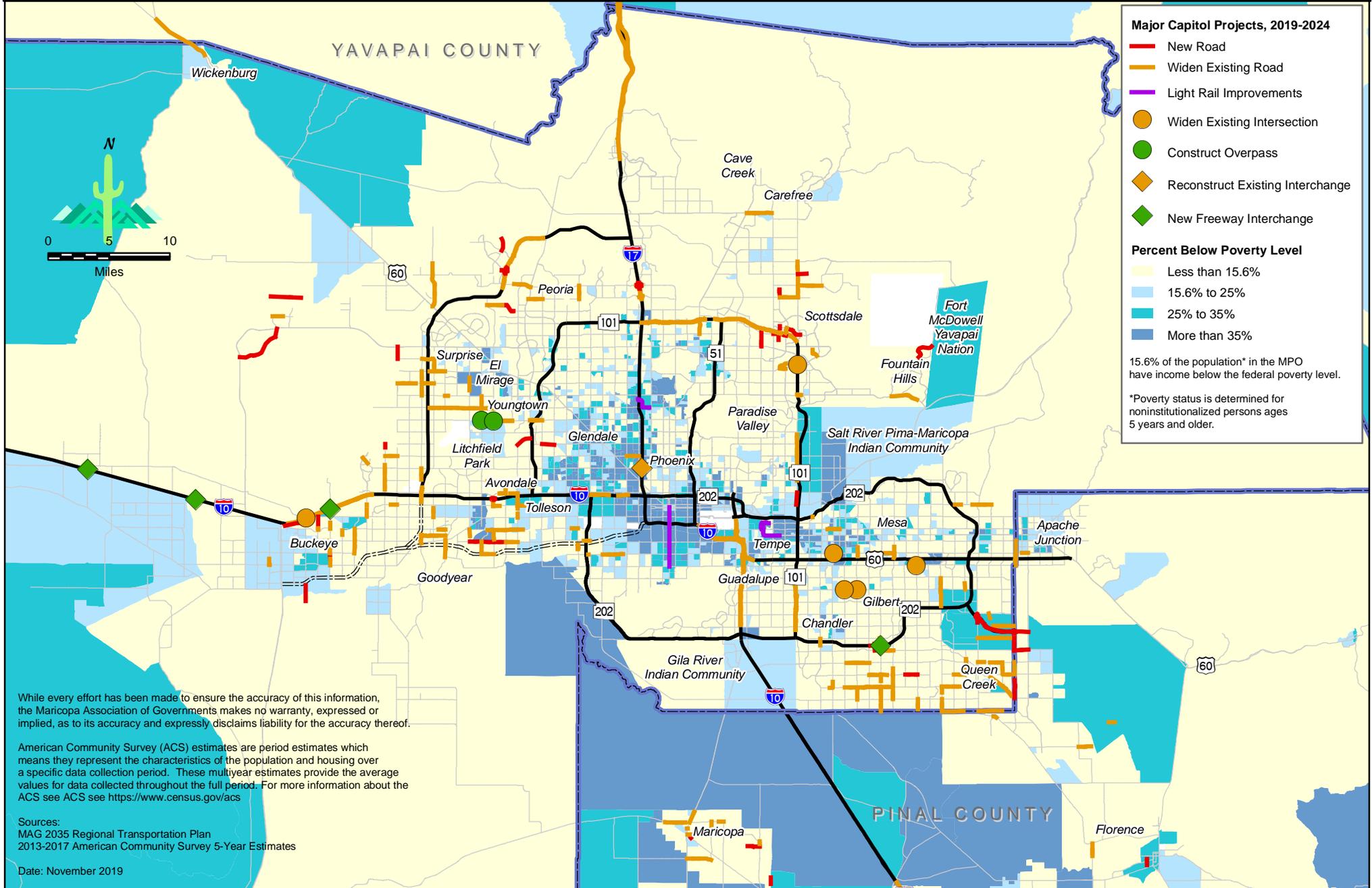
American Community Survey (ACS) estimates are period estimates which measure the characteristics of the population and housing over a specific data collection period. These multiyear estimates provide the average values for data collected throughout the full period. For more information about the ACS see ACS see <https://www.census.gov/acs>

Sources:
MAG 2035 Regional Transportation Plan
2013-2017 American Community Survey
5-Year Estimates

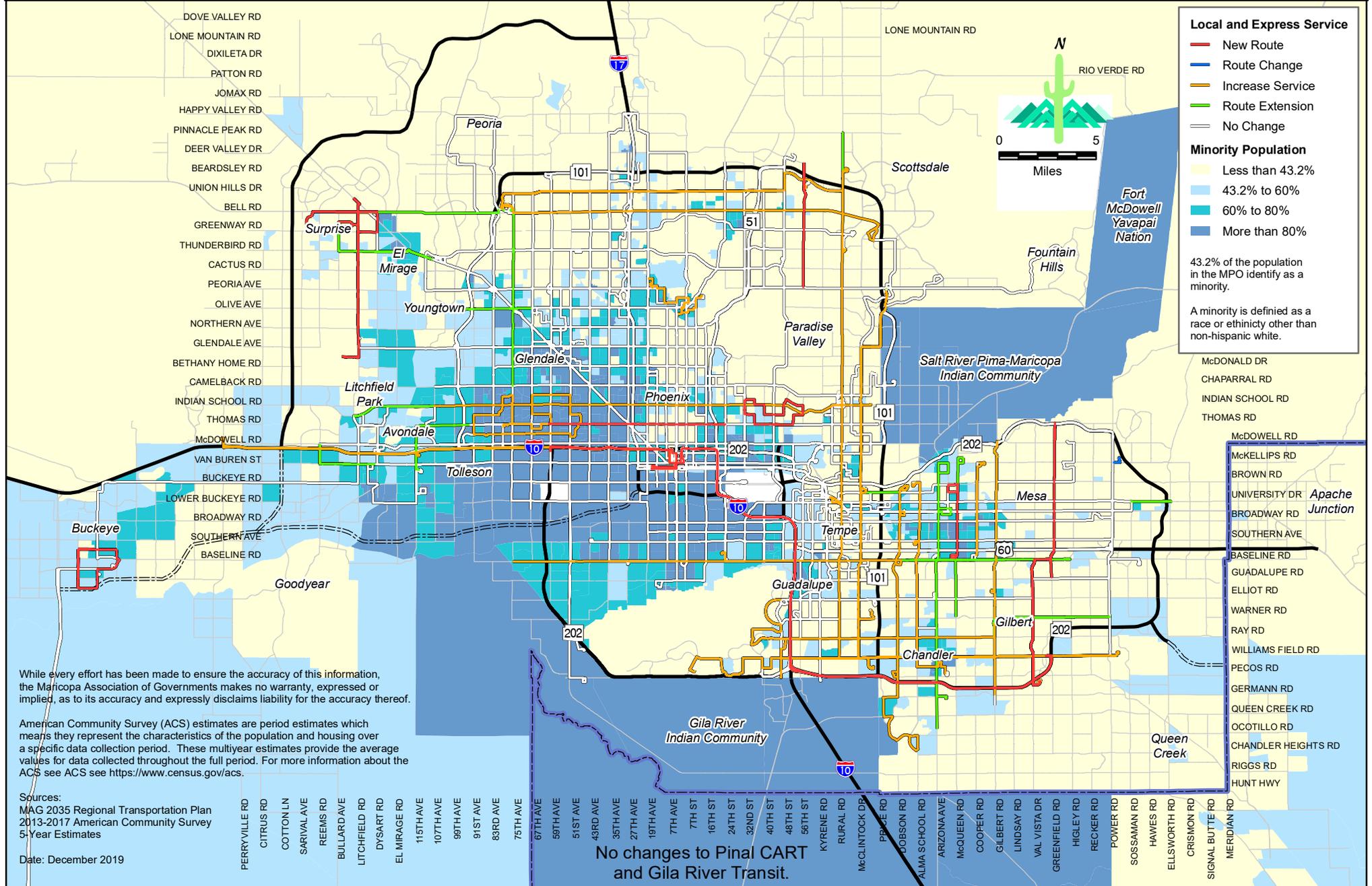
Date: December 2019

No changes to Pinal CART and Gila River Transit.

Capital Improvements, 2020-2024, and Population at or Below Poverty Level



Bus Route Changes, 2020-2024, and Minority Population



Local and Express Service

- New Route
- Route Change
- Increase Service
- Route Extension
- No Change

Minority Population

- Less than 43.2%
- 43.2% to 60%
- 60% to 80%
- More than 80%

43.2% of the population in the MPO identify as a minority.

A minority is defined as a race or ethnicity other than non-hispanic white.

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Sources:
 MAG 2035 Regional Transportation Plan
 2013-2017 American Community Survey
 5-Year Estimates

Date: December 2019

No changes to Pinal CART and Gila River Transit.

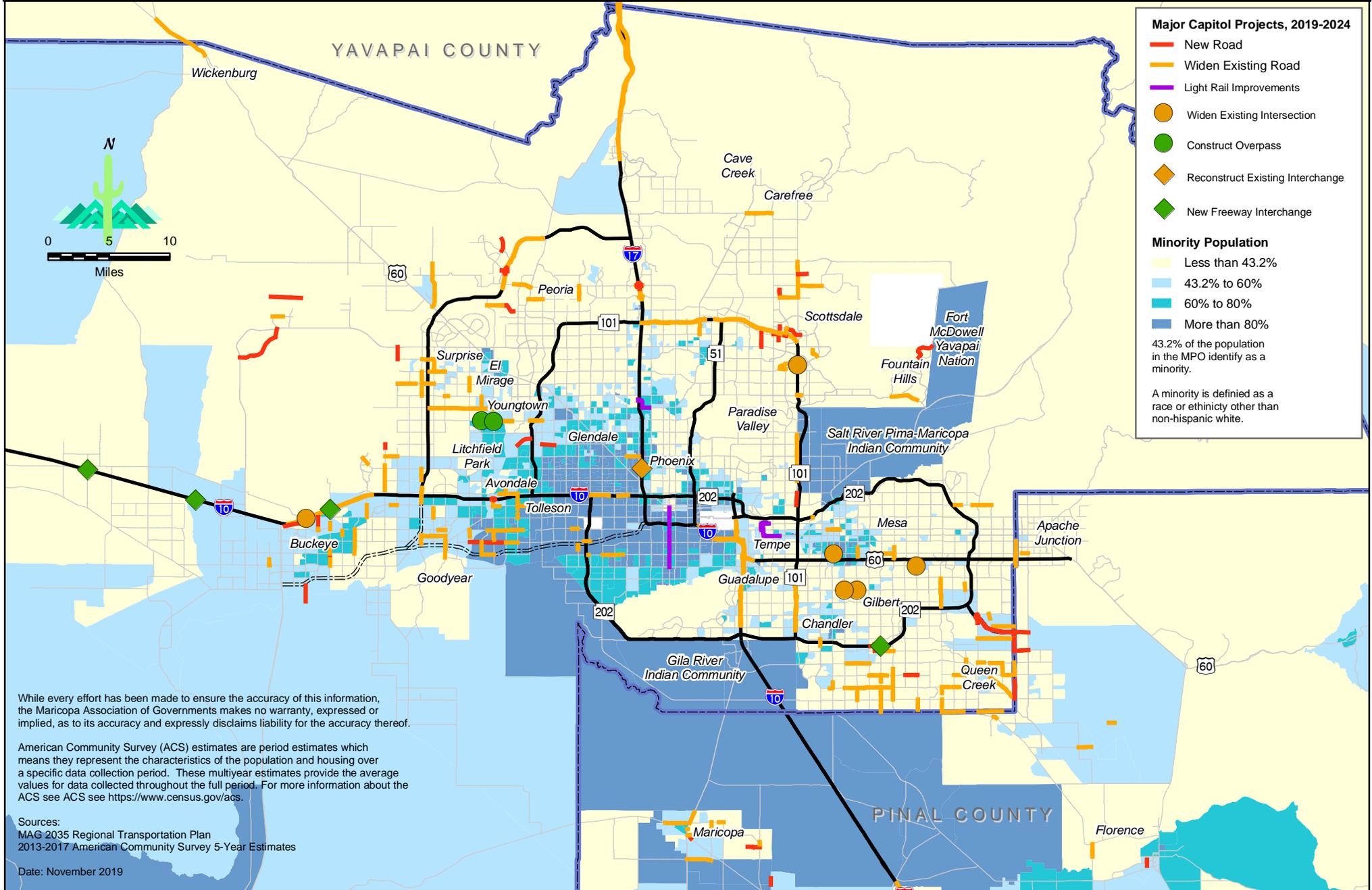
DOVE VALLEY RD
 LONE MOUNTAIN RD
 DIXILETA DR
 PATTON RD
 JOMAX RD
 HAPPY VALLEY RD
 PINNACLE PEAK RD
 DEER VALLEY DR
 BEARDSLEY RD
 UNION HILLS DR
 BELL RD
 GREENWAY RD
 THUNDERBIRD RD
 CACTUS RD
 PEORIA AVE
 OLIVE AVE
 NORTHERN AVE
 GLENDALE AVE
 BETHANY HOME RD
 CAMELBACK RD
 INDIAN SCHOOL RD
 THOMAS RD
 McDOWELL RD
 VAN BUREN ST
 BUCKEYE RD
 LOWER BUCKEYE RD
 BROADWAY RD
 SOUTHERN AVE
 BASELINE RD

McDONALD DR
 CHAPARRAL RD
 INDIAN SCHOOL RD
 THOMAS RD

McDOWELL RD
 McKELLIPS RD
 BROWN RD
 UNIVERSITY DR
 BROADWAY RD
 SOUTHERN AVE
 BASELINE RD
 GUADALUPE RD
 ELLIOT RD
 WARNER RD
 RAY RD
 WILLIAMS FIELD RD
 PECOS RD
 GERMANN RD
 QUEEN CREEK RD
 OCOTILLO RD
 CHANDLER HEIGHTS RD
 RIGGS HWY
 HUNT HWY

PERRYVILLE RD
 CITRUS RD
 COTTON LN
 SARVAL AVE
 REIMS RD
 BULLARD AVE
 LITCHFIELD RD
 DYSART RD
 EL MIRAGE RD
 115TH AVE
 107TH AVE
 99TH AVE
 91ST AVE
 83RD AVE
 75TH AVE
 67TH AVE
 59TH AVE
 51ST AVE
 43RD AVE
 35TH AVE
 27TH AVE
 19TH AVE
 7TH AVE
 7TH ST
 16TH ST
 24TH ST
 32ND ST
 40TH ST
 48TH ST
 56TH ST
 KYRENE RD
 RURAL RD
 McCLINTOCK DR
 PRICE RD
 DOBSON RD
 ALMA SCHOOL RD
 ARIZONA AVE
 McQUEEN RD
 COOPER RD
 GILBERT RD
 LINDSAY RD
 VAL VISTA DR
 GREENFIELD RD
 HIGLEY RD
 RECKER RD
 POWER RD
 SOSSAMAN RD
 HAWES RD
 ELLSWORTH RD
 CRISMON RD
 SIGNAL BUTTE RD
 MERIDIAN RD

Capital Improvements, 2020-2024, and Minority Population



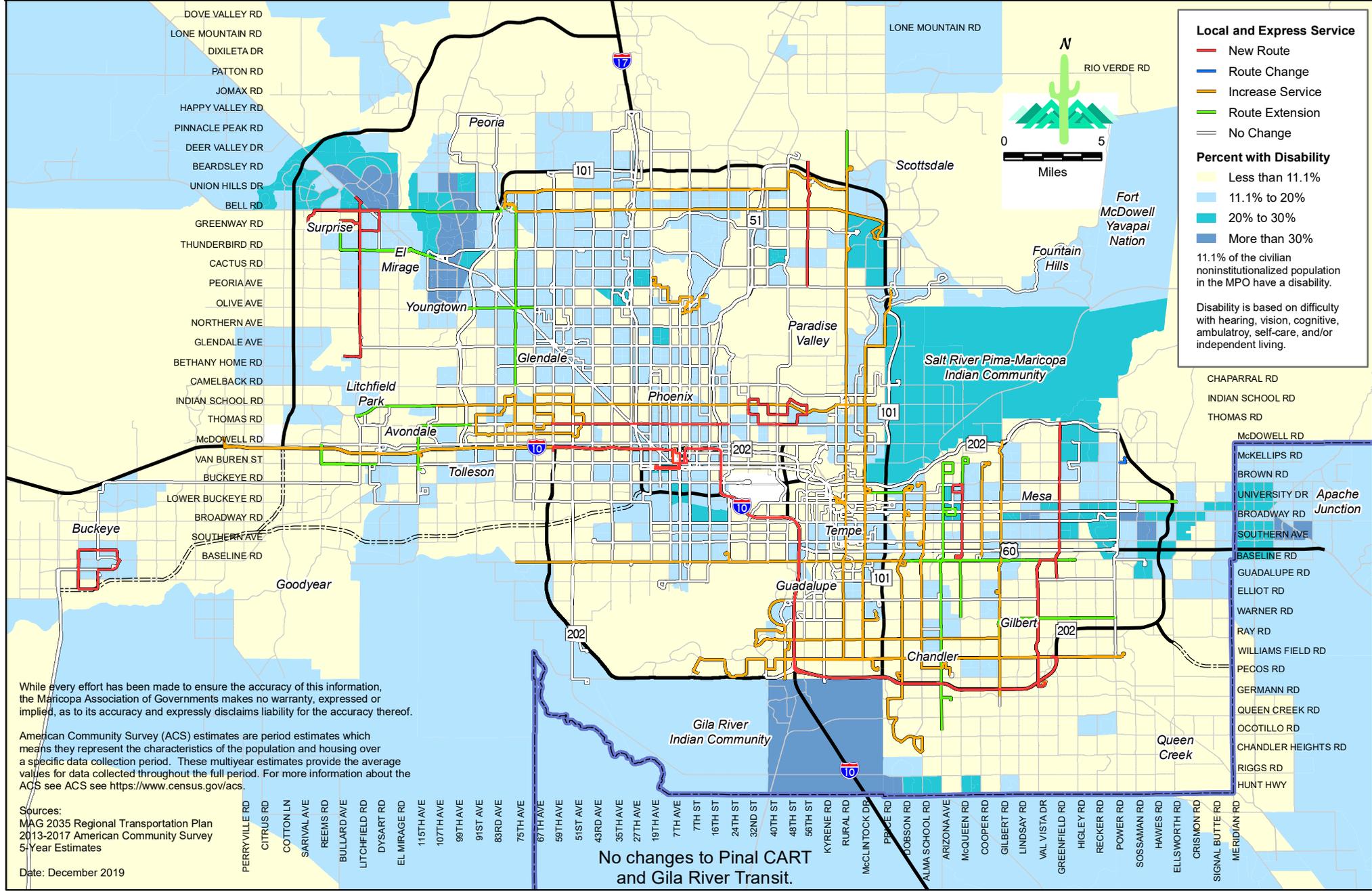
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Sources:
MAG 2035 Regional Transportation Plan
2013-2017 American Community Survey 5-Year Estimates

Date: November 2019

Bus Route Changes, 2020-2024, and Civilian Noninstitutionalized Population with a Disability



Local and Express Service

- New Route
- Route Change
- Increase Service
- Route Extension
- No Change

Percent with Disability

- Less than 11.1%
- 11.1% to 20%
- 20% to 30%
- More than 30%

11.1% of the civilian noninstitutionalized population in the MPO have a disability.

Disability is based on difficulty with hearing, vision, cognitive, ambulatory, self-care, and/or independent living.

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Sources:
MAG 2035 Regional Transportation Plan
2013-2017 American Community Survey
5-Year Estimates

Date: December 2019

No changes to Pinal CART and Gila River Transit.

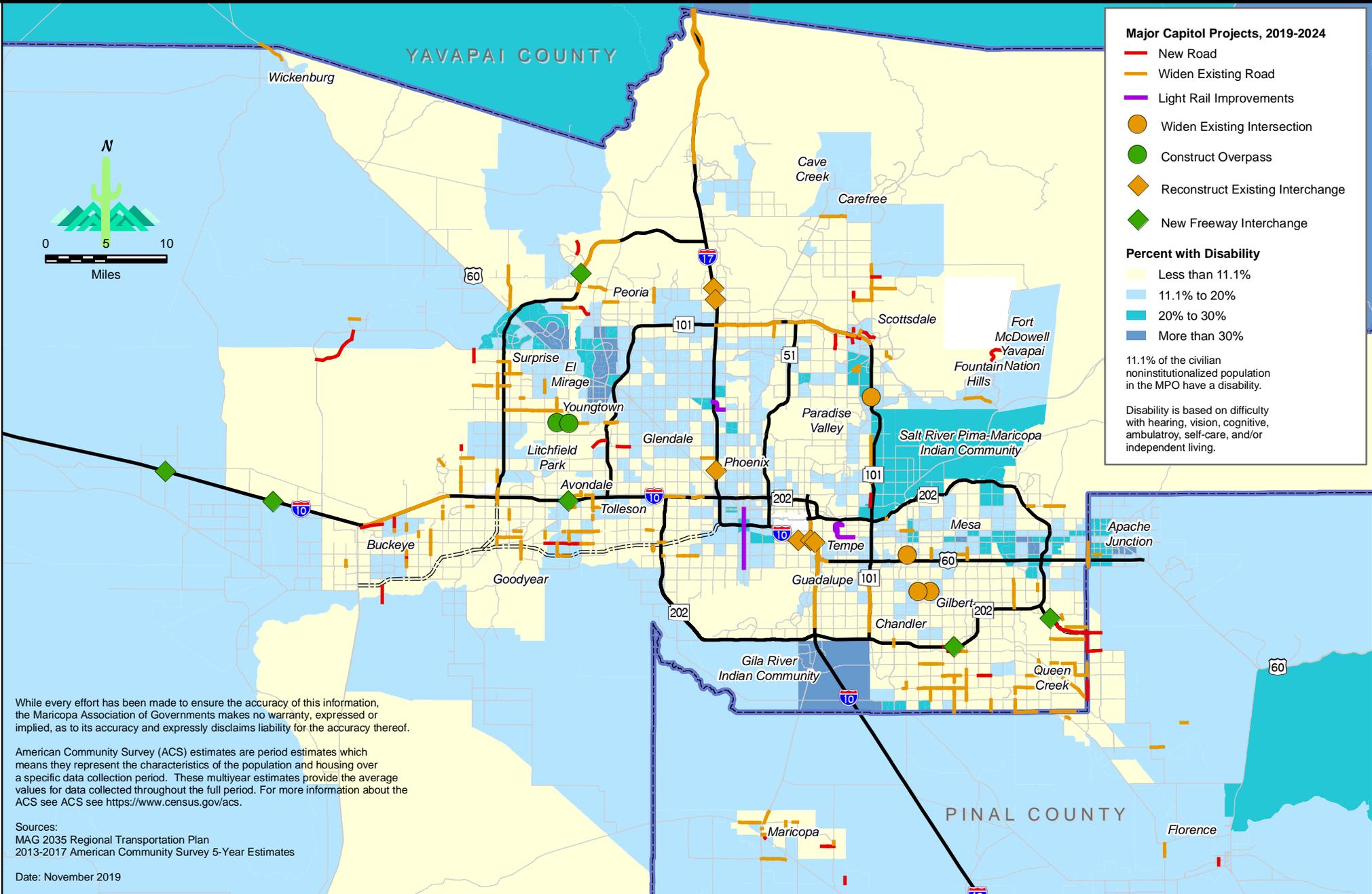
DOVE VALLEY RD
LONE MOUNTAIN RD
DIXILETA DR
PATTON RD
JOMAX RD
HAPPY VALLEY RD
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BEARDSLEY RD
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COTTON LN
SARVAL AVE
REEMS RD
BULLARD AVE
LITCHFIELD RD
DYSART RD
EL MIRAGE RD
115TH AVE
107TH AVE
99TH AVE
91ST AVE
88RD AVE
75TH AVE
67TH AVE
59TH AVE
51ST AVE
43RD AVE
35TH AVE
27TH AVE
19TH AVE
7TH AVE

7TH ST
7TH ST
24TH ST
32ND ST
40TH ST
48TH ST
56TH ST
KYRENE RD
RURAL RD
McCLINTOCK DR
PRICE RD
JOBSON RD
ALMA SCHOOL RD
ARIZONA AVE
McQUEEN RD
COOPER RD
GILBERT RD
LINDSAY RD
VAL VISTA DR
GREENFIELD RD
HIGLEY RD
RECKER RD
POWER RD
SOSSAMAN RD
HAWES RD
ELLSWORTH RD
CRISMON RD
SIGNAL BUTTE RD
MERIDIAN RD

CHAPARRAL RD
INDIAN SCHOOL RD
THOMAS RD
McDOWELL RD
McKELLIPS RD
BROWN RD
UNIVERSITY DR
BROADWAY RD
SOUTHERN AVE
BASELINE RD
GUADALUPE RD
ELLIOT RD
WARNER RD
RAY RD
WILLIAMS FIELD RD
PECOS RD
GERMANN RD
QUEEN CREEK RD
OCOTILLO RD
CHANDLER HEIGHTS RD
RIGGS RD
HUNT HWY

Capital Improvements, 2020-2024, and Civilian Noninstitutionalized Population with a Disability



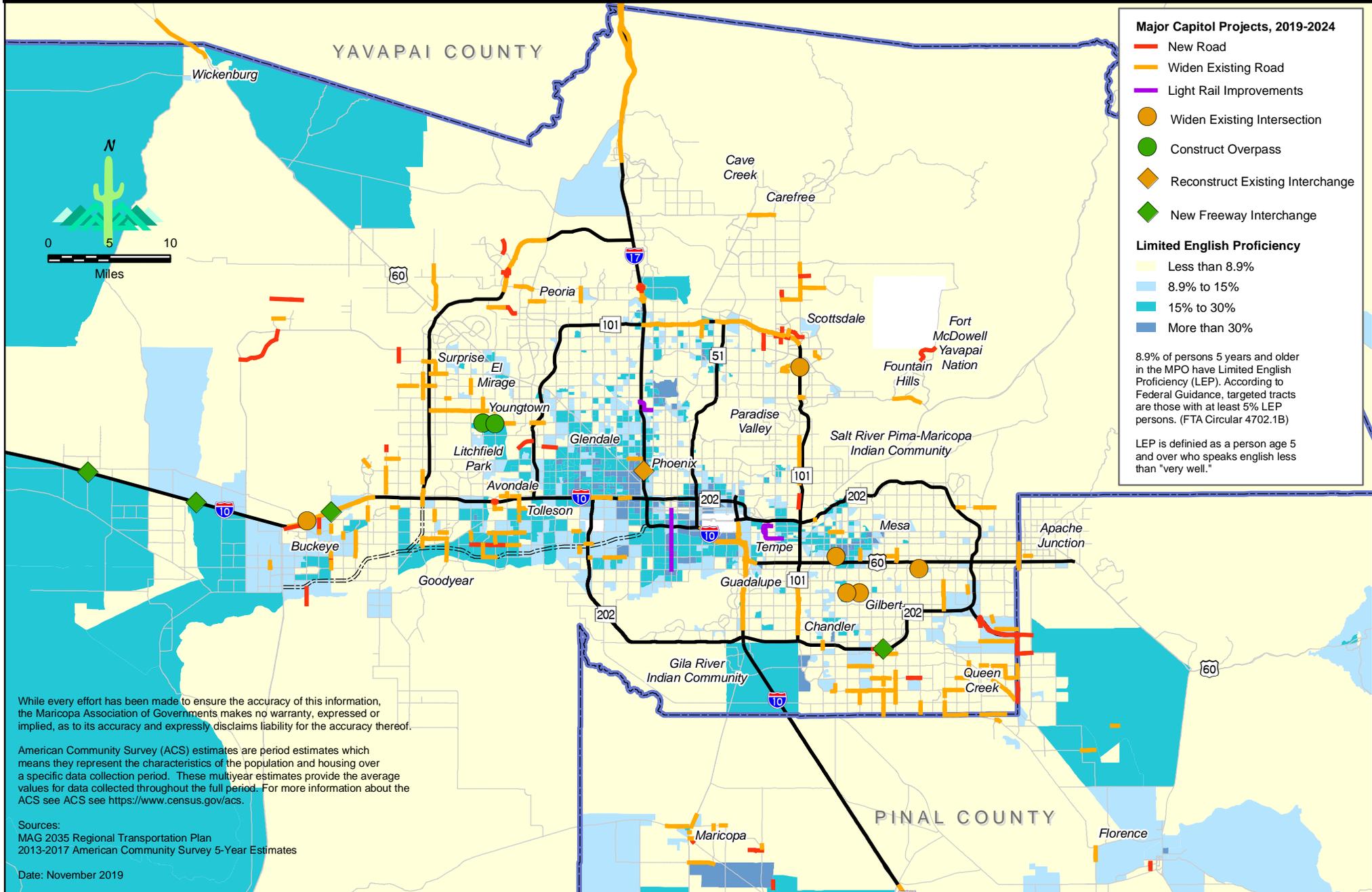
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Sources:
 MAG 2035 Regional Transportation Plan
 2013-2017 American Community Survey 5-Year Estimates

Date: November 2019

Capital Improvements, 2020-2024, and Population with Limited English Proficiency



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Sources:
 MAG 2035 Regional Transportation Plan
 2013-2017 American Community Survey 5-Year Estimates

Date: November 2019

Appendix B

Consultation on Environmental Mitigation and Resource Conservation Factors

TABLE B-1

ENVIRONMENTAL INFORMATION RESOURCES

The following information resources have been used in the development of the 2003 MAG Regional Transportation Plan (RTP) and subsequent updates.

- Arizona Department of Environmental Quality (ADEQ)
 - Air Quality Inventory (Ambient air quality data).
 - AZMAPPER: Water Quality Database.

- Arizona Department of Transportation (ADOT)
 - The website has environmentally related resources. ADOT assumed the responsibility for categorical exclusion determinations. Additional environmental resources regarding water resources, air quality, noise, biology, and cultural resources can be found on the ADOT website, in addition to related resources and information.

- Arizona Game and Fish Department
 - The website covers species of concern, riparian locations, wildlife environments, and other related information. The Department has additional resources useful to the transportation planning process, such as wildlife habitat corridors and its HabiMap, a web-based tool containing wildlife distribution, potential stressors to wildlife, and other relevant data.
 - Wildlife Linkages Assessment by the Arizona Wildlife Linkages Workgroup. Specific linkage assessment documents and maps will be made available through the ADOT Linkages Website.
 - The Heritage Data Management System is a database that tracks locations of sensitive species in Arizona. This data system has GIS and analysis for species in a particular area. The online Environmental Review Tool also provides special status species list for Phase I Environmental Compliance and National Environmental Policy Act documents and guideline links for incorporating wildlife conservation into project planning.

- Arizona State Historic Preservation Office
 - AZSITE Database – Arizona’s designated Cultural Resources Electronic Inventory system, including a database of identified properties, information about the properties, National Register eligibility, and survey areas.
 - Archeological and Historical Sites Inventory (hardcopy listing and maps).

- Arizona State Land Department
 - Land Use GIS Database.

- Gila River Indian Community (GRIC)
 - Historical and Cultural Site Inventories.

- Maricopa County Air Quality Department
 - Maricopa County Point Source Emission Inventories.
 - Travel Reduction Program Commuter Travel Database.

- Maricopa County Department of Transportation (MCDOT)
 - Environmental information resources applicable to the regional transportation planning process.

- Maricopa County Flood Control District
 - Water Course Master Plans.
 - Drainage Area Master Plans.
 - Cultural and biological inventories from watercourse and drainage studies.
 - GIS flood plain contours and other GIS cultural and biological layers.

- National Resource Conservation Service
 - Soil and vegetation maps can be used in the long-range transportation planning process to identify potential wetland areas.

- U. S. Army Corp of Engineers
 - Los Angeles District Regulatory web page.
 - Clean Water Act Section 404 Program Regulations (33 CFR 320-331).

- U. S. Bureau of Land Management
 - Soil and vegetation maps can be used in the long-range transportation Preliminary Draft Management Alternatives; Phoenix South and Sonoran Desert National Monument Planning Areas; Department of the Interior, Bureau of Land Management, Phoenix Field Office; Public Workshops February – March 2005.
 - Agua Fria National Monument and Bradshaw-Harquahala Draft Resource Management Plan and Draft Environmental Impact Statement; Department of the Interior, Bureau of Land Management, Phoenix Field Office; October 2005.

- U. S. Forest Service - Tonto National Forest
 - Tonto National Forest: Forest Resources GIS Database.
 - Tonto National Forest: Land Management Plan.

FIGURE B-1

CONSULTATION ON ENVIRONMENTAL MITIGATION AND RESOURCE CONSERVATION

FY 2020 Agency Consultation

To support the update of the 2040 Regional Transportation Plan (RTP), MAG consulted with agencies in accordance with its Public Participation Plan, adopted in May 2019. Agencies will be invited to provide comment on the draft Plan Update in the winter of 2019 and comments received during the consultation period will be summarized here.

FY 2017 Agency Consultation

A stakeholder workshop to obtain input on the RTP update process was held on August 22, 2016. Environmental and resource agencies were invited to attend. In addition, MAG member agencies were notified of the workshop. Since the update of the RTP is not anticipated to consider any new corridors, the workshop focused on the project programming process, as well as refinements to the existing freeway/highway life-cycle program. The meeting began with presentations from MAG staff on the public involvement process, transportation planning and programming, and current rebalancing efforts of the regional freeway and highway program. The presentations concluded with an overview of upcoming dates to help stakeholders in understanding the MAG planning and programming efforts, and facilitate future input to the process. Following the presentations, a stakeholder discussion was held where agency representatives were encouraged to share information, ask questions, or discuss future projects.

Freeway/Highway Program Rebalancing Process

Agency comments regarding rebalancing the freeway/highway program included:

- Will the current MAG freeway/highway program rebalancing effort affect facilities in the Pinal County portion of the MAG planning area?
- Pinal County wants to work with MAG and ADOT to obtain funding for needed freeway/highway improvements in the Pinal County area of MAG.
- Will MAG be considering new projects or only projects that have already been identified and previously deferred as part of the rebalancing?
- Since Proposition 400 was voted on with different modal emphasis for east/central/west areas, the earlier rebalancing of the program affected different areas in different ways and there is a concern as to how these effects can be addressed.

- Will the Regional Transportation Plan update only consider projects proposed in studies that have already been conducted or will new projects also be considered?
- What will the timeframe be to submit proposals to MAG for projects to be consideration in the rebalancing process?
- Will the rebalancing process first accumulate project costs and then see how such costs line up with the total funding available, or will a cushion be identified and project selections required to fit within that cushion?

Transportation Framework Studies

Agency comments regarding MAG transportation framework studies included:

- Upcoming regional transportation studies should cover the entire MAG planning area, including the Pinal County portion of the MAG planning area.
- As part of the State Route 24 design and environmental process, Pinal County is attempting to identify approximately \$1.0 to \$1.5 million in design dollars for the extension of SR-24 to Ironwood Road in Pinal County.
- Maps and listings of all Pinal County Regional Transportation Authority proposed projects are being made available to MAG staff.
- Pinal County has hired a consultant to perform a Santan Valley Area Study with boundaries that generally include the area from Elliot Road to Hunt Highway and from Meridian Road to the Central Arizona Project Canal. The County wants to coordinate this study closely with the MAG Superstition Vistas Transportation Framework Study.
- The State Lands Department wants to coordinate closely with MAG on the upcoming MAG Superstition Vistas Transportation Framework Study. Who will the study manager be?

Bicycle/Pedestrian Trails

Agency comments regarding bicycle pedestrian trails included:

- The Maricopa (Bicycle/Pedestrian) Trail is progressing with completion anticipated within the next three years.
- Agencies should connect their trail systems to this regional system, if they are not already a part of it.

FY 2013 Agency Consultation

An update of the RTP was not conducted during FY 2011. Beginning in FY 2012 and continuing into FY 2013, work proceeded on the preparation of the 2035 RTP, which was targeted for adoption in August 2013. In conjunction with the development of the 2035 RTP, an agency workshop was held on November 6, 2012 to receive input from

environmental and resource agencies, regarding the application of environmental mitigation and resource conservation concepts in the transportation planning process.

The emphasis at the November 2012 workshop was on work MAG conducted in the areas of: (1) sustainable transportation and land use integration, (2) complete streets guidelines, and (3) bicycle and pedestrian planning. In addition, an overview of the approach to developing the 2035 RTP was provided, which covered background on the contents of the current plan, new factors to be considered in preparing the updated plan, and future opportunities for comment on the planning process. Agencies were encouraged to provide input, either at the workshop or through later correspondence, regarding experiences, insights, or concerns from their agency perspective on the studies MAG conducted, as well as the overall regional transportation planning process.

Sustainable Transportation and Land Use Integration

Agency comments regarding sustainability issues and transportation included:

- Transit oriented development (TOD) can be a very positive factor in enhancing the climate for transit usage, but the need to consistently retain business at TOD sites should not be overlooked.
- TOD is means to not only enhance transit usage, but offers an opportunity to promote and implement “green design” and other environmental considerations.
- The maintenance of wildlife habitat needs to be recognized as an important factor in the sustainability arena. Thinking should move from a view of “how do we have to accommodate wildlife” to “look at the benefits of keeping these habitats and wildlife intact”.
- There is a need to get people at all levels of government to think more about infrastructure development and how it affects wildlife resource conservation and open space, especially protecting wildlife corridors/linkages and habitats. A wealth of information is available regarding these issues and should be taken advantage of during the planning, design and construction of transportation facilities.

Complete Streets Guidelines

Agency comments regarding street planning issues included:

- There appear to be conflicting messages sent by the transportation planning process regarding transit and street development. While a strong emphasis is placed on the benefits and desirability of transit usage, at the same time a major amount of resources is spent on planning, designing and constructing street facilities.
- Long-range street plans for currently undeveloped areas seem to include excessive amounts of street mileage, which may be redundant and encourage leap-frog development into these areas.

- There is a continuing need to maintain coordination among all levels of government in the street planning process. Local-government-to-local government coordination is an aspect that appears to need greater emphasis.

Bicycle and Pedestrian Planning

Agency comments regarding bicycle and pedestrian planning included:

- Bicycle and pedestrian planning efforts should stay aware of the need to improve non-motorized access to park and other recreational areas.
- Bicycle and pedestrian facilities have a large constituency that may, sometimes, be overlooked in the transportation planning process. Transportation plans should be more specific, regarding these facilities.

2035 Regional Transportation Plan Approach

Agency comments regarding the approach to development of the 2035 RTP included:

- Multi-modal ground access to aviation facilities is an important element of the transportation planning process that warrants continuing consideration.
- Consultation early and often with environmental and resources agencies is a very productive effort and can yield increasing benefits to the transportation planning process. This kind of consultation should also be applied to neighboring counties, regional planning organizations, and large activity centers such as hospitals and other health care centers. In addition, consultation efforts with environmental and resources agencies should be pursued not only by regional organizations but also by local governments.
- The regional transportation planning process should be continuously aware of the need to minimize right-of-way requirements for all types of transportation projects, and avoid impacts of facilities on the surrounding land uses.

FY 2010 Agency Consultation

The development of the 2010 Update of the RTP continued through calendar year 2009, and an additional agency workshop was held on November 9, 2009 to receive input from environmental and resource agencies, regarding the application of environmental mitigation and resource conservation concepts in the transportation planning process.

The emphasis at the 2009 workshop was on proposed legislation at the federal level that may have an effect on the transportation planning process. In this regard, considerable activity had been occurring at the federal level in the areas of clean energy, climate

change, and national funding for transportation. Many of the concepts in this proposed legislation address issues affecting the environmental and resource conservation aspects of transportation planning. The goal of the workshop was to discuss pending legislation and develop insights and draw conclusions about the potential future direction of the regional transportation planning process.

Clean Energy Jobs and American Power Act - S. 1733 and American Clean Energy and Security Act of 2009 - H.R. 2454

The Clean Energy Jobs and American Power Act (S. 1733) was introduced in the U.S. Senate on September 30, 2009. A similar proposal, the American Clean Energy and Security Act of 2009 (H.R. 2454), was passed by the U.S. House of Representatives on June 26, 2009. Both pieces of legislation set targets for carbon emission reductions from major U.S. sources by 80 percent by 2050, and include greenhouse gas (GHG) requirements on the utility sector, as well as other elements of business and industry.

In addition, both proposed measures identify new roles and requirements for metropolitan planning organizations (MPOs), regarding the transportation planning process. While the details differ somewhat between the two proposals, the major thrust of each piece of legislation is very similar and is described in general terms below.

- New planning considerations for MPOs:
 - Achieve sustainability and livability.
 - Reduce surface transportation-related GHG emissions and reliance on oil.
 - Adapt to the effects of climate change.
 - Protect public health.
 - Promote consistency between transportation improvements and housing and land use patterns.
 - Assess impacts on the environment.

- MPOs in Transportation Management Areas must develop targets and strategies for GHG reductions to meet targets. Targets must demonstrate progress in stabilizing and reducing transportation GHG emissions, and contribute to national goals. MPOs must consult with state air agencies in setting targets and selecting strategies, and cooperate with state land use, resource management and environmental agencies.

- Possible MPO strategies for GHS reductions:
 - Increase transit ridership.
 - Increase walking, bicycling and other forms of nonmotorized transportation.
 - Implementation of zoning and other land use regulations and plans to support infill and transit oriented development.

- Travel demand management programs – carpool, vanpool or car-share projects, transportation pricing measures, parking policies and programs to promote telecommuting, flexible work schedules, and satellite work centers.
 - Transportation system operation improvements – intelligent transportation systems and congestion system management.
 - Intercity passenger rail.
 - Intercity bus improvements.
 - Freight rail improvements.
 - Use of materials or equipment for construction or maintenance of transportation projects that reduce GHG emissions.
 - Public facilities for supplying electricity to electric and hybrid-electric vehicles.
- U.S. DOT and EPA must approve the plan and determine that plan is likely to achieve the GHG targets.

Surface Transportation Reauthorization

The current surface transportation funding legislation, the Safe, Accountable, Flexible, Efficient, Transportation Equity Act - A Legacy for Users (SAFETEA – LU) was signed by former President George W. Bush on August 10, 2005. This act expired on September 30, 2009, and has been held over through continuing resolutions. These temporary extensions are anticipated to continue for the foreseeable future. However, in June 2009, the U.S. House Transportation and Infrastructure Committee passed a concept for the Surface Transportation Authorization Act of 2009, which provides some indication of the direction of future transportation legislation at the federal level. Key features of this legislative blueprint are listed below:

- Create a National Transportation Strategic Plan.
- Improve the safety of the surface transportation network.
- Bring existing highway and transit facilities and equipment to a state of good repair.
- Facilitate goods movement.
- Improve metropolitan mobility and access.
- Expand rural access and interconnectivity.
- Lessen environmental impacts from the transportation network.
- Improve the project delivery process by eliminating duplication in documentation and procedures.
- Facilitate private investment in the national transportation system that furthers the public interest.
- Ensure that States receive a fair rate of return on their contributions to the Trust Fund.
- Provide transportation choices.

- Improve the sustainability and livability of communities.

MPOs may be particularly affected by proposals involving a Metropolitan Mobility Program, a larger role for transit services in urban areas, an emphasis on livability to be facilitated through cooperative efforts of U.S. DOT, EPA and HUD, implementation of high speed and commuter rail, and a changing revenue source landscape.

FY 2009 Agency Consultation

MAG reached out to Federal, State, Tribal, regional, and local agencies to consult on environmental mitigation and resource conservation issues and concerns, during the development of the 2010 Update of the RTP. An agency workshop was held on November 13, 2008 to review MAG studies and receive input from environmental and resource agencies, regarding the application of environmental mitigation and resource conservation concepts in the transportation planning process.

Three studies were discussed at the workshop, including the I-10/Hassayampa Valley Transportation Framework Study, the I-8/I-10/ Hidden Valley Transportation Framework Study, and the Regional Transit Framework Study. Preliminary information from the first two of these studies was presented at the FY 2008 Workshop, and the FY 2009 Workshop provided an opportunity to discuss the studies in greater detail. In addition, preliminary information from the MAG Regional Transit Framework Study was presented, which evaluates future transit needs beyond those contained in the RTP.

Comparisons of Transportation Plans with Conservation Plans and Inventories of Natural or Historic Resources

As part of the FY 2009 consultation effort, environmental scans prepared for the I-10/Hassayampa Valley Transportation Framework Study and the I-8/I-10/Hidden Valley Transportation Framework Study were presented at the November 13, 2008 agency workshop. These environmental scans included geographic coverages to help identify potential areas where future facilities may impact environmental and resource elements in the surrounding areas.

Specific overlays that were reviewed included:

- Air Quality Non-Attainment Areas
- Drainage Floodplains
- Hazardous Materials
- Existing Land Use
- Natural Vegetation
- Recreational Opportunities
- Wildlife Linkages
- Conservation Areas
- Environmental Justice Populations
- Land Ownership
- Future Land Use
- Planned Developments
- Biological Resources/Species

In addition, as part of the presentation of findings from the MAG Regional Transit Framework Study, land use patterns and the transportation system were discussed, including key connections between activity centers. Corridor concepts at the community level, subarea level, and regional level were described, and the tie between transit system options and environmental issues such as sustainability, carbon footprint, smart growth, and air quality were assessed.

Environmental Mitigation Factors, Natural and Historic Resource Conservation, and Planning Process Considerations

Key comments received at the FY 2009 workshop are summarized below. The points listed are not intended to represent MAG policies, but rather, are factors for consideration in the transportation planning process.

- Significant progress regarding the consideration of environmental mitigation factors, as well as natural and historic resource conservation, has been made in the MAG long-range transportation planning process. The environmental scans included in the transportation framework studies have been particularly effective in analyzing environmental and resource factors. This approach should be pursued on a continuing basis, as it offers the opportunity to identify environmental and resource issues early in the transportation planning process and effectively involve key environmental and resource agencies.
- As a part of the transportation framework studies, as well as the transportation planning process in general, it will continue to be important to emphasize that findings resulting from study efforts are general and subject to change. It is true that identifying the potential, future location of transportation facilities and services is a key output of planning studies and is of major interest to the public. However, it is important to avoid premature conclusions by neighborhoods, communities, and the public-at-large about the localized impacts, and benefits, of transportation improvements. Every effort should be made to remind the audiences of both planning presentations and written documents that the “lines on the map” are not “cast in stone”.
- Drainage studies by the Maricopa County Flood Control District are ongoing in the Wittman area and should be used as a resource in transportation planning activities.
- The location of existing and future power transmission lines should be considered as part of the transportation planning process for new facilities, as well as the location of waters of the United States.
- Continuing involvement of the Maricopa County Parks and Recreation Department will be important to identify recreational opportunities as new areas of the region develop.

- Planning of future transportation systems in developing areas should recognize the need for accessibility to health care facilities.
- Land use planning in the developing parts of the region should take into account conflicts between conservation areas and areas planned for development. In addition, the potential limits of water availability and strategies for water reuse should be included in the planning process.

FY 2008 Agency Consultation

Although the RTP was not updated during FY 2008, an agency workshop was held on November 6, 2007 to obtain input on ongoing MAG transportation studies. The main purpose of the workshop was to receive input on two MAG studies that assess transportation needs in developing areas of the region. These studies were the I-10/Hassayampa Valley Transportation Framework Study, and the I-8 and I-10/Hidden Valley Transportation Framework Study.

The I-10/Hassayampa Valley Roadway Framework Study covers the western portions of the MAG planning area and included concepts for future freeway and parkway corridors in the area. Since these corridors are not yet a part of the RTP, the goal of the workshop was to gain insights regarding agency concerns before the corridors are considered for inclusion in the Plan at some future date. In addition, preliminary results from the I-8 and I-10/ Hidden Valley Roadway Framework Study were reviewed. This study covers southwest Maricopa County and west/central Pinal County. Although the process for both these studies included extensive involvement of environmental and resource agencies, the RTP workshop provided another opportunity for MAG to familiarize the agencies with the study results and to obtain comments on potential mitigation and conservation approaches.

Comparisons of Transportation Plans with Conservation Plans and Inventories of Natural or Historic Resources

As part of the FY 2008 consultation effort, a series of maps that depict the distribution of natural resources, land use patterns, demographic factors, and conservation areas was prepared for the Hassayampa Valley and Hidden Valley study areas. Proposed transportation facility networks were overlaid on these coverages to help identify potential areas where future facilities may impact the natural environment, and existing or future land use patterns. These maps were presented at the November 6, 2007 Workshop and provided a basis for comment and discussion.

Specific overlays that were reviewed included:

- Air Quality Non-Attainment Areas
- Drainage Floodplains
- Hazardous Materials
- Existing Land Use
- Natural Vegetation
- Recreational Opportunities
- Wildlife Linkages
- Conservation Areas
- Environmental Justice Groups
- Land Ownership
- Future Land Use
- Planned Developments
- Biological Resources/Species

Environmental Mitigation Factors, Natural and Historic Resource Conservation, and Planning Process Considerations

Key comments received at the FY 2008 workshop are summarized below. The points listed are not intended to represent MAG policies, but rather, are factors for consideration in the transportation planning process.

- When assessing air quality issues and potential impacts, the new eight-hour ozone standards and non-attainment area boundaries should be employed.
- The transportation planning process in developing areas should include consideration of methods for protecting right-of-way for new freeway corridors and other key transportation facilities.
- Drainage studies by the Maricopa County Flood Control District are ongoing in the Wittman area and should be used as a resource in transportation planning activities.
- The location of existing and future power transmission lines should be considered as part of the transportation planning process for new facilities, as well as the location of waters of the United States.
- Continuing involvement of the Maricopa County Parks and Recreation Department will be important to identify recreational opportunities as new areas of the region develop.
- Planning of future transportation systems in developing areas should recognize the need for accessibility to health care facilities.
- Land use planning in the developing parts of the region should take into account conflicts between conservation areas and areas planned for development. In addition, the potential limits of water availability and strategies for water reuse should be included in the planning process.
- Future noise mitigation issues should be anticipated in planning corridors in currently vacant areas. Policies should be established as part of the planning process to help ensure that community development patterns are designed to minimize future mitigation requirements. This is especially important to conserve funding so that it can be focused on construction of actual transportation facilities.
- Provisions for future park-and-ride lots should be considered in the planning process for the transportation framework in developing areas. These facilities

are key elements of the transportation system and need to be recognized early, and throughout, the planning process. Fueling locations for alternative vehicle should also receive some consideration.

- The full range of transportation modes should be addressed in planning for developing areas, including high capacity transit facilities, goods movement facilities, and both passenger and freight intermodal facilities.
- The effects of an extensive roadway network on the urban heat island effect should be considered in the planning process as new areas are developed.
- Concerns about the impacts of transportation facilities on specific cultural sites, as well as the overall effects on the traditional cultural, are an important issue for Native American communities.

FY 2007 Agency Consultation

The FY 2007 consultation effort was initiated with an agency workshop, which was held on August 17, 2006. The workshop provided an opportunity to familiarize the agencies with MAG's organization and planning responsibilities, as well the goals of the consultation process. Most importantly, agency input was obtained on environmental mitigation and resource conservation issues, available databases and other information resources, and future steps in the planning process. Following the workshop, MAG staff held additional individual meetings with thirteen key environmental and resource agencies during September/October 2006.

Key input provided at the workshop and follow-up sessions is summarized below. This input cover three main topic areas: (1) environmental mitigation factors, (2) natural and historic resource conservation, and planning process considerations.

Environmental Mitigation Factors

The consultation process with environmental and resource agencies yielded mitigation issues and concepts in four major areas: air quality, water quality, noise, and habitat. The key points emerging from the discussions on these topics have been summarized below for consideration in the transportation planning process.

Air Quality

- PM-10 - A major, transportation-related air quality issue in the MAG Region is PM-10 non-attainment. Streets and highways are a source of fugitive dust, as the action of traffic stirs up dust from the roadway into the air. Also, construction activity on transportation facilities can result in the track-out of soil onto streets and highways, and fugitive dust can be generated on transportation construction

sites. Unpaved roads are also dust generators. Currently undeveloped areas contain significant mileages of unpaved roads. As development in the region expands, these facilities could become an increasingly important element in addressing PM-10 air quality issues.

Street sweeping, paving of shoulders, paving unpaved roads, and construction site management can help reduce dust emissions significantly. The application of "best practice" dust control measures at construction sites is essential in helping to reduce the impacts of developing new transportation corridors or improving existing facilities. Making effective use of available funds for PM-10 control measures may help move the region into attainment as quickly as possible. Arterial improvement projects to extend existing roadway would have the dual benefit of improved access and reducing emissions from unpaved roads. At the same time, paving these unpaved roads may increase access to sensitive habitat areas.

- Other Mobile Sources - Transportation can affect air quality because of the tailpipe emissions of gases and particles from vehicles. Increases in vehicle-miles-of-travel can result in higher total emissions compared to what they would be without those increases. The emissions from potential future transportation corridors in both attainment and non-attainment areas of the region should be considered. An overall assessment of how additional corridors will affect regional air quality issues is important.

Efforts to reduce growth in vehicle-miles traveled can help lessen the impacts of the transportation system. The overall impact of travel and transportation facilities can be reduced by measures that lessen the amount of vehicular travel on streets and highways. Steps such as telecommuting, carpooling, flexible schedules, transit, and usage of alternative modes such as bicycles and walking can contribute to this effort. MAG Region ambient air quality readings for ozone are quite close to the allowable 8-hour standard. At some point in the future, this may require the implementation of new or enhanced transportation control measures aimed at reducing precursor emissions.

- Stationary Sources - The location of significant stationary sources should be considered when locating new transportation corridors or expanding existing transportation facilities. The proximity of transportation sources and stationary sources may have the potential to create concentration "hot spots" that should be avoided. On the other hand, serving certain major stationary sources with adequate transportation facilities may be important to minimize impacts on surrounding communities.

Water Quality

- **Development Impacts** - In general, transportation facilities, as a component of development in the region, place an increasingly intensive burden on natural water systems. Effective design and management of this development to take into account the range of impacts it has on the environment will be vital as growth continues in the region.
- **Storm Water Runoff from Existing Facilities** - A major water quality issue affected by transportation facilities involves the storm water runoff from existing roads. Beginning in December 2007, the U.S. Environmental Protection Agency is expected to increase the enforcement of water quality standards related to storm water runoff. Runoff contains contaminants that may affect the quality of surface water and ultimately ground water. The quality of runoff from existing transportation facilities into rivers and streams represents a significant water quality issue. In addition, ground water may be affected by the retention basins associated with major freeways and highways, especially where drywells are employed.

The runoff from existing transportation facilities can be dealt with through containment and treatment, before it is allowed to enter surface streams or ground water aquifers. The primary mitigation measures for storm water runoff involve the application of best management practices to address transportation facility impacts. These best management practices include steps such as retention basins or traps for runoff that enable capture of sediments before the runoff enters natural streams or lakes. Use of screens at facility drains can catch trash and prevent it from entering natural water courses. Substitution of planted drainage channels for concrete-lined structures can improve water quality and also reduce the velocity of water that enters natural streams and lakes, reducing erosion. Best management practices need to be applied to both freeways and arterial streets, and the right-of-way needs of these measures should be taken into account when new facilities are being identified and developed.

In addition, the amount of runoff and the areas where water is concentrated can affect surrounding land uses. Storm water runoff from freeways can impact ground water quality in adjacent areas. Best management practices should be employed to monitor and treat any runoff that may encroach into the adjacent community. In the long term, storm water should be directed away from the adjacent areas entirely.

- **Storm Water Runoff During Construction** - Storm water runoff from transportation facilities under constructions may also contain contaminants that affect surface and ground water quality. In addition, any discharge of dredge or fill materials into waters of the U.S. during construction must adhere to a series of

watercourse permitting procedures administered by the U.S. Army Corp of Engineers. This includes the 404 Permit process.

During the construction of transportation facilities, measures are needed to control and/or treat storm water to meet water quality discharge standards and avoid exacerbating any existing water quality problems. The water quality impacts from storm runoff at transportation facility construction sites can be addressed through site management plans. These plans call for "Best Management Practices" that apply specific measures to limit the amount of contaminants that may be contained in the runoff from construction sites. On larger projects, this can include installation of sediment basins to ensure the quality of discharges. Measures such as street sweeping and steps to reduce track-out from construction sites can also reduce the amount of sediments in runoff from transportation facilities.

- Disturbance of Watercourses and Wetlands - Another effect of transportation facilities on water resources is related to the disturbance of watercourses and wetlands, impacting the ability of washes, rivers and wetlands to exist as functioning systems. Transportation structures can impede natural flow and flood patterns, which may affect surface water quality, the ground water recharge process, and riparian habitats.

The impacts of transportation facility crossings of washes, rivers and wetlands can be addressed through design practices that focus attention on keeping water courses as functional as possible. In addition to design measures, direct avoidance of sites, where possible, is another approach to limiting the impacts of transportation facilities. The trade-off between channelizing and bridging a stream, river or wetland involves both cost considerations and environmental factors. Bridging with channelization may be more attractive than bridging, alone, in terms of cost, but the environmental consequences of the former may be much more significant.

Future locations where new transportation facilities may have significant effects on water courses are in the Hassayampa Valley area and along the Gila River. In particular, this would involve an expanded transportation network to handle population growth west of the White Tank Mountains and the development of SR 801 (I-10 Reliever Freeway). New or expanded transportation facilities in both these locations will be affecting major riparian areas and their biological habitats. The crossing of the Agua Fria River delta at the Gila River will involve a number of major of 404 Permit and other environmental factors.

- Water Conservation, Subsidence and Other Factors - Ground water should not be used for high water using plants and water features located in publicly owned rights-of-way of highways, streets and other transportation facilities. Subsidence

due to ground water pumping can present an issue for transportation facilities, causing settling or misalignment of roadways after they are constructed. In addition other water-related sites should be avoided where possible. Examples of such sites includes water treatment plants, fresh water wells, test wells, contaminated or potentially contaminated areas (bio-soils, feed lots, superfund sites), surface water intakes, earth fissures, runoff discharges near well sites, and unique streams.

The evolving nature of data needs to be kept in mind. Features such as water tables, stream contours and water sheds can change in response to climatic trends, development and other factors.

Noise

- Facility Mitigation - The vehicular traffic in transportation corridors may potentially affect noise levels in areas adjacent to the corridor. Mitigation measures such as rubberized asphalt pavement overlays, noise walls, berms and depressed facilities should be considered. Also, coordination with local government planning can direct appropriate land uses to areas adjacent to major transportation facilities.

Habitat

- Wildlife Corridors - Wildlife movements often form corridors, and transportation facilities that cut across these corridors can interrupt normal migration patterns and jeopardize the viability of wildlife groups. Canals and railways, as well as roads, can be barriers to habitat and wildlife connectivity. Like wildlife, plant life dispersal patterns can be affected by transportation facilities, but perhaps to a lesser extent than wildlife. A wildlife corridor in general is defined as the entire habitat area including the entrance, exit, and habitat within.

As development increases along a wildlife corridor, it decreases the likelihood of travel by wildlife. Mountain ranges in general have been relatively easier to conserve due to the understanding that the species found there are specific to the montane habitat. However, now the valley bottoms between mountain ranges are becoming more important than ever. The species contained in these areas are becoming more threatened due to development and habitat fragmentation. It is important to note that even if wildlife connectivity corridors are incorporated into development patterns, it may be difficult for wildlife to find the specific corridor, because they are accustomed to traveling the entire valley bottom. One of the long term concerns is that wildlife populations will have to be artificially augmented through animal transportation to have continued genetic diversity, due to habitat fragmentation.

An effective response to this issue is to identify where wildlife corridor interruptions may occur and to provide “wildlife-friendly” crossing structures (bridges, culverts, underpasses etc.) for the involved transportation facility. Studies to determine the best habitat corridor and fencing options to funnel wildlife may be able to assist in these types of situations. Other measures include timing construction to minimize disruption of breeding seasons, and pursuing mitigation banking. Also, using existing utility corridors for roads, canals, railways, etc. can help limit the amount of disruption. The area along 51st Avenue needs a wildlife friendly crossing structure so that wildlife may travel from South Mountain to the Sierra Estrella Mountains. It should be noted that paving existing dirt roads may tend to increase traffic volumes and speeds, increasing barrier effects to wildlife.

- Riparian Areas - Wildlife migration patterns form corridors that are often along riparian areas. Transportation facilities can affect the wildlife and plant life associated with rivers, streams and wetlands, in addition to the water quality. Locations such as the Salt River, Gila River, Agua Fria River, and many large washes are used by a large diversity of wildlife. A continuing effort will be required in order to preserve existent habitat in the central part of Maricopa County, as well as the habitat in the currently rural areas of the County. Providing wildlife-friendly” crossings, reducing the number of streambed crossings, and eliminating wetland intrusions can help minimize impacts. The current location of the Canamex Corridor crosses a number of major washes and will pose riparian habitat challenges.
- Mitigation Banking - There is a tendency for mitigation efforts to lag, and not be effective until well after construction is completed, resulting in greater impacts on habitat. Mitigation banking attempts to ameliorate this pattern by establishing new habitats, or implementing other mitigation measures at locations removed from the construction site, so that habitats will be continuously available. This helps maintain uninterrupted habitat opportunities for wildlife and lessens the impacts of new construction. The priority for mitigation banking is in a location immediately adjacent to a project, followed by locations in the same watershed, and finally “in-lieu” habitat purchases or mitigation measures in well removed locations.
- Facility Maintenance and Surveys - The timing of road maintenance and repairs, surveys of riparian vegetation and aquatic communities around bridge abutments, assessment of hazardous spills, and designation of critical habitat are factors of continuing interest for habitat protection as the transportation planning process proceeds.

- Urban Heat Island - The urban heat island effect of transportation facilities, especially heat retention by pavements, warrants consideration in assessing environmental issues related to long-range transportation planning efforts.

Natural and Historic Resource Conservation

The consultation process with environmental and resource agencies yielded conservation issues and concepts in three major areas: cultural resources, natural resources, and land use patterns. The key points emerging from the discussions on these topics have been summarized below for consideration in the transportation planning process.

Cultural Resources

- Tribal Cultural Resources - In the transportation planning process tribal cultural resources, in particular, should be considered early and in considerable detail. This may warrant early consultation with Native American Tribes concerning facility locations, before alternatives are actually identified in detail. This may help avoid selection of a final option that has major impacts that are not discovered until construction earthwork is underway. New technologies can yield significant information that will help in the definition of alignment alternatives that have the least impact on archaeological sites. In general, riparian locations are may be closely associated with archeological sites. This will be a major factor affecting the S.R. 801 corridor.

Excavation, particularly of burial sites, is no longer considered under Section 106 of the National Historic Preservation Act, to be a "no adverse effect" mitigation measure, but rather an "adverse effect." Therefore, the potential for new transportation facilities to intrude in such areas has taken on greater significance and warrants extensive identification and eligibility determinations before final decisions are made regarding facility locations.

- Cultural Context - Another factor that warrants early consideration in the transportation planning process relates to the historic and cultural context (theme, location, time period) associated with the potential location of a transportation facility. Certain locations and topographical/geological features may have particular significance to a given culture. The potential impact of transportation structures in these locations bears consideration in the planning process. This factor is particularly relevant to the S.R. 202L (South Mountain Freeway) corridor.
- Historic Structures - Negative impacts to historic structures, archaeological sites, and Traditional Cultural Places should be avoided where possible. Cultural features such as canals may be historic, and the impacts of new transportation facilities or facility improvements not overlooked. The structures associated

with transportation facilities, in themselves, can be historic in nature, and a given route can represent an historic element in the overall history of a particular region or place. It is important to identify the key historical aspects of transportation facilities for future preservation.

- Visual Factors - The general visual effects of transportation facilities on the surrounding community are an aspect that should not be overlooked. This may be particularly important as it relates to historic and cultural elements of the community.
- Federal Requirements - Some projects will involve federal funding, land, permits, or other types of federal involvement. These projects will need to be reviewed for impacts to cultural resources following the Section 106 process. There are federal standards (the Secretary of Interior's Standards) and requirements, such as tribal consultation, that will need to be followed. The federal agency involved in the project or plan will take the lead completing this process.
- Other Considerations - While often not addressed in this context, bicycle and pedestrian facilities represent, in effect, important cultural resources that need to be maintained and fully taken into account in the transportation planning process.

Natural Resources

- National Forest Areas - Transportation facilities have high impacts on National Forest areas, potentially bringing high volumes of vehicles and people to areas that are readily affected by the accompanying air pollution, fire risk, soil erosion, damage to plants and wildlife, and other impacts. In addition, development that is adjacent to National Forest areas will place an increasing burden of users on a finite resource. Dealing with these demands, while conserving forest resources, requires a balanced approach and presents a variety of challenges.

Given their extensive impacts, new transportation corridors are a major concern for the protection of National Forest areas. Proposals for new corridors must first have a clearly defined purpose and need, as well as demonstrated benefits for Forest areas, before they can be considered for further study. The potential impacts of new transportation corridors are always accompanied by public and agency concerns over the degradation of the natural environment of Forest areas.

It is recognized that there may be a need for transportation facility operators to address safety and capacity issues related to existing highways through forest

areas. This may result in the need for rock-fall prevention measures, addition of grade separations, shoulder widening or additional lanes. Assessing the potential impact of these kinds of improvements and identifying mitigation measures are a key element in the NEPA process. In addition to project-specific mitigation, there may be a need to mitigate the presence of a highway corridor, in general, through accommodations for wildlife linkages or other facility alterations.

- Other Federal Lands - Access to federal lands is a major issue in the relationship between transportation and resource conservation. An effort is made to focus access to federal lands through specific "portals" that control where people and vehicles can enter but, at the same time, provide adequate opportunities for the public to take advantage of recreational opportunities. Designated Federal Wilderness Areas may not be used for transportation purposes or developed in any other manner.

If local government land use and circulation plans result in blocking portals to federal lands, effectively isolating the land, public access suffers. On the other hand, if major roadways run through federal lands, it opens up the potential for vehicles to turn off and enter these areas indiscriminately. This can result in environmental damage and create other environmental issues such as dust from unauthorized off-road vehicle usage. In both cases, coordination by land use and transportation agencies is vital to reach a balance between too much and too little access. Exits from major roadways specifically to provide access to federal lands can help address the issue. Also, integrating federal land portals into local land use and circulation plans can help avoid isolating federal lands and maintain public access.

The future extension of the Loop 303 corridor, enhancements to SR 238, implementation of the Wickenburg Bypass, and development of new corridors in the West Valley will potentially have major impacts on federal lands.

Land Use Patterns

- Open Space - Maintaining critical open space areas should be a major factor in preparing future transportation plans, along with wildlife migratory routes between habitats. The Regional Park and Trail System warrant careful consideration as part of the transportation planning process. Maricopa County has a County Park Master Plan for the regional park system that looks out over the next 20 years. Similarly, the Maricopa Trail is an example of a resource that needs to be protected in the future. Transportation also needs to consider transportation facilities that are effective in moving people to regional park areas.

- Sustainable Communities - A major aspect of the land use planning/transportation planning process should be a focus on the development of sustainable communities, taking a comprehensive view of transportation trade-offs in the urban environment. The land use planning/transportation planning nexus is key in the overall effort to maintain environmental quality. Land use planning approaches that emphasize mixed use development are essential. They help increase the proximity of homes to shopping and jobs and minimize the increase in travel that accompanies population growth in the region. Developments should be planned to accommodate park-and-ride lots and other alternative mode facilities, so that their implementation is not precluded as land costs increase in the future.

At the same time, traditional activities, such as agriculture, produce complaints from nearby residents who live in neighborhoods that were constructed immediately at the boundaries of these activities. Sustaining these activities in the overall land use mix represents a major challenge.

- Development Community - The development community should take a proactive role in addressing environmental issues and the impacts of development on transportation facilities and other infrastructure. Careful attention to the development process is vital to dealing with the high pace of growth in the region, and the resulting major infrastructure and environmental impacts. By working closely, at every opportunity with the development community during the land use planning process, State, regional, and local agencies can help ensure that effective infrastructure systems, including transportation facilities, are identified and integrated into development plans. This helps maintain an orderly development process and helps mitigate the regional impacts of growth.
- Access Impacts - Transportation facilities that lie along the border of a community may result in environmental impacts on that community, including effects on air and water quality, noise, dumping of trash, vehicle trespass, and potential effects of trucking. The commercial development that transportation facilities attract also may affect the surrounding community. These effects should be considering as part of the transportation planning process.

Planning Process Considerations

During the meetings with key environmental and resource agencies, the discussions often led into the area of transportation planning, in general, and how environmental and resource concerns can be effectively integrated into the planning process. The major points made in this connection, which focused on the areas of early agency involvement and planning coordination, are summarized below.

Early Involvement

- Environmental and Resource Agencies - Early involvement by environmental and resource agencies in planning for new transportation corridors, as well as improvements to existing facilities, is essential to ensure that workable alternatives are defined, and full consideration of required mitigation measures is properly addressed. It is especially important not to overlook the fact that the need for early involvement improvements/changes to existing transportation facilities is as important as coordination on new corridors.
- All Project Levels - Early involvement is not only important for major corridors, such as those developed by ADOT, but is also vital for projects constructed at the city and county level. Participation in the planning process during MAG area studies and transportation corridor studies will provide the opportunity for input before key planning decisions are made. This involvement should occur prior to implementing the NEPA process, so that key environmental and resource issues can be considered before they become large and significant. Early involvement is also important for effective identification and application of databases and other information inventories.
- Cultural Resources - Early consultation regarding cultural resources has become an increasingly important factor in transportation studies. It is important to consider land use, cultural, and environmental factors at the very beginning of transportation studies (including the identification of alternatives), so that significant conflicts can be noted and alternatives with high impacts can potentially be avoided, before major amounts of time and resources are invested in analysis.
- Access Issues - Early involvement of resource agencies in the transportation planning process can help ensure that access control issues are addressed effectively, both in terms of the location of access and the timing of access control structures. Controlling access is a key factor in limiting damage to sensitive areas, but, at the same time, adequate access is an important factor for the value of State land holdings. Features such as interchange spacing intervals along freeway/expressway routes are especially significant.

Planning Coordination

- Corridor Level Focus - In transportation corridor and area studies, potential environmental mitigation measures specific to each corridor alternative should be described and assessed as part of the characteristics of the corridor, rather than addressing the issue, as a whole, in the overall study process. In addition, as part of these studies it is important to maintain the focus on issues affecting the immediate study area and avoid diverting attention to other areas or facilities.
- Technical Committees - MAG technical committees and working groups represent an excellent avenue for agencies to follow key issues in the region, as

well as to provide information on environmental mitigation and resource conservation methods and concerns. It would be advantageous for key environmental and resource agencies to be involved in these groups.

- Emergency Management - Emergency evacuation routes should be a consideration in the transportation planning process. This includes the potential need for evacuation of the MAG Region, as well as handling of evacuees into the area from other parts of the country. The need to use transportation facilities for evacuation purposes also has numerous design implications, including ease of facility ingress/egress, chokepoints, and alternative routes. Emergency evacuation preparedness requires regional coordination among local entities. As transportation facilities are planned, consideration should also be given to the need for access by emergency service vehicles and accommodation of farm equipment.
- Interregional Planning - The central Arizona area, especially the Maricopa County and Pinal County areas, would greatly benefit from an integrated planning program. The growth in this area has become a multi-county proposition, as development patterns have extended across county boundaries. Additionally, the issue of an adequate resources base needed to deal with multi-county infrastructure needs is a growing issue. Public transit services in the MAG Region should be closely coordinated with Pinal County communities. The impact of the motor vehicle travel from this high growth area into Maricopa County is significant and needs to be addressed.
- Public Information - A broad range of street, highway and light rail transit improvements are being constructed in the region simultaneously. Implementing agencies should make every effort to schedule improvement projects in a way that retains alternative route options along major north-south and east-west corridors. In addition, construction activities and closures should be well-publicized in advance, allowing motorists to make efficient adjustments in their travel patterns.
- Right-of-Way - The potential complexities of right-of-way acquisition for future facilities should be recognized early in the planning process, so that they do not become a major barrier to effective project development later in the plan implementation process. This is particularly the case where right-of-way on allotted Indian Community land might be involved.

The State Land Department is legally prohibited from donating right-of-way for the construction of transportation facilities. Also, early transportation right-of-way sales, when prices are lower, to ensure good access to State lands in the future are problematic. The courts have held that the actual realization of increased future access and the resulting land value benefits are too uncertain to justify early sale of right-of-way.

Appendix C

Regional Freeway/Highway Projects

TABLE C-1
2040 REGIONAL TRANSPORTATION PLAN UPDATE
REGIONAL FREEWAY/ HIGHWAY PROJECTS

PROJECT DESCRIPTION	COST FY 2020 - FY 2040 (2019 \$'s in 1,000's)	PLAN GROUP *
<u>I-10/Papago</u>		
10 (Papago): SR85 to Verrado Way Construct general purpose lanes	118,200	1
10 (Papago): Fairway Dr (El Mirage Rd) TI Construct new traffic interchange	23,900	1
10 (Papago): Desert Creek/323rd Ave Construct new interchange ***	20,400	1
10 (Papago): 395th Ave Construct new interchange ***	20,020	1
Subtotal	182,520	
<u>I-10/Maricopa</u>		
10 (Maricopa): Sky Harbor West Airport Access Reconstruct traffic interchange (RFHP Map I.D. # 3)	100,000	2
10 (Maricopa): I-17 Split to SR-202L/Santan Construct lanes, rebuild interchanges, construct bike/ped overcrossings	681,000	1
10 (Maricopa): SR202L/Santan to Riggs Rd Construct HOV and general purpose lanes	129,100	2
10 (Maricopa): Chandler Heights Rd (Gila River Indian Community Access Imp.) Construct new traffic interchange	15,000	1
10 (Maricopa): Baseline Rd Reconstruct traffic Interchange	75,000	3
10 (Maricopa): Baseline Rd to Elliot Rd Construct collector-distributor lanes	145,000	3
10 (Maricopa): Riggs Rd to MPA Boundary Construct general purpose lanes**	296,800	3
Subtotal	1,441,900	
<u>I-11</u>		
11: Interstate 10 to US-93 Construct four-lane rural freeway	1,214,506	3
<u>I-17/Black Canyon</u>		
17: Central Ave Rebuild Overcrossing	31,600	1
17: I-10 Split to 19th Ave Construct Construct auxiliary lanes	77,800	1
17: I-10 Split to 19th Ave Construct lanes & rebuild interchanges	276,900	3
17: Indian School Rd Rebuild traffic interchange	59,100	1

PROJECT DESCRIPTION	COST FY 2020 - FY 2040 (2019 \$'s in 1,000's)	PLAN GROUP *
17: Camelback Rd Rebuild traffic interchange	85,900	2
17: Glendale Ave Rebuild traffic interchange	65,500	3
17: Northern Ave Rebuild traffic interchange	74,700	3
17: Peoria Ave to Greenway Rd Construct drainage improvements	36,200	1
17: Thunderbird Rd Rebuild traffic interchange	106,600	3
17: Bell Rd Rebuild traffic interchange	136,600	3
17: Pinnacle Peak Rd to Happy Valley Rd Rebuild traffic interchanges	44,000	1
17: Anthem Way to Yavapai County Line Construct general purpose lanes	50,000	1
17: SR-74 to Anthem Wy Construct HOV lanes	47,560	3
17: 19th Ave. to Indian School Reconstruct mainline and construct HOV lanes	462,375	3
17: Indian School to Dunlap Reconstruct mainline and construct HOV lanes	437,625	3
17: Dunlap to SR-101L Reconstruct mainline and construct HOV lanes	220,440	3
17: US-60/Grand Ave Construct DHOV traffic interchange	150,000	3
17: SR-101L System interchange Construct DHOV freeway ramps	150,000	3
17: I-10/Maricopa (Split) Interchange Construct DHOV freeway ramps	200,000	3
17: Mores Gulch Replace bridge****	10,000	1
Subtotal	2,722,900	
<u>SR-24/Gateway</u>		
24 (Gateway): Ellsworth Rd to Ironwood Rd Construct new freeway - Phase 1 (RFHP Map I.D. # 33)	216,300	1
24 (Gateway): 202L to Meridian Rd (Ironwood Dr) Convert to full freeway	105,000	3
Subtotal	321,300	
<u>SR-30/Tres Rios</u>		
30 (I-10 Reliever): SR303L to SR202L Preserve R/W for a full freeway	464,600	1
30 (I-10 Reliever): SR303L to SR202L Construct full freeway	2,370,000	3
30 (I-10 Reliever): SR85 to SR303L Construct Phase 1 roadway & preserve R/W for a full freeway	350,000	3
30 (I-10 Reliever): SR85 to SR303L convert to full freeway, SR-85 system interchange	1,650,000	3

PROJECT DESCRIPTION	COST FY 2020 - FY 2040 (2019 \$'s in 1,000's)	PLAN GROUP *
30 (I-10 Relever): SR 202L to I-17 Construct new freeway, including I-17 system interchange	1,500,000	3
Subtotal	6,334,600	
<u>SR-51/Piestewa</u>	N/A	N/A
<u>US-60/Grand Ave</u>		
60 (Grand Ave): 35th Ave/Indian School Rd Rebuild traffic interchange	162,700	2
60 (Grand) 101L to Van Buren St. Construct two traffic interchanges (locations to be determined)	250,000	3
Subtotal	412,700	
<u>US-60/Superstition</u>		
60 (Superstition): Crismon Rd to Meridian Rd Construct general purpose and HOV lanes	28,800	3
60 (Superstition): Crismon Rd to Idaho Rd Install FMS	4,300	3
60 (Superstition): Mountain Rd to Renaissance Festival Construct Arizona parkway **	28,800	3
Subtotal	61,900	
<u>SR-74/Carefree Hwy</u>		
74: US60 Grand Ave to SR-303 Protect R/W for future freeway corridor	42,500	3
<u>SR-79</u>		
79: Butte Ave to CAP (North of Florence) Construct general purpose lanes **	15,225	3
<u>SR-85</u>		
85: Warner Street Construction Bridge	5,500	1
<u>SR-87</u>	N/A	N/A
<u>SR-88</u>	N/A	N/A
<u>US-93</u>		

PROJECT DESCRIPTION	COST FY 2020 - FY 2040 (2019 \$'s in 1,000's)	PLAN GROUP *
93: Tegner St to MPA Bndry. Construct general purpose lanes	26,000	1
<u>SR-101L/Agua Fria</u>		
101 (Agua Fria): I-10 System Interchange Construct interchange improvements	202,500	2
101 (Agua Fria): I-10 to US-60 Construct general purpose lanes	162,600	3
101 (Agua Fria): US-60 to 75th Ave Construct general purpose lanes	95,400	3
101 (Agua Fria): 75th Ave to I-17 Construct general purpose lanes	110,900	2
Subtotal	571,400	
<u>SR-101L/Pima</u>		
101 (Pima): I-17 to Pima Road Construct general purpose lanes	190,300	1
101 (Pima): Pima Rd to Shea Blvd Construct general purpose lanes	77,300	1
101 (Pima) Pima Rd Extension (JPA)	3,931	2
Subtotal	271,531	
<u>SR-101L/Price</u>		
101 (Price): Baseline Rd to SR-202L/Santan Construct general purpose lanes (RFHP Map I.D. # 27)	68,400	1
<u>SR-143/Hohokam</u>		
	N/A	N/A
<u>SR-202L/Red Mountain</u>		
202 (Red Mountain): Broadway Road to Gilbert Road/Santan Fwy Construct HOV lanes	89,500	3
202 (Red Mountain): Val Vista Dr to Higley Rd Construct general purpose lanes	51,900	3
202 (Red Mountain): Higley Rd to US-60 Construct general purpose lanes	108,300	3
202 (Red Mountain): US-60 Superstition TI Construct DHOV freeway ramps	138,900	3
Subtotal	388,600	
<u>SR-202L/Santan</u>		
202 (Santan): Lindsay Rd Construct new traffic interchange	26,900	1

PROJECT DESCRIPTION	COST FY 2020 - FY 2040 (2019 \$'s in 1,000's)	PLAN GROUP *
202 (Santan): Val Vista Rd to SR-101 Construct general purpose lanes	166,400	2
202 (Santan): SR-101 to I-10 Construct general purpose lanes	52,000	3
202 (Santan): US-60 to Val Vista Rd Construct general purpose lanes	121,000	3
Subtotal	366,300	
SR-202L/South Mountain		
203 (South Mountain): P3 Maintenance Design, build, and maintain new freeway	6,072	1
Subtotal	6,072	
SR-238		
238: SR-347 to Warren Rd Construct general purpose lanes**	25,500	2
SR-287		
287: SR-79 to MPA Boundary Construct general purpose lanes **	15,225	3
SR-303L/Estrella		
303 (Estrella): MC 85 to Van Buren St Construct new freeway	303,200	3
303 (Estrella): Northern Ave/Olive Ave Construct traffic interchange improvements	21,500	3
303 (Estrella): Happy Valley Pkwy to Lake Pleasant Pkwy Construct general purpose lanes	37,500	1
303 (Estrella): Northern Ave to Clearview Blvd Install FMS	4,864	1
303 (Estrella): Lake Pleasant Rd to I-17 Install FMS	4,864	1
303 (Estrella): US60 Grand Ave Construct traffic interchange improvements	124,600	3
303 (Estrella): Northern Parkway Construct traffic interchange improvements	85,600	3
303 (Estrella): Lake Pleasant Pkwy to I-17 Construct ultimate freeway section & system interchange at I-17	255,500	3
303 (Estrella): Riggs Rd - SR-30 Protect R/W	100,000	3
Subtotal	937,629	
SR-347		
347: I-10 to SR-238 Construct general purpose lanes **	82,000	3

PROJECT DESCRIPTION	COST FY 2020 - FY 2040 (2019 \$'s in 1,000's)	PLAN GROUP *
<u>North-South Freeway</u>		
North-South Freeway Protect R/W, including SR-24	69,000	3
<u>System-wide Programs</u>		
System-wide Preliminary Engineering	175,770	1-3
System-wide Freeway Management System	18,690	1-3
System-wide Maintenance	287,700	1-3
System-wide Freeway Service Patrol	21,000	1-3
System-wide Quiet Pavement	160,000	1-3
System-wide Right of Way Management	58,800	1-3
Subtotal	721,960	
TOTAL	16,305,168	

* Plan Groups:

Group 1 - (FY 2020 - FY 2024)

Group 2 - (FY 2024 - FY 2026)

Group 3 - (FY 2027 - FY 2040)

** Project is not part of Freeway/Highway Life Cycle Program. Cost covers MAG planning area portion only.

*** Privately funded.

****ADOT statewide funds.

For freeway/highway projects, the Plan Group generally indicates the period in which the majority of a project is programmed for construction activity. Projects may be programmed for design and/or right-of-way acquisition in earlier periods. It should be noted that the RTP presents the overall, long-range outlook for transportation improvements in the region, while the TIP provides project details.

Appendix D

Regional Arterial Street Projects

**TABLE D-1
2040 REGIONAL TRANSPORTATION PLAN
REGIONALLY FUNDED ARTERIAL STREET PROJECTS**

FACILITY/LOCATION	REGIONALLY FUNDED REIMBURSEMENTS: FY 2020 - FY 2026 (2019 \$'S in millions)	REGIONALLY FUNDED REIMBURSEMENTS: FY 2026 - FY 2040 (2019 \$'S in millions)	TOTAL PROJECT COST: FY 2020 - FY 2040 (2019 \$'S in millions) *	PLAN GROUP**
CHANDLER				
Price Rd Substitute Projects				
Chandler Heights Rd: Arizona Avenue to McQueen Road	0.069	0.000	0.099	Group 1
Chandler Heights Road: McQueen Road to Gilbert Road	6.582	0.000	9.403	Group 1
Ocotillo Road: Cooper Road to Gilbert Road	4.999	0.000	7.142	Group 1
Chandler Heights Rd: Gilbert Rd to Val Vista Rd	2.587	0.000	9.388	Group 2
Ray Rd/Dobson Rd				
Ray Rd at Dobson Rd: Intersection Improvements Phase II	0.000	6.452	9.216	Group 3
Ray Rd at McClintock Rd: Intersection Improvements	0.000	3.775	8.511	Group 3
Ocotillo Rd: Gilbert Rd to 148th Street	2.358	0.000	6.767	Group 1
Cooper Rd: Alamosa Dr to Riggs Rd				
Cooper Rd: Alamosa Dr to Riggs Rd (ROW)	0.967	0.000	0.000	Group 1
Cooper Rd: Alamosa Dr to Riggs Rd (DES/CONST)	10.025	0.474	0.000	Group 1
Lindsay Rd: Ocotillo Rd to Hunt Hwy	7.451	0.211	23.832	Group 1
CHANDLER/GILBERT				
Queen Creek Rd: Arizona Ave to Higley Rd				
Queen Creek Rd: McQueen Rd to Gilbert Rd (CHN)	0.000	5.112	13.402	Group 1
EL MIRAGE/MARICOPA COUNTY				
EI Mirage Rd: Northern Ave to Bell Rd (Phase I)				
EI Mirage Rd: Northern Ave to Peoria Ave (MC)	2.363	0.000	3.375	Group 1
Thunderbird Rd: 127th Ave to Grand Ave (ELM)	3.344	0.000	0.000	Group 1
EI Mirage Rd: Peoria Ave to Cactus Rd (ELM)	0.500	0.000	0.000	Group 1
EI Mirage Rd: Northern Ave to Bell Rd (Phase II)				
EI Mirage Rd: Cactus to Grand Avenue (ELM)	2.353	0.000	0.000	Group 1
Dysart Rd: Northern Ave to Peoria Ave	0.000	0.000	10.600	Group 1
FOUNTAIN HILLS				
Shea Blvd: Palisades Blvd to Cereus Wash				
Shea Blvd: Palisades Blvd to Technology Dr	2.172	0.692	5.442	Group 1
GILBERT				
Elliot Rd at Cooper Rd: Intersection Improvements	7.614	0.000	10.877	Group 1
Germann Rd: Gilbert Rd to Power Rd				
Germann Rd: Gilbert Rd to Val Vista Dr	15.501	0.000	23.170	Group 1

FACILITY/LOCATION	REGIONALLY FUNDED REIMBURSEMENTS: FY 2020 - FY 2026 (2019 \$'S in millions)	REGIONALLY FUNDED REIMBURSEMENTS: FY 2026 - FY 2040 (2019 \$'S in millions)	TOTAL PROJECT COST: FY 2020 - FY 2040 (2019 \$'S in millions) *	PLAN GROUP**
Guadalupe Rd at Power Rd: Intersection Improvements	0.000	6.280	11.428	Group 2
Ray Rd at Gilbert Rd: Intersection Improvements	0.000	3.775	7.594	Group 3
Higley Rd at Baseline Rd: Intersection Improvements	3.364	0.000	4.806	Group 1
Lindsay Road/SR-202L Transportation Interchange and Corridor Improvements				
Lindsay Road/SR-202L Transportation Interchange & Frontage Road	2.225	0.000	26.120	Group 1
Lindsay Road: Pecos Road to Germann Road	7.608	0.000	10.426	Group 1
Mustang Drive: Rivulon Blvd to Germann Road	6.850	0.000	7.512	Group 2
Val Vista Dr: Appleby Rd to Riggs Rd	19.796	4.515	34.044	Group 1
McQueen Rd at Elliot Rd	2.992	1.919	10.384	Group 1
<u>GILBERT/MESA/MARICOPA COUNTY</u>				
Power Rd: Santan Fwy to Chandler Heights				
Power Rd: Pecos to Chandler Heights (GIL)	0.000	0.000	27.993	Group 2
Power Rd: Baseline Rd to Santan Fwy				
Power Rd: East Maricopa Floodway to Santan Fwy/Loop 202 (MES)	8.193	0.000	31.046	Group 1
<u>MARICOPA COUNTY</u>				
Dobson Rd: Bridge over Salt River	0.000	0.000	44.110	Group 3
El Mirage Rd: Bell Rd to Jomax Rd				
El Mirage Rd: Bell Rd to Deer Valley Dr	0.853	0.000	0.000	Project Complete
El Mirage Rd: L303 to Jomax	0.000	0.000	17.889	Group 3
Gilbert Rd: Bridge over Salt River	39.037	0.000	85.438	Group 2
McKellips Rd: Bridge over Salt River	0.000	14.005	72.925	Group 3
McKellips Rd: Loop 101 to SRP-MIC/Alma School Rd	11.948	14.567	10.807	Group 1
Northern Pkwy: Sarival to Grand (Phase II)				
Northern Pkwy: Dysart to 111th	24.504	0.000	31.239	Group 1
Northern Parkway: 99th Ave to 91st Ave	16.100	0.000	41.056	Group 1
Northern Pkwy: Dysart Overpass	0.000	0.000	0.050	Group 1
Northern Parkway: 111th Ave to Grand	0.000	0.000	1.250	--
Northern Parkway: Loop 101 to Grand Ave Scoping Assessment	0.000	0.000	0.235	--
Northern Parkway: Dysart and El Mirage Overpass	15.311	0.000	30.322	Group 1
Northern Pkwy: Sarival to Grand (Phase III)				
Northern Pkwy: El Mirage Alternative Access	3.199	0.000	4.560	Group 1
Northern Pkwy: El Mirage Overpass	0.000	0.000	0.050	--
Northern Pkwy: Agua Fria to 112th	12.460	0.000	19.400	Group 1
Northern Pkwy: 112th to 107th	15.820	0.000	20.346	Group 1
Northern Pkwy: 107th to 99th	31.571	0.000	29.289	Group 1
Northern Pkwy: Loop 101 to 91st	3.575	0.000	5.108	Group 2

FACILITY/LOCATION	REGIONALLY FUNDED REIMBURSEMENTS: FY 2020 - FY 2026 (2019 \$'S in millions)	REGIONALLY FUNDED REIMBURSEMENTS: FY 2026 - FY 2040 (2019 \$'S in millions)	TOTAL PROJECT COST: FY 2020 - FY 2040 (2019 \$'S in millions) *	PLAN GROUP**
Northern Pkwy: 91st to Grand Intersection Improvements	0.000	0.000	9.939	Group 2
Northern Pkwy: ROW Protection	0.000	0.000	0.000	--
Northern Pkwy: Ultimate Construction	0.000	0.000	1.010	Group 2
Northern Pkwy: Agua Fria to 99th	2.169	0.000	3.100	--
MESA				
Broadway Rd: Country Club Dr to Stapley Dr				
Broadway Rd: Country Club Dr to Mesa Dr	5.640	0.000	12.555	Group 1
Broadway Rd: Mesa Dr to Stapley Dr	15.467	0.000	15.991	Group 1
Country Club Dr at University Dr: Intersection Improvements	0.000	8.325	25.268	Group 3
Crismon Rd: Broadway Rd to Germann Rd				
Crismon Rd: Broadway Rd to Guadalupe Rd	0.000	9.919	17.965	Group 3
Dobson Rd at University Dr: Intersection Improvements	0.000	4.921	8.224	Group 3
Elliot Rd: Power Rd to Meridian Rd				
Elliot Rd: Power Rd to Ellsworth Rd	12.423	5.063	15.947	Group 2
Elliot Rd: Ellsworth Rd to Signal Butte Rd	8.560	0.000	14.313	Group 1
Hawes Rd: Broadway Rd to Ray Rd				
Hawes Rd: Broadway Rd to US60	0.000	0.000	10.697	Group 2
Hawes Rd: Baseline Rd to Elliot Rd	7.108	0.000	10.368	Group 3
Hawes Rd: Elliot Rd to Santan Freeway	4.415	0.000	8.386	Group 3
McKellips Rd: East of Sossaman to Meridian				
McKellips Rd: East of Sossaman to Crismon Rd	12.283	0.000	17.440	Group 2
McKellips Rd: Crismon Rd to Meridian Rd	0.000	0.000	11.545	Group 3
Mesa Dr: Southern Ave to US60 and Mesa Dr to Broadway Rd				
Mesa Dr: US 60 to Southern Ave	0.053	0.000	0.076	Project Complete
Mesa Dr: 8th Ave to Main Street	9.870	0.000	14.100	Group 1
Pecos Rd: Ellsworth Rd to Meridian Rd				
Pecos Rd: Ellsworth Rd to Meridian Rd Phase I	6.985	0.000	9.979	Group 1
Pecos Rd: Ellsworth Rd to Meridian Rd Phase II	8.396	0.000	19.603	Group 2
Signal Butte Rd: Broadway to Pecos Rd				
Signal Butte Rd: Broadway Rd to Elliot Rd	11.693	0.000	18.151	Group 3
Signal Butte Rd: Williams Field Rd to Germann Rd	12.664	0.000	16.946	Group 1
Signal Butte Rd: Ray Rd to Williams Field Rd	0.000	0.000	8.000	Group 3
Southern Ave: Country Club Dr to Recker Rd				
Southern at Country Club Dr: Intersection Improvements	6.469	0.000	12.647	Group 1
Southern Ave at Stapley Dr: Intersection Improvements	10.952	0.000	16.097	Group 1
Southern Ave: Gilbert Rd to Val Vista Dr	4.715	0.000	11.590	Group 2

FACILITY/LOCATION	REGIONALLY FUNDED REIMBURSEMENTS: FY 2020 - FY 2026 (2019 \$'S in millions)	REGIONALLY FUNDED REIMBURSEMENTS: FY 2026 - FY 2040 (2019 \$'S in millions)	TOTAL PROJECT COST: FY 2020 - FY 2040 (2019 \$'S in millions) *	PLAN GROUP**
Southern Ave: Greenfield Rd to Higley Rd	5.606	0.000	0.000	Group 1
Southern Ave: Sossaman Rd to Meridian Rd				
Southern Ave: Sossaman Rd to Crismon Rd	0.000	8.014	11.449	Group 3
Southern Ave: Crismon Rd to Meridian Rd	0.000	5.296	10.788	Group 3
Stapley Dr at University Dr: Intersection Improvements	7.785	6.585	5.448	Group 1
University Dr: Val Vista Dr to Hawes Rd				
University Dr: Val Vista Dr to Higley Rd	11.204	0.000	15.600	Group 3
University Dr: Higley Rd to Sossaman Rd	9.018	0.000	16.127	Group 3
Val Vista Dr: University Dr to Baseline Rd				
Val Vista Dr: Baseline Rd to US-60	3.416	4.722	4.880	Group 1
Val Vista Dr:US-60 to Pueblo	0.000	0.000	7.661	Group 2
Baseline Rd: 24th Sreet to Consolidated Canal	7.726	0.000	11.037	Group 1
Mesa Main Street: Mesa Dr to Gilbert Rd Light Rail Extension	15.476	0.000	16.411	Group 1
PEORIA				
Happy Valley Rd: L303 to 67th Avenue				
Happy Valley Rd: Agua Fria to Loop 303	0.000	0.000	5.383	Group 1
Happy Valley Rd: Lake Pleasant Pkwy to Agua Fria	0.700	11.114	20.070	Group 1
Lake Pleasant Pkwy: Union Hills to SR74				
Lake Pleasant Pkwy:Loop 303 to SR-74/Carefree Hwy	0.000	0.000	22.045	Group 3
Jomax Rd: SR-303L to Vistancia Blvd	6.830	17.761	7.000	Group 1
PHOENIX				
Avenida Rio Salado: 51st Ave. to 7th St.				
Avenida Rio Salado Phase II: 51st Ave to 35th Ave,7th Ave, and 7th St.	0.000	0.000	0.400	Group 1
Happy Valley Rd: 67th Ave to I-17				
Happy Valley Rd: I-17 to 35th Ave	0.000	0.078	0.000	Project Complete
Happy Valley Rd: 35th Ave to 43rd Ave	0.000	5.232	8.191	Group 3
Happy Valley: 43rd Ave to 55th Ave	0.000	4.671	9.497	Group 3
Happy Valley: 55th Ave to 67th Ave	0.000	3.310	10.124	Group 3
Happy Valley: I-17 to 35th Ave Scoping and Environmental Study	0.500	0.000	0.714	--
SCOTTSDALE/CAREFREE				
Pima Rd: SR101L to Happy Valley Rd and Dyn. Rd to Cave Creek				
Happy Valley Rd: Pima Rd to Alma School Rd	12.316	0.000	16.543	Group 1
Pima Rd: Pinnacle Peak to Happy Valley Rd (SCT)	15.199	0.000	4.664	Group 1
Pima Rd: Dynamite Blvd to Las Piedras (SCT)	14.130	0.000	20.186	Group 2

FACILITY/LOCATION	REGIONALLY FUNDED REIMBURSEMENTS: FY 2020 - FY 2026 (2019 \$'S in millions)	REGIONALLY FUNDED REIMBURSEMENTS: FY 2026 - FY 2040 (2019 \$'S in millions)	TOTAL PROJECT COST: FY 2020 - FY 2040 (2019 \$'S in millions) *	PLAN GROUP**
Pima Rd: Las Piedras to Stagecoach Rd (SCT)	18.130	0.000	27.350	Group 2
Pima Rd: Stagecoach Rd to Cave Creek (CFR)	4.933	0.625	7.940	Group 2, 3
SCOTTSDALE				
Carefree Hwy: Cave Creek Rd to Scottsdale Rd	8.012	0.000	11.446	Group 2
SR-101L North Frontage Roads: Pima/Princess Dr to Scottsdale Rd				
SR-101L Frontage Rd: Pima Rd/Princess Dr to Hayden Rd	0.000	29.014	41.449	Group 3
Miller Rd/SR-101L Underpass				
Miller Rd/SR-101L Underpass	13.305	0.000	13.250	Group 1
Miller Road: Princess Blvd. to Legacy Blvd	0.000	0.000	9.000	Group 3
Pima Rd: Happy Valley Rd to Dynamite Blvd				
Pima Rd: Happy Valley Rd to Jomax Rd	15.546	0.000	29.059	Group 2
Pima Rd: Jomax Rd to Dynamite Blvd	8.202	0.000	4.867	Group 2
Pima Rd: McKellips Rd to Via Linda				
Pima Rd: Via Linda to Via De Ventura	1.237	0.000	1.410	Group 1
Pima Rd: Krail St to Chaparral Rd	13.751	0.000	7.759	Group 1
Pima Rd: Chaparral Rd to Thomas Rd	6.683	0.000	9.547	Group 2
Pima Rd: Thomas Rd to McDowell Rd	0.341	0.000	0.487	Group 3
Scottsdale Airport: Runway Tunnel				
Frank Lloyd Wright Blvd at Loop 101 Traffic Interchange	1.573	0.000	2.247	Group 1
Raintree Dr at Loop 101 Traffic Interchange	5.267	0.000	7.524	Group 1
Redfield Rd: Raintree Dr to Hayden Rd	1.500	0.000	2.143	Group 1
Raintree Drive: Scottsdale Rd to Hayden Rd	13.214	0.000	18.878	Group 1
Raintree Drive: Hayden to Loop 101	4.023	0.000	6.500	Group 1
Hayden Rd - Loop 101 Interchange Improvements	3.715	10.022	5.307	Group 3
Scottsdale Rd: Thompson Peak Pkwy to Jomax Rd				
Scottsdale Rd: Thompson Peak Pkwy to Pinnacle Peak Pkwy Phase II	6.128	0.000	8.754	Group 3
Scottsdale Rd: Pinnacle Peak Pkwy to Jomax Rd	1.800	0.000	2.571	Group 3
Scottsdale Rd: Jomax Rd to Carefree Hwy				
Scottsdale Rd: Jomax Rd to Dixileta Dr	16.659	0.000	23.799	Group 1
Scottsdale Rd: Dixileta Dr to Carefree Hwy	11.838	0.000	16.911	Group 2
Shea Blvd: SR-101L to SR-87				
Shea Auxiliary Lane from 90th St to Loop 101	3.760	0.000	5.397	Group 2
Shea Blvd Intersection Improvements	9.927	0.000	14.181	Group 1
Shea Blvd at 124th St: Intersection Improvements	0.428	0.000	0.000	Project Complete
Legacy Blvd: Hayden Rd to Pima Rd	19.840	0.000	28.350	Group 1

FACILITY/LOCATION	REGIONALLY FUNDED REIMBURSEMENTS: FY 2020 - FY 2026 (2019 \$'S in millions)	REGIONALLY FUNDED REIMBURSEMENTS: FY 2026 - FY 2040 (2019 \$'S in millions)	TOTAL PROJECT COST: FY 2020 - FY 2040 (2019 \$'S in millions) *	PLAN GROUP**
Drinkwater Blvd Bridge	5.999	0.000	8.570	Group 1
TOTAL	739.9	196.5	1,575.5	

** Plan Groups:

- Group 1 (FY 2020 - FY 2024)
- Group 2 (FY 2025 - FY 2026)
- Group 3 (FY 2027 - FY 2040)

For arterial projects, the Plan Group indicates the period in which a project is anticipated to be completed. Certain projects in Group 1 may have been completed before FY 2020. Reimbursements from regional funding sources for arterial projects may occur in later periods.

Appendix E

Regional Transit Projects

**TABLE E-1
2040 REGIONAL TRANSPORTATION PLAN
REGIONAL BUS ROUTES - OPERATING**

	ROUTE	OPERATING COSTS FY 2020 - FY 2040 (2019 \$'S in THOUSANDS)	PLAN GROUP *
<u>Express and LINK</u>			
511	Tempe/Scottsdale Airpark Express	0	NA
512	Scottsdale Express	0	NA
514	Scottsdale Express	5,299	Existing
520	Tempe Express	2,887	Existing
521	Tempe Express	5,358	Existing
522	Tempe Express SC	6,190	Existing
531	Mesa/Gilbert Express	11,529	Existing
533	Mesa Express	12,799	Existing
535	Northeast Mesa/Downtown Express	10,292	Existing
541	Chandler Express	7,912	Existing
542	Chandler/Downtown Express	10,315	Existing
562	Goodyear Express	4,652	Existing
563	Buckeye Express	3,603	Existing
571	Surprise Express	3,091	Existing
573	Northwest Valley/Downtown Express	9,688	Existing
575	Northwest Valley/Downtown Express	6,183	Existing
801	Ahwatukee Connector	2,747	Group 3
802	Anthem Express	7,468	Group 3
803	Apache Junction Express	7,882	Group 3
361	Arizona Ave/Country Club LINK	0	NA
560	Avondale Express	0	NA
805	Black Canyon Freeway Connector	4,488	Group 3
563	Buckeye Express	3,603	Existing
807	Chandler Blvd LINK	19,859	Group 3
371	Grand Ave Limited	2,788	Existing
808	Loop 303 Express	8,932	Group 3
351	Main St LINK	0	Existing
809	North I-17 Express	8,065	Group 3
810	Peoria Express	7,488	Group 3
811	Pima Express	6,517	Group 3
812	Red Mountain Freeway Connector	6,880	Group 3
813	San Tan Express	19,575	Group 3
814	Scottsdale/Rural Rd LINK	7,932	NA
816	South Central Express	0	NA
815	South Central LINK A	5,732	Group 3
819	South Central LINK B	6,012	Group 3
817	Superstition Freeway Connector	2,480	Group 3
818	Superstition Springs Express	10,445	Group 3
Sub-total		238,687	
<u>Supergrid Routes</u>			
3	Van Buren St	23,934	Existing
13	Buckeye Rd	7,456	Group 3
17	McDowell/McKellips	27,732	Existing
29	Thomas Rd	16,927	Existing
30	University Dr	44,775	Existing
40	Main St	55,776	Existing
41	Indian School Rd	15,617	Group 1

	ROUTE	OPERATING COSTS FY 2020 - FY 2040 (2019 \$'S in THOUSANDS)	PLAN GROUP
44	44th St/Tatum	1,276	Group 3
45	Broadway Rd	26,276	Existing
48	48th St/Rio Salado Pkwy	6,571	Existing
50	Camelback Rd	8,569	Existing
56	56th St	7,631	Existing
59	59th Ave	25,428	Existing
61	Southern Ave	81,565	Existing
66	Mill/Kyrene	6,894	Existing
70	Glendale Ave	41,033	Existing
72	Scottsdale/Rural	128,292	Existing
77	Baseline Rd	26,500	Group 1
81	Hayden/McClintock	79,856	Existing
83	83rd/75th Ave	5,299	Group 2
90	Dunlap/Olive	18,028	Group 3
96	Dobson Rd	42,510	Existing
99	99th Ave	25,456	Group 3
104	Alma School Rd	35,144	Group 1
106	Peoria/Shea	36,175	Existing
108	Elliot Rd	40,586	Existing
112	Arizona Ave/Country Club Dr	42,824	Existing
131	Dysart Rd	6,439	Group 3
136	Gilbert Rd	41,941	Existing
138	Wadell/Thunderbird	20,922	Existing
139	Litchfield Rd	25,609	Group 3
140	Ray Rd	2,639	Group 3
156	Chandler Blvd	67,408	Existing
160	Greenfield Rd	23,341	Group 3
170	Bell Rd	18,558	Group 1
184	Power Rd	42,576	Existing
204	Queen Creek Rd	6,323	Group 3
	Sub-total	1,133,887	
	Rural Service		
685	Gila Bend connector	8,839	Existing
660	Wickenburg connector	0	N/A
	Sub-total	8,839	
	Other Services		
	ADA Complementary Paratransit	778,802	Existing
	Regional Customer Services	163,959	Existing
	RPTA Planning and Administration	119,231	Existing
	Safety and Security Programs	14,318	Existing
	Vanpool Operations	21,774	Existing
	Sub-total	1,098,084	
	Total	2,479,497	

* Plan Groups: Group 1 (FY 2020 - FY 2024), Group 2 (FY 2024 - FY 2026), Group 3 (FY 2027 - FY 2040)
Existing (in operation and being funded prior to the "Group 1" period)

For bus operations, the "Group" designations represents the first period in which at least some regional funding was provided for the route. Funding for these routes continues during subsequent periods, and service improvements on certain routes may also be provided in a later period. Operating costs reflect total costs and are not offset by farebox receipts. Routes designated as "Existing" may also receive service enhancements in later periods which are not specifically indicated. For detailed service enhancements please refer to the latest version of the Transit Life Cycle Program.

TABLE E-2
2040 REGIONAL TRANSPORTATION PLAN
REGIONAL BUS PROJECTS - CAPITAL

PROJECT		CAPITAL COSTS FY 2020 - FY 2040 (2019 \$'S in THOUSANDS)	PLAN GROUP *
Fleet			
	Fixed Route Buses	907,382	Group 1,2,3
	Rural Routes	7,868	Group 1,2,3
	Paratransit	75,334	Group 1,2,3
	Vanpool	84,270	Group 1,2,3
Total Fleet		1,074,853	
Park and Rides			
	Baseline/24th St	0	Group 1
	Camelback/101	6,683	Group 3
	Elliot/I-10	6,703	Group 3
	Glendale Loop 101	2,646	Group 2
	Laveen/59th Ave	5,811	Group 1
	Peoria Grand	1,104	Group 1
Total Park and Rides		22,947	
Transit Centers			
	19thAveCamelback 6-bay	4,041	Group 3
	44th Cactus 6-bay	4,078	Group 3
	Arrowhead	0	Group 1
	Downtown Chandler 4-bay	2,815	Group 3
	Glendale/Grand 4-bay	2,828	Group 3
	Mesa Downtown 6-bay	0	Group 1
	Metrocenter TC Rehab	9,696	Group 3
	Peoria 4-bay	3,141	Group 1
	Scottsdale 4-bay	2,837	Group 3
	South Chandler	2,815	Group 3
	South Tempe 4-bay	2,811	Group 3
Total Transit Centers		35,062	
Operations and Maintenance Facilities			
	Heavy Maintenance	70,843	Group 3
	Mesa Rehab	14,457	Group 3
	Paratransit Phoenix	14,047	Group 3
	South Rehab	14,457	Group 3
Total O & M Facilities		113,804	
BRT Right-of-Way Improvements			
	Scottsdale/Rural Rd LINK	54,501	Group 1,3
	South Central LINK	24,540	Group 3
Total BRT ROW Improvements		79,041	
Other Capital Improvements			
	Bus Stop Improvements	0	N/A
	Vehicle Upgrades	3,623	Group 1
Total Other Capital		3,623	
TOTAL		1,329,329	

* Plan Groups: Group 1 (FY 2020 - FY 2024), Group 2 (FY 2024 - FY 2026), Group 3 (FY 2027 - FY 2040)

For transit capital expenditures, the group designation indicates the period when equipment or other capital items are acquired, or when construction of facilities is funded.

TABLE E-3
2040 REGIONAL TRANSPORTATION PLAN
REGIONAL LIGHT RAIL TRANSIT/HIGH CAPACITY TRANSIT - OPERATING

ROUTE		OPERATING COSTS FY 2020 - FY 2040 (2019 \$'S in THOUSANDS)	PLAN GROUP *
LRT/HCT Segments			
	CP/EV	957,083	Existing
	Northwest Phase I	162,570	Existing
	Northwest Phase II	57,031	Group 2
	Central Mesa	139,275	Existing
	Tempe Streetcar	129,682	Group 1
	Capitol / I-10 West Phase I	75,770	Group 2
	Capitol / I-10 West Phase II	242,394	Group 3
	Northeast Phoenix	0	Group 3
	Gilbert Road Extension	89,922	Group 1
	West Phoenix	0	Group 2
	South Central	440,548	Group 2
Total		2,294,276	

TABLE E-4
2040 REGIONAL TRANSPORTATION PLAN
REGIONAL LIGHT RAIL TRANSIT/HIGH CAPACITY TRANSIT - CAPITAL

ROUTE		CAPITAL COSTS FY 2020 - FY 2040 (2019 \$'S in THOUSANDS)	PLAN GROUP
LRT/HCT Segments			
	Northwest Phase I	0	Existing
	Central Mesa	340	Existing
	Tempe Streetcar	120,365	Group 1
	West Phoenix	0	Group 2
	Northwest Phase II	364,890	Group 2
	Capitol / I-10 West Phase I	220,931	Group 2
	Capitol / I-10 West Phase II	890,703	Group 3
	Northeast Phoenix	1,083,860	Group 3
	Gilbert Road Extension	12,084	Group 1
	South Central Extension	1,202,771	Group 2
Sub-total		3,895,944	
LRT Systemwide Support			
	Systemwide Support Infrastructure	638,080	Group 1,2,3
	Capital Project Development	4,425	Group 1,2,3
	System Planning and Design	174,624	Group 1,2,3
	Utility Reimbursements	0	NA
Sub-total		817,129	
TOTAL		4,713,073	

* Plan Groups:

Group 1 (FY 2020 - FY 2024)

Group 2 (FY 2024 - FY 2026)

Group 3 (FY 2027 - FY 2040)

For transit capital expenditures, the group designation indicates the period when equipment or other capital items are acquired, or when construction of facilities is funded. For light rail transit/high capacity transit (LRT/HCT) operations, the group designation indicates the period when service is initiated. Funding continues during subsequent periods, and service improvements on certain routes may also be initiated in a later period. Operating costs reflect total costs and are not offset by farebox receipts. No regional funding is provided for LRT/HCT operating expenses.

Appendix F

Transportation Safety

**TABLE F-1
SEVERITY OF CRASHES IN THE MAG PLANNING AREA & ECONOMIC LOSS (2006-2015)**

Year	Fatal Crashes	Injury Crashes	Property Damage Only (PDO) Crashes	Total Crashes	Economic Loss (Millions \$)
2006	599	31,265	67,880	83,203	\$6,574
2007	485	29,418	66,634	86,977	\$5,755
2008	391	24,786	55,569	86,789	\$4,733
2009	334	22,274	48,697	87,881	\$4,176
2010	332	22,167	48,572	84,651	\$4,110
2011	361	23,525	51,063	93,152	\$4,436
2012	356	23,761	50,304	96,701	\$4,389
2013	423	24,747	53,878	94,339	\$4,854
2014	377	25,385	56,062	78,180	\$4,562
2015	418	26,583	60,370	68,707	\$4,968

**TABLE F-2
COMPARISON OF CRASH RISK - STATEWIDE vs. MAG REGION (2006-2015)**

Year	Fatalities		% in MAG	Injuries		% in MAG	Total Crashes		% in MAG
	Arizona	MAG		Arizona	MAG		Arizona	MAG	
2006	1,296	685	53%	68,574	48,019	70%	140,197	99,744	71%
2007	1,071	536	50%	65,705	44,442	68%	140,371	96,537	69%
2008	937	438	47%	56,009	36,952	66%	119,588	80,746	68%
2009	806	369	46%	50,610	33,629	66%	106,767	71,305	67%
2010	762	358	47%	50,110	33,464	67%	106,177	71,071	67%
2011	825	391	47%	49,550	35,212	71%	103,423	74,949	72%
2012	821	384	47%	49,896	35,450	71%	103,637	74,421	72%
2013	844	450	53%	50,284	36,594	73%	107,348	79,048	74%
2014	708	402	57%	50,890	37,766	74%	109,554	81,824	75%
2015	895	450	50%	53,554	39,484	74%	116,609	87,371	75%

Table F-3

CRASH RISK ON ARTERIALS AND LOCAL STREETS vs. FREEWAYS (2006-2015)

Year	ARTERIALS & LOCAL STREETS			FREEWAYS		
	Fatalities	Injuries	All Crashes	Fatalities	Injuries	All Crashes
2006	532	38,767	78,868	153	9,252	20,876
2007	429	34,974	74,530	107	9,468	22,007
2008	349	29,083	62,165	89	7,869	18,581
2009	293	26,956	56,051	76	6,673	15,254
2010	281	26,199	54,317	77	7,265	16,754
2011	320	26,895	56,403	71	8,317	18,546
2012	301	27,264	55,912	83	8,186	18,509
2013	341	27,743	58,568	109	8,851	20,180
2014	333	28,794	60,358	69	8,972	21,466
2015	373	29,991	63,338	77	9,493	24,033

TABLE F-4

CRASH RISK ON ARTERIALS (2006-2015)

Year	INTERSECTION RELATED			MID- BLOCK			ALL		
	Fatal	Injury	PDO	Fatal	Injury	PDO	Fatal	Injury	PDO
2006	180	14,148	25,705	295	11,008	27,532	475	25,156	53,237
2007	151	12,850	24,040	241	10,335	26,913	392	23,185	50,953
2008	127	10,839	20,279	187	8,695	22,038	314	19,534	42,317
2009	105	10,228	19,009	162	7,680	18,867	267	17,908	37,876
2010	87	10,260	19,198	179	7,025	16,568	266	17,285	35,766
2011	119	10,905	20,836	179	6,918	17,446	298	17,823	38,282
2012	113	11,133	20,960	169	6,928	16,609	282	18,061	37,569
2013	152	11,062	20,132	169	7,587	19,466	321	18,649	39,598
2014	127	11,574	22,224	188	7,583	18,662	315	19,157	40,886
2015	141	12,044	23,518	205	7,899	19,531	346	19,943	43,049

**TABLE F-5
SEVERITY OF CRASHES INVOLVING BICYCLISTS & PEDESTRIANS**

Year	PEDESTRIAN		BICYCLIST	
	Fatal	Injury	Fatal	Injury
2006	108	969	22	1,075
2007	88	1,037	15	1,067
2008	76	939	10	1,144
2009	58	835	16	1,175
2010	88	796	16	1,117
2011	75	838	17	1,218
2012	75	891	14	1,282
2013	93	956	20	1,238
2014	104	895	18	1,082
2015	110	838	18	894

**TABLE F-6
SEVERITY OF CRASHES INVOLVING YOUNGER DRIVERS & OLDER DRIVERS**

Year	YOUNGER DRIVERS (< 25 YRS)			OLDER DRIVERS (> 65 YRS)		
	Fatal	Injury	PDO	Fatal	Injury	PDO
2006	238	14,993	30,714	71	3,632	6,854
2007	190	13,761	29,631	68	3,484	6,907
2008	147	11,017	23,540	63	3,240	6,420
2009	101	9,704	20,849	57	3,058	6,117
2010	94	9,586	20,610	52	3,152	6,331
2011	120	10,101	21,546	69	3,360	6,746
2012	122	10,063	20,937	52	3,553	6,811
2013	116	10,584	22,584	87	3,823	7,463
2014	119	10,889	23,740	66	4,051	7,799
2015	127	11,892	26,079	74	4,412	8,612

**TABLE F-7
PEDESTRIANS INJURED & KILLED BY AGE GROUP (2006-2015)**

Age	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2010 Populatio n	% Populatio n by Age
<5	51	45	32	53	49	52	58	37	49	30	303,034	7%
5 - 14	191	209	142	165	224	157	175	142	141	142	596,246	15%
15 - 24	281	280	330	258	175	259	303	392	307	286	570,468	14%
25 - 34	201	181	153	145	140	181	186	208	203	187	580,435	14%
35 - 44	184	190	155	162	149	150	144	148	160	155	559,034	14%
45 - 54	178	175	152	144	152	159	167	180	174	131	531,678	13%
55 - 64	118	123	102	71	102	118	112	131	113	140	423,415	10%
>65	163	101	93	93	106	95	82	123	110	120	490,971	12%
Unknown	65	53	58	37	69	17	8	6	5	6		
Total	1,432	1,357	1,217	1,128	1,166	1,188	1,235	1,367	1,262	1,197	4,055,281	100%

**TABLE F-8
BICYCLISTS INJURED & KILLED BY AGE GROUP (2006-2015)**

Age	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2010 Populatio n	% Population by Age
<5	4	4	3	9	2	9	10	4	1	3	303,034	7%
5 - 14	218	218	216	212	201	182	156	135	95	94	596,246	15%
15 - 24	284	286	305	358	312	367	434	388	336	253	570,468	14%
25 - 34	150	158	166	182	173	194	275	222	210	170	580,435	14%
35 - 44	198	170	170	170	159	162	168	158	167	91	559,034	14%
45 - 54	174	157	170	174	172	210	201	214	156	164	531,678	13%
55 - 64	49	70	91	84	100	112	102	113	107	98	423,415	10%
>65	45	35	52	38	57	52	70	70	71	64	490,971	12%
Unknown	32	26	33	19	17	17	8	6	4	0		
Total	1,154	1,124	1,206	1,246	1,193	1,305	1,424	1,310	1,147	937	4,055,281	100%

FIGURE F-1 TOTAL CRASHES BY FREEWAY CORRIDOR

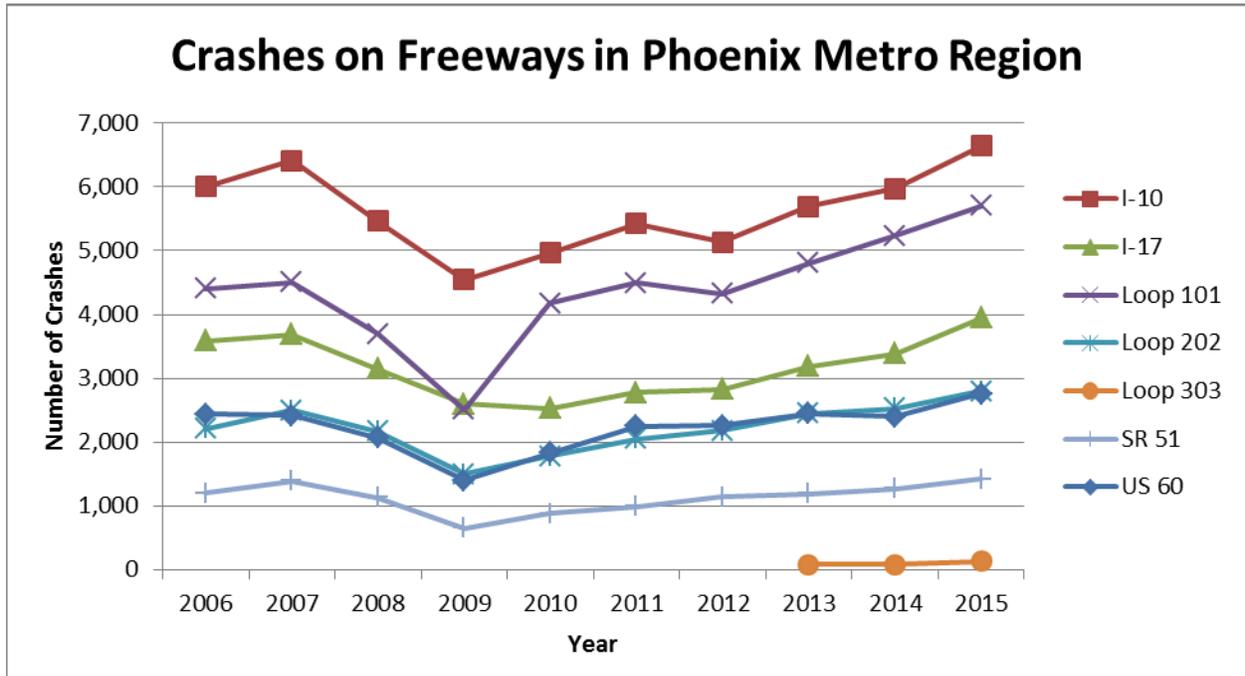


FIGURE F-2 NUMBER OF INJURIES BY FREEWAY CORRIDOR

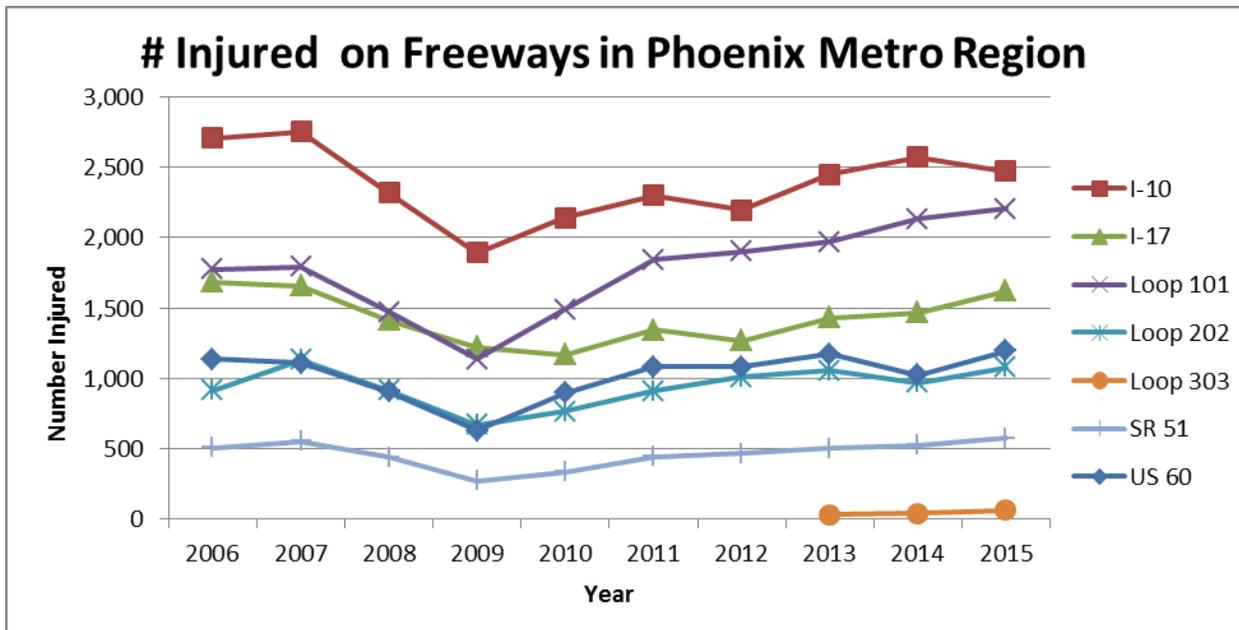


FIGURE F-3 NUMBER OF FATALITIES BY FREEWAY CORRIDOR

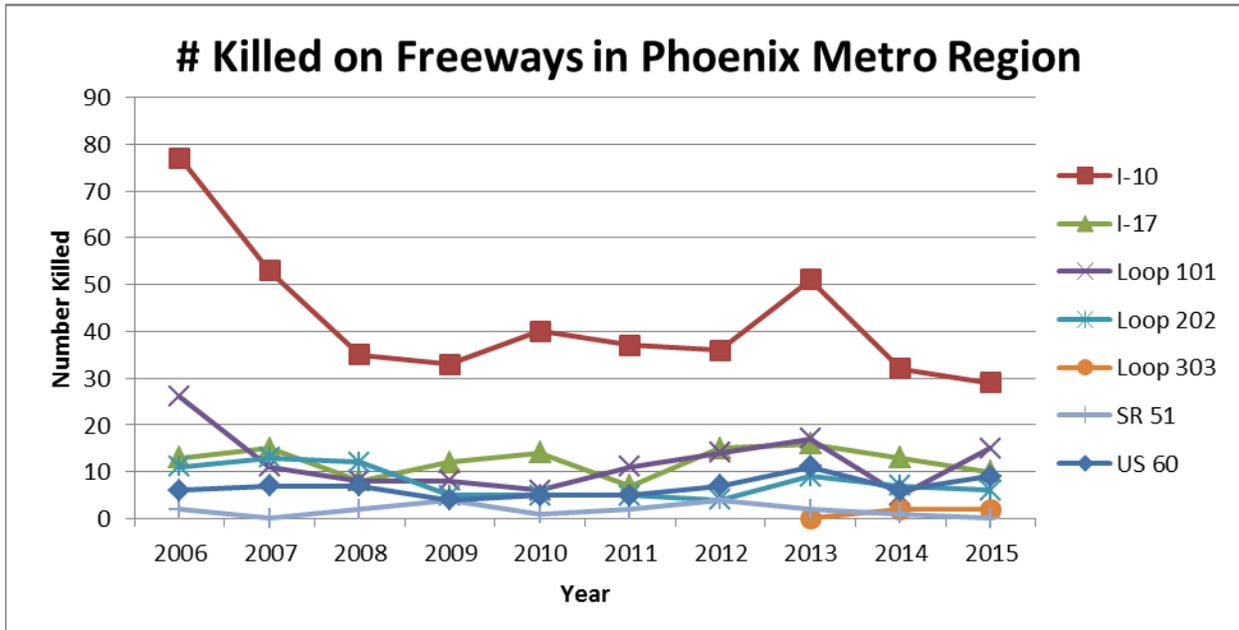
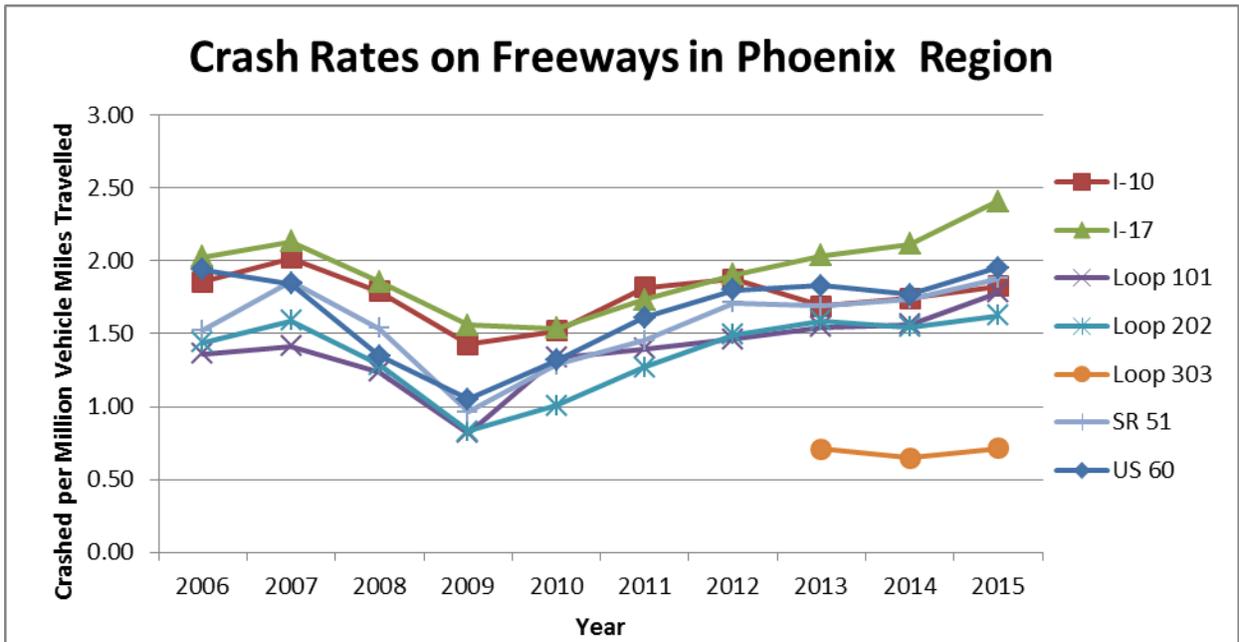


FIGURE F-4 CRASH RATES BY FREEWAY CORRIDOR



Note: Figure F-1 through F-4 depict Freeway Corridors in service during 2006-2015; Loop 303 opened as a limited access freeway in 2013.

Appendix G

Performance Monitoring

**TABLE G-1
TRAVEL TIME INDEX FOR SELECTED FREEWAY CORRIDORS (ALL TRAVEL LANES)**

Freeway	Direction	From	To	AM Peak Period TTI			PM Peak Period TTI		
				2016	2017	% change	2016	2017	% change
I-10	EB	AZ 85	Loop 303	1.022	1.024	0.17%	1.016	1.019	0.31%
	WB	Loop 303	AZ 85	1.009	1.015	0.53%	1.029	1.040	1.09%
I-10	EB	Loop 303	Loop 101 Agua Fria	1.058	1.063	0.50%	1.019	1.023	0.32%
	WB	Loop 101 Agua Fria	Loop 303	1.015	1.012	-0.26%	1.050	1.052	0.19%
I-10	EB	Loop 101 Agua Fria	I-17	1.931	1.961	1.50%	1.050	1.047	-0.29%
	WB	I-17	Loop 101 Agua Fria	1.028	1.028	0.02%	1.518	1.550	2.05%
I-10	EB	I-17	SR 51	1.547	1.558	0.69%	1.384	1.359	-1.81%
	WB	SR 51	I-17	1.078	1.078	-0.02%	2.879	2.706	-5.99%
I-10	EB	SR 51	US 60	1.094	1.093	-0.08%	1.697	1.744	2.76%
	WB	US 60	SR 51	1.237	1.258	1.74%	1.282	1.259	-1.82%
I-10	EB	US 60	Loop 202 Santan	1.036	1.039	0.28%	1.230	1.253	1.83%
	WB	Loop 202 Santan	US 60	1.670	1.734	3.78%	1.091	1.097	0.54%
I-17	NB	I-10 Maricopa	I-10 Papago	1.052	1.068	1.51%	1.506	1.538	2.13%
	SB	I-10 Papago	I-10 Maricopa	1.447	1.496	3.37%	1.112	1.113	0.05%
I-17	NB	I-10 Papago	Peoria Ave	1.073	1.076	0.23%	1.455	1.489	2.32%
	SB	Peoria Ave	I-10 Papago	1.518	1.571	3.49%	1.132	1.117	-1.29%
I-17	NB	Peoria Ave	Loop 101 Agua Fria	1.074	1.072	-0.17%	1.150	1.136	-1.24%
	SB	Loop 101 Agua Fria	Peoria Ave	1.262	1.250	-1.00%	1.121	1.120	-0.05%
I-17	NB	Loop 101 Agua Fria	Loop 303	1.020	1.019	-0.08%	1.023	1.028	0.51%
	SB	Loop 303	Loop 101 Agua Fria	1.024	1.026	0.13%	1.014	1.014	0.05%
US 60	EB	I-10	Loop 101 Price	1.046	1.047	0.11%	1.185	1.210	2.12%
	WB	Loop 101 Price	I-10	1.532	1.550	1.13%	1.087	1.100	1.14%
US 60	EB	Loop 101 Price	Val Vista Dr	1.042	1.045	0.26%	1.179	1.208	2.53%
	WB	Val Vista Dr	Loop 101 Price	1.282	1.314	2.45%	1.044	1.048	0.43%
US 60	EB	Val Vista Dr	Loop 202 Santan	1.028	1.029	0.05%	1.019	1.020	0.12%
	WB	Loop 202 Santan	Val Vista Dr	1.020	1.031	1.12%	1.015	1.021	0.62%
US 60	EB	Loop 202 Santan	Goldfield Rd	1.017	1.019	0.23%	1.039	1.039	-0.06%
	WB	Goldfield Rd	Loop 202 Santan	1.006	1.012	0.66%	1.013	1.016	0.35%
SR 51	NB	I-10	Glendale Ave	1.085	1.078	-0.66%	1.354	1.415	4.46%
	SB	Glendale Ave	I-10	1.449	1.507	4.04%	1.191	1.178	-1.12%
SR 51	NB	Glendale Ave	Loop 101 Pima	1.042	1.040	-0.22%	1.069	1.067	-0.21%
	SB	Loop 101 Pima	Glendale Ave	1.136	1.135	-0.10%	1.033	1.036	0.36%
SR 143	NB	I-10	McDowell Rd	1.047	1.047	0.02%	1.047	1.059	1.19%
	SB	McDowell Rd	I-10	1.046	1.044	-0.23%	1.235	1.276	3.32%

TABLE G-1 (continued)
TRAVEL TIME INDEX FOR SELECTED FREEWAY CORRIDORS (ALL TRAVEL LANES)

Freeway	Direction	From	To	AM Peak Period TTI			PM Peak Period TTI		
				2016	2017	% change	2016	2017	% change
Loop 101 Agua Fria	NB	I-10	Union Hills Dr	1.044	1.047	0.29%	1.029	1.026	-0.32%
	SB	Union Hills Dr	I-10	1.025	1.032	0.69%	1.069	1.081	1.18%
Loop 101 Agua Fria	NB/EB	Union Hills Dr	I-17	1.260	1.274	1.18%	1.017	1.019	0.25%
	WB/SB	I-17	Union Hills Dr	1.022	1.022	0.05%	1.189	1.221	2.70%
Loop 101 Price	NB	Loop 202 Santan	US 60	1.402	1.456	3.87%	1.105	1.140	3.21%
	SB	US 60	Loop 202 Santan	1.070	1.079	0.80%	1.262	1.275	1.09%
Loop 101 Price	NB	US 60	Loop 202 Red Mountain	1.273	1.358	6.67%	1.062	1.078	1.51%
	SB	Loop 202 Red Mountain	US 60	1.056	1.068	1.13%	1.830	1.936	5.80%
Loop 101 Pima	NB	Loop 202 Red Mountain	Pima Rd / 90th St	1.254	1.166	-7.03%	1.087	1.037	-4.67%
	SB	Pima Rd / 90th St	Loop 202 Red Mountain	1.047	1.031	-1.59%	1.328	1.327	-0.06%
Loop 101 Pima	NB	Pima Rd / 90th St	Pima Rd / Princess Dr	1.049	1.100	4.88%	1.089	1.169	7.37%
	SB	Pima Rd / Princess Dr	Pima Rd / 90th St	1.059	1.076	1.53%	1.074	1.100	2.42%
Loop 101 Pima	NB/WB	Pima Rd / Princess Dr	SR 51	1.013	1.017	0.46%	1.349	1.411	4.61%
	EB/SB	SR 51	Pima Rd / Princess Dr	1.245	1.289	3.51%	1.024	1.028	0.41%
Loop 101 Pima	WB	SR 51	I-17	1.033	1.034	0.05%	1.594	1.656	3.89%
	EB	I-17	SR 51	1.584	1.647	3.97%	1.084	1.108	2.21%
Loop 202 Red Mountain	EB	I-10	Washington St	1.058	1.063	0.44%	1.103	1.108	0.45%
	WB	Washington St	I-10	1.299	1.309	0.80%	1.280	1.269	-0.81%
Loop 202 Red Mountain	EB	Washington St	Loop 101 Price	1.034	1.037	0.29%	1.237	1.285	3.85%
	WB	Loop 101 Price	Washington St	1.353	1.379	1.94%	1.039	1.046	0.71%
Loop 202 Red Mountain	EB	Loop 101 Price	McDowell Rd	1.036	1.035	-0.08%	1.031	1.066	3.44%
	WB	McDowell Rd	Loop 101 Price	1.084	1.111	2.54%	1.030	1.036	0.52%
Loop 202 Red Mountain	EB/SB	McDowell Rd	US 60	1.026	1.028	0.18%	0.977	0.995	1.78%
	NB/WB	US 60	McDowell Rd	0.993	1.009	1.57%	1.016	1.017	0.08%
Loop 202 Santan	EB	I-10	Loop 101 Price	1.016	1.021	0.48%	1.014	1.022	0.78%
	WB	Loop 101 Price	I-10	1.030	1.023	-0.60%	1.019	1.019	-0.03%
Loop 202 Santan	EB	Loop 101 Price	Lindsay Rd	1.036	1.035	-0.07%	1.233	1.308	6.12%
	WB	Lindsay Rd	Loop 101 Price	1.197	1.229	2.64%	1.033	1.037	0.36%
Loop 202 Santan	EB/NB	Lindsay Rd	US 60	1.011	1.015	0.36%	1.013	1.023	0.99%
	SB/WB	US 60	Lindsay Rd	1.011	1.021	1.00%	1.001	1.003	0.20%
Loop 303	NB	I-10	Nothern Pkwy	1.016	1.015	-0.10%	0.986	0.990	0.47%
	SB	Northern Pkwy	I-10	1.015	1.005	-1.03%	1.014	1.005	-0.87%
Loop 303	NB	Northern Pkwy	US 60	1.035	1.006	-2.81%	1.017	0.996	-2.02%
	SB	US 60	Northern Pkwy	1.042	1.009	-3.12%	1.026	0.999	-2.64%
Loop 303	NB/EB	US 60	I-17	1.050	1.005	-4.21%	1.041	1.012	-2.86%
	WB/SB	I-17	US 60	1.047	1.020	-2.56%	0.987	0.974	-1.28%

**TABLE G-2
AVERAGE AM PEAK PERIOD SPEED FOR SELECTED FREEWAY CORRIDORS**

Freeway Corridor	Dir	From	To	Average AM Peak Period Speed (mph)							
				General-purpose Lanes				HOV Lanes			
				2015	2016	2017	% Change 2016 to 2017	2015	2016	2017	% Change 2016 to 2017
I-10 Papago	EB	83rd Ave	I-17	40.3	39.2	not available	not available	46.4	46.5	not available	not available
	WB	I-17	83rd Ave	65.6	68.7	not available	not available	67.3	71.0	not available	not available
I-10 Papago	EB	I-17	SR 51/Loop 202	45.7	43.4	41.5	-4.3%	62.4	61.5	60.3	-2.0%
	WB	SR 51/Loop 202	I-17	63.7	65.3	65.0	-0.5%	70.6	71.8	71.8	0.0%
I-10 Maricopa	EB	SR 51/Loop 202	US 60	60.9	61.5	61.3	-0.4%	67.8	69.0	68.8	-0.3%
	WB	US 60	SR 51/Loop 202	56.5	56.5	57.1	1.1%	62.7	62.7	63.1	0.6%
I-10 Maricopa	EB	US 60	Chandler Blvd	65.0	64.8	64.9	0.1%	72.6	72.6	72.9	0.5%
	WB	Chandler Blvd	US 60	39.7	37.9	36.5	-3.7%	57.6	57.3	54.9	-4.2%
I-17	NB	Maricopa TI	I-10	61.8	61.9	61.0	-1.4%	n/a	n/a	n/a	n/a
	SB	I-10	Maricopa TI	44.5	44.2	43.9	-0.8%	n/a	n/a	n/a	n/a
I-17	NB	I-10	Peoria Ave	58.0	57.5	59.3	3.1%	59.2	59.0	62.8	6.4%
	SB	Peoria Ave	I-10	46.1	47.5	43.9	-7.5%	51.0	52.0	50.8	-2.2%
I-17	NB	Peoria Ave	Loop 101	63.0	63.3	63.1	-0.4%	72.9	74.1	71.9	-3.0%
	SB	Loop 101	Peoria Ave	54.8	53.8	56.0	4.1%	67.5	67.2	69.3	3.0%
SR 51	NB	I-10/Loop 202	Glendale Ave	61.3	61.1	61.0	-0.1%	62.9	62.9	68.3	8.6%
	SB	Glendale Ave	I-10/Loop 202	not available	49.0	not available	not available	not available	54.9	not available	not available
SR 51	NB	Glendale Ave	Loop 101	67.5	68.7	70.3	2.3%	74.1	75.7	75.0	-0.8%
	SB	Loop 101	Glendale Ave	62.1	63.5	not available	not available	69.1	70.0	not available	not available
Loop 202 Red Mountain	EB	I-10/SR 51	Loop 101	66.2	66.5	67.8	1.9%	71.8	72.7	68.8	-5.3%
	WB	Loop 101	I-10/SR 51	53.9	53.0	52.2	-1.5%	62.9	63.6	62.8	-1.3%
Loop 202 Red Mountain	EB	Loop 101	Gilbert Rd	not available	not available	69.2	not available	not available	not available	not available	not available
	WB	Gilbert Rd	Loop 101	not available	not available	66.9	not available	not available	not available	not available	not available
US 60	EB	I-10	Loop 101	64.5	64.6	66.3	2.7%	69.3	69.3	72.5	4.7%
	WB	Loop 101	I-10	44.0	43.0	42.3	-1.7%	not available	not available	not available	not available
US 60	EB	Loop 101	Val Vista Dr	64.4	65.2	67.7	3.9%	68.8	71.2	74.7	4.9%
	WB	Val Vista Dr	Loop 101	58.2	59.9	56.4	-5.8%	69.3	69.6	67.3	-3.3%
US 60	EB	Val Vista Dr	Loop 202	67.6	67.2	69.2	3.0%	72.9	73.8	76.1	3.1%
	WB	Loop 202	Val Vista Dr	69.2	70.0	70.7	0.9%	73.4	not available	74.1	not available
SR 143	NB	I-10	Loop 202/McDowell Rd	56.1	59.5	61.6	3.6%	n/a	n/a	n/a	n/a
	SB	Loop 202/McDowell Rd	I-10	61.2	62.5	61.0	-2.4%	n/a	n/a	n/a	n/a
Loop 101 Price	NB	Loop 202 Santan	US 60	51.8	47.1	49.1	4.3%	65.6	64.2	64.7	0.8%
	SB	US 60	Loop 202 Santan	66.2	66.5	66.9	0.6%	74.8	75.4	76.4	1.4%
Loop 101 Price	NB	US 60	Loop 202 Red Mountain	55.2	58.2	55.0	-5.4%	71.5	73.1	71.2	-2.6%
	SB	Loop 202 Red Mountain	US 60	68.0	67.6	67.7	0.2%	76.0	76.5	76.8	0.4%
Loop 101 Pima	NB	Loop 202 Red Mountain	90th St	not available	not available	62.6	not available	not available	not available	not available	not available
	SB	90th St	Loop 202 Red Mountain	not available	not available	71.4	not available	not available	not available	not available	not available
Loop 101 Pima	NB	90th St	Pima Rd	not available	not available	65.2	not available	not available	not available	71.5	not available
	SB	Pima Rd	90th St	not available	not available	67.5	not available	not available	not available	71.6	not available
Loop 101 Pima	EB	SR 51	Pima Rd	58.3	59.3	58.6	-1.2%	69.0	70.3	69.9	-0.6%
	WB	Pima Rd	SR 51	70.9	71.7	71.2	-0.6%	75.5	76.7	76.6	-0.2%
Loop 101 Pima	EB	I-17	SR 51	46.1	48.1	46.1	-4.1%	not available	not available	not available	not available
	WB	SR 51	I-17	69.3	69.5	69.7	0.3%	not available	not available	not available	not available
Loop 101 Agua Fria	EB	Union Hills Dr	I-17	58.0	57.1	56.8	-0.5%	69.0	68.4	67.8	-0.8%
	WB	I-17	Union Hills Dr	70.7	70.8	70.6	-0.3%	76.8	76.8	77.1	0.3%
Loop 101 Agua Fria	NB	Northern Ave	Union Hills Dr	64.2	64.3	64.4	0.1%	not available	not available	not available	not available
	SB	Union Hills Dr	Northern Ave	66.2	66.7	66.4	-0.4%	not available	not available	not available	not available
Loop 101 Agua Fria	NB	I-10	Northern Ave	66.3	66.6	66.7	0.2%	75.7	74.9	75.7	1.1%
	SB	Northern Ave	I-10	65.9	65.8	65.8	-0.1%	not available	not available	not available	not available

Source: ADOT FMS
n/a = not applicable

TABLE G-3
AVERAGE PM PEAK PERIOD SPEED FOR SELECTED FREEWAY CORRIDORS

Freeway Corridor	Dir	From	To	Average PM Peak Period Speed (mph)							
				General-purpose Lanes				HOV Lanes			
				2015	2016	2017	% Change 2016 to 2017	2015	2016	2017	% Change 2016 to 2017
I-10 Papago	EB	83rd Ave	I-17	65.7	67.5	not available	not available	67.7	69.7	not available	not available
	WB	I-17	83rd Ave	52.6	53.3	not available	not available	56.8	57.5	not available	not available
I-10 Papago	EB	I-17	SR 51/Loop 202	49.6	48.6	50.0	2.8%	60.0	60.0	60.1	0.2%
	WB	SR 51/Loop 202	I-17	30.3	30.2	28.5	-5.6%	36.0	35.6	34.7	-2.5%
I-10 Maricopa	EB	SR 51/Loop 202	US 60	40.7	40.9	39.0	-4.6%	47.4	48.6	47.7	-1.8%
	WB	US 60	SR 51/Loop 202	54.6	58.6	60.3	3.0%	62.1	63.5	65.1	2.6%
I-10 Maricopa	EB	US 60	Chandler Blvd	54.9	54.8	50.8	-7.3%	65.0	65.3	63.9	-2.2%
	WB	Chandler Blvd	US 60	60.4	60.9	60.1	-1.2%	69.9	70.5	70.1	-0.5%
I-17	NB	Maricopa TI	I-10	40.8	40.3	40.3	0.1%	n/a	n/a	n/a	n/a
	SB	I-10	Maricopa TI	57.7	58.5	60.0	2.5%	n/a	n/a	n/a	n/a
I-17	NB	I-10	Peoria Ave	44.6	43.6	44.1	1.1%	49.5	49.2	50.2	2.1%
	SB	Peoria Ave	I-10	58.4	58.1	58.3	0.2%	59.8	59.2	62.3	5.2%
I-17	NB	Peoria Ave	Loop 101	59.1	60.0	59.6	-0.6%	68.7	70.6	70.1	-0.6%
	SB	Loop 101	Peoria Ave	60.9	60.3	60.7	0.6%	71.7	71.3	71.9	0.8%
SR 51	NB	I-10/Loop 202	Glendale Ave	50.3	50.0	42.7	-14.5%	57.7	57.3	56.5	-1.5%
	SB	Glendale Ave	I-10/Loop 202	not available	56.4	not available	not available	not available	57.4	not available	not available
SR 51	NB	Glendale Ave	Loop 101	63.4	65.6	66.5	1.3%	70.3	72.7	72.1	-0.8%
	SB	Loop 101	Glendale Ave	68.0	68.7	not available	not available	73.1	73.7	not available	not available
Loop 202 Red Mountain	EB	I-10/SR 51	Loop 101	58.1	57.6	58.5	1.5%	66.3	65.8	62.1	-5.7%
	WB	Loop 101	I-10/SR 51	59.1	59.5	60.7	2.0%	69.2	69.8	70.5	0.9%
Loop 202 Red Mountain	EB	Loop 101	Gilbert Rd	not available	not available	66.2	not available	not available	not available	not available	not available
	WB	Gilbert Rd	Loop 101	not available	not available	70.2	not available	not available	not available	not available	not available
US 60	EB	I-10	Loop 101	57.3	58.9	58.3	-1.1%	65.7	66.6	68.5	2.9%
	WB	Loop 101	I-10	64.0	64.8	64.2	-1.0%	not available	not available	not available	not available
US 60	EB	Loop 101	Val Vista Dr	59.1	59.8	57.9	-3.2%	67.6	70.7	68.5	-3.2%
	WB	Val Vista Dr	Loop 101	66.5	66.8	67.2	0.6%	70.8	71.8	74.3	3.5%
US 60	EB	Val Vista Dr	Loop 202	67.7	67.7	68.2	0.9%	72.2	74.0	75.5	2.1%
	WB	Loop 202	Val Vista Dr	69.5	69.7	70.5	1.1%	73.3	not available	74.5	not available
SR 143	NB	I-10	Loop 202/McDowell Rd	55.3	58.5	60.4	3.3%	n/a	n/a	n/a	n/a
	SB	Loop 202/McDowell Rd	I-10	55.7	56.8	54.4	-4.3%	n/a	n/a	n/a	n/a
Loop 101 Price	NB	Loop 202 Santan	US 60	65.2	63.4	63.3	-0.2%	72.5	72.3	71.9	-0.5%
	SB	US 60	Loop 202 Santan	56.2	56.0	57.5	2.6%	66.5	67.0	68.7	2.6%
Loop 101 Price	NB	US 60	Loop 202 Red Mountain	66.5	67.4	66.8	-0.9%	77.3	77.6	77.7	0.1%
	SB	Loop 202 Red Mountain	US 60	37.0	38.2	33.7	-11.8%	56.5	59.2	52.9	-10.5%
Loop 101 Pima	NB	Loop 202 Red Mountain	90th St	not available	not available	69.5	not available	not available	not available	not available	not available
	SB	90th St	Loop 202 Red Mountain	not available	not available	56.3	not available	not available	not available	not available	not available
Loop 101 Pima	NB	90th St	Pima Rd	not available	not available	61.5	not available	not available	not available	68.5	not available
	SB	Pima Rd	90th St	not available	not available	64.5	not available	not available	not available	70.0	not available
Loop 101 Pima	EB	SR 51	Pima Rd	69.9	71.1	70.1	-1.4%	76.2	77.4	77.5	0.2%
	WB	Pima Rd	SR 51	52.3	49.3	47.4	-3.7%	62.5	60.8	59.2	-2.6%
Loop 101 Pima	EB	I-17	SR 51	65.0	65.6	63.2	-3.7%	not available	not available	not available	not available
	WB	SR 51	I-17	47.6	47.0	46.4	-1.1%	not available	not available	not available	not available
Loop 101 Agua Fria	EB	Union Hills Dr	I-17	68.2	68.4	69.3	1.3%	75.7	75.9	75.9	0.0%
	WB	I-17	Union Hills Dr	60.4	60.4	55.6	-7.9%	68.9	68.7	66.1	-3.8%
Loop 101 Agua Fria	NB	Northern Ave	Union Hills Dr	64.9	65.8	65.9	0.2%	not available	not available	not available	not available
	SB	Union Hills Dr	Northern Ave	63.5	63.6	63.3	-0.4%	not available	not available	not available	not available
Loop 101 Agua Fria	NB	I-10	Northern Ave	66.0	65.3	66.0	1.0%	74.1	73.6	74.6	1.4%
	SB	Northern Ave	I-10	60.5	59.8	58.4	-2.2%	not available	not available	not available	not available

Source: ADOT FMS

n/a = not applicable

