Performance Measurement Framework and Congestion Management Update Study

Phase III

Baseline Congestion Management Process Report

MARICOPA ASSOCIATION of GOVERNMENTS

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report

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Phase III: Baseline Congestion Management Process Report

prepared for

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Executive Summary

This document is the Baseline Congestion Management Process (CMP) Report. The focus of the CMP Baseline Report is to illustrate the impacts of potential congestion management strategies in the Maricopa Association of Governments (MAG) Region. It is a summary of the third phase of the three-phase project, including a report on Best Practices in Performance Measurement (Phase 1) and development of a MAG Performance Measurement Framework (Phase 2) and the CMP Update Report (Part 1 of Phase 3). This document summarizes the entire congestion management process for MAG. It also provides detail and examples for an analysis process to evaluate congestion management strategies or projects using a sketch planning tool. The core of the tool is a spreadsheet that uses both quantitative and qualitative criteria to assess strategy/project effectiveness and to assist in the assignment of ranks to projects so they can be prioritized. The process and sketch planning tool are designed to be applied to sets of projects or congestion management strategies for which some quantitative data is available.

The result of this report is a well-defined repeatable process designed to assist MAG with its congestion management process.

1.0 Introduction

1.1 Need for a Congestion Management Process

The CMP is required under federal planning regulations for metropolitan regions the size of the Phoenix metropolitan area. It also represents "best practice" in planning for and managing congestion. This section will briefly discuss the purpose of the CMP and how it meets Federal requirements.

1.2 Elements of the CMP

The MAG Congestion Management Process is designed to be an integral part of the planning and programming process. It is intended to complement, not replace, the project evaluation processes in the MAG modal committees. In the development of the Regional Transportation Plan (RTP), the CMP provides a mechanism for considering the congestion management impacts of projects and project packages, making use of sketch planning approaches as well as the MAG regional travel demand forecasting model. The CMP also provides input to the development of the Transportation Improvement Program (TIP), using quantitative and qualitative methods to assist MAG committees in considering the merits of proposed projects under consideration for competitive funding. The CMP makes use of existing performance measurement systems that monitor and report on the status of the transportation network.

Figure 1.1 shows the 8 steps of the CMP from the FHWA CMP guidebook.

Figure 1.1 The Congestion Management Process

1.3 Description of Report Sections

The remainder of this report is structured according to the following steps:

Section 2.0	Congestion Management Objectives (Step 1)
Section 3.0	Area of Application (Steps 2 and 3)
Section 4.0	Performance Measures and Monitoring Plan (Steps 4 and 5)
Section 5.0	Identify and Evaluate Strategies (Step 6)
Section 6.0	Implement Selected Strategies and Manage Transportation System (Step 7)
Section 7.0	Monitor Strategy Effectiveness (Step 8)

2.0 Congestion Management Objectives

Federal guidance on the congestion management process suggests that the CMP should be closely linked to regional goals and objectives, as part of an objectives-based, performance-driven planning process.[1] As noted in the MAG Regional Transportation Plan, 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 identified 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.

The congestion management objectives shown in Table 2.1 were developed by the MAG Congestion Management Technical Advisory Group (TAG)[2].

While not all of the regional goals and objectives relate directly to congestion, it is possible to relate several of the adopted RTP goals and objectives to specific congestion management objectives. In some instances, these objectives are relevant to a particular mode or to particular elements of the MAG regional transportation network.

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[1] Congestion management is required in federal regulation as follows: 23CFR500.109, 23CFR450.320, and 23CFR450.322.

[2] The TAG is not a MAG standing committee.

Table 2.1 Congestion Management Objectives

MAG RTP Goals	MAG RTP Objectives	Congestion Management Objectives
Goal 1: System Preservation and Safety	1B: Provide a safe and secure environment for the traveling public, addressing roadway hazards, pedestrian and bicycle safety, and transit security.	• Reduce crash rate
Goal 2: Access and Mobility	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.	• Minimize delay and improve travel time • Reduce travel time variability in all modes
	2C: Maintain a reasonable and reliable travel time for moving freight into, through, and within the region.	• Minimize delay and improve travel time in freight corridors • Reduce travel time variability in freight corridors
	2D: Provide the transportation multi-modal options necessary to carry out essential daily activities and support equitable access to the region's opportunities.	• Improve system connectivity • Develop and maintain a functional roadway hierarchy • Minimize delay in HOV lanes • Manage congestion on facilities used for bus service
Goal 3: Sustaining the Environment	3B: Encourage programs and land use planning that advance efficient trip-making patterns.	• Promote travel demand management programs
	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.	• Reduce emissions and fuel consumption through congestion management

3.0 Area of Application

The CMP provides a framework within which MAG can analyze congestion problems in the context of identified corridors, such as the freeway corridors; combined corridors, which might include both freeways and elements of the arterial street network; multimodal corridors that might include light rail, bus services operating in high-occupancy vehicle (HOV) lanes, or bus rapid transit; and other modifications or extensions of corridors. For analysis purposes, the CMP has the potential to make use of "activity areas," including central business districts (CBD), cultural centers, freight, warehousing and distribution centers, transportation nodes such as Sky Harbor International Airport or the Phoenix-Mesa Gateway Airport, and other centers of economic activity.

The CMP covers the MAG transportation management area, including the freeway corridors identified in the MAG Performance Measurement Framework report, the arterial street network, and transit facilities and services, as well as bicycle and pedestrian facilities. The corridors described in the CMP Baseline Report are not necessarily intended to be comprehensive or all-inclusive. New and revised corridors will be defined over time as the CMP is applied to new and emerging congestion challenges. These corridors may be defined in any number of ways, including, for example, "Top 10 Commutes," or representative congested routes from one community to another.

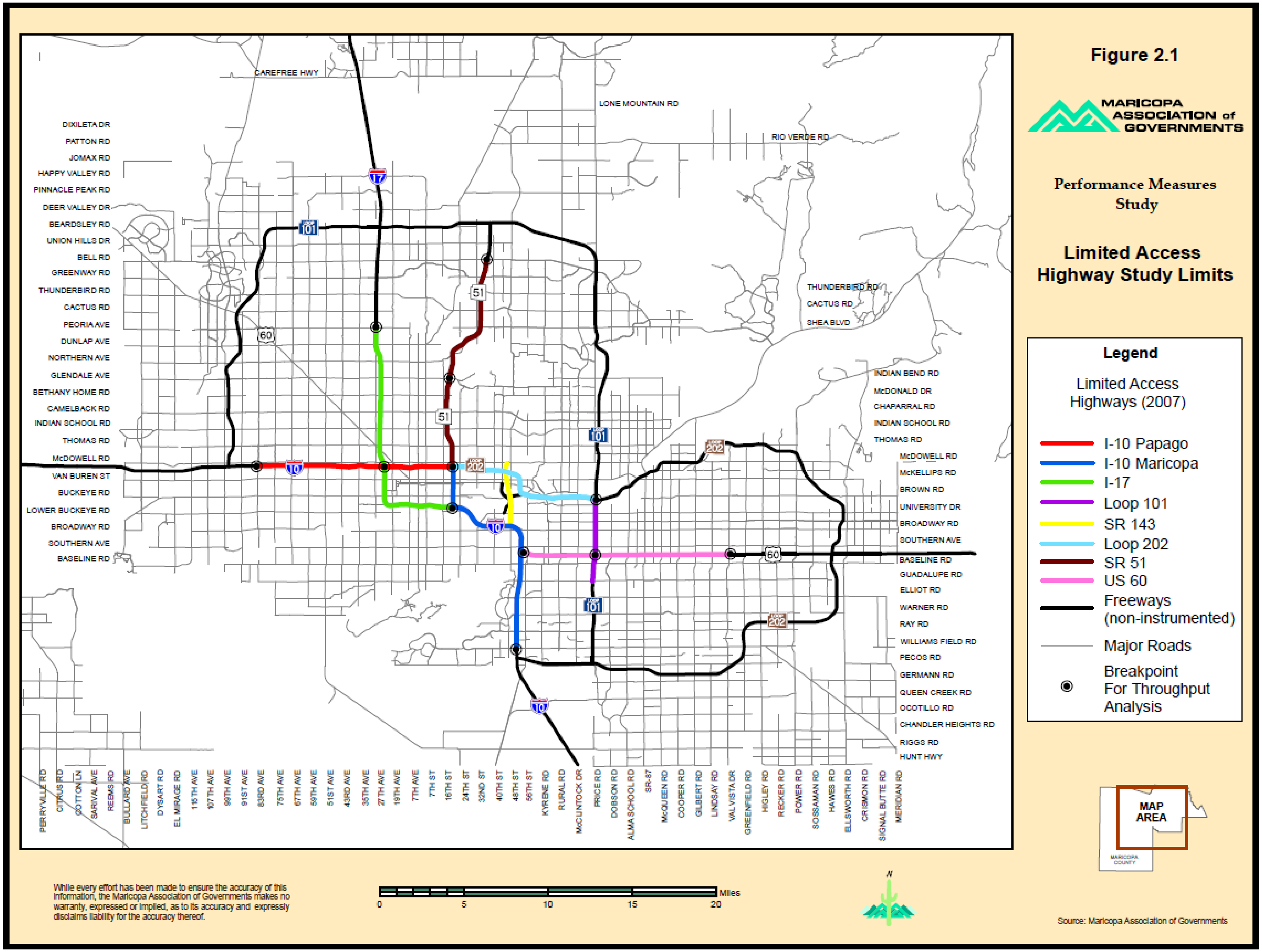
3.1 Regional Freeway and Highway System

The freeway corridors identified as part of the Performance Measurement Framework process provide a good starting point for CMP analysis purposes. These corridors were selected for the Framework because they comprise the portion of the freeway system that is instrumented for purposes of managing the system and collecting data for archival purposes. The following freeways, expressways, and Interstates (hereafter referred to as limited access highways), were selected for inclusion in the performance measurement framework based on the coverage of the ADOT FMS during 2006 and 2007:

- I-10 from 83rd Avenue to Chandler Boulevard;
- I-17 from Maricopa Traffic Interchange (TI) to Peoria Avenue;
- SR 51 from I-10/Loop 202 to Bell Road;
- Loop 202 from I-10/SR 51 to Loop 101;
- U.S. 60 (Superstition Freeway) from I-10 to Gilbert Road/Val Vista Drive;
- Loop 101 from Guadalupe Road to Loop 202; and
- SR 143 from I-10 to Loop 202 – McDowell Road.

The CMP provides a mechanism for identifying new multimodal corridors for purposes of analysis of different strategies and strategy packages. The CMP will evolve and other limited access highways will be incorporated into the framework as more data becomes available through data collection efforts. For example, when other freeway segments are added or instrumented data will be collected for them as well. In addition, if other data sources become available, they will also be used.

Figure 3.1 MAG Limited Access Highways



3.2 Arterial Roadway Network

The arterial street system is a critical element of the regional transportation network, consisting 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 automobile, transit, bicycle, and pedestrian traffic. In the RTP, funding for improvements to the arterial street network is established by the Arterial Life-Cycle Program. For purposes of the CMP, arterial streets will be identified that either currently experience significant congestion, or are projected to experience significant congestion in the future; or that make up part of a corridor or activity area that is subject to current or future congestion.

The following arterials were selected for inclusion in the performance measurement framework based on the large volumes of traffic they carry across the Valley:

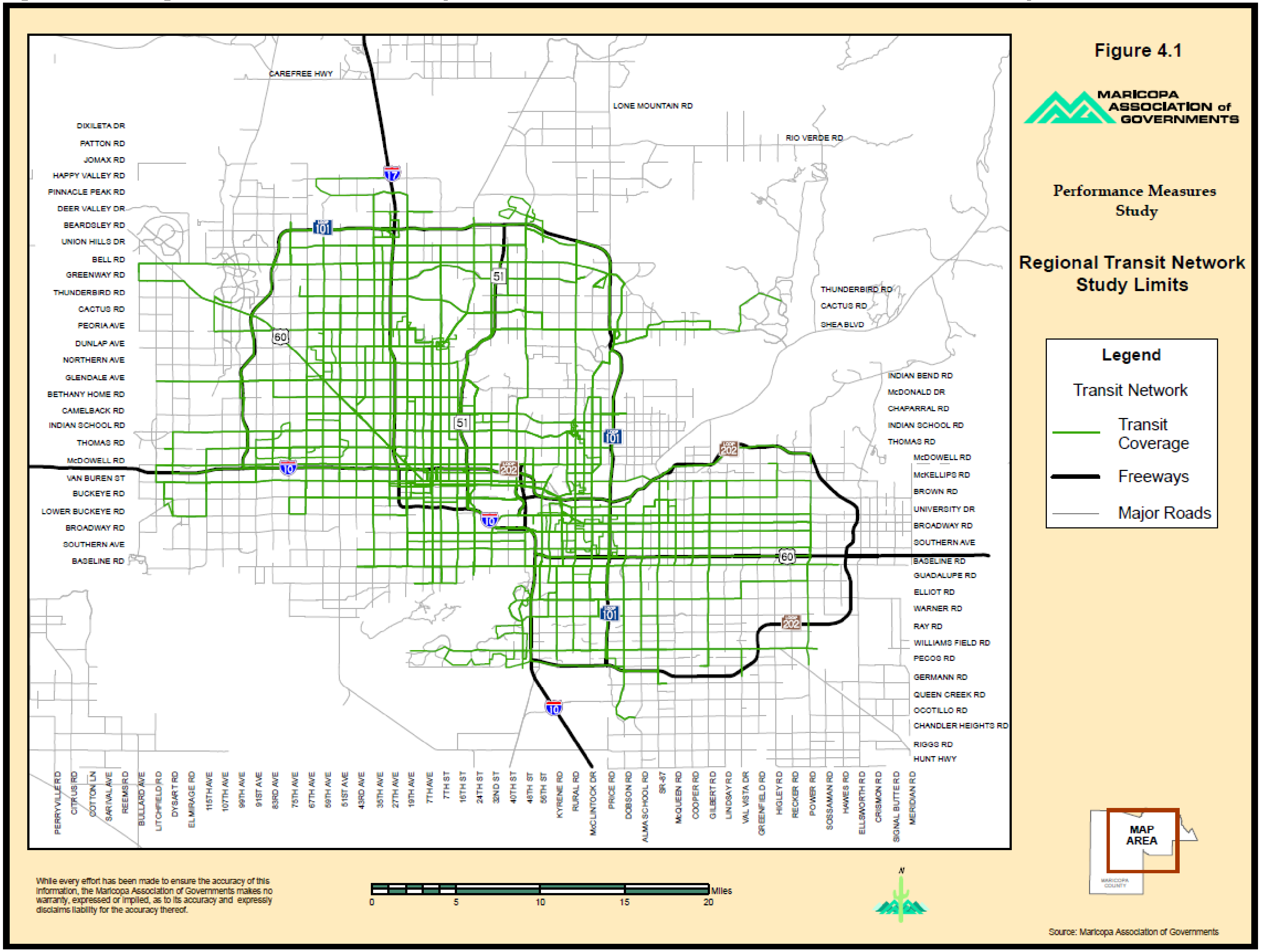
- Bell Road from Litchfield to Scottsdale Rd (24.7 mi.)
- Frank Lloyd Wright Blvd from Scottsdale Rd to Shea Blvd (6.8 mi.)
- Glendale Avenue from 91st Ave to Scottsdale Rd (19.2 mi.)
- Indian School Rd from Cotton to Loop 101 North (31.2 mi.)
- Southern Ave from 19th Ave to Tomahawk Rd (33 mi.)
- Baseline Rd from 51st Ave to Ellsworth Rd (31 mi.)
- Chandler Blvd from 3rd Ave to Gilbert Rd (16.8 mi)
- 59th Ave from Van Buren to Deer Valley Rd (16 mi.)
- 7th St from Baseline to Deer Valley Rd (21.1 mi.)
- Scottsdale Rd from Baseline Rd to Cave Creek (31.1 mi.)
- Country Club Dr from Riggs Rd to McDowell Rd (17.2 mi.)
- Grand Avenue from 7th Avenue to Loop 101 (14.3 mi.)
- 19th Avenue from Baseline to Deer Valley Rd (21.1 mi.)
- McDowell Road from Litchfield to Loop 101 North (27.1 mi.)
- Shea Boulevard from SR 51 to Frank Lloyd Wright Blvd (10 mi.)
- Dysart from Bell Road to I-10 (12.5 mi.)
- Power Road from Loop 202 (Red Mountain Freeway) to Elliot Rd (8.4 mi.)

3.3 REGIONAL TRANSIT SYSTEM

Figure 3.2 shows the Regional Transit Network. The presence of transit is an important criteria for the congestion management analysis process described in Section 5.0 – Identifying and Analyzing Strategies.

The CMP described later in Section 5 emphasizes the importance of transit in terms of addressing congestion within the MAG region.

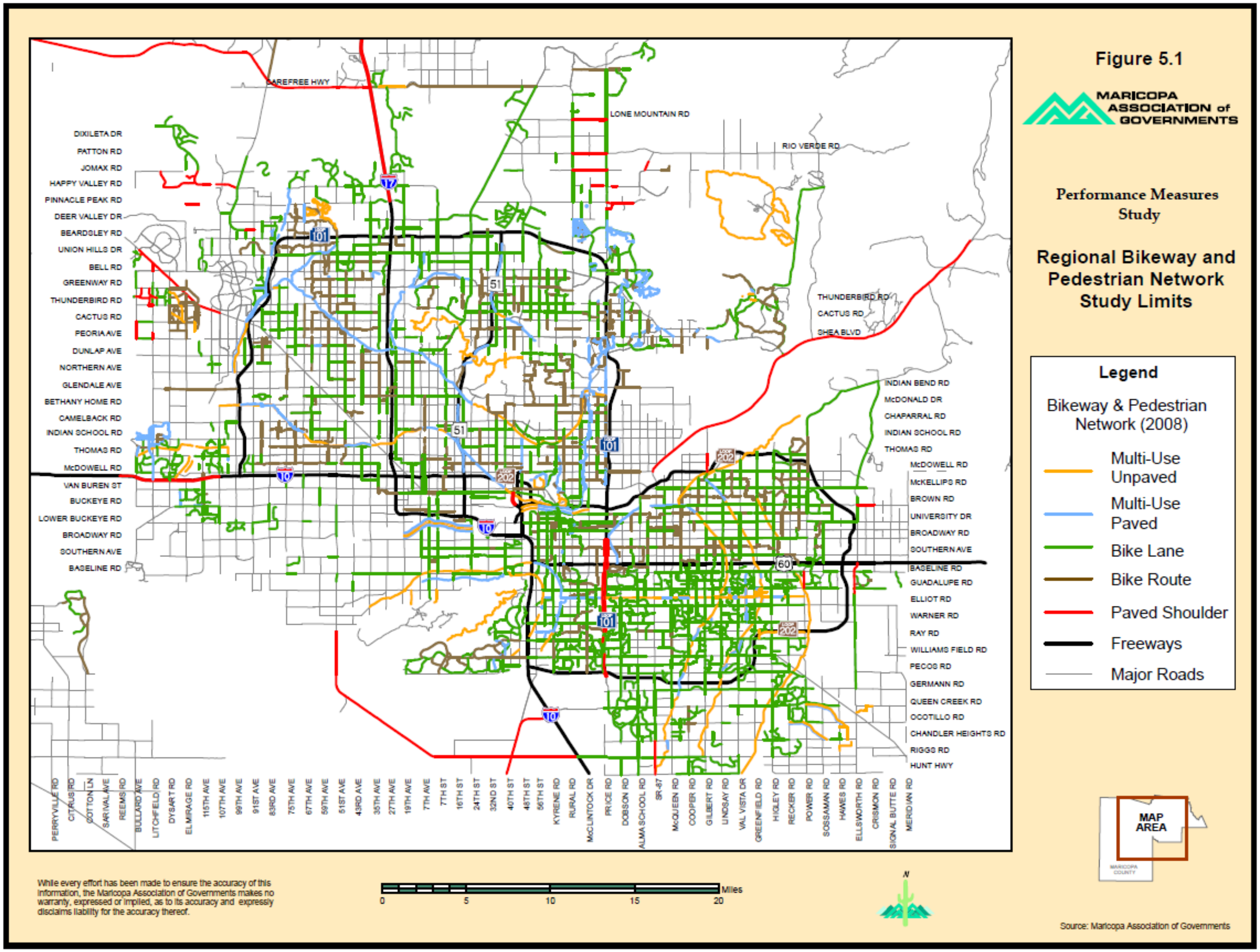
Figure 3.2 Regional Transit Network Study Limits from Performance Measurement Framework Study



3.4 REGIONAL BICYCLE AND PEDESTRIAN NETWORK

Figure 3.3 shows the Regional Bikeway and Pedestrian Network (Bike/Ped). The presence of Bike/Ped is an important criterion for the congestion management analysis process described in Section 5.0 – Identifying and Analyzing Strategies.

Figure 3.3 Regional Bikeway and Pedestrian Network Study Limits from Performance Measurement Framework Study



4.0 Performance Measures and System Monitoring Plan

4.1 MAG Performance Measurement Framework

MAG reports periodically on the performance of the transportation system on the basis of data collected through area-wide studies like the 2006/2007 MAG Regional Travel Time and Speed Study, traffic volume counts, data collected by the ADOT Freeway Management System, and other technical studies such as the 1998 MAG Regional Congestion Study. Information on congestion is reported periodically through the Performance Measurement Program and is used for the preparation of reports such as the Annual Report on the Status of the Implementation of Proposition 400. This section provides an overview of the existing performance monitoring and reporting system.

As part of the development of MAG's Performance Measurement Framework, a number of performance measures were developed that are designed to be used to assess the extent of congestion and to support the evaluation of congestion reduction strategies.

Among the identified performance measures in this section, there will be a subset of measures that will allow for long-term operation of the CMP based on data analysis that is available to MAG on a consistent basis. Some of these measures will be used as criteria in making decisions about which strategies, strategy packages, and programs will be selected in the planning and programming process. Not all of these measures will be used in every analysis; measures will be selected based on the characteristics of the project and the congestion condition being addressed.

MAG has identified a number of measures that will be used to track the performance of the transportation system over time. These measures address system performance in terms of access and mobility (e.g., person throughput and vehicle miles traveled – VMT), travel time and delay, and safety (e.g., crashes and crash rates), for both the freeway and arterial system. RPTA also has identified several performance measures for transit (e.g., transit boardings and on-time performance).

Table 4.1 indicates the performance measures that were identified in the Performance Measures Framework for MAG. The table provides examples of the types of measures used as qualitative criteria in the CMP described in Section 5.

Table 4.1 Modified Performance Measures Framework

Focus Area/Mode	Limited Access Highways (GP)	HOV Lanes	Arterials	Transit	Freight	Bicycle/Pedestrian (Non-Motorized)
Travel Time, Delay, & Reliability	Mean and 80th - 95th percentile & point-to-point travel times	Mean and 80th - 95th percentile & point-to-point travel times	Mean and 80th-95th percentile & point-to-point travel times	Point-to-point travel times	Point-to-point travel times	Bicycle detection at traffic signals
	Congestion delay – spatial & temporal	Congestion delay – spatial & temporal	Congestion delay – spatial & temporal	Congestion delay – spatial & temporal		
	Travel time reliability index [buffer index]	Travel time reliability index [buffer index]	Travel time reliability index [buffer index]	On-time performance (peak period and overall)		
Incident Management	Incident clearance time		Incident clearance time			
Mobility – Throughput (People/ Freight)	Volume (person and/or vehicle)	Volume (person and/or vehicle)	Volume (person and/or vehicle)	Ridership – by mode (peak period and total)	Freight volume	Bicycle/pedestrian LOS
	On-ramp queue size		Intersection LOS – based on V/C	Peak hour load factor (average load factor on express bus/freeway brt)	Commodity flows from, to, within, and through the region, by mode	Per capita miles traveled
	Lost capacity		Signal cycle failures / intersection queue size			
	Per capita VMT		Per capita VMT	Boardings per revenue mile		
Safety & Security	Crash/injury/ fatality rate		Crash/injury/fatality rate for intersections	Crash rate	Crash/injury/fatality rates for large truck involved crashes on the freeway system	Crash/injury/fatality rate per 100,000 population
			Crash/ injury/fatality rates for segments	Transit crime rate (safety incidents per 100k vehicle miles)	Crash/injury/fatality rates for large truck involved crashes on the arterial system	Number of schools participating in safe routes to schools program
						Availability of safe street crossings for access to pedestrian & bicycle facilities
System Accessibility & Modal Options				Percent of park and ride capacity used	Percent of freight terminals/intermodal facilities (air, rail, & truck cargo) located within 5 miles of a freeway	Sidewalk and/or bicycle network completeness

Focus Area/Mode	Limited Access Highways (GP)	HOV Lanes	Arterials	Transit	Freight	Bicycle/Pedestrian (Non-Motorized)
				Vehicle revenue miles of service per resident of MAG urbanized area		Availability of safe street crossings for access to transit stops
				Percent of population residing within ¼ mile of local bus and ½ mile of LRT/Express Bus		Bicycle storage facilities
				Transit share of travel (by mode) – miles traveled or trips taken		Bicycle/pedestrian share of travel
System Preservation	Bridge/pavement condition rating	Bridge/pavement condition rating	Bridge/pavement condition rating			
Environmental Preservation	Air quality index	Air quality index	Air quality index	Air quality index	Air quality index	Vehicle emissions reduced by pedestrians and bicycle users
Quality of Life	Customer satisfaction	Customer satisfaction	Customer satisfaction	Customer satisfaction	Customer satisfaction	Customer satisfaction
				Number of employers with a trip reduction program		
Cost Effectiveness	Trips served/time savings per dollar invested	Trips served/time savings per dollar invested	Trips served/time savings per dollar invested	Trips served/time savings per dollar invested	Trips served/time savings per dollar invested	

Yellow = data is available
Orange = some data is available, but additional refinement and/or data collection is needed prior to use
Red = limited or no data available, or significant additional refinement/analysis is needed prior to use

For purposes of the congestion management process, the types of performance measures available will be limited to the measures that can be derived from available tools as they come available, including the regional travel demand model, subregional modeling, and sketch planning. The regional model estimates future demand in terms of VMT and projects the extent of congestion in terms of congested lane-miles and the percent of travel under congested conditions. It also produces an estimate of total vehicle hours of delay. Performance measure data (either observed or modeled) are necessary to support the CMP quantitative criteria.

4.2 STATE OF CONGESTION

The state of congestion was documented in Phase II Performance Measures Report (September 2009). The report highlights performance on freeways, arterials, transit, and bicycle and pedestrian. This report should be the method for assessing the state of congestion within the MAG region on a regular basis.

Congestion Monitoring on the Web

MAG and ADOT provide the most recent available data to the public through the MAG Transportation Data Management System, the MAG Multimodal Transportation Performance Measurement Web Tool, and ADOT's AZ511 traveler information site. These applications make the most up-to-date information available to transportation practitioners and to other transportation stakeholders among the public.

5.0 Identify and Evaluate Strategies

As defined and documented through the MAG planning process and through this study, components of the congestion management process include congestion mitigation strategies, performance measures and the process for evaluating congestion. This section presents an implementation framework of how these components integrate with one another and with a series of analytical tools. As presented below, this process is designed to link these components to identify, evaluate, and screen the potential congestion reduction impacts of selected projects and/or strategies.

5.1 Congestion Management Strategies

A matrix of congestion mitigation strategies applicable to the Phoenix region was defined and documented in the *Phase III: Congestion Management Process Update Report* for this Study. These strategies represent the types of projects that could be applied in the development of the RTP over the long-term, or in the short- and medium-term programming processes, including competitively funded projects. The strategies can be categorized into the following types of projects or modes:

1. Land use/ Workplace-based
2. Transit
3. Operations improvements and ITS
4. Bicycle and pedestrian (non-motorized)
5. High Occupancy Vehicle
6. Additional system capacity (including freeways and arterial roadways)
7. New roadway facility construction

The strategies are summarized in Table 5.1 according to the categories described above. A summary of each of these project/mode types is provided following the table. Appendix A presents examples of these strategies in more detail. The matrix in Appendix A includes:

- A description of the strategy;
- The congestion management objectives to which the strategy best relates;
- Complementary strategies, for purposes of assembling packages of strategies; and

- Performance measures to assist in the assessment of which strategies would be most effective, or for evaluation of strategy effectiveness after implementation.

Table 5.1 Congestion Mitigation Strategies

	Strategy Type	Demand Management	Transit	Encourage Higher Occupancy Modes	Operations-Related/ITS	Expand Existing/ Construct New Facilities
1	Telework and Flex Hours	✓				
	Trip Reduction Ordinances	✓				
	Transportation Management Associations	✓				
	Transit-Oriented Development	✓	✓			
2	Expand Transit Facilities (Bus, LRT)		✓			
	Implement Bus Rapid Transit (BRT)		✓			
	Implement New Commuter Rail Service		✓			
3	Expansion of Ramp Metering				✓	
	Advanced Traveler Information				✓	
	Access Management				✓	
	ITS Cameras at Intersections				✓	
4	Bicycle and Pedestrian Facilities					✓
5	Promote Carpooling and Vanpooling			✓		
	Extend HOV Lanes			✓		✓
6	New General Purpose Freeway Lanes					✓
	New Freeway Interchanges					✓
	New Arterial Lanes					✓
	Arterial Intersection Improvements					✓
7	New Freeway Facilities					✓
	New Arterial Facilities					✓

Source: *Performance Measurement Framework and Congestion Management Update Study. Phase III: Congestion Management Process Update Report*

1. Land Use and Workplace-Based Strategies

The land use and workplace-based congestion mitigation strategies were specifically selected for their applicability to address conditions in the Phoenix region. These strategies, including land use and workplace-based, were defined to be feasible, implementable, and measurable to mitigate congestion in the region. While in some cases, the implementation of land use and workplace-based strategies would be long-term, many could be implemented in the medium to short-term to help assist MAG and its regional partners mitigate congestion.

Land use strategies have been used in urban areas to manage transportation demand on the surface transportation systems and to help agencies meet air quality conformity standards. Land use strategies can include limits on the amount and location of development until certain service standards are met or policies that encourage development patterns better served by public transportation and non-motorized modes.

While implementable over the long-term, public policy and private development patterns will need to change significantly to further encourage Transit-Oriented Development (TOD) and Growth Management Strategies in the Phoenix region. The development of TODs, mixed-use developments in connection with transit systems reduce single occupant vehicle (SOV) movements within subareas and corridors within a region. TOD development traditionally has occurred in urban areas with multimodal and rapid transit options available to travelers. With the implementation and proposed expansion of Valley Metro's light rail system, the feasibility of developing TOD subareas adjacent to station locations is a distinct possibility. Increased ridership on the light rail system could help drive the potential development of TODs by the private sector. For example, the San Francisco Bay Area Rapid Transit System (BART) was the catalyst for TOD development adjacent to various suburban stations (e.g., Walnut Creek, Pleasant Hill).

The public policy changes and public (political, business, developer, general public) buy-in required to implement growth management boundaries in a region are often time consuming and can be insurmountable. Partnerships between the public and private sectors are necessary to begin to formulate and implement these types of policies. Growth management strategies provide the opportunity for regions to increase land use densities, reduce urban sprawl, and increase transit services. A number of member jurisdictions include growth area elements that address this kind of development as part of their growth plan.

Traditional Transportation Demand Management (TDM) or workplace-based strategies are used to reduce travel during the peak commute periods. They are also used to help agencies meet air quality conformity standards and are intended to provide ways to provide congestion relief/mobility improvements without high cost infrastructure projects. These strategies can potentially build upon ITS and other initiatives being considered and implemented in the region.

TDM strategies include changing the time of day that employees commute to work (flextime, staggered work hours); changing the mode used by employees for commuting (transit subsidies, car-pooling and van pooling programs); or reducing the number of trips through compressed workweeks and telecommuting. The impact of these programs can often be determined through employer surveys, which can provide an actual measure of the trips reduced or shifted into other modes.

Over the past 20 years, workplace-based strategies have evolved into voluntary programs for both public agencies and private businesses within a region. While implementable in the short-term and cost effective, these strategies need a significant level of public agency promotion and private sector incentive to be successfully implementable within a region. These strategies can provide some level of congestion relief in the region and are recommended for implementation. Realistically, implementation will require significant work from MAG's local jurisdictions to promote these concepts, buy-in from large employers and businesses to participate in these programs, as well as participation from the commuting public to make these strategies successful.

Trip Reduction Ordinances can be implemented by local agencies to encourage large employers (e.g., with over 500 employees) to develop promotional programs and to provide incentives for their employees to use alternative modes of transportation such as vanpools, carpools, and transit; adopt telework or alternative work schedules; or other strategies to reduce both SOV and peak period travel. These have been implemented in urban areas and can be quite successful in mitigating congestion in central business districts and similar subareas. Transportation Management Associations (TMAs) are often implemented and subsidized to provide alternative transportation mode options (e.g., park and ride shuttles, free downtown shuttles) to travelers. In many cases, TMAs are generally non-profit organizations who provide transit or shuttle services, working hand-in-hand with public agencies, transit operators, and large employers to implement alternative transportation systems that support urban Trip Reduction Ordinances and intermodal connections with larger transit services such as Valley Metro's light rail system.

Other short-term and low cost workplace-based strategies, such as alternative work schedules, telework (telecommuting), teleconferencing/ videoconferencing, rideshare programs, vanpool programs, and park and ride, have been implemented in the Phoenix region by large employers with public agency support. These strategies could further reduce SOV travel and congestion when implemented in conjunction with enhanced public agency programs and private business support. For example, the public agency promotion and implementation of Trip Reduction Ordinances could help large employers understand the impacts on congestion of their activities. This could result in significant efforts to promote alternative work schedules and telecommuting with their employees.

2. Transit Strategies

Transit infrastructure projects traditionally have been implemented in regions to provide an alternative to automobile travel potentially reducing peak-period congestion and improving mobility and accessibility for commuters. These strategies tend to reduce systemwide VMT only in relatively small increments, but do improve corridor and systemwide accessibility, improve roadway travel times, and decrease congestion on the roadway system. Transit improvements are also analyzed as part of MAG's RTP process. MAG also has recently implemented a Transit Committee to review transit projects, which will facilitate the project selection process as part of the periodic TIP, as well as the selection of other federally funded projects.

3. Operations and ITS Strategies

ITS and operations strategies have traditionally focused on improving the operation of the transportation system without major capital investment and cost. While ITS strategies may be costly compared to more traditional transportation system management strategies, their relative congestion-reduction impacts can be significant. These types of strategies can build upon current ITS initiatives in the region.

Improvements to traffic flow and reductions in delay can be estimated using either sketch planning methods or through use of the regional travel demand model. However, it is generally agreed that regional models are not well suited to estimating the impacts of operational improvements. Some methods, including the use of post-processors such as the ITS Deployment Analysis System (IDAS), can provide an estimate of the impact of ITS improvements and other operational measures.

MAG's Air Quality Technical Advisory Committee has developed a methodology that will estimate reduction in emissions from the deployment of ITS improvements and other operational measures, such as traffic signal improvements or freeway management system projects. In general, the methodology estimates: (1) daily emission reductions of the project in kilograms per day; and (2) the cost effectiveness of each project in dollars per metric ton of emissions reduced per year. The daily emission reduction is reported in annual CMAQ reports that are submitted to FHWA, while the cost effectiveness measure is used for prioritizing projects that are candidates for future CMAQ funds.

The document, "Methodologies for Evaluating Congestion Mitigation and Air Quality Improvement Projects,"[3] describes in detail the methodologies and

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[3] MAG, "Methodologies for Evaluating Congestion Mitigation and Air Quality Improvement Projects," April 2009. Accessed September 1, 2010. http://www.mag.maricopa.gov/detail.cms?item=9971.

assumptions used to estimate emission reductions and cost-effectiveness for typical operations improvement and ITS projects.

4. Bicycle and Pedestrian (non-motorized) Strategies

Transportation professionals often overlook non-motorized modes of transportation, such as bicycling and walking. Investments in these modes can increase safety and mobility in a cost-efficient manner, while providing a zero-emission alternative to motorized modes. The strategies can be implemented with relatively little cost, but tend to have local rather than systemwide impacts. The effectiveness of an investment in non-motorized travel depends heavily on coordination with local land use policies and connections with other modes, such as transit, for longer-distance travel. Safety and aesthetics should also be emphasized in the design of bicycle and pedestrian facilities in order to increase their attractiveness.

MAG's Bicycle and Pedestrian Committee evaluates proposed non-motorized projects as part of the CMAQ funding process and the TIP development process. Most projects considered by the Bicycle and Pedestrian Committee utilize a detailed qualitative set of measures for project review, since generalized methods for evaluating non-motorized transportation improvements are not available for quantifying the impacts of such projects on congestion.

5. High Occupancy Vehicle Strategies

Actions that would shift trips into higher-occupancy modes such as carpooling and vanpooling can have a positive impact on congestion mitigation including improved travel times, reduced delay, and reduced emissions for HOVs and bus transit.

6. Additional System Capacity

Adding capacity is a "last resort" strategy that is used when other strategies fail to provide the improvements in service and other benefits, based on future demand. Regional travel demand models generally do a good job of estimating the benefits of major capacity improvements. For smaller projects, sketch-planning methods can provide estimates of reduction in delay. Sketch planning approaches are most appropriate for the types of projects that would be considered in the context of the TIP development process.

7. New Roadway Facility Construction

Constructing new roadway facilities (arterial and freeways) is used to respond to the need for capacity in areas newly opened for development or where gaps exist in the existing freeway or arterial network.

5.2 CONGESTION MANAGEMENT GOALS AND PERFORMANCE MEASURES

Goals and performance measures already identified in previous components of the CMP will be used to evaluate projects. The two most important criteria for selecting these measures include: 1) ability to support agency goals and objectives, and 2) ability to be calculated with existing data. Examples of the categories of goals to be used include:

- **Mobility** – Mobility describes how well the corridor moves people and freight. Common measures of mobility include reductions in travel time, delay, vehicle miles traveled (VMT), and vehicle hours traveled (VHT).
- **Reliability and Variability of Travel Time** - Reliability and variability capture the relative predictability of the public's travel time. Travel Time Reliability can be measured in several ways including Buffer Time Index, Planning Time Index, and hours of congestion/delay. For this screening process, the IDAS measure for travel time reliability, hours of unexpected delay, is used.
- **Emissions and Fuel Consumption** - The method utilizes the IDAS methodology, which incorporates reference values to identify the emissions and fuel consumption rates based on variables such as facility type, vehicle mix, and travel speed. The emissions and fuel consumption rates were based on currently available sources such as California Air Resources Board EMFAC 2007 and EPA's MOVES model. Emissions and fuel consumption is monetized, using costs per ton of pollutants released and the purchase price of fuel, for use in the benefit/cost analysis.
- **Modal Shifts** – Modal shift captures the impacts of projects and/or improvements on the mode share proportions of the region. Measures of effectiveness of a project can include reduction in SOV trips and increase in transit, HOV, and/or bicycle/pedestrian trips.
- **Measures of Cost Effectiveness** – Annualized benefits and life-cycle costs of the projects/strategies can be calculated to estimate a benefit-cost ratio.

Data to support all of these goal categories may not be readily available; however, these were nevertheless selected for the CMP because they are directly related to the overall MAG Goals and Objectives. The following section provides more detail regarding these goal categories and how they were used to develop specific criteria and how data is to be gathered for them.

5.3 CMP Analysis and Screening Process

Most agencies have more transportation needs than funding which is referred to as a funding gap. Thus, agencies must make tough decisions regarding which projects to fund. Data driven and transparent approaches to this problem should be developed to help agencies make these decisions within the RTP, TIP, CMP, and other processes. The screening approach defined in this section for MAG is consistent with a national trend among transportation agencies working to implement a more transparent and quantitative means of project evaluation and instill more accountability into the project selection process. This approach combines performance analysis with an assessment of how well each potential project supports stated policy goals and objectives, in this case, congestion reduction. The approach is not intended to create a purely mechanical system, devoid of public input and policy discussions. Rather it is intended to support and integrate with MAG's current planning and policy decision-making process.

The following section describes the CMP Analysis and Screening process. Appendices B and C contain case study examples showing how the process can be applied for a set of freeway projects (Appendix B) and arterials (Appendix C).

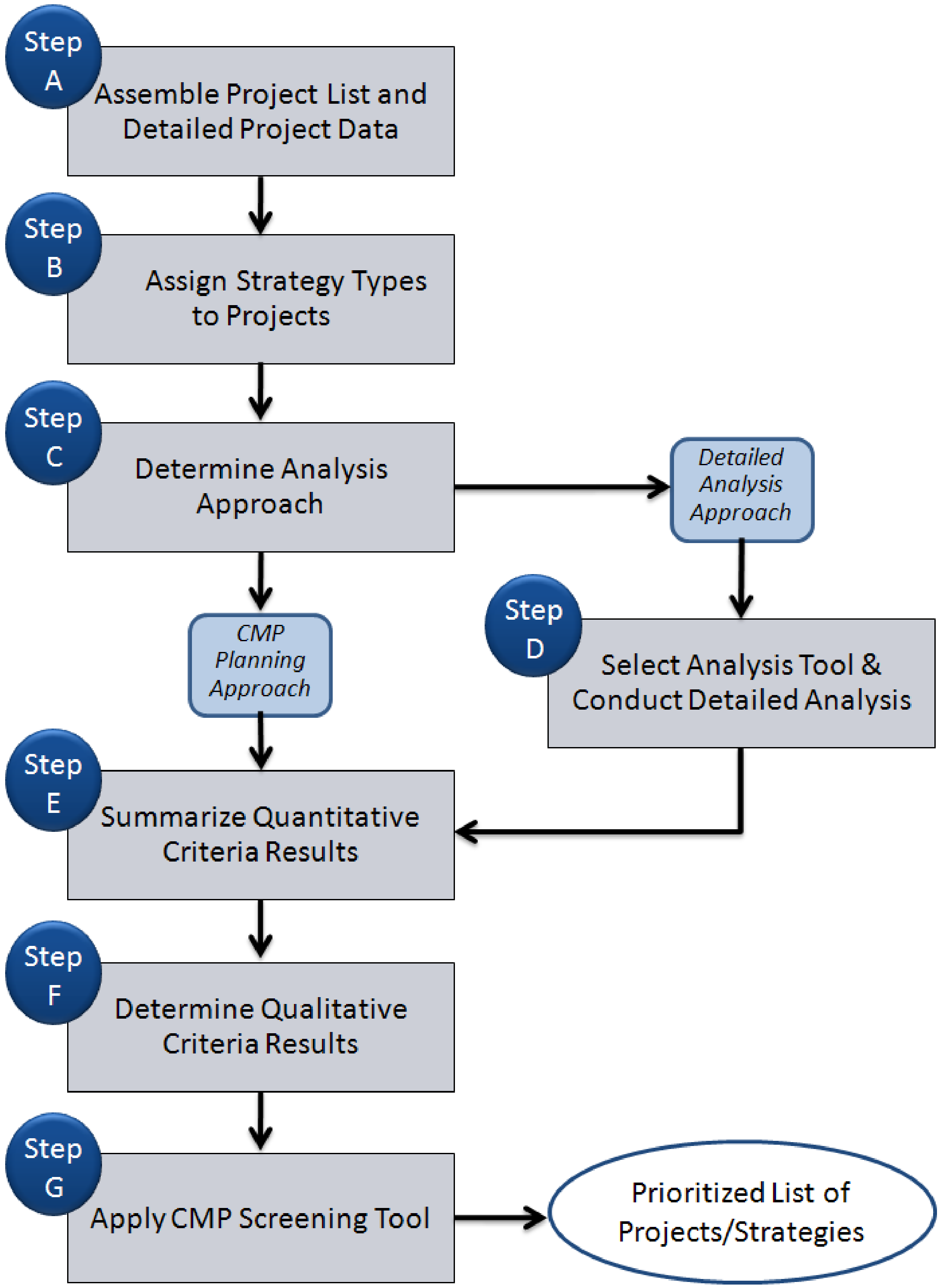
The MAG CMP Analysis and Screening Process can be used to screen and prioritize potential projects based on their effectiveness in mitigating congestion in the region. The following figure illustrates the CMP Analysis and Screening process. The individual steps are described in detail following the diagram.

The tool is designed for flexibility so the user can adjust values, criteria and weighting to be consistent with committee priorities and other available information.

The specific steps where the user has options for flexibility are as follows:

- Type and number of strategies;
- Type and number of quantitative criteria;
- Number and content of questions in project/mode specific criteria; and
- Weights to calculate results.

Figure 5.1 CMP Analysis and Screening Process



Step A Assemble List of Projects or Strategies and Detailed Project Data

Objective:

The user assembles a list of candidate projects or strategies to be used for analysis and screening, along with detailed information about the projects. The users are members of MAG modal committees.

Step A.1: Assemble List of Projects or Strategies

The first step in the process is to compile a list of candidate projects to be evaluated. For CMP screening purposes, the list of projects should be short (e.g., between 3 and 20 projects) with some similar characteristics. For example, the projects could all be located in a certain geographic area or they could be subsets of a larger project. The projects could also encompass different modes. The CMP tool as described will first be applied with modal committees at MAG. Projects within modes will have common elements that will aid in the evaluation process.

Candidate projects can be compiled from a number of sources, include the following:

- ☐ TIP Projects
- ☐ RTP Projects, Life Cycle Program Projects
- ☐ Localized Projects/Strategies
- ☐ Strategies from the Congestion Management Process (CMP) Toolbox

The Congestion Management Process (CMP) Toolbox is a compilation of potential congestion reduction and mobility strategies. The toolbox is designed to encourage solutions beyond traditional roadway widening projects to manage congestion and mobility issues. MAG and its members can use the CMP Toolbox as an additional resource when selecting and screening alternative transportation solutions. The CMP Toolbox is discussed in more detail in Section 5.4.

Step A.2: Assemble Detailed Project Data

The CMP Analysis and Screening Process is designed to be applied to sets of projects or congestion management strategies for which some quantitative data is available. The following detailed project data should be assembled for each candidate project:

- Source of project (TIP, RTP, Corridor Study, etc.)
- Project location
- Project limits
- Type of work
- Type of project (roadway, transit, bicycle/pedestrian, ITS)
  - Roadway volumes (freeway general purpose lanes, HOV lanes, arterials)
  - Presence of transit/bicycle/pedestrian facilities
- Project length or area of influence
- Project cost

Step B

Assign Strategy Types to Projects

Objective:

Assign congestion management strategy type to each project on the project list.

Step B: Assign Strategy Types to Projects

For each project on the list, determine the type of congestion management strategy encompassed by the project according to the following strategy types:

1. **Land Use and Workplace-Based**. These strategies include telework and flex hour programs, trip reduction ordinances, Transportation Management Associations, transit oriented development, and others.

2. **Transit**. These strategies include expanding transit facilities (bus, LRT), bus rapid transit (BRT), new commuter rail service, and others.

3. **Operations and ITS**. These strategies include expansion of ramp metering, advanced traveler information, access management, and others.

4. **Bicycle and Pedestrian (non-motorized)**. These strategies include bicycle and pedestrian facilities, and others.

5. **High Occupancy Vehicle**. These strategies include expanding HOV lanes.

6. **Additional System Capacity**. These strategies include new general purpose freeway lanes, new freeway interchanges, new arterial lanes, arterial intersection improvements, and others.

7. **New Roadway Facility Construction**. These strategies include construction of new freeway or arterial facilities.

The Congestion Mitigation Strategy Matrix in Appendix A and the CMP Toolbox (Table 5.4) both contain a detailed matrix of congestion management strategies by type that can be used as a resource in assigning strategy type.

Step C

Determine Analysis Approach

Objective:

Determine the analysis approach to be used to screen and evaluate projects.

Step C: Determine Analysis Approach

The CMP Analysis and Screening Process has been developed as a sketch planning tool. As such, it can be used to screen and prioritize projects regardless of the availability of detailed project data and analysis results. In this step, the user determines whether a Detailed Analysis or CMP Planning approach will be followed:

Option 1: Detailed Analysis Approach. If there is sufficient project data and resources to use more detailed analysis tools such as the regional travel model (or other tools suggested in the CMP toolbox), the detailed analysis approach is used. This approach allows for the application of detailed modeling, analysis and/or simulation tools, resulting in accurate, quantifiable performance measure results for potential projects.

Option 2: CMP Planning Approach. If there is insufficient project data and resources to use the more detailed analysis tools, the CMP planning approach is used. This approach allows for a high level, order-of-magnitude assessment of the impacts of potential projects based on quantitative and qualitative criteria. The CMP planning approach could also be used to screen a larger number of projects in order to select specific projects for the detailed analysis approach.

Generally, MAG should strive to work with the detailed analysis approach so that specific, quantifiable performance measure results can be obtained for each project under consideration.

Step D

Select Analysis Tool and Conduct Detailed Analysis

Objective:

This step is necessary only if the detailed analysis approach is selected in Step C.

The objective is to select an appropriate analysis tool from the CMP Toolbox or other available resources and conduct detailed analysis.

Step D.1: Select Analysis Tool from the CMP Toolbox

If there is sufficient project data and resources to support the detailed analysis approach, the user can select an analysis tool to use for detailed modeling, simulation, and/or analysis of projects on the candidate project list. There are numerous tools available and selection of an appropriate analysis tool will depend on the type of strategy being evaluated; the size and scope of the candidate project; the availability of detailed project data required for input by the analysis tool; and the availability of agency staff, expertise, and resources required to conduct detailed analysis.

MAG and its member agencies can use the CMP Toolbox (Table 5.4) as a starting point for selecting an appropriate analysis tool. Depending on the type of project being considered (e.g., land use, workplace-based, transit, operations and ITS, etc.), the CMP Toolbox recommends several options for analysis tools designed to assess the congestion reduction potential of the projects carried forward for analysis and screening in MAG's congestion management process. These tools, and in some cases, combinations of tools, can be used to identify the impacts of various types of projects on congestion in the region.

Section 5.4 should be referenced for more detail regarding the tools and toolbox.

Step D.2: Conduct Detailed Analysis using Selected Analysis Tool

The selected analysis tool is then used to conduct detailed modeling, simulation, and/or analysis in order to evaluate the congestion reduction impacts of projects on the candidate project list. The user should work with the appropriate MAG modal committee or local agency staff to compile the detailed project data required for input by the tool. Input data requirements will differ depending on the tool being used.

The user would then use the tool to conduct a detailed before/after analysis to assess the congestion reduction impacts of each candidate project compared to baseline or existing conditions. The detailed analysis will allow the user to generate accurate, quantifiable performance measure results for each candidate project. The specific quantitative and qualitative criteria to be generated by the analysis tool are discussed in Steps E and F.

Step E

Summarize Quantitative Criteria Results

Objective:

Quantitatively assess the congestion reduction impacts of candidate projects based on performance measures such as the potential reduction of SOV trips, improved travel times, reduced delay, among others.

Step E.1: Select Quantitative Criteria

The CMP Analysis and Screening Process' flexibility allows for different combinations of criteria depending on type of congestion management strategy, analysis approach and analysis tool capabilities, availability of detailed project data, and MAG modal committee objectives. The CMP Toolbox provides a starting point for selecting quantitative criteria. For each of the congestion reduction projects and strategies, the CMP Toolbox identifies the potential for congestion reduction impacts based on measures such as vehicle miles traveled, vehicle hours traveled, crashes, reduction in trips/mode split, emission reductions, and economic benefits. It is strongly recommended that at least three quantitative criteria be used. The minimum set of quantitative criteria is volume, crash rate, and congestion. *NOTE: For ITS projects, AADT can be replaced by VMT or VMT/lane. Cost can be another quantitative factor expressed in VMT/$ spent.*

Step E.2: Assess Quantitative Criteria Results

The next step is to quantitatively assess the congestion reduction impacts of candidate projects based on the performance measures selected above. This will be performed based on the analysis approach selected in Step C:

Option 1: Detailed Analysis Approach. If the detailed analysis approach is used, the quantitative criteria are calculated using the detailed analysis tool selected in Step D.

Option 2: CMP Planning Approach. If the CMP planning approach is used, the user would rely on the detailed project information referred to in Step A. Any other project data can and should be used if available.

Step F

Determine Qualitative Criteria Results

Objective:

Qualitatively assess the congestion reduction impacts of candidate projects based on two distinct sets of qualitative criteria: 1) those based on CMP objectives, and 2) those based on project/mode type.

Step F.1: Assess Qualitative Results Based on CMP Objectives Criteria

This step translates the quantitative performance measure results into congestion relief thresholds that can be used to screen the projects. Although the analysis tool may indicate the level of VMT reduction this does not indicate the system's benefit on its own. Table 5.2 shows the evaluation criteria based on CMP objectives and how they are used to score the merits of each candidate project in the CMP Analysis and Screening Process. A score of 1 through 4 is assigned based on the potential of the project to meet each of the seven CMP objectives. A higher score indicates that the project has the highest potential to mitigate congestion based on the criteria. If it is determined that an objective does not apply to the project then NA (not applicable) can be assigned.

The intent is to assess the potential impact of the project in terms of CMP objectives such as minimizing delay, travel time reliability, and other congestion management objectives. For example, one of the primary objectives of the CMP is to *promote projects that minimize transportation system delay and improve travel times.* The candidate project would be scored based on its ability to reduce delay, as follows: A score of 1 is assigned if the project does not affect delay; a score of 2 is assigned if the project affects delay somewhat; a score of 3 is assigned if the project addresses and will result in reduction in delay; and a score of 4 is assigned if the project has the highest potential to decrease delay.

It is entirely appropriate to compare projects against each other when conducting the assessment. Other sources such as the annual MAG Performance Measures report, project reports, corridor studies, ALCP applications, and other resources could be used to answer the questions. Ideally, MAG would obtain consensus from MAG modal committees and other stakeholders to assist in assessing the qualitative criteria based on CMP objectives.

CMP Objective 7, Measures of Cost Effectiveness, is an assessment of the ability of a project to provide systemwide benefits. If benefit/cost ratio data are available, projects are scored based on the magnitude of the benefit/cost ratio; if not, projects are scored relative to other projects.

Table 5.2 CMP Objectives Qualitative Assessment Criteria

CMP Objectives	Evaluation Criteria	Addresses	Score			
			1	2	3	4
1. Minimize Delay and Improve Travel Time	• Increased vehicle throughput • VHT Reduction • Travel Time Savings	• Does the project decrease travel time or delay?	No impact on travel time or delay	May reduce travel time or delay	Likely to reduce travel time or delay	Highest impact on travel time and delay
2. Reduce Travel Time Variability	• Travel Time Reliability (hours of unexpected delay)	• Does the project reduce crash risk? • Does the project reduce weave/merge conflicts?	No impact on travel time variability	May reduce travel time variability	Likely to reduce travel time variability	Highest impact on travel time variability
3. Improve System Connectivity	• Network connectivity and completeness	• Does this project improve connections to regional intermodal or emergency facilities?	No impact on system connectivity	May improve system connectivity	Likely to improve system connectivity	Highest impact on system connectivity
4. Increase Alternative Mode Share	• Vehicle Trip Reduction/ Reduce SOV Mode Share • Increased HOV Mode Share • Increased Transit Mode Share	• Does the project reduce mode share for drive alone trips? • Does the project increase alternative mode share?	No impact on alternative mode share	May increase alternative mode share	Likely to increase alternative mode share	Highest impact on alternative mode share
5. Improve Level of Service / Reduce Congestion	• LOS Improvement • V/C Ratio • Increased Person-throughput	• Does the project improve the Level of Service of the facility? • Does this project increase the roadway capacity?	No impact on congestion	May reduce congestion	Likely to reduce congestion	Highest impact on congestion
6. Reduce Emissions and Fuel Consumption	• Emissions Reduction • Fuel Consumption Rates	• Does the project reduce vehicle emissions? • Fuel consumption?	No impact on emissions	May reduce emissions	Likely to reduce emissions	Highest impact on emissions
7. Measures of Cost Effectiveness	• Benefit/Cost Ratio	• Does the project provide system-wide benefits? • Do the project benefits outweigh the costs?	No impact on systemwide benefits	May provide some benefit	Likely to provide systemwide benefit	Highest impact on systemwide benefit

Step F.2: Assess Qualitative Results Based on Project/Mode Specific Criteria

This step evaluates the potential of the project to mitigate congestion based on project or mode specific qualitative criteria. Table 5.3 shows the evaluation criteria and how they are used to score the merits of each candidate project based on the criteria. The user must determine the project/mode type that best fits a candidate project. The user then answers the questions related to that project/mode type and counts the total number of yes/no responses. A score of 1 through 4 is assigned based on the number of questions (or yes responses) addressed by a project. A higher score indicates that the project has the highest potential to mitigate congestion based on the criteria.

The intent is to assess the potential impact of the project in terms of MAG modal committee objectives. For example, one of the primary objectives of the MAG Bicycle and Pedestrian Committee is to promote projects that encourage the development of bicycle and pedestrian facilities and ultimately increase bicycling and walking as viable modes of transportation throughout the region. One criterion for qualitatively assessing the congestion impacts of projects is whether the project will improve connectivity in the MAG Regional Bicycle and Pedestrian Network.

It is entirely appropriate to compare projects within a modal type against each other when answering the questions. Sources such as the project reports, corridor studies, ALCP applications, TIP project applications, and other resources could be used to answer the questions. Ideally, MAG would obtain consensus from MAG modal committees and other stakeholders to assist in assessing the qualitative criteria based on project/mode type.

The qualitative criteria for each project/mode type were derived from existing MAG planning documents and MAG regional goals/objectives, described as follows:

- **Land Use or Workplace-Based Criteria:** These criteria were derived from best practice recommendations for the MAG Sustainable Transportation Land Use Integration Study, as well as a review of best practices in land use and workplace based project prioritization. *NOTE: The MAG Sustainable Transportation Land Use Integration Study is currently in progress, and the qualitative criteria related to Land Use/Workplace-Based projects should be updated by MAG at the conclusion of that study.*

- **Transit Criteria:** These criteria were derived from the transit project prioritization process described in the MAG Transit Life Cycle Program (TLCP) Working Group Final Report, as well as a review of best practices in Transit project prioritization.

- **Management & Operations (ITS) Criteria:** These were derived from the MAG Intelligent Transportation Systems Project Rating System (June 2000), which is used by the MAG ITS Committee to prioritize ITS projects for inclusion in the annual update of the TIP, as well as a review of best practices in ITS project prioritization.

- **Bicycle/Pedestrian Criteria:** These were developed by the MAG Bicycle/Pedestrian Committee.

- **High Occupancy Vehicle (HOV) Criteria:** These criteria were derived from a review of best practices in HOV project prioritization.

- **System Capacity and New Facilities Criteria:** These criteria were derived from MAG regional goals and objectives, as well as a review of best practices in roadway based project prioritization.

Table 5.3 Project/Mode Specific Qualitative Assessment Criteria

Project / Mode Type	Criteria for Determining Support	Score			
		1	2	3	4
Land Use or Workplace-Based[4]	1. Does project strongly support or enhance travel demand management programs which are already in place and which have regional importance? 2. Will the project reduce traffic congestion by reducing vehicle trips or VMT by 100 or more vehicles? 3. Does project promote sustainable transportation[5]? 4. Does project promote development patterns and densities to support high capacity transit services (including BRT)? 5. Does project include marketing, education and incentive programs that encourage shift to alternative modes?	*Yes* answers to zero to 25% of applicable questions	*Yes* answers to 26% to 50% of applicable questions	*Yes* answers to 51% to 75% of applicable questions	*Yes* answers to 76% to 100% of applicable questions

[4] NOTE: The MAG Sustainable Transportation Land Use Integration Study is currently in progress. The qualitative criteria related to Land Use/Workplace-Based projects should be updated by MAG at the conclusion of that study.

[5] Sustainable Transportation is defined as the provision of safe, effective and efficient access and mobility into the future while considering economic, social, and environmental needs of society. *T.L. Ramani, J. Zietsman, W.L. Eisele, D. Rosa, D.L. Spillane, B.S. Bochner. Developing Sustainable Performance Measures for TxDOT's Strategic Plan: Technical Report. 0-5541-1. Texas Transportation Institute, College Station, TX. April 2009.*

Project / Mode Type	Criteria for Determining Support	Score			
		1	2	3	4
Transit[6]	1. Does the project provide for replacement of equipment, facilities and/or amenities along an existing route? 2. Does the project provide for expansion of existing service or provide new service between origins and destinations of regional importance, significantly improve a connection between modes, or provide essential facilities to serve riders who are elderly or disabled? 3. Does the project provide access to existing and/or future business and job activity centers, commercial destinations, transit facilities (e.g., park & ride lots), and schools? 4. Will the project significantly reduce transit vehicle overloading or transit facility crowding? 5. Will the project provide a significant mode shift to transit from a congested roadway corridor, or provide other significant congestion relief on a congested roadway? 6. Will the project increase the average transit level speed (including stops) along an existing route? 7. Does the project reduce the percentage of trips requiring one or more transfers?	*Yes* answers to zero to 25% of applicable questions	*Yes* answers to 26% to 50% of applicable questions	*Yes* answers to 51% to 75% of applicable questions	*Yes* answers to 76% to 100% of applicable questions
Management and Operations (ITS)	1. Is the project located within ITS priority areas defined by city/town? 2. Is the project located within an ITS priority corridor as defined in the ITS Strategic Plan? 3. Is the project included in MAG ITS Strategic Plan? 4. Is the project consistent with the MAG Regional ITS Architecture? 5. Does the project enhance traffic management capabilities for special events? 6. Does the project coordinate signal systems across jurisdictional boundaries and improve progression? 7. Does the project improve accuracy, timeliness and availability of real-time information to the public? 8. Does the project improve automated traffic data collection and archiving ability? 9. If the project is a component of an ITS project (i.e., canvas, fiber, dynamic message signs) is it part of a fully funded project?	*Yes* answers to zero to 25% of applicable questions	*Yes* answers to 26% to 50% of applicable questions	*Yes* answers to 51% to 75% of applicable questions	*Yes* answers to 76% to 100% of applicable questions

[6] MAG Transit Committee is initiating a prioritization process for transit projects. MAG is currently coordinating these efforts.

Project / Mode Type	Criteria for Determining Support	Score			
		1	2	3	4
Bicycle / Pedestrian	1. Does the project or program close a gap in a pedestrian or bicycle facility? 2. Does the project or program promote or improve access to short trip destinations, such as activity centers, commercial destinations, transit services, libraries, parks, and schools? 3. Is the project part of a designated regional or multi-jurisdictional facility or program? 4. Are the project or program elements supported by the MAG Pedestrian Policies and Design Guidelines or AASHTO Guide for Bicycle Facilities? 5. Is the project or program supported by the jurisdiction or agency's policies, plans, or objectives? 6. Does the project or program include significant marketing, education, safety, and/or incentives that are expected to encourage a shift to bicycle and pedestrian transportation modes?	*Yes* answers to zero to 25% of applicable questions	*Yes* answers to 26% to 50% of applicable questions	*Yes* answers to 51% to 75% of applicable questions	*Yes* answers to 76% to 100% of applicable questions
High Occupancy Vehicle (HOV)	1. Will the project reduce traffic congestion by reducing vehicle trips or VMT by 100 or more vehicles? 2. Does project include marketing, education and incentive programs that encourage HOV ride sharing?	*Yes* answers to zero to 25% of applicable questions	*Yes* answers to 26% to 50% of applicable questions	*Yes* answers to 51% to 75% of applicable questions	*Yes* answers to 76% to 100% of applicable questions
System Capacity and New Facilities	1. Does the project complete or improve a segment which helps to provide a continuous link between two points of regional importance for travel, or improve an intersection or interchange of two corridors of regional importance? 2. Does the project include segments of high congestion that result in lost productivity along the corridor, and will the project help to mitigate this congestion? 3. Does the project provide access to existing and/or future business and job activity centers, shopping, educational, cultural, and recreational opportunities? 4. Will the project accommodate or create significant benefits to at least two additional modes of travel, or complete a link to intermodal or freight facilities of regional importance? 5. Is the project located along a high crash corridor, or will the project help to mitigate a specific safety problem? 6. Does the project impact a network-level change in congestion?	*Yes* answers to zero to 25% of applicable questions	*Yes* answers to 26% to 50% of applicable questions	*Yes* answers to 51% to 75% of applicable questions	*Yes* answers to 76% to 100% of applicable questions

Step G

Apply CMP Screening Tool

Objective:

Apply the CMP Screening Tool (Excel spreadsheet) to provide an overall assessment of the value of candidate projects in terms reducing congestion in the region. Steps G.1 through G.4 below require interaction with the tool. The remainder of the steps are performed by the tool. Project information will only be entered in the first step. Thereafter it will be automatically included on every page.

NOTE: Red type in the spreadsheet indicates a user instruction.

Step G.1: Enter Results from Steps A and B

Detailed project information such as location, limits, length, cost, roadway characteristics, strategy type, etc. are entered on the **Project Information** tab (Figure 5.2) of the CMP Screening Tool Spreadsheet. Additional strategies are entered as well and will result in a bonus point if more than one is selected.

Figure 5.2 Project Information Tab

Case Study A: RTP Freeway Projects		PROJECT #:								
		1	2	3	4	5	6	7	8	9
Enter detailed project data.	Source:	RTP 2010	RTP 2010	RTP 2010	RTP 2010	RTP 2010	RTP 2010	TIP 2011 Project Lis	RTP 2010	RTP 2010
	Location:	I-10 Papago	I-10 Papago	I-10 Papago	I-10 Maricopa	I-10 Maricopa	I-10 Maricopa	I-10 Maricopa	I-17/Black Canyon Freeway	SR 51/Piestawa Freeway
	Limits:	Loop 101 (Agua Fria) to I-17	I-10 at I-17	Loop 202 Interchange at I-	32nd Street to Baseline Rd	I-10/SR-143 Interchange	Baseline Rd to Loop 202	40th St to Baseline Rd	I-10 (Stack) to I-10 Split	Shea Blvd to Loop 101
	Type of Work:	Increase general purpose lane capacity	Possible Improvements to I-10/I-17 interchange	Construction of interchange	Construction of local/express lanes	Improvements to I-10/SR-143 interchange	Addition of one general purpose lane in each direction	Construct CD roads (FY 2011)	Addition of one general purpose and one HOV lane in each	Addition of one general purpose lane in each direction
	Miles:							4		
	Ln Before:							8		
	Ln After:							12		
	Fund Type:							State		
	Federal Cost:							0		
	Regional Cost:							0		
	Local Cost:							55765000		
	Total Cost:							55765000		
	Corr ID:	A	A	B	C	C	D	C	E	H
	IDN:						DOT11-826			
	Transit:	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Type of Strategy:	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity
	Type of Strategy:									
	Type of Strategy:									
	Type of Strategy:									
	Type of Strategy:									
	Type of Strategy:									
	Type of Strategy:									
	Type of Strategy:									
	Bonus Point?	0	0	0	0	0	0	0	0	0

Step G.2: Enter Quantitative Criteria Results and Data from Step E

The quantitative criteria are entered in the **Quantitative Criteria** tab (Figure 5.3).

Figure 5.3 Quantitative Criteria Tab

Case Study A: RTP Freeway Projects	CRITERIA #:	
Enter quantitative criteria.	1	VOLUME/AADT
	2	CRASH RATE
(Minimum recommended: 1 for volume, 1 for crash rate, 1 for congestion)	3	TRUCK VOLUME / AADT
(Limit 6)	4	CONGESTION / LOST PRODUCTIVITY GP

Quantitative Data for each candidate project are then entered into the **Quantitative Data** tab (Figure 5.4).

Figure 5.4 Quantitative Data Tab

Case Study A: RTP Freeway Projects		PROJECT #:	1	2	3	4	5	6	7	8	9
		Source:	RTP 2010	RTP 2010	RTP 2010	RTP 2010	RTP 2010	RTP 2010	TIP 2011 Project List	RTP 2010	RTP 2010
		Location:	I-10 Papago	I-10 Papago	I-10 Papago	I-10 Maricopa	I-10 Maricopa	I-10 Maricopa	I-10 Maricopa	I-17/Black Canyon Freeway	SR 51/Piestawa Freeway
		Limits:	Loop 101 (Agua Fria) to I-17	I-10 at I-17	Loop 202 Interchange at I-10	32nd Street to Baseline Rd	I-10/SR-143 Interchange	Baseline Rd to Loop 202 (Santan)	40th St to Baseline Rd	I-10 (Stack) to I-10 Split	Shea Blvd to Loop 101
	CRITERIA #:										
	1	VOLUME/AADT	203,184	203,184	223,047	197,766	197,766	171,316	197,766	94,830	138,463
Enter quantitative data.	2	CRASH RATE	1.8	1.8	1.8	1.8	1.8	1.8	1.8	2.1	1.8
	3	TRUCK VOLUME / AADT	20,200	20,200	23,700	20,000	20,000	19,200	20,000	12,200	10,500
	4	CONGESTION / LOST PRODUCTIVITY	50.40%	50.40%	30.60%	52.00%	52.00%	33.30%	52.00%	25.60%	7.50%

Step G.3: Enter Qualitative Criteria Results from Step F

The qualitative criteria results as described in Step F for both CMP Objectives and Project/Mode Type are entered into the **Qualitative Data** tab (Figure 5.5).

Figure 5.5 Qualitative Data Tab

Case Study A: RTP Freeway Projects											
CMP OBJECTIVES		**PROJECT #: 1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
Minimize Delay and Improve Travel Time	Project impact in terms of reducing travel time or delay.	4	2	3	4	2	4	4	4	4	Enter score according to project impact:
Reduce Travel Time Variability	Project impact in terms of reducing travel time variability, crash risk, or weave/merge conflicts.	4	2	3	4	2	4	4	4	4	Highest impact = score of 4
Improve System Connectivity	Project impact in terms of improving connections to regional intermodal or emergency facilities?	2	3	4	3	2	3	3	3	3	Likely impact = score of 3
Increase Alternative Mode Share	Project impact in terms of reducing mode share for drive alone trips or increasing alternative mode share.	3	2	2	3	1	3	4	3	3	May impact = score of 2
Improve LOS/Reduce Congestion	Project impact in terms of reducing the Level of Service of the facility and increasing roadway capacity.	4	2	2	4	2	4	4	4	4	No impact = score of 1
Reduce Emissions & Fuel Consumption	Project impact in terms of reducing vehicle emissions?	2	3	2	2	3	2	3	3	2	NA = statement not applicable
Measures of Cost Effectiveness	Project impact in terms of systemwide benefits (project benefits outweighing the costs).	3	3	2	3	3	3	3	3	3	
	Score:	3.14	2.43	2.57	3.29	2.14	3.29	3.57	3.43	3.29	

PROJECT/MODE SPECIFIC ASSESSMENT	**SYSTEM CAPACITY AND NEW FACILITIES:**	**PROJECT #: 1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Answer Yes, No, or NA.	Does the project complete or improve a segment which helps to provide a continuous link between two points of regional importance for travel, or improve an intersection or interchange of two corridors of regional importance?	no	no	no	no	no	no	no	no	no
	Does the project include segments of high congestion that result in lost productivity along the corridor, and will the project help to mitigate this congestion?	no	no	yes	no	yes	no	yes	no	no
	Does the project provide access to existing and/or future business and job activity centers, shopping, educational, cultural, and recreational opportunities?	no	no	yes	no	no	no	no	no	no
	Will the project accommodate or create significant benefits to at least two additional modes of travel, or complete a link to intermodal or freight facilities of regional importance?	no	no	yes	no	no	no	no	no	no
	Is the project located along a high crash corridor, or will the project help to mitigate a specific safety problem?	yes	yes	yes	yes	yes	yes	yes	yes	yes
	Score:	1	1	4	1	2	1	2	1	1

Step G.4: Assign Weights to Quantitative and Qualitative Criteria

In this step, the user assigns a weighting percentage to each of the quantitative and qualitative criteria. The weighting is assigned at the users' discretion and will depend on the project type and criteria the user considers to be important.

For example, a user assessing a set of freeway capacity projects might decide that all criteria are equally important and assign weighting percentages equally. The user assigns a weighting of 20 percent to each of the selected quantitative criteria: volume, crash rate, and congestion. The qualitative criteria based on CMP objectives is assigned a weighting of 20 percent, while qualitative criteria based on project/mode type is also assigned a weighting of 20 percent. A user assessing a set of projects to mitigate a specific bottleneck location might assign more weighting to congestion, while a user assessing a set of projects to mitigate a specific safety concern or high crash area might assign more weighting to crash rate. A user assessing a set of bicycle/pedestrian projects or TDM programs might assign more weighting to qualitative criteria based on project/mode type. The weighting percentages must add up to 100 percent.

The weighting percentages are entered by the user on the **Assign Weights** tab (Figure 5.6) of the CMP Screening tool.

Figure 5.6 Assign Weights Tab

Case Study A: RTP Freeway Projects			
	Quantitative Criteria:		
	VOLUME/AADT	25%	Assign Weights
	CRASH RATE	5%	
	TRUCK VOLUME / AADT	5%	
	CONGESTION / LOST	10%	
	Qualitative Criteria:		
	CMP OBJECTIVES	35%	Assign Weights
	PROJECT/MODE SPECIFIC	20%	
		100%	(must equal 100%)

Step G.5: Scores Calculated and Projects Ranked by CMP Screening Tool

For the quantitative criteria (i.e., volume, crash rate, and congestion), the CMP Screening Tool automatically assigns a score based on the magnitude of the value. For example, if there were six projects with six different AADT values, the tool would automatically assign a value of “1” to the lowest AADT and a “6” to the highest AADT. The second highest AADT would be assigned a “5”. For crash rates, scores are assigned in a similar manner. A higher score indicates that the project has the highest potential to mitigate congestion based on the quantitative criteria.

For the qualitative criteria, the spreadsheet automatically assigns scores based on the answers to each set of qualitative criteria: 1) those based on CMP objectives, and 2) those based on project/mode specific criteria. For the CMP objectives, the spreadsheet automatically calculates an average score across all of the CMP objectives criteria. For the project/mode specific criteria, the spreadsheet automatically calculates an average score based on the number of YES answers. A higher score indicates that the project has the highest potential to mitigate congestion based on each set of the qualitative criteria.

The CMP Screening Tool Spreadsheet automatically ranks projects by multiplying the user-specified weighting by the scores for the quantitative and qualitative criteria. A total weighted score is then calculated for each project. The total weighted scores for each candidate project can be ranked in order of magnitude and compared to the other projects in the set. The higher the score, the more capability that project has in mitigating congestion. The average score results for each set of quantitative and qualitative criteria and the ranking results are summarized on the **Calcs** tab (Figure 5.7) of the CMP Screening Tool.

It is important to note that the ranking is only useful for the set of projects and should only be used to compare the projects in the chosen set. The screening tool is designed to be flexible and the user can change the weights and criteria easily.

Figure 5.7 Calcs Tab

		PROJECT #:	1	2	3	4	5	6	7	8	9
VOLUME/AADT		score:	7	7	9	4	4	3	4	1	2
weight:	25%	weighted:	1.75	1.75	2.25	1	1	0.75	1	0.25	0.5
CRASH RATE		score:	1	1	1	1	1	1	1	9	1
weight:	5%	weighted:	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.45	0.05
TRUCK VOLUME / AADT		score:	7	7	9	4	4	3	4	2	1
weight:	5%	weighted:	0.35	0.35	0.45	0.2	0.2	0.15	0.2	0.1	0.05
CONGESTION / LOST PRODUCTIVITY GP		score:	5	5	3	7	7	4	7	2	1
weight:	10%	weighted:	0.5	0.5	0.3	0.7	0.7	0.4	0.7	0.2	0.1
TOTAL QUANTITATIVE WEIGHTED SCORE:			2.65	2.65	3.05	1.95	1.95	1.35	1.95	1	0.7
CMP OBJECTIVES:		score:	3.33	2.60	2.57	3.29	2.14	3.29	3.57	3.43	3.29
weight:	35%	weighted:	1.17	0.91	0.90	1.15	0.75	1.15	1.25	1.20	1.15
PROJECT/MODE SPECIFIC ASSESSMENT:		score:	1	1	4	1	2	1	2	1	1
weight:	20%	weighted:	0.2	0.2	0.8	0.2	0.4	0.2	0.4	0.2	0.2
TOTAL QUALITATIVE WEIGHTED SCORE:			1.37	1.11	1.70	1.35	1.15	1.35	1.65	1.40	1.35
BONUS POINTS:			0	0	1	0	0	0	0	0	0
TOTAL ALL PLUS BONUS:			4.0	3.8	5.8	3.3	3.1	2.7	3.6	2.4	2.1

Step G.6: Results and Prioritized List of Projects Presented by CMP Screening Tool

The **Results** tab (Figure 5.8) reveals a color-coded table showing the ranking of each project. Blue indicates projects with the greatest potential to mitigate congestion (i.e., a higher score), while red indicates projects with the least impact on congestion (i.e., a lower score). In the example shown below, Project 3 would have the greatest impact on congestion, while Project 9 would have the least impact.

Figure 5.8 Results Tab

Case Study A: RTP Freeway Projects

MAG CMP Screening Tool Summary Rankings

			PROJECT NUMBERS:								
	CRITERIA	Weight	1	2	3	4	5	6	7	8	9
Quantitative Data	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
Qualitative Data	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
All Data	**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

5.4 Congestion Management Process Toolbox

One of the key components of the process used in Step D is a CMP Toolbox of potential congestion reduction and mobility strategies. The idea behind this toolbox is to encourage ways to deal with congestion and mobility problems beyond traditional roadway widening projects. MAG and its members can use this toolbox as a starting point when selecting and screening alternative transportation solutions (in Step A), selecting an analysis tool if the detailed analysis approach is selected (in Step C), and in selecting performance measures for quantitative criteria (Step E).

For each of the congestion reduction projects and strategies already identified by MAG, the CMP toolbox can be used to identify the potential for congestion reduction, implementation cost and schedule, and suggested tools for detailed analysis. The congestion reduction impacts are defined by measures such as the potential reduction of SOV trips, improved travel times, reduced delay, among others.

The implementation costs and schedules consider design and maintenance costs, inter-jurisdictional agreements, and implementation timing over the short-term (one to five years), medium-term (five to 10 years), and long-term (over 10 years). The implementation costs and schedules presented in the toolbox are primarily based on information prepared by the Institute of Transportation Engineers (ITE) and Cambridge Systematics for other projects, and therefore, will vary for specific implementation in the Phoenix region. Specific costs are specified when available.

The suggested tools for detailed analysis were identified based on project data availability and include readily available tools sponsored, developed, and maintained by MAG (Regional Travel Model, Simulation Model). The toolbox also includes tools sponsored by the Federal Highway Administration and U.S. Environmental Protection Agency to specifically evaluate the roadway operations, ITS, and workplace based strategies and projects. The CMP Toolbox is shown in Table 5.4.

Table 5.4 CMP Toolbox

Project/Mode Type	Congestion Impacts	Implementation Costs	Implementation Timeframe	Suggested Analysis Tools
1. Land Use and Workplace-Based Strategies				
Transit-Oriented Development (TOD) – Mixed-use, commercial, and/or residential development that includes features designed to promote the use of transit.	• Reduce VMT • Reduce SOV trips • Increase transit mode share	• Public costs to set up & monitor appropriate ordinances • Economic incentives used to encourage developer buy-in	• Long-term: 10 or more years	• Regional Travel Model • EPA Commuter Model
Growth Management Strategies – Mechanisms to reduce urban sprawl, including urban growth boundaries, agricultural zoning, and transfer or purchase of development rights.	• Reduce VMT • Reduce SOV trips • Increase alternative modes share	• Public costs to set up & monitor appropriate ordinances • Economic incentives used to encourage developer buy-in	• Long-term: 10 or more years	• Regional Travel Model • EPA Commuter Model
Trip Reduction Strategies – Plans, policies, and regulations instituted to reduce the use of SOVs for commuting; often linked to air quality planning.	• Reduce VMT • Reduce SOV trips • Increase alternative modes share • Increase transit mode share	• First-year implementation costs for private-sector (per employee equipment) • Second-year costs tend to decline • Requires interagency and private sector coordination	• Employer-based • Short-term: 1 to 5 years	• EPA Commuter Model
Transportation Management Associations – Nonprofit, member-controlled organizations that provide transportation services in a particular area, such as a commercial district, mall, medical center, or industrial park. They are generally public-private partnerships consisting primarily of area businesses with local government support.[a]	• Reduce VMT • Reduce SOV trips • Increase alternative modes share • Increase transit mode share	• First-year implementation costs for private-sector (per employee equipment) • Second-year costs tend to decline • Requires interagency and private sector coordination	• Employer-based • Short-term: 1 to 5 years	• EPA Commuter Model
Alternate Work Schedules – Employer-based programs that offer employees flexibility in commuting patterns, including compressed workweek, flextime, and staggered shifts.	• Reduce SOV trips • Reduce VMT • Improve travel time among participants	• No capital costs • Agency costs for outreach & publicity • Employer costs associated with accommodating alternative work schedules	• Employer-based • Short-term: 1 to 5 years	• EPA Commuter Model • Regional Travel Model

Project/Mode Type	Congestion Impacts	Implementation Costs	Implementation Timeframe	Suggested Analysis Tools
Telework – Commuting to a central location is replaced by telecommunication links. Also known as telecommuting, working at home, or working from home. In some cases, telework involves Telework Centers or Remote Office Centers.	• Reduce VMT • Reduce SOV trips	• First-year implementation costs for private-sector (per employee equipment) • Second-year costs tend to decline	• Employer-based • Short-term: 1 to 5 years	• EPA Commuter Model • Regional Travel Model
Teleconferencing/Videoconferencing – The live exchange of information among several persons and machines linked by telecommunications; includes telephone conferencing and videoconferencing.	• Reduce VMT • Reduce SOV trips	• First-year implementation costs for private-sector (per employee equipment) • Second-year costs tend to decline	• Employer-based • Short-term: 1 to 5 years	• EPA Commuter Model • Regional Travel Model
2. Transit Strategies				
Light-Rail Service Extension – High-capacity, fixed-guideway system operating on dedicated right-of-way or in mixed traffic.	• Reduce VMT • Reduce SOV trips • Increase transit ridership & mode share	• Capital costs per passenger trip • New & expanded systems require large up-front capital outlays and ongoing sources of operating subsidies, in addition to funds that may be obtained from federal sources, under increasingly tight competition	• Long-term: 10 or more years (includes planning, engineering, and construction)	• Regional Travel Model • EPA Commuter Model
BRT – High-capacity, highly efficient bus service designed to compete with rail in terms of quality of service.	• Reduce VMT • Reduce SOV trips • Increase transit ridership & mode share	• Capital costs per passenger trip • New & expanded systems require large up-front capital outlays and ongoing sources of operating subsidies, in addition to funds that may be obtained from federal sources, under increasingly tight competition	• Long-term: 10 or more years (includes planning, engineering, and construction)	• Regional Travel Model • EPA Commuter Model
Express Bus Service Expansion – Bus service with high-speed operations, usually between two commuter points.	• Reduce VMT • Reduce SOV trips • Increase transit ridership & mode share	• Capital costs per passenger trip • Operating costs per trip • New bus purchases	• Short-term: 1 to 5 years (includes planning, engineering, and construction)	• Regional Travel Model • EPA Commuter Model

Project/Mode Type	Congestion Impacts	Implementation Costs	Implementation Timeframe	Suggested Analysis Tools
Regular Route Service Expansion – Fixed-route service over arterial streets designed to provide mass transportation and circulation.	• Reduce VMT • Reduce SOV trips • Increase transit ridership & mode share	• Capital costs per passenger trip • Operating costs per trip • New bus purchases	• Short-term: 1 to 5 years (includes planning, engineering, and construction)	• Regional Travel Model • EPA Commuter Model
Local circulator expansion – Fixed-route service within an activity area, such as a CBD or campus, designed to reduce short trips by car.	• Reduce VMT • Reduce SOV trips • Increase transit boardings	• Capital costs per passenger trip • Operating costs per trip • New bus purchases	• Short-term: 1 to 5 years (includes planning, engineering, and construction)	• Regional Travel Model • EPA Commuter Model
3. Operations and ITS Strategies				
Enabling Infrastructure – Components of ITS systems that form the building blocks for other applications.	• Reduce accident delay • Decrease travel time	• Design and implementation costs variable • Annual operating and maintenance costs	• Medium: 5 to 10 years	• IDAS • Regional Travel Model
Vehicle Detection – Sensors that detect the presence of motor vehicles.	• Reduce accident delay • Decrease travel time • Increase vehicle throughput	• Capital costs for sensors & communications • Annual operating and maintenance costs	• Short-term: 1 to 5 years	• IDAS • Regional Travel Model
Surveillance Systems – CCTV systems used to observe the functioning of the transportation system to detect problems.	• Reduce accident delay • Decrease travel time • Increase vehicle throughput	• Capital costs for CCTV cameras & communications • Annual operating and maintenance costs	• Short-term: 1 to 5 years	• IDAS • Regional Travel Model

Project/Mode Type	Congestion Impacts	Implementation Costs	Implementation Timeframe	Suggested Analysis Tools
DMS – Fixed overhead signs or portable roadside devices used to advise travelers about incidents, travel times, or other relevant information.	• Reduce congestion • Reduce secondary crashes	• Capital costs for sign, tower, & communications • Annual operating and maintenance costs	• Short-term: 1 to 5 years	• IDAS • Regional Travel Model
Highway Advisory Radio – Licensed low-power AM radio stations set up to provide bulletins to motorists and other travelers regarding traffic and other delays.	• Reduce delay • Decrease travel time • Some peak-period travel & mode shift	• Design and implementation costs variable • Operating and maintenance costs variable	• Medium: 5 to 10 years	• IDAS • Regional Travel Model
Transportation Management Center – Central location where data about the performance of the freeway management system is processed, monitored, and fused with other data to improve performance of the system.	• Reduce accident delay • Decrease travel time	• Capital costs variable and substantial • Annual operating and maintenance costs	• Medium: 5 to 10 years	• IDAS • Regional Travel Model
Freeway Management System – A suite of ITS applications that helps the freeway system operator to manage the flow of traffic, provide information to travelers about incidents or construction, and respond to incidents.	• Reduce accident delay • Decrease travel time	• Capital costs variable and substantial • Annual operating and maintenance costs	• Medium to Long-term: likely 10 years or more	• IDAS • Regional Travel Model
Ramp Meter – A device, usually a basic traffic light or a two-section signal (red and green only, no yellow) light together with a signal controller that regulates the flow of traffic entering freeways according to real-time traffic conditions.	• Reduce accident delay • Decrease travel time • Increase vehicle throughput • Decrease crash rate • Some peak-period travel shift	• O&M costs • Significant costs associated with enhancements to centralized control system • Capital costs	• Medium: 5 to 10 years	• IDAS • Regional Travel Model
Freeway Service Patrol – Program implemented to reduce traffic congestion and improve highway safety by having specially marked and equipped vehicles patrol designated sections of roadway and provide incident management and motorist assistance.	• Reduce congestion • Reduce accident delay • Reduce secondary incidents • Decrease accident clearance time	• Capital costs • Operating and maintenance costs variable	• Short-term: 1 to 5 years	• IDAS • Regional Travel Model

Project/Mode Type	Congestion Impacts	Implementation Costs	Implementation Timeframe	Suggested Analysis Tools
Managed Lanes – Lanes regulated by vehicle eligibility (number of occupants or vehicle type), pricing, and access control; includes HOV lanes and HOT lanes.	• Reduce SOV trips • Increase vehicle throughput • Increase auto occupancy • Increase transit use & improve bus travel times	• HOV, separate ROW costs • HOV, barrier separated costs • HOV, contraflow costs • Annual operations and enforcement costs • Can create environmental, community, & social equity impacts	• Medium-term: 5 to 10 years (includes planning, engineering, and construction)	• Regional Travel Model • Simulation Models
Traveler Information – Communications and information management systems used to advise travelers about roadway conditions and performance, either pretrip or en route.	• Reduce delay • Reduce travel time • Some peak-period travel & mode shift	• Design and implementation costs variable • Operating and maintenance costs variable	• Medium: 5 to 10 years	• IDAS • Regional Travel Model
511 System – Traveler information service using web-based and telephone-based systems to inform travelers about system condition and performance and to provide route-planning services.	• Reduce delay • Reduce travel time • Some peak-period travel & mode shift	• Design and implementation costs variable • Operating and maintenance costs variable	• Medium: 5 to 10 years	• IDAS • Regional Travel Model
Arterial System Management – Applications of ITS technology to improve the performance of the arterial roadway network.	• Reduce delay • Reduce travel time • Reduce the number of stops	• Design and implementation costs variable • Operating and maintenance costs variable	• Medium: 5 to 10 years	• IDAS • Regional Travel Model
Traffic Signal Coordination – Modifying signal timing plans to process traffic efficiently through a group of intersections to insure optimum travel speeds while reducing delay at a corridor or regionwide.	• Reduce delay • Reduce travel time • Reduce the number of stops	• Operating and maintenance costs per signal • Signalized intersection per mile cost variable	• Short-term: 1 to 5 years	• IDAS • Regional Travel Model
Intersection Signal Improvements – Improving signal operations through re-timing signal phases, modifying signal to allow for turning phases, or adding signal actuation.	• Reduce delay • Reduce travel time • Increase vehicle throughput	• Design and implementation costs variable	• Short-term: 1 to 5 years	• Regional Travel Model • Simulation Model

Project/Mode Type	Congestion Impacts	Implementation Costs	Implementation Timeframe	Suggested Analysis Tools
Access Management – Proactive management of vehicular access points to reduce or manage the number of conflict points that exist along a corridor through traffic engineering and regulatory techniques.	• Reduce travel time • Increase vehicle throughput • Reduce the number of stops	• Design and implementation costs variable	• Short-term: 1 to 5 years	• IDAS • Regional Travel Model
Automated Vehicle Location System – Means for automatically determining the geographic location of a vehicle and transmitting the information to a central location, usually through GPS system.	• Reduce delay • Reduce travel time • Some peak-period travel & mode shift	• Design and implementation costs variable • Operating and maintenance costs variable	• Medium: 5 to 10 years	• IDAS • Regional Travel Model
Traveler or Transit Passenger Information Systems – An electronic information system which provides real-time passenger information. It may include both predictions about arrival and departure times, as well as information about the nature and causes of disruptions.	• Reduce delay • Reduce travel time • Some peak-period travel & mode shift	• Design and implementation costs variable • Operating and maintenance costs variable	• Medium: 5 to 10 years	• IDAS • Regional Travel Model
4. Bicycle and Pedestrian (non-motorized) Strategies				
Construct New or Connect Existing Bicycle and Pedestrian Facilities – Use of bicycling and walking is often discouraged by a fragmentary, incomplete network of sidewalks and shared use facilities. Constructing new facilities, such as bike lanes on arterials and/or connecting existing facilities, will encourage greater use of walking and bicycling.	• Shift trips into non-SOV modes such as walking, bicycling, transit • Increase bicycle/pedestrian mode share	• Design and construction costs for paving, striping, signals, and signing • ROW costs if widening existing/ constructing new facility • Bicycle lanes may require improvements to roadway shoulders to ensure acceptable pavement quality	• Short-term: 1 to 5 years (includes planning, engineering, and construction)	• EPA Commuter Model

Project/Mode Type	Congestion Impacts	Implementation Costs	Implementation Timeframe	Suggested Analysis Tools
Promote Bicycle and Pedestrian Use Through Education and Information Dissemination – Bicycle and pedestrian use can be promoted through educational programs and through distribution of maps of bicycle facility/multi-use path maps.	• Shift trips into non-SOV modes such as walking, bicycling, transit • Increase bicycle/pedestrian mode share	• First-year implementation costs for private-sector • Second-year costs tend to decline • Requires interagency and private sector coordination • Requires public agency support & coordination	• Employer-based • Short-term: 1 to 5 years	• EPA Commuter Model
5. High Occupancy Vehicle Strategies				
Rideshare Programs – Programs to promote carpooling and vanpooling, including ridematching services and policies that give ridesharing vehicles priority in traffic and parking.	• Reduce VMT • Reduce SOV trips	• Savings per carpool and vanpool riders • Costs per year per free parking space provided • Agency Administrative costs	• Employer-based • Short-term: 1 to 5 years	• EPA Commuter Model • Regional Travel Model
Vanpool Programs – Vanpool programs facilitate organization and maintenance of vanpools – groups of 7 to 15 people who share rides on a regular basis in a van. Vanpool programs often underwrite leases of vans and help with logistics.	• Reduce VMT • Reduce SOV trips	• Savings per carpool and vanpool riders • Costs per year per free parking space provided • Agency Administrative costs	• Employer-based • Short-term: 1 to 5 years	• EPA Commuter Model • Regional Travel Model
Park-and-Ride – Car parks with connections to public transport that allow commuters and others wishing to travel into the city center to leave their personal vehicles in the parking lot and transfer to a bus, light rail, or carpool for the rest of the trip.	• Reduce SOV trips • Reduce VMT • Increased transit boardings & mode share	• Structure costs for transit stations, shared facilities • Land acquisition costs	• Medium: 5 to 10 years (includes planning, engineering, and construction)	• EPA Commuter Model • Regional Travel Model
6. Additional System Capacity				
Freeway Capacity Expansion				

Project/Mode Type	Congestion Impacts	Implementation Costs	Implementation Timeframe	Suggested Analysis Tools
Elimination of Bottlenecks – Removal of a physical constriction that delays travel, such as widening an underpass, providing lane continuity, improving acceleration/deceleration lanes, or eliminating a sight barrier.	• Increase vehicle throughput • Reduce delay	• Design and implementation costs variable	• Short-term: 1 to 5 years	• Regional Travel Model
Added General Purpose Capacity – Widening freeway to add general purpose lanes.	• Increase vehicle throughput • Reduce delay	• Costs vary by type of highway constructed; in dense urban areas can be very expensive • Can create environmental and community impacts	• Long-term: 10 or more years (includes planning, engineering, and construction)	• Regional Travel Model • Simulation Model
Added HOV Capacity – Widening freeway to add HOV or HOT lanes. Adding freeway ramps to connect HOV to HOV.	• Reduce SOV trips • Increase vehicle throughput • Increase auto occupancy • Increase transit use & improve bus travel times	• HOV, separate ROW costs • HOV, barrier separated costs • HOV, contraflow costs • Annual operations and enforcement costs • Can create environmental & community impacts	• Medium-term: 5 to 10 years (includes planning, engineering, and construction)	• Regional Travel Model • IDAS • EPA Commuter Model
Arterial Capacity Expansion				
Added Segment Capacity – Widening an arterial segment to add traffic lanes.	• Increase vehicle throughput • Reduce delay	• Costs vary by type of highway constructed; in dense urban areas can be very expensive • Can create environmental and community impacts	• Medium-term: 5 to 10 years (includes planning, engineering, and construction)	• Regional Travel Model • Simulation Model
Added Intersection Capacity – Adding turning lanes or through lanes at an intersection, realignment of intersection streets, intersection channelization, or modifying intersection geometrics to improve overall efficiency and operation.	• Increase mobility • Reduce delay • Increase traffic flow & improve safety	• Costs vary by type of design	• Short-term: 1 to 5 years	• Regional Travel Model • Simulation Model

Project/Mode Type	Congestion Impacts	Implementation Costs	Implementation Timeframe	Suggested Analysis Tools
7. New Roadway Facility Construction				
New Freeways – Construction of new, access-controlled, high-capacity roadways in areas previously not served by freeways.	• Reduce arterial street network congestion • Reduce travel times & delay	• Costs vary by type of highway constructed; in dense urban areas can be very expensive • Can create environmental and community impacts	• Long-term: 10 or more years (includes planning, engineering, and construction)	• Regional Travel Model • Simulation Model
New Arterial Streets – Construction of new, higher-capacity roads designed to carry large volumes of traffic between areas in urban settings.	• Provide connectivity • Carry traffic from local & collector streets to other areas	• Can create environmental and community impacts • Construction and engineering costs substantial (grade separate, other design features) • Maintenance variable based on urban region	• Medium-term: 5 to 10 years (includes planning, engineering, and construction)	• Regional Travel Model • Simulation Model

[a] On-line TDM Encyclopedia; Victoria Transportation Policy Institute http://www.vtpi.org/tdm/tdm44.htm.

The CMP Toolbox includes all strategies discussed in Section 5.1 (included in detail in Appendix A). For each strategy, the potential congestion impacts are listed, along with implementation costs, timeframe, and suggested analysis method. The analysis tools proposed are needed to generate specific, detailed results. These tools are designed to assess the congestion reduction potential of the projects and strategies carried forward for analysis and screening in MAG's congestion management process.

This information can be used by MAG modal committees to screen and compare projects, supplementing existing methods used to select among competing projects. These tools, and in some cases, combinations of these tools, can be used to identify the impacts of the different types of projects identified in the Toolbox (e.g., land use, workplace-based, transit, operations and ITS, etc.). A summary of each analysis tool is presented below.

Regional Travel Model

MAG has developed a suite of analytical tools that are used to support transportation planning and policy in the region. These tools include a traditional four-step Regional Travel Model that is used by MAG staff to support a variety of analytical needs such as preparation of various system and subarea studies such as the RTP, updates to the RTP, Central Phoenix Framework Study, and the Hassayampa Valley Framework Study. The Regional Travel Model is also used to support ongoing evaluations of the region's air quality conformity analysis and other technical analysis. In the past, the Model has been the primary analysis method used to support congestion management analysis for additional capacity projects. This system will remain as one of the analysis methods of the CMP Update to support many of the different types of congestion reduction projects and strategies to be tested in the planning process. In some cases, the results from the Regional Travel Model will be used to assess the impacts of alternative strategies, specifically the additional system capacity (freeway, arterial roadway, and new roadway facility construction) projects. The Regional Travel Model results (VMT, VHT, other travel statistics) can be used as input into other analysis tools suggested for use (e.g., simulation, IDAS, EPA Commuter Model) to fully assess the congestion reduction impacts of potential projects such as operations, ITS, land use, and workplace-based strategies.

Simulation Model

MAG is currently updating its suite of analytical tools to include Microscopic Simulation Models that are designed to assess the inter-relationship of proposed multimodal and roadway specific projects for detailed subarea analysis. These models are currently being developed to support the Central Phoenix Framework Study and will be fully integrated with the Regional Travel Model already maintained by MAG. These Models are best suited to evaluate the impacts of individual corridor project solutions, and the inter-relationship of multiple roadway projects and the entire system.

MAG 2009 CMAQ Methodologies

In 2009, MAG's Air Quality Technical Advisory Committee developed CMAQ methodologies for estimating reduction in emissions from the deployment of ITS improvements and other operational measures, such as traffic signal improvements or freeway management system projects. In general, the methodology estimates: (1) daily emission reductions of the project in kilograms per day; and (2) the cost effectiveness of each project in dollars per metric ton of emissions reduced per year. The daily emission reduction is reported in annual CMAQ reports that are submitted to FHWA, while the cost effectiveness measure is used for prioritizing projects that are candidates for future CMAQ funds. The document, "Methodologies for Evaluating Congestion Mitigation and Air Quality Improvement Projects," describes in detail the methodologies and assumptions used to estimate emission reductions and cost-effectiveness for typical operations improvement and ITS projects. This methodology is suited for evaluating the air quality impacts of various types of projects, including bicycle/pedestrian, transit, intersection improvements, operations, ITS, and various workplace-based programs such as ride share, telework, trip reduction, and vanpools.

Intelligent Transportation System Deployment Analysis System (IDAS)

The Intelligent Transportation System Deployment Analysis System (IDAS) is an operations and ITS sketch-planning analysis tool that interfaces with planning data prepared from existing regional travel demand models. IDAS was first developed in 1998 for the Federal Highway Administration (FHWA) and has been updated numerous times through the 2000s. IDAS provides a comprehensive analysis tool for determining the system, subarea, corridor-specific impacts, benefits, and costs of the full spectrum of operations and ITS deployments and strategies. IDAS was designed to meet the needs of MPOs by offering the capability for a systematic assessment of operations and ITS with one analysis tool, with the overall goal of assisting these agencies in integrating ITS into their ongoing transportation planning process. Although IDAS has not been used by MAG in the past, it could be linked with the Regional Travel Model to assess the impacts of various operations, ITS, and roadway capacity projects as defined in the CMP Toolbox.

U.S. Environmental Protection Agency COMMUTER Model

The U.S. EPA prepared a spreadsheet-based analysis model that was specifically designed to model and evaluate the potential travel and emissions impacts of Transportation Demand Management (TDM) strategies, including land use, workplace-based, and transit-based transportation projects. This model, initially prepared in 2000, and updated in 2005, was designed to assist MPOs, state DOTs, and individual employers to identify the impacts of these programs at a systemwide, as well as at the corridor, subarea, and employer-specific level. The documentation that supports this system was also designed to provide guidance to MPOs about the appropriate use and applications of the model and to help

MPOs provide guidance and assistance to local employers participating in voluntary workplace-based programs. The full modeling system and documentation (Version 2.0 Coefficients, User Manual, and Procedures Manual) are available from the U.S. EPA, state and Local Transportation Resources link http://www.epa.gov/oms/stateresources/policy/pag_transp.htm.

6.0 Implement Selected Strategies and Manage Transportation System

6.1 Updating the RTP

For updates to the RTP, the Congestion Management Process applies to the extent that any new projects that would add single occupancy vehicle capacity have to be part of the CMP. The Updates to the RTP will note that the programming process incorporates the analysis of projects through the existing Modal Committee structure and the CMP is an integral part of that process. To the extent that the RTP update involves either significant new regional scale projects, or major changes that reduce the size of the capital improvement program, the most appropriate tools for analyzing these changes may be the regional travel demand model

6.2 Developing a New Regional Transportation Plan

The Congestion Management Process is an integral part of the development of the Regional Transportation Plan. It is anticipated that a new RTP will be developed in conjunction with the authorization of new funding sources through the approval of new tax-funded financing for transportation improvements.

As part of the development of the RTP, MAG will work closely with regional transportation system managers to identify the transportation improvement projects to be implemented over a multi-year period. The CMP will be among the tools used by MAG and the operating agencies to analyze the impacts of proposed projects, including multimodal improvement projects that require coordination across agencies.

The CMP will be an integral part of the development of the Regional Transportation Plan, rather than a separate, stand-alone process. Consequently, discussions of how the CMP influences the development of the RTP will be incorporated directly into the RTP document.

6.3 KEEPING THE CMP VISIBLE

Informing Stakeholders

While the CMP will be used in the development of a new Regional Transportation Plan, in periodic RTP updates, and in the annual process of competitive project selection for the Transportation Improvement Program, the CMP might not be very visible to the many stakeholders who are concerned about congestion and its impacts. It will be important for MAG to maintain the visibility of the CMP, and inform stakeholders about MAG's ongoing efforts to address congestion and its impacts. Some examples of how this might be accomplished include:

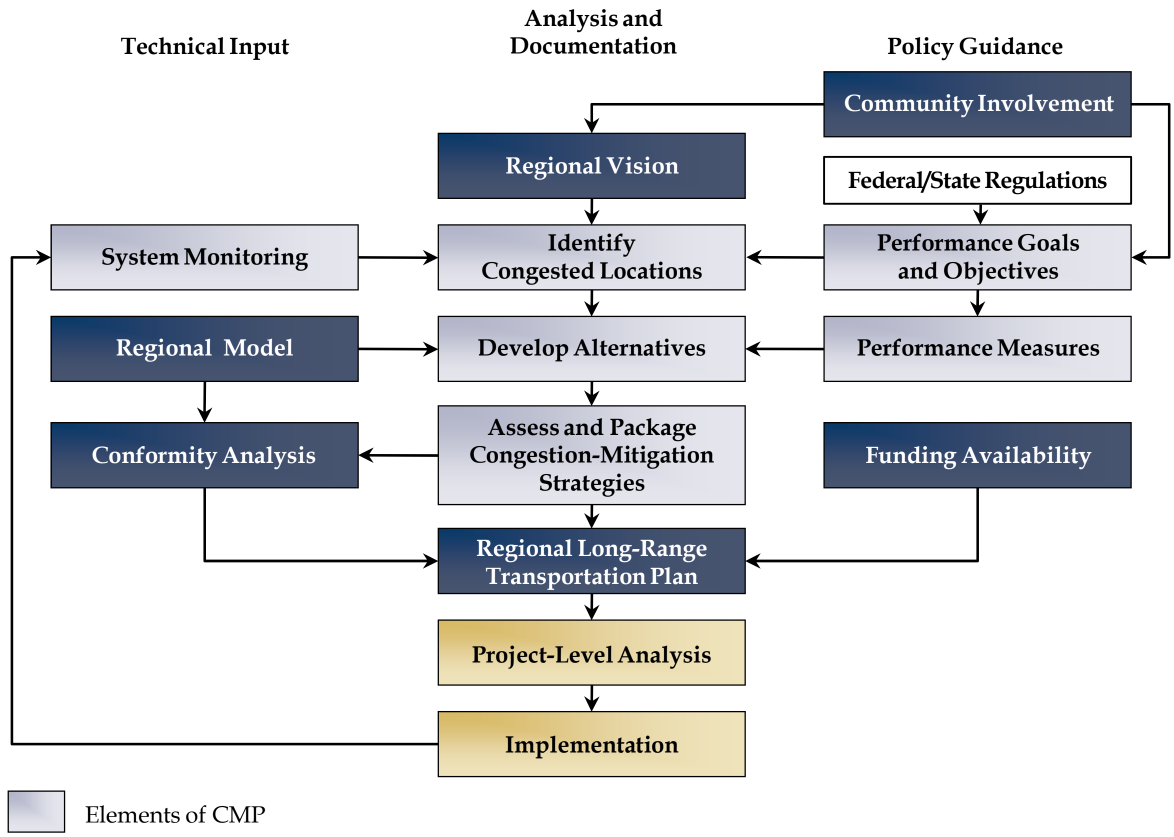
- A CMP page on MAG's website, linking stakeholders to CMP-related documents and existing web tools;
- Addition of a section regarding the CMP in the MAG Transportation Programming Guidebook;
- Mention of CMP in RTP and TIP process documents;
- Periodic feature articles in existing MAG newsletters; and
- A stand-alone CMP newsletter that would be issued in conjunction with significant milestones, such as completion of the new RTP, completion of an RTP Update or the TIP cycle, or other similar events.

Documenting the CMP

The Congestion Management Process is required under Federal transportation planning and programming regulations. This Baseline Report was designed to meet all of the Federal planning regulations.

Figure 6.1 shows how the CMP relates to the MAG Regional Transportation planning process.

Figure 6.1 The Congestion Management Process in Regional Transportation Planning



The CMP will play a role, both in the process of updating the current RTP, and in developing a new long-range plan for the MAG Region. Updated cost estimates for completion of the Regional Freeway and Highway Program have caused MAG and ADOT to investigate steps that can be taken to reduce the regional freeway program costs through management strategies such as savings from lower construction and systemwide costs, value engineering savings in selected corridors, and deferral of some elements of the program. It is likely that similar savings will have to be sought in other elements of the current transportation program.

As noted before, the CMP is intended to supplement, not replace, the existing strategy identification and selection process that has been used by MAG up until now. The involvement of the modal committees in project planning and programming will continue, with the CMP providing additional information and insight for use by the committees. Screening for ITS projects, for example, will be coordinated with an assessment of how the Regional ITS Architecture and ITS

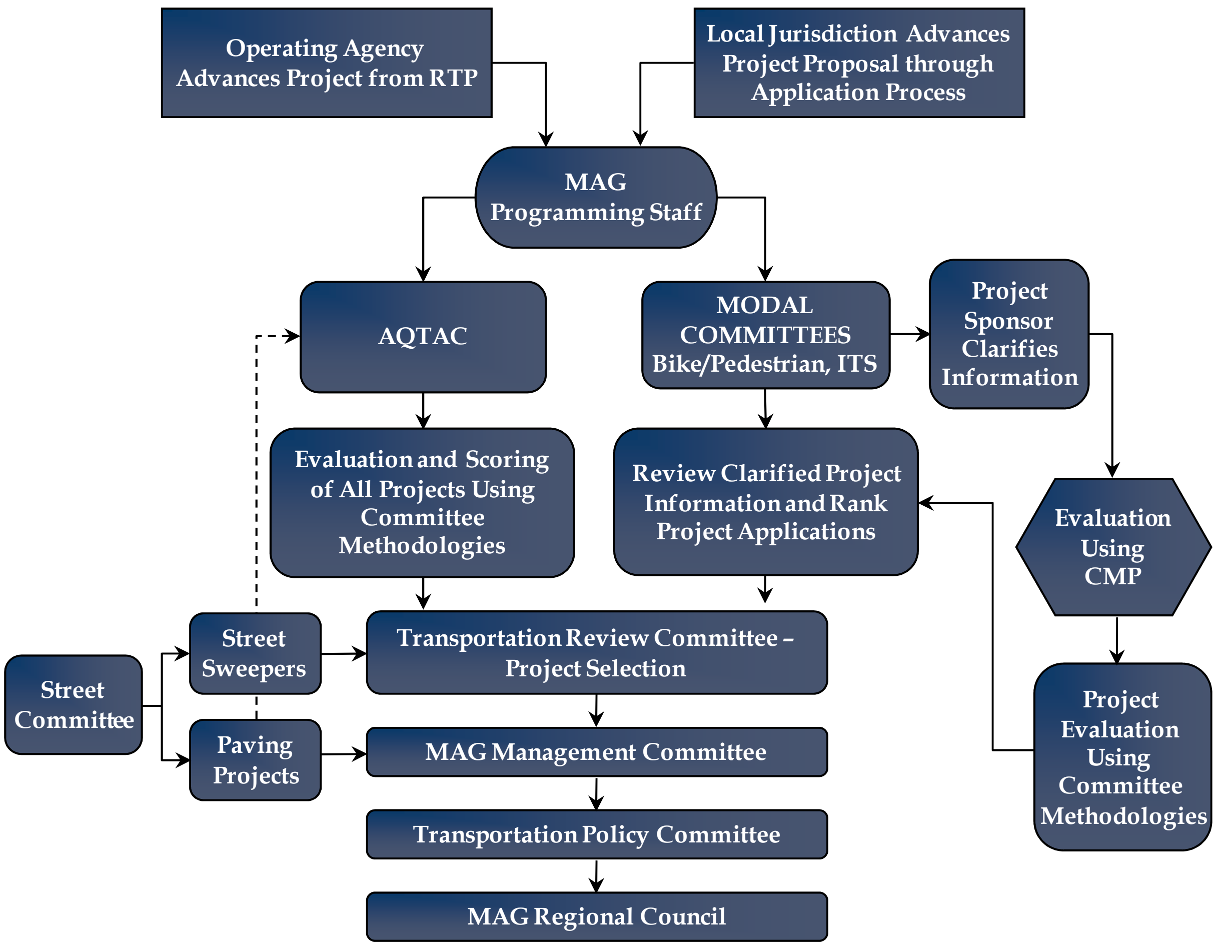
Strategic Plan influence the availability of ITS solutions and operational improvements for the freeway and arterial network, while screening of other strategies may involve consideration of existing and proposed transit facilities.

One example of a successful process for "packaging" different strategies is the I-10 Integrated Corridor Management System (ICMS) plan. Not all strategy packages would include as comprehensive an intelligent transportation systems (ITS) component. However, in developing the I-10 ICMS Concept of Operations, MAG considered I-10 and a number of parallel arterials (Van Buren Street, McDowell Road, Buckeye Road, Maricopa County Route 85, and intersecting arterials), as well as the fixed route and demand responsive services in the region. In developing the final Concept of Operations, MAG proposed an extensive package of improvements that included Traffic Signal Optimization (TSOP) improvements, extension of the Freeway Management System, and ITS improvements such as closed circuit television (CCTV) and Dynamic Message Signs (DMS). In developing the ICMS, MAG considered possible improvements to transit operations as well, including park-and-ride expansion, and future extension of Light Rail Transit.

The transportation project types and responsible technical advisory committees (TAC) are:

- Bicycle and pedestrian projects are presented, reviewed, and ranked at the Bicycle and Pedestrian Committee, and then forwarded to the TRC;
- Intelligent transportation system (ITS) projects are presented, reviewed, and ranked at the ITS Committee, and then forwarded to the TRC;
- Paving unpaved road projects are presented and reviewed at the Streets Committee for information purposes, forwarded to the Air Quality TAC (AQTAC) for ranking, and then forwarded to the TRC;
- PM10-certified street sweeper projects are reviewed at the Streets Committee, prioritized at the Air Quality TAC, and then forwarded to the MAG Management Committee; and
- In addition, the AQTAC also forwards a ranking of Congestion Mitigation and Air Quality Improvement (CMAQ) Projects, bicycle and pedestrian projects, and ITS projects, to the Transit Committee.

Figure 6.2 CMP in Project-Level Analysis



7.0 Monitor Strategy Effectiveness

Inherently the CMP is an iterative process and the effectiveness of the strategies will be continually monitored by performing all steps of the CMP annually. The actual impact of strategies will be revealed with performance reporting on a regular basis.

Appendix A. Congestion Mitigation Strategies

The matrix that follows presents candidate strategies in hierarchical order, starting with travel demand management strategies, and progressing to strategies that shift trips to transit; shift trips from single occupancy vehicles (SOV) to a higher occupancy mode; management and operations strategies that make the best use of existing capacity; strategies that expand the capacity of existing facilities; and those strategies that involve new capacity on new facilities.

Included among the strategies are some of the infrastructure elements in the intelligent transportation systems section. These "building blocks" are used to implement other strategies, and consequently do not themselves relate to any specific congestion management objectives.

Strategy	Description	Congestion Management Objective	Complementary Strategies	Performance Measures
Travel Demand Management Strategies				
Land Use Strategies				
Transit-Oriented Development	Mixed-use, commercial, and/or residential development that includes features designed to promote the use of transit.	Reduce trips; encourage use of alternative modes	Transit Service Expansion	Reduction in trips; reduction in VMT; increase in transit mode share
Growth Management Strategies	Growth management strategies include mechanisms to reduce urban sprawl, including urban growth boundaries, agricultural zoning, and transfer or purchase of development rights.	Reduce trips; encourage use of alternative modes		Reduction in trips; reduction in VMT
Trip Reduction Ordinances	Plans, policies, and regulations instituted to reduce the use of single occupancy vehicles for commuting; often linked to air quality planning.	Reduce trips; reduce VMT		Reduction in trips; reduction in VMT
Transportation Management Associations	Nonprofit, member-controlled organizations that provide transportation services in a particular area, such as a commercial district, mall, medical center, or industrial park. They are generally public-private partnerships consisting primarily of area businesses with local government support.[a]	Reduce trips; reduce VMT; encourage use of alternative modes		Reduction in trips; reduction in VMT; increase in transit mode share
Alternate Work Schedules	Employer-based programs that offer employees flexibility in commuting patterns, including compressed work week, flextime, and staggered shifts.	Shift trips, out of peak hours and reduce trips		Reduction in peak-period trips
Telework	Commuting to a central location is replaced by telecommunication links. Also known as telecommuting, working at home, or working from home. In some cases, telework involves Telework Centers or Remote Office Centers.	Reduce trips		Reduction in trips
Teleconferencing/ Videoconferencing	The live exchange of information among several persons and machines linked by telecommunications; includes telephone conferencing and videoconferencing.	Reduce trips		Reduction in trips

[a] On-line TDM Encyclopedia; Victoria Transportation Policy Institute http://www.vtpi.org/tdm/tdm44.htm.

Strategy	Description	Congestion Management Objective	Complementary Strategies	Performance Measures
Shift Trips to Transit				
Transit Service Expansion				
Light Rail Service Extension	High-capacity, fixed-guideway system operating on dedicated right-of-way or in mixed traffic.	Reduce VMT; increase transit mode share	Feeder bus service Park-and-ride	Reduction in VMT; increase in transit ridership; increase in transit mode share
Bus Rapid Transit	High-capacity, highly efficient bus service designed to compete with rail in terms of quality of service.	Reduce VMT; increase transit mode share	Transit signal priority Park-and-ride Complete streets program	Reduction in VMT; increase in transit ridership; increase in transit mode share
Express Bus Service Expansion	Bus service with high-speed operations, usually between two commuter points.	Reduce VMT; increase transit mode share	Transit signal priority Park-and-ride Transit centers HOV lanes and ramps	Reduction in VMT; increase in transit trips; increase in transit mode share
Regular Route Service Expansion	Fixed route service over arterial streets designed to provide mass transportation and circulation.	Reduce VMT; increase transit mode share	Transit signal priority Transit centers Bus turnouts	Reduction in VMT; increase in transit trips; increase in transit mode share
Local circulator expansion	Fixed route service within an activity area such as a CBD or campus, designed to reduce short trips by car.	Reduce VMT	Park-and-ride Transit centers	Reduction in VMT; transit boardings

Strategy	Description	Congestion Management Objective	Complementary Strategies	Performance Measures
Shift Trips to Bicycle and Pedestrian Modes				
Construct New or Connect Existing Bicycle and Pedestrian Facilities	Use of bicycling and walking is often discouraged by a fragmentary, incomplete network of sidewalks and shared use facilities. Constructing new facilities such as bike lanes on arterials and/or connecting existing facilities will encourage greater use of walking and bicycling.	Shift trips into Non-Single Occupancy Vehicle modes such as walking, bicycling, transit, or High-Occupancy Vehicles	Transit-oriented development Access management strategies	Increase in bicycle/ pedestrian mode share
Promote Bicycle and Pedestrian Use through Education and Information Dissemination	Bicycle and pedestrian use can be promoted through educational programs and through distribution of maps of bicycle facility/shared use trail maps.	Shift trips into Non-Single Occupancy Vehicle modes such as walking, bicycling, transit, or High-Occupancy Vehicles		
Shift Trips to Higher Occupancy Mode				
Rideshare Programs	Programs to promote carpooling and vanpooling, including ridematching services and policies that give ridesharing vehicles priority in traffic and parking.	Reduce VMT	Park-and-ride HOV lanes	VMT reduction
Vanpool Program	Vanpool programs facilitate organization and maintenance of vanpools – groups of 7 to 15 people who share rides on a regular basis in a van. Vanpool programs often underwrite leases of vans and help with logistics.	Reduce VMT	Park-and-ride HOV lanes	VMT reduction
Park-and-Ride	Car parks with connections to public transport that allow commuters and others wishing to travel into the city center to leave their personal vehicles in the parking lot and transfer to a bus, light rail, or carpool for the rest of the trip.	Reduce VMT	Rideshare programs Light rail service extension Express bus service expansion	VMT reduction Increased transit boardings Increased transit mode share

Strategy	Description	Congestion Management Objective	Complementary Strategies	Performance Measures
Make Best Use of Existing Capacity				
Management and Operations Strategies				
Intelligent Transportation Systems Strategies	Strategies to improve transportation safety and mobility through the use of advanced information and communications technologies.			
Enabling Infrastructure	Components of ITS systems that form the building blocks for other applications.			
Vehicle Detection	Sensors that detect the presence of motor vehicles.			
Surveillance Systems	Closed circuit TV systems used to observe the functioning of the transportation system to detect problems.			
Fiber Optic Network	High-capacity communications system used to carry high-bandwidth signals to and from parts of the ITS network.			
Dynamic Message Signs	Fixed overhead signs or portable roadside devices used to advise travelers about incidents, travel times, or other relevant information.			
Highway Advisory Radio	Licensed low-power AM radio stations set up to provide bulletins to motorists and other travelers regarding traffic and other delays.			
Transportation Management Center	Central location where data about the performance of the freeway management system is processed, monitored, and fused with other data to improve performance of the system.			
Freeway Management System	A suite of ITS applications that helps the freeway system operator to manage the flow of traffic, provide information to travelers about incidents or construction, and respond to incidents.			
Ramp Meter	A device, usually a basic traffic light or a two-section signal (red and green only, no yellow) light together with a signal controller that regulates the flow of traffic entering freeways according to real-time traffic conditions.	Reduce delay		Reductions in delay

Strategy	Description	Congestion Management Objective	Complementary Strategies	Performance Measures
Make Best Use of Existing Capacity (continued)				
Management and Operations Strategies (continued)				
Freeway Service Patrol	Program implemented to reduce traffic congestion and improve highway safety by having specially marked and equipped vehicles patrol designated sections of roadway and provide incident management and motorist assistance.	Reduce delay Reduce secondary incidents		Reductions in delay; reduction in secondary incidents
Managed Lanes	Lanes regulated by vehicle eligibility (number of occupants or vehicle type), pricing, and access control; includes HOV lanes and HOT lanes.	Increase person throughput; provide preferential treatment for rideshare vehicles and buses	Rideshare programs Bus rapid transit Express bus	Increased person throughput
Traveler Information	Communications and information management systems used to advise travelers about roadway conditions and performance, either pretrip or en route.			
511 System	Traveler information service using web-based and telephone-based systems to inform travelers about system condition and performance and to provide route-planning services.			
En Route Traveler Information	Traveler information services using dynamic message signs, highway advisory radio, and in-vehicle telematics to inform travelers of system condition and performance.			
Arterial System Management	Applications of ITS technology to improve the performance of the arterial roadway network.			
Traffic Signal Coordination	Modifying signal timing plans to process traffic efficiently through a group of intersections to insure optimum travel speeds while reducing delay.	Reduce delay		Reductions in delay

Strategy	Description	Congestion Management Objective	Complementary Strategies	Performance Measures
Make Best Use of Existing Capacity (continued)				
Advanced Public Transportation Systems				
Automated Vehicle Location System	Means for automatically determining the geographic location of a vehicle and transmitting the information to a central location, usually through GPS system.			
Passenger Information Systems	An electronic information system which provides real-time passenger information. It may include both predictions about arrival and departure times, as well as information about the nature and causes of disruptions.			
Expand Capacity of Existing Facilities				
Freeway System Capacity Increases				
Added General Purpose Capacity	Widening freeway to add general purpose lanes.	Increase throughput Reduce delay	Rideshare programs	Increase in throughput Reduction in delay
Added HOV Capacity	Widening freeway to add HOV or HOT lanes. Adding freeway ramps to connect HOV to HOV.	Increase throughput Reduce delay	Rideshare programs Expanded bus rapid transit or express bus service	Increased throughput Reduction in delay
Arterial Roadway Capacity Expansion				
Added Segment Capacity	Widening an arterial segment to add traffic lanes.	Reduce delay		Reduction in delay
Added Intersection Capacity	Adding turning lanes or through lanes at an intersection, or modifying signal to allow for turning phases.	Reduce delay	Signal coordination	Reductions in delay

Strategy	Description	Congestion Management Objective	Complementary Strategies	Performance Measures
Construct New Facilities				
New Freeways	Construction of new, access-controlled, high-capacity roadways in areas previously not served by freeways.	Reduce congestion on existing arterial street network; reduce travel times and delay		Reductions in travel time Reductions in delay
New Arterial Streets	Construction of new, higher-capacity roads designed to carry large volumes of traffic between areas in urban settings.	Provide connectivity and carry traffic from local and collector streets to other areas		

Appendix B. Case Study A – Freeways

Case Study A

Case Study Example: Freeway Projects

Background

The 2010 Update of the MAG Regional Transportation Plan has identified the need for several freeway expansion projects throughout the region:

- For the I-10 Papago Freeway, the RTP identifies the need for additional general purpose lanes from SR-85 to I-17. In addition, HOV lanes are called for between Loop 101 (Agua Fria) and Loop 303, providing a continuous HOV connection between Loop 303 and I-17. New traffic interchanges are also proposed at El Mirage Rd., Bullard Ave., and Perryville Rd.

- For the I-10 Maricopa Freeway, the RTP has identified the need for capacity improvements on the Maricopa Freeway to ease congestion from central Phoenix to the Pinal County line at Riggs Rd. This would be addressed through construction of local/express lanes in the I-10 corridor between 32nd St. and Baseline Rd., addition of general purpose lanes between Baseline Rd. and Riggs Rd., and extension of HOV lanes from Loop 202 (Santan) to Riggs Rd. A new traffic interchange at Chandler Heights Rd. is also proposed.

- For Interstate 17/Black Canyon Freeway, the RTP includes capacity improvements on I-17 between I-10 at the "Split" on the south and New River Rd. on the north. This includes the addition of both general purpose lanes and HOV lanes to address capacity needs and bottlenecks. In addition, new traffic interchanges are identified for Dove Valley Rd., Jomax Rd. and Dixileta Dr.

- On State Route 51/Piestawa Freeway, the RTP includes construction of additional general purpose and HOV lanes on SR 51 between Shea Boulevard and Loop 101 (Pima). The addition of direct HOV ramp connections is also included at the freeway-to-freeway interchange at Loop 101 (Pima). The Piestawa Freeway between I-10 and Glendale Ave. was originally constructed by the City of Phoenix and is designed to lower standards than the rest of the regional freeway system.

The MAG Transportation Review Committee wants to prioritize these projects for advancement into the TIP based on their ability to mitigate congestion in the region. They select the MAG Congestion Management Process as a resource for evaluating and prioritizing projects.

Step A: Assemble List of Projects and Detailed Project Data

The committee reviews the RTP and Life Cycle Program Projects and identifies the following candidate projects for these freeways:

- **Project 1:** I-10 Papago from Loop 101 (Agua Fria) to I-17 – Increase general purpose lane capacity
- **Project 2:** I-10 Papago from I-10 to I-17 – Improvements to I-10/I-17 interchange
- **Project 3:** I-10 Papago at Loop 202 Interchange – Construct new interchange
- **Project 4:** I-10 Maricopa from 32nd Street to Baseline Road – Construct local/express lanes
- **Project 5:** I-10 Maricopa at SR-143 Interchange – Improvements to interchange
- **Project 6:** I-10 Maricopa from Baseline Rd to Loop 202 (Santan) – Addition of one general purpose lane in each direction
- **Project 7:** I-10 Maricopa from 40th Street to Baseline Road – Construct collector-distributor (CD) roads
- **Project 8:** I-17/Black Canyon Freeway from the I-10 (Stack) to I-10 Split – Addition of one general purpose and one HOV lane in each direction
- **Project 9:** SR 51/Piestawa Freeway from Shea Boulevard to Loop 101 – Addition of one general purpose lane in each direction

The committee reviews the RTP project descriptions and identifies the following detailed project data for each candidate project:

☑ Source of project (TIP, RTP, Corridor Study, etc.)

☑ Project location

☑ Project limits

☑ Type of work☑ Type of project (roadway, transit, bicycle/pedestrian, ITS)

☑ Project length or area of influence

☑ Project cost

☑ Number of lanes (before/after) – for roadway projects

☑ Presence of transit/bicycle/pedestrian facilities

Step B: Assign Strategy Types to Projects

The committee reviews Appendix A and the CMP Toolbox and determines that all of the projects are "Additional System Capacity" strategies. Project 3 is also a "New Roadway Facility Construction" strategy.

Step C: Determine Analysis Approach

The committee has limited project data and analysis resources, so they select the CMP Planning Approach.

Step D: Select Analysis Tool & Conduct Detailed Analysis

Since the CMP Planning Approach is being used, Step D does not apply.

Step E: Summarize Quantitative Criteria Results

The committee consults the CMP Toolbox and notes that for "Additional System Capacity" projects the impacts on congestion include increased vehicle throughput and reduced delay. They decide to select the minimum set of quantitative criteria, which are volume, crash rate and congestion. Because I-10 Maricopa and I-10 Papago are freight significant corridors, the committee selects truck volumes as an additional quantitative measure. Because the CMP planning approach is being used, the committee relies on the detailed project data from Step A, along with performance measure results from the MAG 2009 Performance Measures Framework Report to generate quantitative criteria results.

The committee identifies the corridor that corresponds to each of the candidate projects from the MAG 2009 Performance Measures Framework report and identifies the following quantitative data for each corridor:

- Vehicle throughput for general purpose (GP) and high occupancy vehicle (HOV) lanes
- Crash rate
- Freight throughput
- Congestion as measured using lost productivity (for general purpose lanes)

Step F: Determine Qualitative Criteria Results

Step F.1: Assess Qualitative Results Based on CMP Objectives Criteria

The committee conducts a qualitative assessment to evaluate the potential impact of each candidate project in terms of CMP objectives such as minimizing congestion and improving travel time reliability. They consult the project descriptions from the RTP, Life Cycle Program Project applications, corridor studies, and the MAG 2009 Performance Measures Framework Report to conduct the qualitative assessment.

For Project 1, the committee determines that the project would have the ***highest impact*** in minimizing delay, reducing travel time variability and improving level of service/reducing congestion. They assign a score of 4 for these objectives. They determine that the project would ***likely impact*** transit mode share and provide systemwide benefits and they assign a score of 3 for these objectives. They determine that the project ***may impact*** system connectivity and emissions and fuel consumption, and they assign a score of 2 for these objectives. The remaining candidate projects are also evaluated, and scores are assigned based on committee input and consensus.

If the committee determines that an objective does not apply to the project then NA (not applicable) can be assigned.

Step F.2: Assess Qualitative Results Based on Project/Mode Specific Criteria

Next, the committee conducts a qualitative assessment based on project/mode specific qualitative criteria. They consult the project descriptions from the RTP, Life Cycle Program Project applications, corridor studies, and the MAG 2009 Performance Measures Framework Report to conduct the assessment.

Because the candidate projects are all "Additional System Capacity", they apply the qualitative criteria related to "System Capacity and New Facilities." For Project 1, the committee determines that ***YES***, the project ***would help*** mitigate segments of high congestion that result in lost productivity along the corridor (Question 2). However, the project did not meet any of the other criteria. They assess the other candidate projects and answer the qualitative criteria based on committee input and consensus.

Step G: Apply CMP Screening Tool

The Excel spreadsheet titled *CMP Screening Tool.xls* will be used for the remaining steps. Open the tool and read the **NOTES to USER** tab for guidelines in using the tool.

Step G.1: Enter Results from Steps A and B

The committee enters the detailed project data (from Step A) and type of congestion management strategies (from Step B) for each project on the **Project Information** tab of the CMP Screening Tool. Only Project 3 is assigned more than one strategy, which results in a bonus point.

	PROJECT #:								
	1	2	3	4	5	6	7	8	9
Source:	RTP 2010	RTP 2010	RTP 2010	RTP 2010	RTP 2010	RTP 2010	TIP 2011 Project Lis	RTP 2010	RTP 2010
Location:	I-10 Papago	I-10 Papago	I-10 Papago	I-10 Maricopa	I-10 Maricopa	I-10 Maricopa	I-10 Maricopa	I-17/Black Canyon Freeway	SR 51/Piestawa Freeway
Limits:	Loop 101 (Agua Fria) to I-17	I-10 at I-17	Loop 202 Interchange at I-	32nd Street to Baseline Rd	I-10/SR-143 Interchange	Baseline Rd to Loop 202	40th St to Baseline Rd	I-10 (Stack) to I-10 Split	Shea Blvd to Loop 101
Type of Work:	Increase general purpose lane capacity	Possible Improvements to I-10/I-17 interchange	Construction of interchange	Construction of local/express lanes	Improvements to I-10/SR-143 interchange	Addition of one general purpose lane in each direction	Construct CD roads (FY 2011)	Addition of one general purpose and one HOV lane in each	Addition of one general purpose lane in each direction
Miles:							4		
Ln Before:							8		
Ln After:							12		
Fund Type:							State		
Federal Cost:							0		
Regional Cost:							0		
Local Cost:							55765000		
Total Cost:							55765000		
Corr ID:	A	A	B	C	C	D	C	E	H
IDN:						DOT11-826			
Transit:	Y	Y	Y	Y	Y	Y	Y	Y	Y
Type of Strategy:	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity
Type of Strategy:			New Roadway Facility Construction						
Type of Strategy:									
Type of Strategy:									
Type of Strategy:									
Type of Strategy:									
Type of Strategy:									
Type of Strategy:									
Extra credit for more than one strategy type:	0	0	1	0	0	0	0	0	0

Step G.2: Enter Quantitative Criteria Results and Data from Step E

The committee enters the selected quantitative criteria – volume, crash rate, truck volume, and congestion/lost productivity – on the **Quantitative Criteria** tab of the tool.

Case Study A: RTP Freeway Projects	CRITERIA #:	
Enter quantitative criteria.	1	VOLUME/AADT
	2	CRASH RATE
(Minimum recommended: 1 for volume, 1 for crash rate, 1 for congestion)	3	TRUCK VOLUME / AADT
(Limit 6)	4	CONGESTION / LOST PRODUCTIVITY GP

The quantitative data for each candidate project are then entered into the **Quantitative Data** tab.

Case Study A: RTP Freeway Projects		PROJECT #:	1	2	3	4	5	6	7	8	9
		Source:	RTP 2010	RTP 2010	RTP 2010	RTP 2010	RTP 2010	RTP 2010	TIP 2011 Project List	RTP 2010	RTP 2010
		Location:	I-10 Papago	I-10 Papago	I-10 Papago	I-10 Maricopa	I-10 Maricopa	I-10 Maricopa	I-10 Maricopa	I-17/Black Canyon Freeway	SR 51/Piestawa Freeway
		Limits:	Loop 101 (Agua Fria) to I-17	I-10 at I-17	Loop 202 Interchange at I-10	32nd Street to Baseline Rd	I-10/SR-143 Interchange	Baseline Rd to Loop 202 (Santan)	40th St to Baseline Rd	I-10 (Stack) to I-10 Split	Shea Blvd to Loop 101
	CRITERIA #:										
	1	VOLUME/AADT	203,184	203,184	223,047	197,766	197,766	171,316	197,766	94,830	138,463
Enter quantitative data.	2	CRASH RATE	1.8	1.8	1.8	1.8	1.8	1.8	1.8	2.1	1.8
	3	TRUCK VOLUME / AADT	20,200	20,200	23,700	20,000	20,000	19,200	20,000	12,200	10,500
	4	CONGESTION / LOST PRODUCTIVITY	50.40%	50.40%	30.60%	52.00%	52.00%	33.30%	52.00%	25.60%	7.50%

Step G.3: Enter Qualitative Criteria Results from Step F

The committee enters the qualitative criteria results from Step F on the **Qualitative Data** tab of the tool. The scores for CMP Objectives are entered as numerical values or NA, and the answers to the project/mode specific criteria are entered as yes, no or NA.

Case Study A: RTP Freeway Projects											
		PROJECT #:									
CMP OBJECTIVES		1	2	3	4	5	6	7	8	9	
Minimize Delay and Improve Travel Time	Project impact in terms of reducing travel time or delay.	4	2	3	4	2	4	4	4	4	Enter score according to project impact:
Reduce Travel Time Variability	Project impact in terms of reducing travel time variability, crash risk, or weave/merge conflicts.	4	2	3	4	2	4	4	4	4	Highest impact = score of 4
Improve System Connectivity	Project impact in terms of improving connections to regional intermodal or emergency facilities?	2	3	4	3	2	3	3	3	3	Likely impact = score of 3
Increase Alternative Mode Share	Project impact in terms of reducing mode share for drive alone trips or increasing alternative mode share.	3	2	2	3	1	3	4	3	3	May impact = score of 2
Improve LOS/Reduce Congestion	Project impact in terms of reducing the Level of Service of the facility and increasing roadway capacity.	4	2	2	4	2	4	4	4	4	No impact = score of 1
Reduce Emissions & Fuel Consumption	Project impact in terms of reducing vehicle emissions?	2	3	2	2	3	2	3	3	2	NA = statement not applicable
Measures of Cost Effectiveness	Project impact in terms of systemwide benefits (project benefits outweighing the costs).	3	3	2	3	3	3	3	3	3	
	Score:	3.14	2.43	2.57	3.29	2.14	3.29	3.57	3.43	3.29	

PROJECT/MODE SPECIFIC ASSESSMENT										
	SYSTEM CAPACITY AND NEW FACILITIES:	PROJECT #:								
		1	2	3	4	5	6	7	8	9
Answer Yes, No, or NA.	Does the project complete or improve a segment which helps to provide a continuous link between two points of regional importance for travel, or improve an intersection or interchange of two corridors of regional importance?	no	no	no	no	no	no	no	no	no
	Does the project include segments of high congestion that result in lost productivity along the corridor, and will the project help to mitigate this congestion?	no	no	yes	no	yes	no	yes	no	no
	Does the project provide access to existing and/or future business and job activity centers, shopping, educational, cultural, and recreational opportunities?	no	no	yes	no	no	no	no	no	no
	Will the project accommodate or create significant benefits to at least two additional modes of travel, or complete a link to intermodal or freight facilities of regional importance?	no	no	yes	no	no	no	no	no	no
	Is the project located along a high crash corridor, or will the project help to mitigate a specific safety problem?	yes	yes	yes	yes	yes	yes	yes	yes	yes
	Score:	1	1	4	1	2	1	2	1	1

Step G.4: Assign Weights to Quantitative and Qualitative Criteria

The committee determined that the quantitative criteria would be assigned an overall weighting of 45 percent, with Vehicle Throughput being the most important. They assign the following weighting percentages:

- Vehicle Throughput – 25 percent
- Crash Rate – 5 percent
- Freight Throughput – 5 percent
- Congestion (Lost Productivity) – 10 percent

They determine that the qualitative criteria would be assigned a weighting of 55 percent and assign the following weighting percentages:

- CMP Objectives – 35 percent
- Project/Mode Specific Assessment – 20 percent

The committee enters the weighting percentages on the **Assign Weights** tab of the CMP Screening Tool. This step marks the end of the input from the user into the tool.

Case Study A: RTP Freeway Projects			
	Quantitative Criteria:		
	VOLUME/AADT	25%	Assign Weights
	CRASH RATE	5%	
	TRUCK VOLUME / AADT	5%	
	CONGESTION / LOST	10%	
	Qualitative Criteria:		
	CMP OBJECTIVES	35%	Assign Weights
	PROJECT/MODE SPECIFIC	20%	
		100%	(must equal 100%)

Step G.5: Scores Calculated and Projects Ranked by CMP Screening Tool

The committee noted that the CMP Screening Tool automatically assigned scores to each of the candidate projects based on the quantitative and qualitative criteria entered. The average score results for each set of quantitative and qualitative criteria are displayed on the **Calcs** tab of the CMP Screening Tool.

The committee clicked on the **Calcs** tab and noted that the CMP Screening Tool automatically ranked projects based on the total weighted score for each candidate project.

		PROJECT #:	1	2	3	4	5	6	7	8	9
VOLUME/AADT		score:	7	7	9	4	4	3	4	1	2
weight:	25%	weighted:	1.75	1.75	2.25	1	1	0.75	1	0.25	0.5
CRASH RATE		score:	1	1	1	1	1	1	1	9	1
weight:	5%	weighted:	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.45	0.05
TRUCK VOLUME / AADT		score:	7	7	9	4	4	3	4	2	1
weight:	5%	weighted:	0.35	0.35	0.45	0.2	0.2	0.15	0.2	0.1	0.05
CONGESTION / LOST PRODUCTIVITY GP		score:	5	5	3	7	7	4	7	2	1
weight:	10%	weighted:	0.5	0.5	0.3	0.7	0.7	0.4	0.7	0.2	0.1
TOTAL QUANTITATIVE WEIGHTED SCORE:			2.65	2.65	3.05	1.95	1.95	1.35	1.95	1	0.7
CMP OBJECTIVES:		score:	3.33	2.60	2.57	3.29	2.14	3.29	3.57	3.43	3.29
weight:	35%	weighted:	1.17	0.91	0.90	1.15	0.75	1.15	1.25	1.20	1.15
PROJECT/MODE SPECIFIC ASSESSMENT:		score:	1	1	4	1	2	1	2	1	1
weight:	20%	weighted:	0.2	0.2	0.8	0.2	0.4	0.2	0.4	0.2	0.2
TOTAL QUALITATIVE WEIGHTED SCORE:			1.37	1.11	1.70	1.35	1.15	1.35	1.65	1.40	1.35
BONUS POINTS:			0	0	1	0	0	0	0	0	0
TOTAL ALL PLUS BONUS:			4.0	3.8	5.8	3.3	3.1	2.7	3.6	2.4	2.1

Step G.6: Results and Prioritized List of Projects Presented by CMP Screening Tool

The committee clicked on the **Results** tab to reveal the Summary Rankings from the CMP Screening Tool and noted that Project 3 would have the greatest impact on congestion, while Project 9 would have the least impact.

Case Study A: RTP Freeway Projects

MAG CMP Screening Tool Summary Rankings

	CRITERIA	Weight	1	2	3	4	5	6	7	8	9
			PROJECT NUMBERS:								
Quantitative Data	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
Qualitative Data	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
All Data	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

Appendix C. Case Study B – Arterials

Case Study B

Case Study Example: Arterial Projects

Background

The City of Scottsdale recently completed an Airpark Circulation Study for the Scottsdale Airport and surrounding Airpark study area. The study resulted in several parking management, travel demand management, and roadway improvement strategies proposed for the area. The MAG Street Review Committee wants to prioritize these projects for advancement into the TIP based on their ability to mitigate congestion in the region. They select the MAG Congestion Management Process as a resource for evaluating and prioritizing projects.

Step A: Assemble List of Projects and Detailed Project Data

The Committee reviews the Airpark Circulation Study and Arterial Life Cycle Program Project application and identifies the following candidate projects for the Airpark:

- **Project 1:** Redfield Rd from Scottsdale Rd to Hayden Rd – Widen Redfield Road from two to four lanes, and add bicycle lanes, sidewalks and landscaping.
- **Project 2:** Northsight Blvd from Hayden Rd to Frank Lloyd Wright Blvd – Widen Northsight Blvd from one lane to two lanes in each direction (four lanes total). This project includes bike/ped improvements.
- **Project 3:** Hayden Rd and Loop 101 intersection improvements – Construct ramps which enable drivers to free flow from Loop 1010 directly to Hayden Rd both westbound and eastbound.
- **Project 4:** Raintree Drive and SR Loop 101 intersection improvements – Add triple left turns, additional storage, traffic operations improvements.
- **Project 5:** Raintree Drive from Loop 101 to Hayden Rd – Widen Raintree Drive to six lanes between Loop 101 and Hayden Road, and add bike lanes, pedestrian sidewalks and landscaping.
- **Project 6:** Hayden Road from Redfield Road to Raintree Drive – Widen Hayden to six lanes between Redfield Road and Raintree Drive. This project is a continuation of the Redfield widening project. This project includes bike/ped improvements.
- **Project 7:** Frank Lloyd Wright and SR Loop 101 intersection improvements – Additional turn lanes at Northsight, Hayden, 90th Street, and Loop 101. Pedestrian access modifications.

The Committee reviews the project descriptions from the Arterial Life Cycle Program Project application and identifies the following detailed project data for each candidate project:

- ☑ Source of project (TIP, RTP, Corridor Study, etc.)
- ☑ Detailed project description/type of work
- ☑ Project location
- ☑ Project limits
- ☑ Type of project (roadway, transit, bicycle/pedestrian, ITS)
- ☑ Project length or area of influence
- ☑ Project cost
- ☑ Number of lanes (before/after) – for roadway projects
- ☑ Presence of transit/bicycle/pedestrian facilities

Step B: Assign Strategy Types to Projects

The Committee reviews Appendix A and the CMP Toolbox and assigns the following strategy types to the candidate projects:

- **Project 1:** Additional System Capacity, Bike/Ped
- **Project 2:** Additional System Capacity, Bike/Ped
- **Project 3:** Additional System Capacity
- **Project 4:** Additional System Capacity, Management & Operations
- **Project 5:** Additional System Capacity, Bike/Ped
- **Project 6:** Additional System Capacity, Bike/Ped
- **Project 7:** Additional System Capacity, Management & Operations, Bike/Ped

Step C: Determine Analysis Approach

The Committee has limited project data and analysis resources, so they select the CMP Planning Approach.

Step D: Select Analysis Tool & Conduct Detailed Analysis

Since the CMP Planning Approach is being used, Step D does not apply.

Step E: Summarize Quantitative Criteria Results

The Committee consults the CMP Toolbox and notes that for Additional System Capacity projects, the impacts on congestion include increased vehicle throughput and reduced delay. They decide to select volume and congestion as the quantitative criteria. Crash data are not available for the study area, so crash rate is not applied as the third criteria. Because the CMP planning approach is being used, the Committee relies on the detailed project data from Step A, along with the Airpark Circulation Study and performance measure results from the MAG 2009 Performance Measures Framework Report to generate quantitative criteria results.

The Committee identifies the corridor that corresponds to each of the candidate projects from the MAG 2009 Performance Measures Framework report and identifies the following quantitative data for each corridor:

- Vehicle throughput for arterials
- Congestion as measured using volume/capacity ratio

Step F: Determine Qualitative Criteria Results

Step F.1: Assess Qualitative Results Based on CMP Objectives Criteria

The Committee conducts a qualitative assessment to evaluate the potential impact of each candidate project in terms of CMP objectives such as minimizing congestion and improving travel time reliability. They consult the project descriptions from the Arterial Life Cycle Program Project applications, Airpark Circulation Study, and the MAG 2009 Performance Measures Framework Report to conduct the qualitative assessment.

For Project 1, the Committee determines that the project would have the ***highest impact*** in minimizing delay and assign a score of 4 for this objective. They determine that the project would ***likely impact*** travel time variability, LOS/congestion, and provide systemwide benefits, and they assign a score of 3 for these objectives. They determine that the project ***may impact*** system connectivity and emissions and fuel consumption, and they assign a score of 2 for these objectives. They determine that the project has ***no impact*** on mode share, so they assign a score of 1 for this objective. The remaining candidate projects are also evaluated, and scores are assigned based on Committee input and consensus.

Step F.2: Assess Qualitative Results Based on Project/Mode Specific Criteria

Next, the Committee conducts a qualitative assessment based on project/mode specific qualitative criteria. They consult the project descriptions from the Arterial Life Cycle Program Project applications, Airpark Circulation Study, and the MAG 2009 Performance Measures Framework Report to conduct the assessment.

Because all 7 candidate projects include "Additional System Capacity", they apply the qualitative criteria related to "System Capacity and New Facilities." For Project 1, the Committee determines that ***YES***, the project ***would help*** a segment that provides a continuous link between two points of regional significance (Question 1), mitigate segments of high congestion that result in lost productivity along the corridor (Question 2), and provide access to business and job activity centers (Question 3). However, the project did not meet any of the other criteria. They assess the other candidate projects and answer the qualitative criteria for "System Capacity and New Facilities" based on Committee input and consensus.

Projects 4 and 7 include traffic operations improvements, so they apply the qualitative criteria related to "Management and Operations (ITS)." For Project 4, the Committee determines that ***YES***, the project is located within an ITS priority area/corridor (Question 1 & 2) , is included in the ITS Strategic Plan (Question 3), is consistent with the Regional ITS Architecture (Question 4), would improve roadway safety (Question 6), and would coordinate signal systems (Question 7). They note that the total number of YES answers is tallied as 6, and a score of 4 is assigned. They assess Project 7 and answer the qualitative criteria for "Management & Operations (ITS)" based on Committee input and consensus.

Projects 1, 2, 5, 6, and 7 include bicycle/pedestrian improvements, so they apply the qualitative criteria related to "Bike/Ped." For Project 1, the Committee determines that ***YES***, the project would improve connectivity in the MAG Regional Bicycle and Pedestrian network (Question 1), is in accordance with design guidelines (Question 2), would improve access to activity centers (Question 3), is identified in regional plans (Question 4), and is required by local jurisdiction policies and plans (Question 5). They note that the total number of YES answers is tallied as 5, and a score of 4 is assigned. They assess projects 5 and 7 and answer the qualitative criteria for "Bike/Ped" based on Committee input and consensus.

The Committee notes that the CMP Screening Tool Spreadsheet calculates an average score across all of the project/mode specific criteria.

Step G: Apply CMP Screening Tool

The Excel spreadsheet titled *CMP Screening Tool.xls* will be used for the remaining steps. Open the tool and read the **NOTES to USER** tab for guidelines in using the tool.

Step G.1: Enter Results from Steps A and B

The committee enters the detailed project data (from Step A) and type of congestion management strategies (from Step B) for each project on the **Project Information** tab of the CMP Screening Tool.

	PROJECT #:						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Source:	ACI-SAT-10-03	ACI-SAT-10-03	ACI-SAT-10-03	ACI-SAT-10-03	ACI-SAT-10-03	ACI-SAT-10-03	ACI-SAT-10-03
Location:	Redfield Rd: Scottsdale Rd to	Northsight Blvd: Hayden Rd to	Hayden Rd and Loop 101	Raintree Dr and Loop 101	Raintree Dr: Loop 101 to Hayden Rd	Hayden Rd: Redfield Rd to	Frank Lloyd Wright and Loop
Limits:	Scottsdale Road to Hayden Rd	Hayden Rd to Frank Lloyd	Hayden Rd and Loop 101	Raintree Dr and Loop 101	Loop 101 to Hayden Rd	Redfield Rd to Raintree Dr	Frank Lloyd Wright
Type of Work:							
Miles:	1.2	0.35	0.75	0.5	1	0.5	0.75
Ln Before:	2	2	4	4	4	4	6
Ln After:	4	4	6	4	6	6	6
Fund Type:	STP-MAG	STP-MAG	STP-MAG	STP-MAG	STP-MAG	STP-MAG	STP-MAG
Federal Cost:							0
Regional Cost:	2,467,500	7.009 M	8.22M	1.115M	17.532M	4.769M	3.913M
Local Cost:	1,057,500	3.003M	3.522M	0.495M	7.513M	2.044M	1.677M
Total Cost:	3,525,000	10.013M	11.743M	1.657M	25.046M	6.813M	5.590M
Corr ID:							
IDN:							
Transit:	N	Northsight Blvd:	N	N	N	N	N
Type of Strategy:	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity	Additional System Capacity	Bicycle & Pedestrian
Type of Strategy:	Bicycle & Pedestrian	Bicycle & Pedestrian		Operations & ITS	Bicycle & Pedestrian	Bicycle & Pedestrian	Operations & ITS
Type of Strategy:							
Type of Strategy:							
Type of Strategy:							
Type of Strategy:							
Type of Strategy:							
Type of Strategy:							
	2	2	1	2	2	2	2
Extra credit for more than one strategy type:	1	1	0	1	1	1	1

Step G.2: Enter Quantitative Criteria Results from Step E

The committee enters the selected quantitative criteria – volume and congestion/lost productivity – on the **Quantitative Criteria** tab of the tool.

Case Study B: Scottsdale Airport Runway Tunnel Arterials Projects	CRITERIA #:		
Enter quantitative criteria.	1	VOLUME/AADT	
(Minimum recommended: 1 for volume, 1 for crash rate, 1 for congestion)	2	CONGESTION / LOST PRODUCTIVITY GP	
(Limit 6)	3		
	4		

Refer to Table 5.4 CMP Toolbox for additional guidance.

The quantitative data for each candidate project are then entered into the **Quantitative Data** tab.

Case Study B: Scottsdale Airport Runway Tunnel Arterials Projects		PROJECT #:	1	2	3	4	5	6	7
		Source:	ACI-SAT-10-03	ACI-SAT-10-03	ACI-SAT-10-03	ACI-SAT-10-03	ACI-SAT-10-03	ACI-SAT-10-03	ACI-SAT-10-03
		Location:	Redfield Rd: Scottsdale Rd to Hayden Rd	Northsight Blvd: Hayden Rd to Frank Lloyd Wright Blvd	Hayden Rd and Loop 101 Intersection improvements	Raintree Dr and Loop 101 Intersection Improvements	Raintree Dr: Loop 101 to Hayden Rd	Hayden Rd: Redfield Rd to Raintree Dr	Frank Lloyd Wright and Loop 101 intersection improvements
		Limits:	Scottsdale Road to Hayden Rd	Hayden Rd to Frank Lloyd Wright Blvd	Hayden Rd and Loop 101 intersection	Raintree Dr and Loop 101 intersection	Loop 101 to Hayden Rd	Redfield Rd to Raintree Dr	Frank Lloyd Wright intersection
	CRITERIA #:								
	1	VOLUME/AADT	14,500	8,200	25,600	23,600	26,000	24,400	47,600
Enter quantitative data.	2	CONGESTION / LOST PRODUCTIVITY	0.7	0.51	0.52	0.56	0.61	0.61	0.79

Step G.3: Enter Qualitative Criteria Results from Step F

The committee enters the qualitative criteria results from Step F on the **Qualitative Data** tab of the tool. The scores for CMP Objectives are entered as numerical values or NA, and the answers to the project/mode specific criteria are entered as yes, no or NA.

Case Study B: Scottsdale Airport Runway Tunnel Arterials Projects

CMP OBJECTIVES

			PROJECT #: 1	2	3	4	5	6	7	
Minimize Delay and Improve Travel Time	1	Project impact in terms of reducing travel time or delay.	4	3	3	2	4	4	2	Enter score according to project impact:
Reduce Travel Time Variability	2	Project impact in terms of reducing travel time variability, crash risk, or weave/merge conflicts.	3	3	3	2	3	3	2	Highest impact = score of 4
Improve System Connectivity	3	Project impact in terms of improving connections to regional intermodal or emergency facilities.	2	2	3	2	2	3	2	Likely impact = score of 3
Increase Alternative Mode Share	4	Project impact in terms of reducing mode share for drive alone trips or increasing alternative mode share.	1	1	1	1	1	1	1	May impact = score of 2
Improve LOS/Reduce Congestion	5	Project impact in terms of reducing the Level of Service of the facility and increasing roadway capacity.	3	2	3	2	3	3	2	No impact = score of 1
Reduce Emissions & Fuel Consumption	6	Project impact in terms of reducing vehicle emissions.	2	2	2	2	2	2	2	NA = statement not applicable
Measures of Cost Effectiveness	7	Project impact in terms of systemwide benefits (project benefits outweighing the costs).	3	2	2	3	1	2	3	
		Score:	2.57	2.14	2.43	2.00	2.29	2.57	2.00	

PROJECT/MODE SPECIFIC ASSESSMENT

		MGT & OPS (ITS):	PROJECT #: 1	2	3	4	5	6	7
	1	Is the project located within ITS priority areas defined by city/town?				YES			YES
Answer Yes, No, or NA.	2	Is the project located within an ITS priority corridor as defined in the ITS Strategic Plan?				YES			YES
	3	Is the project included in ITS Strategic Plan?				YES			YES
	4	Is the project consistent with the Regional ITS Architecture?				YES			YES
	5	Does the project enhance traffic management capabilities for special events?				NO			NO
	6	Does the project coordinate signal systems across jurisdictional boundaries and improve progression?				YES			YES
	7	Does the project improve accuracy, timeliness and availability of real-time information to the public?				NO			NO
	8	Does the project improve automated traffic data collection and archiving ability?				NO			NO
	9	If the project is a component of an ITS project (i.e., canvas, fiber, dynamic message signs), is it part of a fully funded project?				NO			NO
		Score:	#DIV/0!	#DIV/0!	#DIV/0!	3	#DIV/0!	#DIV/0!	3

Step G.4: Assign Weights to Quantitative and Qualitative Criteria

The Committee determined that the quantitative criteria would be assigned an overall weighting of 55 percent, with Congestion being the most important. They assign the following weighting percentages:

- Vehicle Throughput – 25 percent
- Congestion (V/C) – 30 percent

They determine that the qualitative criteria would be assigned a weighting of 45 percent and assign the following weighting percentages:

- CMP Objectives – 25 percent
- Project/Mode Specific Assessment – 20 percent

The committee enters the weighting percentages on the **Assign Weights** tab of the CMP Screening Tool. This step marks the end of the input from the user into the tool.

Case Study B: Scottsdale Airport Runway Tunnel Arterials Projects			
	Quantitative Criteria:		
	VOLUME/AADT	25%	Assign Weights
	CONGESTION / LOST	30%	
	Qualitative Criteria:		
	CMP OBJECTIVES	25%	Assign Weights
	PROJECT/MODE SPECIFIC	20%	
		100%	(must equal 100%)

Step G.5: Scores Calculated and Projects Ranked by CMP Screening Tool

The committee noted that the CMP Screening Tool automatically assigned scores to each of the candidate projects based on the quantitative and qualitative criteria entered. The average score results for each set of quantitative and qualitative criteria are displayed on the **Calcs** tab of the CMP Screening Tool.

The committee clicked on the **Calcs** tab and noted that the CMP Screening Tool automatically ranked projects based on the total weighted score for each candidate project.

Case Study B: Scottsdale Airport Runway Tunnel Arterials Projects			PROJECT #:	1	2	3	4	5	6	7
	VOLUME/AADT		score:	2	1	5	3	6	4	7
	weight:	25%	weighted:	0.5	0.25	1.25	0.75	1.5	1	1.75
	CONGESTION / LOST PRODUCTIVITY GP		score:	6	1	2	3	4	4	7
	weight:	30%	weighted:	1.8	0.3	0.6	0.9	1.2	1.2	2.1
	TOTAL QUANTITATIVE WEIGHTED SCORE:			2.3	0.55	1.85	1.65	2.7	2.2	3.85
	CMP OBJECTIVES:		score:	2.57	2.14	2.43	2.00	2.29	2.57	2.00
	weight:	25%	weighted:	0.64	0.54	0.61	0.50	0.57	0.64	0.50
	PROJECT/MODE SPECIFIC ASSESSMENT:		score:	3	3	3	2	3	3	2
	weight:	20%	weighted:	0.6	0.6	0.6	0.4	0.6	0.6	0.4
	TOTAL QUALITATIVE WEIGHTED SCORE:			1.24	1.14	1.21	0.90	1.17	1.24	0.90
	BONUS POINTS:			1	1	0	1	1	1	1
	TOTAL ALL PLUS BONUS:			4.5	2.7	3.1	3.6	4.9	4.4	5.8

Step G.6: Results and Prioritized List of Projects Presented by CMP Screening Tool

The committee clicked on the **Results** tab to reveal the Summary Rankings from the CMP Screening Tool and noted that Project 7 would have the greatest impact on congestion, while Project 2 would have the least impact.

Case Study B: Scottsdale Airport Runway Tunnel Arterials Projects

MAG CMP Screening Tool Summary Rankings

	CRITERIA	Weight	1	2	3	4	5	6	7
			PROJECT NUMBERS:						
Quantitati	VOLUME/AADT *	25%	2	1	5	3	6	4	7
	CONGESTION / LOST PRODUCTIVITY GP	30%	6	1	2	3	4	4	7
	Total Weighted Score:		2.30	0.55	1.85	1.65	2.70	2.20	3.85
	Rank Order:		3	7	5	6	2	4	1
Qualitative Data	CMP OBJECTIVES	25%	2.57	2.14	2.43	2.00	2.29	2.57	2.00
	PROJECT/MODE SPECIFIC ASSESSMENT	20%	3	3	3	2	3	3	2
	Total Weighted Score:		1.24	1.14	1.21	0.90	1.17	1.24	0.90
	Rank Order:		1	5	3	6	4	1	6
All Data	**Total Weighted Score:**		**4.54**	**2.69**	**3.06**	**3.55**	**4.87**	**4.44**	**5.75**
	Rank Order:		**3**	**7**	**6**	**5**	**2**	**4**	**1**

* For ITS Projects:
- AADT can be replaced by VMT or VMT/lane
- Cost can be another quantitative factor expressed in VMT/$ spent