MAG
Expert Resources. Enriching Lives.

MAG MPO CONGESTION MANAGEMENT PROCESS

January 2025

WCG
WALL CONSULTANT GROUP

Mountainland Association of Governments
Metropolitan Planning Organization Board
RESOLUTION TO APPROVE THE CONGESTION MANAGEMENT PROCESS

WHEREAS, the Mountainland Association of Governments (MAG) Metropolitan Planning Organization (MPO), as the federally designated metropolitan planning organization for the Provo-Orem, Utah urbanized area and the area projected to become urban within 20-25 years; and

WHEREAS, the MAG MPO has the responsibility under the U.S. Department of Transportation for carrying out a continuing, cooperative, and comprehensive transportation planning process for the metropolitan planning area; and

WHEREAS, CFR 450.322 requires a Congestion Management Process (CMP) in for MPOs serving a Transportation Management Area; and

WHEREAS, the Federal Highway Administration provides a model for the development of a CMP in the Congestion Management Process Guidebook; and

WHEREAS, the CMP for the MAG MPO was approved by the MPO Board on January 9, 2025; and

WHEREAS, on January 6, 2025 the MPO Technical Advisory Committee (MPO TAC) reviewed the CMP and recommended approval; and

NOW, THEREFORE, BE IT RESOLVED that the MAG MPO Board approves the CMP for transportation planning for the MAG region.

BE IT FURTHER RESOLVED that the MPO Director is hereby authorized to act on behalf of the Board in matters concerning the CMP, including its administration and execution, and to make adjustments in program element amounts as necessary due to changing state or federal commitments or requirements.

Bill Wright — January 9, 2025

MPO Board Chair, Mayor Bill Wright — Date

[signature] — January 9, 2025

Attest, ~~MAG Executive Director Michelle Carroll~~ MPO Director — Date

Adopted by the MPO Board at its regular meeting on January 9, 2025.

TABLE OF CONTENTS

I. INTRODUCTION 4

II. GOALS & OBJECTIVES. 5

Goal 1: Reduce Congestion & Improve Mobility 5

Goal 2: Enhance Options for Transit and Active Transp Modes 5

Goal 3: Improve Air Quality and the Natural Environment . . 5

Goal 4: Enhance Transportation Network Safety 5

III. CMP STUDY AREA 6

IV. PERFORMANCE MEASURES 8

Volume to Capacity (V/C) 8

Level of Service (LOS) 8

Travel Time Index (TTI) 8

Level of Travel-Time Reliability (LOTTR) 8

Truck Travel-Time Reliability (TTTR) 9

Planning Time Index (PTI). 9

Transit Ridership 9

Transit Coverage 9

Active Transportation Network Mileage 9

Number of Serious and Fatal Crashes 9

Number of Vulnerable Road User Crashes 9

Percent of New Intersections at Target Spacing 10

Extent of Signal Optimization 10

Project Counts 10

V. DATA COLLECTION/MONITOR SYSTEM PERFORMANCE 11

VI. ANALYZE CONGESTION PROBLEMS & NEEDS 13

VII. IDENTIFY & ASSESS STRATEGIES. 15

Transportation Demand Management Strategies 15

Transportation System Management Strategies. 15

VIII. IMPLEMENTATION PROGRAM. 16

IX. EVALUATE STRATEGY EFFECTIVENESS 16

X. HELPFUL LINKS 16

FIGURES

Figure 1: Wasatch Front Model Network within the MAG MPO . . 7

Figure 2: CMP Scenario Flow Chart 14

TABLES

Table 1: Objectives & Performance Metrics Grid. 12

Table 2: Transportation Demand and System Mgmt Strategies . 15

I. INTRODUCTION

The congestion management process (CMP) is a tool to support the development of the Regional Transportation Plan (RTP) and the Transportation Improvement Program (TIP) for the Mountainland Association of Governments (MAG) Metropolitan Planning Organization (MPO). The CMP is a systematic process for managing congestion by identifying congestion management solutions and supporting their effective implementation. Demand management and system management strategies are identified and evaluated with the intent to reduce congestion without increasing highway capacity, or to maximize efficient traffic operations when additional capacity is warranted. The results of the CMP contribute to an efficient and effective transportation system, increased mobility and accessibility, and maximized utility from constrained resources.

The CMP identifies a number of strategies to relieve congestion. Analyzing modeled and observed data facilitates the identification of congested locations and provides potential congestion relief strategies. The CMP lists various system management and demand management strategies that can be used to mitigate identified congestion.

The CMP structure is informed by FHWA guidance to address the following eight actions outlined in the FHWA CMP Guidebook.

1. Develop Regional Objectives for Congestion Management
2. Define CMP Network
3. Develop Multimodal Performance Measures
4. Collect Data/Monitor System Performance
5. Analyze Congestion Problems and Needs
6. Identify and Assess Strategies
7. Program and Implement Strategies
8. Evaluate Strategy Effectiveness.

For additional information regarding congestion management, please contact Bob Allen (rallen@magutah.gov) and Calvin Clark (cclark@magutah.gov).

II. GOALS & OBJECTIVES

Congestion management planning is a cyclical process at MAG and is integrated into the development of the RTP and TIP. Four overall goals that drive planning decisions at MAG are specified as project-selection criteria in the TIP and are identified for the congestion management process below. The regional transportation plan, TransPlan50, identifies additional targeted goals focused on the development of well-connected roadway and active transportation networks, and a robust transit system. The RTP goals support the broader CMP and TIP goals and are frequently referenced in the detailed objectives below.

The planning process attempts to minimize impacts on society and the environment while facilitating future travel with safe and efficient transportation choices.

GOAL 1: Reduce Congestion & Improve Mobility

- **Objective:** Develop an enhanced roadway grid network to disperse traffic, reduce travel times, and keep local trips off regional highways.
- **Objective:** Facilitate transit ridership with improved coverage and more frequent and reliable service.
- **Objective:** Accommodate significant population and employment growth with proper spacing and design of collectors, arterials, expressways, and freeways.
- **Objective:** Maximize roadway efficiency through monitoring and deployment of network optimization strategies.
- **Objective:** Maintain/improve vehicle and truck travel time reliability.

GOAL 2: Enhance Options for Transit and Active Transportation Modes

- **Objective:** Facilitate a more frequent, expansive transit system that is reliable.
- **Objective:** Support development of multi-use paths, neighborhood connections, on-street bike lanes, sidewalks, and pedestrian-friendly development to connect current and future population and employment centers.
- **Objective:** Facilitate accessibility to public transportation options with a focus on first and last mile connections.

GOAL 3: Improve Air Quality and the Natural Environment

- **Objective:** Increase transit and active transportation mode shares through improvements to transit coverage, service, and reliability and development of safe and attractive bicycle and pedestrian networks.
- **Objective:** Improve the efficiency of the existing system.

GOAL 4: Enhance Transportation Network Safety

- **Objective:** Reduce the frequency of fatal and serious injury crashes.
- **Objective:** Reduce the frequency of vulnerable road user crashes.

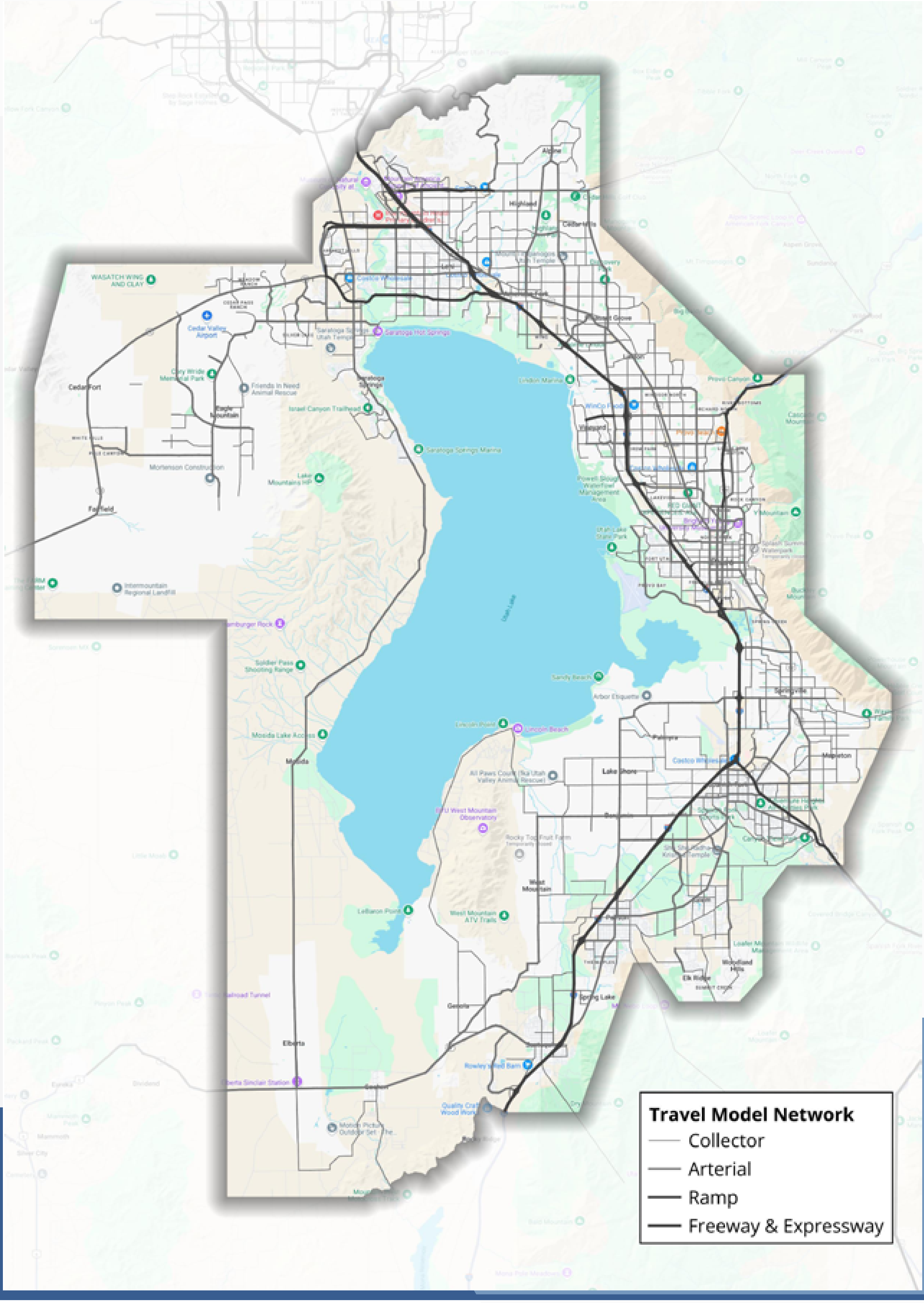
III. CMP STUDY AREA

MAG is the designated Metropolitan Planning Organization (MPO) for the Provo-Orem urbanized area, which is a designated Transportation Management Area (TMA) in Utah county. The MPO is part of the broader MAG AoG area, which encompasses Summit, Utah, and Wasatch counties in Utah.

The Code of Federal Regulations 23 CFR 450.322 requires the CMP planning process to be applied to roads within a TMA that are eligible for funding under title 23 U.S.C and title 49 U.S.C Chapter 53. The MAG CMP analysis process is designed to examine these roadways. However, where possible, the MAG CMP is also used to examine the broader roadway network within the full MAG AoG planning area. Extending CMP process elements to the full MAG planning area ensures consistent analysis across the region and allows planners to identify areas of concern and identify appropriate solutions independent of funding sources.

Different datasets used to inform the CMP vary in their extent of roadway network coverage, and are applied where appropriate and feasible. The Wasatch Front Travel Demand Model informs many elements of the CMP and has network coverage including most Collector and higher functional class roadways across the entire Wasatch Front. The portion of this model covering the MAG MPO is shown in Figure 1.

FIGURE 1: Wasatch Front Model Network within the MAG MPO



IV. PERFORMANCE MEASURES

The first step in the CMP planning process is to identify congested facilities. The MPO can use the following performance measures to identify areas of congestion and to assess the effectiveness of congestion management strategies in relation to CMP objectives. In some cases, one of multiple performance measures could be used to evaluate progress on CMP objectives and the measures presented below provide a range of options for future CMP analysis.

Volume to Capacity (V/C)

The volume to capacity ratio compares roadway volumes with capacities estimated based on roadway functional class and number of lanes. This metric is calculated with the Wasatch Front Travel Demand model.

Level of Service (LOS)

Based on the Highway Capacity Manual's definition of level of service (LOS), the CMP defines congestion as LOS "E" or worse, which is based on volume/capacity ratios (V/C) calculated using the Wasatch Front Travel Demand Model.

Travel Time Index (TTI)

The travel time index (TTI) is a measure of congestion that compares travel times during a given window with travel times during free-flow conditions. For CMP analysis, TTI is calculated using travel times from the model as follows:

$$TTI = \frac{Max(AM\_TIME, PM\_TIME)}{FF\_TIME}$$

Where TTI is the travel time index, AM_TIME is the AM peak period travel time, PM_TIME is the PM peak period travel time, and FF_TIME is the free-flow travel time. TTI can also be calculated with observed travel time data.

Roadways with TTI values greater than 1.4 are considered congested for the CMP. At this level, a trip that would normally take 30 minutes under free-flow conditions would take 42 minutes or longer under congested conditions.

Level of Travel-Time Reliability (LOTTR)

Travel time reliability is a measure of how consistent travel times are from day to day, during similar times of day. Consistent travel times allow roadway users to accurately predict how long it will take them to reach their destinations and to make efficient use of time. Inconsistent travel times can lead to missed meetings and appointments, and inefficient use of time.

The level of travel time reliability (LOTTR) is calculated as the ratio of the 80th percentile travel time to the 50th percentile travel time.

$$LOTTR = \frac{80^{th} \text{ percentile Travel Time}}{50^{th} \text{ percentile Travel Time}}$$

The LOTTR can be calculated with observed data in 15-minute bins for the following time periods.

- Weekdays: 6:00 AM to 10:00 AM, 10:00 AM to 4:00 PM, 4:00 PM to 8:00 PM
- Weekends: 6:00 AM to 8:00 PM

Roadway segments are categorized as reliable if they have LOTTRS below 1.5 for all periods.

Truck Travel-Time Reliability (TTTR)

Truck travel time reliability (TTTR) is calculated by comparing the 95th percentile travel time with the 50th percentile travel time.

$$TTTR = \frac{95^{th} \text{ percentile Travel Time}}{50^{th} \text{ percentile Travel Time}}$$

TTTR is calculated for the same time periods as the LOTTR, but also for an overnight period from 8:00 PM to 6:00 AM using all days of data.

As with LOTTR, roadway segments with TTTR values below 1.5 for all periods are categorized as reliable. The 95th percentile speed used in this calculation, versus the 80th percentile speed used in LOTTR reflects the more direct connection between reliable times and financial impacts to freight operators.

Planning Time Index (PTI)

The planning time index (PTI) represents the travel time that should be planned to ensure on-time arrival 95% of the time. It is calculated as the ratio of the 95th percentile travel time and free-flow travel time.

$$PTI = \frac{95^{th} \text{ percentile Travel Time}}{\text{Free-Flow Travel Time}}$$

Congested Hours

A region-wide review of congestion can be accomplished through aggregating congested hours, as defined using one of the congestion-related measures described above, across all analysis roadways and weighted either through roadway mileage or vehicle miles if using model outputs or if reliable volume data (HPMS or otherwise) can be joined to observed travel-time data.

Transit Ridership

Route-level transit ridership from UTA can be used to evaluate the level of transit usage on individual corridors and region-wide.

Transit Coverage

The total mileage of transit routes represents the full area covered by transit. Weighting routes by the frequency of service (route miles per hour) can further provide an assessment of the overall extent of transit offerings, accounting for the value of high-frequency in core areas.

Active Transportation Network Mileage

The total overall mileage of bike lanes and multi-use paths in the region reflects the amount of active transportation network coverage.

Number of Serious and Fatal Crashes

The total number of serious and fatal crashes provides an assessment of overall system safety. This metric can also be adjusted to account for the amount of traffic or size of the regional population by calculating as a rates-per-VMT or rates-per-population.

Number of Vulnerable Road User Crashes

The total number of crashes involving pedestrians, cyclists, or other vulnerable road users provides an assessment of overall system safety for vulnerable roadway users. This metric can also be adjusted to account for the amount of traffic or size of the regional population by calculating as a rates-per-VMT or rates-per-population.

Percent of New Intersections at Target Spacing

The percentage of new intersections at target spacing examines all new intersections on major collectors and arterial roadways and identifies the share that meet target intersection spacing for desired access management.

Extent of Signal Optimization

The extent of signal optimization is a count of intersections where signal timing plans were evaluated for updates to optimize throughput to current traffic conditions. This measures the degree to which existing infrastructure is optimized for efficiency prior to considering additional roadway capacity.

Project Counts

For some CMP objectives the most practical method of tracking performance is through agency records of applicable projects. This may include a count of projects that complete important grid connections or counts of new pedestrian and bicycle connections proximate to transit routes.

V. DATA COLLECTION/MONITOR SYSTEM PERFORMANCE

Data collection is necessary to support an in-depth understanding of congestion. Data collection activities focus on four areas, including:

- system monitoring,
- congestion identification,
- causes of congestion, and
- project level "before and after" data.

The transportation planning process relies on the ongoing collection of point-source traffic volume and speed data to understand the level of current demand and congestion on regional roadways, and to use in validating the travel demand model. The travel demand model is then used to generate modeled data representing the levels of traffic and congestion in the base year and projected for future scenario years.

Additionally, probe-vehicle data are available for MAG use and are well-suited to confirming current locations and levels of congestion and for evaluating the effects of congestion management projects through before/after studies.

Probe vehicle data are purchased annually by FHWA for use by state, regional, and local transportation agencies and are provided through the National Performance Management Research Data Set (NPMRDS). This data includes passenger vehicle and truck roadway speeds on the National Highway System (NHS) derived from location-services equipped vehicles. The data is anonymously collected and aggregated at resolutions down to 5-minute bins.

Additionally, the Utah Department of Transportation (UDOT) purchases aggregated speed data called iPeMS from probe-vehicles for roads statewide (major collectors and higher). This iPeMS dataset is another potential source for monitoring congestion and evaluating the impact of congestion management projects. This UDOT purchased probe data provides similar utility to the NPMRDS dataset and includes greater roadway network detail, with coverage down to Major Collectors.

To assess transit-related performance measures, MAG coordinates with the Utah Transit Authority (UTA), who maintain data for transit services within the MAG region.

Additional performance measures related to signal timing, project implementations, the available roadway grid, and active transportation networks can be assessed through review of map layers and project records maintained by MAG and UDOT.

Table 1 presents the association between objectives, performance measures, and available data sources.

TABLE 1: OBJECTIVES & PERFORMANCE METRICS GRID			
Goal	**Objective**	**Performance Measures**	**Data Source**
Reduce Congestion & Improve Mobility	Develop an enhanced roadway grid network to disperse traffic, reduce travel times, and keep local trips off regional highways	Project Counts	MAG, UDOT Roads Map Layers
	Facilitate transit ridership with improved coverage and more frequent and reliable service	Transit Coverage	UTA
	Accommodate significant population and employment growth with proper spacing and design of arterials, expressways, and freeways	LOS, TTI, Percent of New Intersections at Target Spacing	Model, NPMRDS/iPeMS, MAG, UDOT Map Layers
	Maximize roadway efficiency through monitoring and deployment of network optimization strategies	TTI, Extent of Signal Optimization	NPMRDS/iPeMS, UDOT
	Maintain/improve vehicle and truck travel time reliability	LOTTR, TTTR, PTI	NPMRDS/iPeMS
Enhance Options for Transit and Active Transportation Modes	Facilitate a more frequent, expansive transit system that is reliable	Transit Ridership & Reliability	UTA
	Support development of multi-use paths, neighborhood connections, on-street bike lanes, sidewalks, and pedestrian-friendly development to connect current and future population and employment centers	Active Transportation Network Mileage	MAG, UDOT Map Layers
	Facilitate accessibility to public transportation options with a focus on first and last mile connections	Transit Connection Project Counts	MAG, UDOT Map Layers
Improve Air Quality and the Natural Environment	Increase transit and active transportation mode shares through improvements to transit coverage, service, and reliability and development of safe and attractive bicycle and pedestrian routes	Transit Ridership, Active Transportation Counts	MAG, UTA
	Improve the efficiency of the existing system	Non-Capacity Project Counts	MAG, UDOT
Enhance Transportation Network Safety	Reduce the frequency of fatal and serious injury crashes	Number of Serious and Fatal Crashes	UDOT Crash Data
	Reduce the frequency of vulnerable road user crashes	Number of Vulnerable Road User Crashes	UDOT Crash Data

VI. ANALYZE CONGESTION PROBLEMS & NEEDS

Travel time data compiled for the CMP are used to identify existing congested roadway segments through segment-level calculations of performance measures listed above. The Wasatch Front Travel Demand Model is calibrated with existing data and used to identify projected future areas of congestion. As noted above, congested roadway segments are identified as those operating at LOS E or worse or those with a TTI greater than 1.4.

Once existing and forecast future congested roadways are identified, further analysis is needed to determine if the congestion may be potentially mitigated with transportation demand management (TDM) and transportation system management (TSM) strategies alone (see Table 2), or if capacity increasing projects are needed in addition to TDM and TSM measures.

Details regarding TDM and TSM strategies employed in the CMP are presented below.

Although engineers, planners, and economists often have a preferred "solution" to congestion and mobility challenges, there really is no single solution. To be effective, one needs to examine how congestion mitigation actions complement one another and, over the long term, how these actions will influence future travel patterns.

To evaluate the need for additional capacity, MAG staff will model roadway congestion under three conditions, including an explicit "CMP" scenario to identify locations of moderate congestion that may be improved through TDM and TSM measures alone.

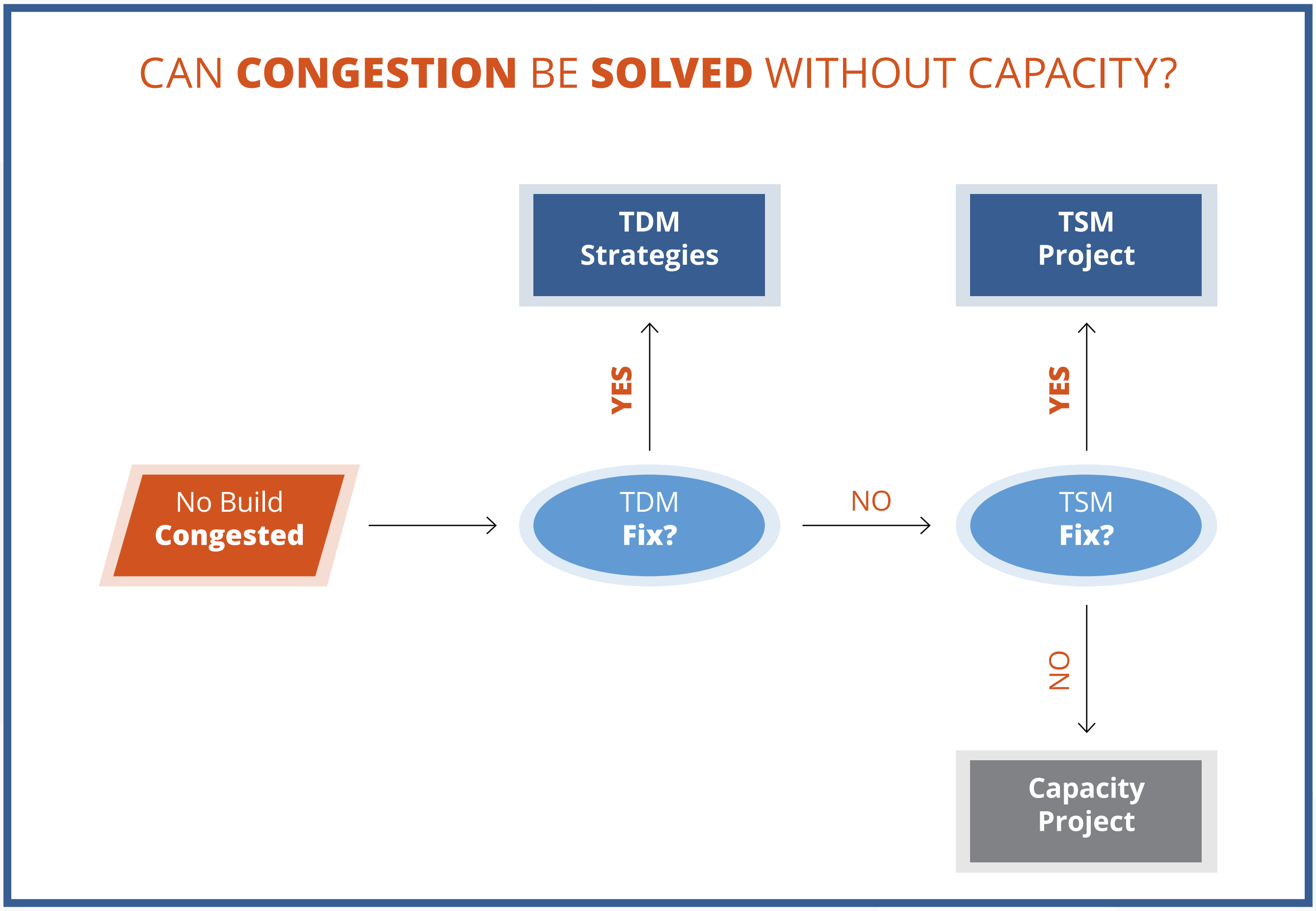
- **No Build**
- **CMP**
- **Build**

The **No Build** scenario examines conditions with projected future socio-economic data (population, households, and employment) and the existing roadway network and transit system with no capacity adding projects beyond those already committed in the TIP.

The No Build scenario results are used to identify congested corridors and evaluate the extent of projected congestion. Locations where TDM and TSM measures may adequately address congestion are flagged for further consideration. Locations deemed appropriate for TSM and TDM are identified and tested in the travel demand model, which mathematically reflects the impact of these efforts on assumed operations in the CMP scenario. The **CMP** scenario includes UTA planned future transit system upgrades and can incorporate adjustments to model assumptions on future penetration of connected autonomous vehicles (CAVs) and degrees of telecommuting and E-commerce. The CMP analysis assesses whether congestion is likely to be mitigated through TDM, TSM, or potential societal and technological shifts alone. Locations identified for TDM or TSM strategies are further reviewed in the context of the strategies listed below to identify appropriate operations projects for future programming.

Figure 2 outlines the CMP scenario modeling work flow, which starts with the No Build model results and tests whether non-capacity adding projects may adequately address congestion.

FIGURE 2: CMP Scenario Flow Chart



Where the need for capacity-adding projects is confirmed following the CMP scenario, roadway projects are added to the model and conditions are tested in the Build scenario. When projects identified in the **Build** scenario are pursued, they are done so with congestion management in mind and must incorporate TDM and TSM measures as appropriate to maximize and maintain the efficiency of the project.

VII. IDENTIFY & ASSESS STRATEGIES

In the coming decades the population of Utah County is projected to nearly double, from 700,000 today to 1.2 million by 2050. With this level of growth, adding general-purpose traffic capacity will be necessary in some cases to accommodate future travel and manage congestion. However, experience from around the country indicates that new travel demand will inevitably outpace the ability to provide new travel capacity alone, and a broad range of strategies will be needed to successfully accommodate transportation demand and manage congestion.

The ability to better manage the system, including maximizing the effectiveness of signal systems and maintaining existing traffic capacity, are strategies that should be given considerable attention. Better ways to manage demand for additional travel must also be considered.

More efficient means of travel should be identified and supported to allow existing revenue sources to meet the public's demand for efficient mobility. The following list provides many of the traditional, as well as nontraditional, congestion mitigation controls available to the Region.

TABLE 2: TRANSPORTATION DEMAND AND SYSTEM MANAGEMENT STRATEGIES

Transportation Demand Management Strategies

- Rideshare promotion
- Car sharing
- Staggered and flexible work hours
- Telecommuting
- Growth planning
- High occupancy vehicle (HOV) lanes
- Park-and-ride lots
- Active Transportation
- Employer commute programs
- Employer transit pass programs
- Trip reduction programs
- Congestion pricing
- Parking management
- Auto-related taxes/fees

Transportation System Management Strategies

- Signal system improvements/coordination
- Grid network connections
- Targeted Capacity additions
- Access management
- Intelligent transportation systems
- Transit signal priority
- Bus-only shoulder lanes
- Bus Rapid Transit
- Incident management
- Work zone management
- Reversible lanes
- Overpasses or underpasses
- Ramp metering
- Intersection/interchange geometrics
- Managed motorways
- Connected vehicles

Locations identified for TDM and TSM strategies are reviewed in the context of these available strategies and in partnership with facility owners to identify appropriate operations projects for future programming.

VIII. IMPLEMENTATION PROGRAM

The CMP is integrated into the MAG planning process with analysis occurring on a four-year cycle with the RTP. Operational TSM and TDM projects identified through the CMP can be considered for project submission to the RTP every four years and the TIP selection process every two years. The TIP selection criteria are used to encourage project sponsors to implement congestion mitigation strategies, to explore operational enhancements to new traffic capacity, to improve and maintain the efficiency of the system, and reduce the demand for single-occupant vehicles. Congestion Mitigation and Air Quality (CMAQ) funds play a significant role in these efforts.

New tools and dashboards to visualize and review roadway performance are currently being developed and will help support the implementation of CMP strategies in the future.

IX. EVALUATE STRATEGY EFFECTIVENESS

A better understanding of CMP strategies and their effectiveness in different situations can be achieved over time as different strategies are implemented and subsequent evaluation occurs.

Evaluation of strategy effectiveness at a regional level is achieved with each planning cycle update, as staff process data, identify congestion, and determine if progress is being made toward regional objectives.

Evaluation of specific project-level strategy effectiveness can be performed as conditions allow but is complicated by many factors affecting traffic performance that can change during the construction phase, such as growing traffic demand, altered travel patterns, impacts of adjacent construction projects, and changes in land use. However, when corridor-level projects are implemented in discrete projects, evaluation of corridor-level performance measures can be compared from data before and after implementation to gain insights into their effectiveness.

X. HELPFUL LINKS

https://magutah.gov/tip/

https://udottraffic.utah.gov/

https://travelwise.utah.gov/

https://www.utacommuter.com/uta2/Home/Home

https://www.fhwa.dot.gov/bipartisan-infrastructure-law/cmaq.cfm