9
CONGESTION MANAGEMENT PROCESS

9.0 Congestion Management Process

9.1 Introduction

Financial considerations, constraints on capacity expansion, and increasing congestion nationally and in Pueblo County are causing concern for the Metropolitan Planning Organization (MPO) and for the residents of the region. Pueblo Area Council of Governments' (PACOG's) metropolitan transportation planning process has traditionally focused on constructing and maintaining new roadways and widening existing highways; however, current challenges associated with transportation system reliability, safety, and security require new methods targeted to improve the operations of the existing system.

Additionally, renewed interest in efficient freight movement means that delays affecting tightly scheduled manufacturing distribution procedures can affect the economic viability of a region. An example in the PACOG region is the need for safe and convenient access for trucks to I-25. There is also an increasing recognition locally of the impact of congestion beyond the need for capacity for trucks. There is growing understanding of the significance of road construction, weather conditions, traffic incidents, special events, and emergency situations on the reliability of the transportation system. It is estimated that about half of regional traffic congestion is caused by temporary disruptions that take away part of the roadway from use ("non-recurring" congestion). Current challenges associated with transportation system reliability, safety, and security will require new strategies. These strategies are delivered by means of a Congestion Management System (CMS).

9.2 Background on Congestion Management

9.2.1 Definition

A CMS is an integrated approach to optimize the performance of existing infrastructure by implementing multimodal, intermodal, and often cross-jurisdictional systems, services and projects. This effort includes regional operations collaboration and coordination activities among transportation and public safety agencies. CMS is not routine road maintenance like resurfacing or guardrail replacement. CMS strategies improve system efficiency, enhance public safety and security, reduce traffic delays of road users, and improve access to information for travelers. The emphasis of CMS is an outcome-driven, performance-based system. CMS strategies include but are not limited to the following:

- Traffic incident management
- Travel information services
- Roadway weather information
- Freeway management
- Automatic vehicle location
- Traffic signal coordination
- Work zone management
- Electronic payment/toll collection
- Emergency response and homeland security
- Freight management
- Transit fleet management and dispatching.

9.2.2 Interface with NEPA, the Metropolitan Transportation Plan and the TIP

While the 2040 Long Range Transportation Plan (LRTP) must include Congestion Management planning, the effort is not intended to be viewed in isolation. In fact, a focus on improving transportation system management and operations can support other planning areasrs. For instance, congestion management strategies can:

- Emphasize preservation of the existing transportation system by focusing resources on optimizing existing capacity rather than building new capacity.
- Improve accessibility and mobility for all modes by implementing strategies that reduce recurrent and non-recurrent congestion and improve the efficiency of operations such as: transit bus priority, signal timing, and, when the region is ready, pricing.
- Support regional economic vitality by improving system reliability, which is valued by the freight and business communities.
- Increase safety by focusing attention on operational strategies such as driver

education, speed enforcement, and technologies to improve pedestrian safety.

- Enhance regional environment, energy conservation, quality of life, and consistency with planned growth by implementing programs to manage travel demand, providing traveler information to help avoid and reduce time stuck in traffic delay, and avoiding the need to develop new transportation infrastructure with negative impacts to the environment and communities.
- Increase security by improving communication and coordination between transportation agencies and law enforcement.

9.2.3 Objectives for Operations

Objectives related to Congestion Management are important to cite at the outset of this discussion. Regional operations objectives are specific, measurable statements of performance describing the desired operations of the regional transportation system. They are specific, agreed-upon measures of system performance that are time-sensitive and can be tracked on a regional level over time. The objectives should relate to both recurring and nonrecurring congestion, access to traveler information, emergency response, and ease of movement across modes and jurisdictions. These measurable regional operations objectives focus attention on the performance of the transportation system and ensure that the CMS is integrated into the long-range transportation planning process. An increased focus on Congestion Management within the 2040 PACOG LRTP will not only fulfill Moving Ahead for Progress in the 21st Century Act (MAP-21) requirements but also address pressing issues facing the Pueblo region, such as congestion, air quality, safety, and security.

And finally regional collaboration is a key component of Congestion Management. The two transportation facilities of focus in the region with serious congestion issues are I-25 and U.S. Highway 50. Both facilities are key corridors in Pueblo and have national significance. Developing effective operations objectives requires regional collaboration among the Colorado Department of Transportation (CDOT), Pueblo Transit Agency, Pueblo County, public safety officials, and PACOG and local entity transportation planners. It is in everyone's interest to establish a framework useful to all in the region.

9.2.4 Congestion Management Process

Within the overall RTP, there is a Congestion Management Process (CMP). The CMP is a systematic approach to identify the causes of congestion and develop solutions to address congestion problems. A CMP is required in metropolitan areas with populations exceeding 200,000, known as Transportation Management Areas (TMAs). Federal planning requirements stipulate that in all TMAs, a CMP must be utilized as part of the metropolitan planning process. Specifically, the federal requirements (23 CFR Part 500 Sec. 109) state that a CMP must include:

- Methods to monitor and evaluate the performance of the multimodal transportation system, identify the causes of congestion, identify and evaluate alternative actions, provide information supporting the implementation of actions, and evaluate the efficiency and effectiveness of implemented actions.
- Definitions of the parameters for measuring the extent of congestion and for supporting the evaluation of the effectiveness of congestion reduction strategies for the movement of people and goods.
- Establishment of a program for data collection and system performance monitoring to define the extent and duration of congestion, to help determine the causes of congestion, and to evaluate the efficiency and effectiveness of implemented actions.
- Identification and evaluation of the anticipated performance and expected benefits of appropriate traditional and nontraditional congestion management strategies.
- Identification of an implementation schedule, implementation responsibilities, and possible funding sources for each strategy.
- Implementation of a process for periodic assessment of the efficiency and effectiveness of implemented strategies, in terms of the area's established performance measures.

Within the process, goals are quite naturally translated into tactics, i.e. concrete steps or strategies that define the way forward. These strategies involve short-range actions and normally require a low level of capital investment. These types of actions are similar to measures classified as traditional Transportation System Management (TSM) strategies. PACOG will utilize measures defined in the previous LRTP as well as those emerging through the renewed focus on freight and non-motorized modes of travel. The CMP will help PACOG:

- Develop a definition of congestion.
- Identify congested locations.
- Determine the causes of recurring and nonrecurring congestion.
- Develop a menu of choices of strategies to mitigate congestion.
- Evaluate the potential of different strategies.
- Propose alternative strategies to address specific occurrences of congestion.
- Develop performance measures to assess the effectiveness of implemented actions and evaluate the level of congestion of the system.
- Establish a program for data collection to measure system performance.
- Set priorities among projects for incorporation into the Transportation Improvement Program (TIP).
- Restore natural ecosystems and wildlife habitat.
- Keep agricultural lands productive and vibrant.
- Preserve a "greenbelt" of open space as a community separator and scenic corridor along Interstate 25 between Pueblo and Colorado Springs.

9.3 Definition of Congestion

Among the immediate first tasks of the CMP is determining how to measure congestion. Congestion is a relative rather than an absolute condition, and a uniform measurement cannot be used for all facilities and cities. In the Pueblo region, roadway congestion is defined by a volume to capacity (V/C) ratio of 1.00 or greater. This corresponds to a Level of Service (LOS) F for regionally significant roadways.

Facilities with LOS D and E are designated as "approaching congestion" and contain V/C ratios with a range from 0.71 to .99V/CV/CV/C. Facilities with a LOS A-C can be described as generally "free-flow conditions" and are not considered congested. Some explanation of LOS is provided in the following section.

9.3.1 Levels of Service (Road Capacity)

The actual capacity of a given road cannot realistically be expressed in an absolute number such as 2,400 vehicles per lane per hour. The traffic stream is not uniform with regard to either weather conditions or driver behavior. The presence of friction from traffic entering or leaving a highway can also impact the through-put of traffic, as does operating speed, number of lanes, width of lanes, shoulder width, sight distance, horizontal (left or right) curvature, and vertical curvature (up and down, or grade) of the road.

What is typically used to measure capacity deficiency is the assignment of LOS to traffic facilities under various traffic flow conditions.[13] LOS measures the restrictive relationship between traffic speed, volume, and density and provides an index to the quality of traffic flow in terms of travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. Six levels of LOS are typically defined for each type of facility. They are given letter designations from A to F, with LOS A representing the best operating conditions and LOS F the worst. Since the LOS of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of LOS, depending on the time of day, day of week, or period of year. **Table 9.1** and **Figure 9.1** and provide tabular and visual definitions of LOS with respect to roads.

[13] Highway Capacity Manual 2010 (HCM2010), National Academy of Sciences, Transportation Research Board, Washington, DC, 2010.

Table 9.1: Typical Roadway Speed, Flow and Density Relationships

LOS	Speed Range (mph)	Flow Range (vehicle/hour/lane)	Density Range (vehicle/mile)
A	Over 60	Under 700	Under 12
B	57–60	700–1,100	12–20
C	54–57	1,100–1,550	20–30
D	46–54	1,550–1,850	30–42
E	30–46	1,850–2,000	42–67
F	Under 30	Unstable	67–Maximum

Source: HCM2010, National Academy of Sciences Transportation Research Board, 2010.

9.3.2 Levels of Service (Intersection)

Level of Service measurement can also be conducted at the intersection level for signalized intersections in terms of both control delay, which is a measure of driver discomfort or frustration, and increased travel time. The delay experienced by the motorist is made up of a number of factors that relate to control, geometrics, traffic, and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Specifically, LOS criteria for traffic signals are stated in terms of the average control delay per vehicle, typically for a 15-minute analysis period. Delay is a complex measure and depends on a number of variables, including the cycle length, the quality of the progression, the green ratio, and the V/C ratio for the lane group.

Intersection LOS A describes operations with low delay, which is described as 10 sec/vehicle (veh) or less. This LOS occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all.

Intersection LOS B describes operations with delay greater than 10 and up to 20 sec/veh. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop in LOS B conditions than in LOS A conditions, causing higher levels of delay.

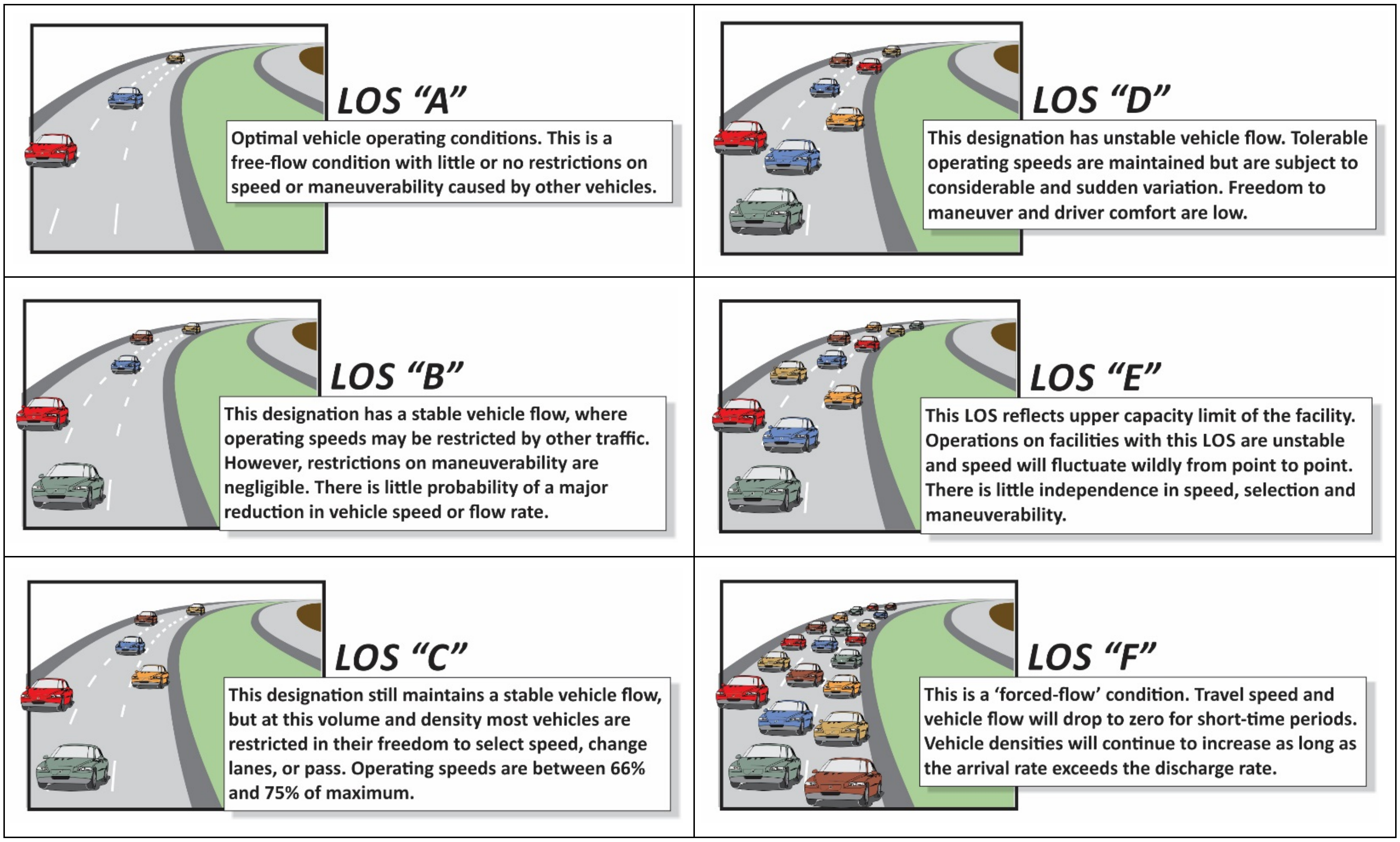
Intersection LOS C describes operations with delay greater than 20 and up to 35 sec/veh. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a given green phase does not serve queued vehicles and overflows occur. The number of vehicles stopping is significant in LOS C, though many still pass through the intersections without stopping.

Intersection LOS D describes operations with delay greater than 35 sec/veh and up to 55 sec/veh. Congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, and high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

Intersection LOS E describes conditions with delay greater than 55 sec/veh and up to 80 sec/veh. These higher delays indicate poor progression, long cycle lengths and high V/C ratios. Individual cycle failures are frequent.

Intersection LOS F describes operations with a control delay in excess of 80 sec/veh. This level, considered unacceptable to most drivers, often occurs with oversaturation – that is, when arrival flow rates exceed the capacity of the lane groups. It may also occur at high V/C ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.

Figure 9.1: Highway Capacity Manual Level of Service (LOS)



Source: HCM2010, National Academy of Sciences Transportation Research Board, 2010.

PACOG has prepared this LRTP with a focus on both motorized and non-motorized movement in the region. As a result, the application of LOS to road and intersection locations has little interaction with the travel of bicyclists and pedestrians. Traffic engineers no longer immediately add capacity to intersections in order to reduce delays for motor vehicles traveling during peak travel periods. Instead, motorized vehicle capacity needs and non-motorized travelers' needs are both included in the decision process. Changing stakeholders' expectations about the physical and operational design of intersections and how a signalized intersection should perform for all travelers (bicycle and pedestrian) are leading to increasing the threshold V/C ratio for motor vehicles.

Careful consideration of the likely impacts of potential improvements on pedestrians, cyclists, and the adjacent land uses before finalizing design decisions helps meet mobility and accessibility goals for all modes of transportation. Once the threshold of congestion is met and an intersection is listed as "saturated," the intersection should be evaluated as to the appropriate types of improvements that might be implemented and the potential impacts of those options. **Table 9.2** shows typical intersection capacity values.

9.4 CMP Goals and Strategies

The goals of the PACOG region related to operations and their identified measurements are to:

- Reduce total congested vehicle miles/hours of travel in the region.
- Optimize the function of existing facilities through Intelligent Transportation Systems (ITS) and surface condition improvements (measured by speed).

9.4.1 CMP Data Collection

Given these performance measures related to congestion, observed data is needed to establish a baseline and to evaluate the impact that the chosen strategies are having on the system. Classified vehicle counts and transit ridership are examples of routinely collected data. However, travel times and length of congested periods are more challenging to collect and analyze. Congestion in the Pueblo region exists; the challenge is how to measure it. The MPO has available a newly calibrated 2010 and 2040 travel demand model which can provide future traffic volumes and areas where congestion is expected to occur.

Table 9.2: Typical Daily Intersection Capacity Values

Uninterrupted Flow by LOS	Signalized by Green Split %		
	40%	50%	60%
20,000/lane/day LOS = E	8000	10,000	12,000
16,000/lane/day LOS = C-D	6400	8,000	9,600
/lane/day LOS = A-B			

Source: HCM2010, National Academy of Sciences, Transportation Research Board, 2010.

The PACOG 2040 LRTP is built on this travel demand model that describes the region, its socioeconomic/demographic patterns, its travel patterns, and its transportation system, both currently and in the future. While this usually means that vehicular volumes are growing, growth rates can vary by location and time of day. To monitor the performance of the system, data such as vehicular counts must be collected for roadway links represented in the regional modeling system. Basic data that was needed and collected included:

- **Traffic Counts** – Needed to monitor the changes in vehicular volume over time and to recalibrate the PACOG travel model in the next cycle. Counts are taken at locations around the PACOG region and compared to the modeled vehicular volumes for all links to determine if the modeled volumes are reasonable. The collection of traffic data is organized and standardized. CDOT counts are integrated with any city, county or MPO count collection data.
- **Travel Speed** – Actual vehicular travel speeds may be sampled along the major corridors in the county. This data can then be used to calibrate the model in the next cycle. Continuous collection of speed data allows comparison between scenario years to capture improvements in mobility, if, for example, I-25 is widened.

- In general, travel time data are collected through two types of techniques:
  - ✓ **Roadside techniques** (radar/laser) utilizing detecting devices physically located along study routes that obtain travel time data from vehicles traversing the route at predefined checkpoints.
  - ✓ **Vehicle techniques** utilizing detection devices carried inside the vehicle (these range from traditional stopwatch and clipboard techniques to use of distance measuring instruments and Global Positioning System (GPS) techniques).

Definitions of performance measures for management and operations that are relevant to the CMP include:

- **Travel Time** – Travel time measures focus on the time needed to travel along a selected portion of the transportation system and can be applied for specific roadways, corridors, and transit lines or at a regional level. Common travel time metrics include:
  - ✓ **Average travel time**, which can be measured based on travel time surveys.
  - ✓ **Average travel speeds**, which can be calculated based on travel time divided by segment length or measured based on real-time information collection.
  - ✓ **Travel time index:** the ratio of peak to non-peak travel time, which provides a measure of congestion.
- **Congestion Extent** – Congestion measures can address both the spatial and temporal extent (duration). Depending on how these measures are defined and the data that are collected, these measures may focus on recurring congestion or address both recurring and non-recurring congestion. Examples include:
  - ✓ **Lane miles of congested conditions** (defined based on V/C ratio, LOS measures, or travel time index).
  - ✓ **Number of intersections experiencing congestion** (based on LOS).
  - ✓ **Percent of roadways congested by type of roadway** (e.g., freeway, arterial, collector).
- **Delay** – Delay measures take into account the amount of time that it takes to travel in excess of travel under unconstrained (ideal or free-flow) operating conditions, and the number of vehicles affected. These measures provide an indication of how problematic traffic congestion is, and can address both recurring and non-recurring congestion-related delay. Examples of delay measures include:
  - ✓ **Vehicle-hours of recurring delay** associated with population and employment growth.
  - ✓ **Vehicle-hours of non-recurring delay** associated with incidents, work zones, weather conditions, and special events.
- **Travel Time Reliability** – Travel time reliability measures take into account the variation in travel times that occur on roadways and across the system. Examples of measures include:
  - ✓ **Buffer time**, which describes the additional time that must be added to a trip to ensure that travelers will arrive at their destination at, or before, the intended time 95% of the time.
  - ✓ **Buffer time index**, which represents the percent of time that should be budgeted on top of average travel time to arrive on time 95% of the time (e.g., a buffer index of 40% means that for a trip that usually takes 20 minutes, a traveler should budget an additional 8 minutes to ensure on-time arrival most of the time).
  - ✓ **Percent of travel when travel time is x%** (e.g., 20%) larger than average travel time.
- **Customer Satisfaction** – Examines public perceptions about the quality of the travel experience, including the efficiency of system management and operations. Customer satisfaction is typically measured through surveys and may include measures such as:
  - ✓ Percent of the population reporting being satisfied or highly **satisfied with travel conditions**.
  - ✓ Percent of the population reporting being satisfied or highly **satisfied with access to traveler information**; and

- ✓ Percent of the population reporting being satisfied or highly **satisfied with the reliability of transit services**.

9.4.2 Strategies and Solutions

CMP strategies will be considered and analyzed in connection with all investments in the plan either as individual "stand-alone" projects or as part of another transportation project. Potential congestion management strategies for the Pueblo region are summarized in the following four topic areas. It is important to understand that both the data collection and the solution sets for congestion management in the PACOG region are well under way with an eye to future enhancements and improvements.

As data becomes richer and more available, the targeted congestion relief projects will become easier to measure.

Construction of New Lanes – The addition of general-purpose lanes in response to inadequate arterial roadway capacity has been a mainstay in dealing with congestion in this region. Additional general-purpose lanes may still need to be added. The number of lanes that should be provided to meet anticipated traffic demands along an arterial roadway is a discrete number; e.g. 4, 6, or 8 through lanes. The volume-to-capacity comparisons should be rounded upward to determine number of lanes that are needed. For example, when 2.3 lanes are needed in each travel direction, the total number of necessary through lanes becomes 6.0. Hence, whether the V/C ratio results in 4.3, 4.4, or 4.6 lanes, the same number lanes should be provided. Therefore, in many situations, the average daily capacity per lane provides a reasonable basis for making design decisions. These average daily capacities should be based on actual operating experience. In establishing future lane requirements, it is desirable to provide some capacity reserve. Accordingly, a value of about 16,000 vehicles per lane per day per hour of green is suggested for design purposes. The anticipated future daily volume can be compared with this number to estimate future lane requirements for any green-per-cycle ratio.

Lane capacity and LOS values, as shown above in **Table 9.2,** indicates that additional lanes are needed when daily volumes exceed 8,000 to 12,000 vehicles per lane per day (depending on the green/per cycle ratio). For design purposes, daily volumes that exceed 6,400 to 9,600 vehicles per lane per day will need additional lanes.

Intelligent Transportation Systems (ITS) – The vision for ITS is to: "Improve the mobility, safety, and comfort of the multi-modal transportation system and support economic development in the region while protecting the natural environment through real time management of the transportation system and providing reliable, timely and accurate traveler information to all users of the system."

ITS components can include:

- Computerized signal systems
- Traffic control and surveillance equipment
- Motorist information systems
- Roadway channelization
- Intersection improvements.

Transportation Demand Management – There are two sides to any transfer of services: supply and demand. Traditional CMP strategies increase transportation supply by more effectively operating the roadway system. In contrast, travel demand management (TDM) strategies indirectly change the demand for travel by spreading the timing of travel to less congested periods; shifting the routing of vehicles, including trucks and single-occupant vehicles, to less congested facilities; and reducing the need to travel at all.

Managing demand means providing all travelers, regardless of whether they drive alone, with choices of location, route, and time, not just mode of travel. TDM strategies include parking pricing, transit and vanpool benefits, flexible work schedules, compressed workweeks, telecommuting, satellite work centers, dynamic message signs, and decreased transit fares.

Real-time information systems can help travelers make better decisions about how they travel (mode), when they travel (time of day), where and whether they travel (location), and which route they travel (path). These information systems can be used at employment centers and to manage critical shifts in demand such as occur for special events, tourist activity, incidents and emergencies, schools, shopping centers, recreation areas, medical facilities, weather problems, and reconstruction projects.

Access Management and Corridor Preservation – Access Management makes more efficient use of the existing roadway system while considering the context in which the improvements are needed. Consolidating access points and using frontage roads can protect the capacity of the road well beyond that of a similar road lacking access control, reducing the need for expansion or replacement. Access management is best incorporated into the initial project planning and design. This avoids costly future expenditures for road expansion or even repurchase of access rights. A related issue that has recently received attention is corridor preservation. This entails preserving rights-of-way for new or expanded roads in order to reduce the amount of development near the property that is needed for construction. This can greatly reduce the cost of projects and shorten the time needed to construct projects.

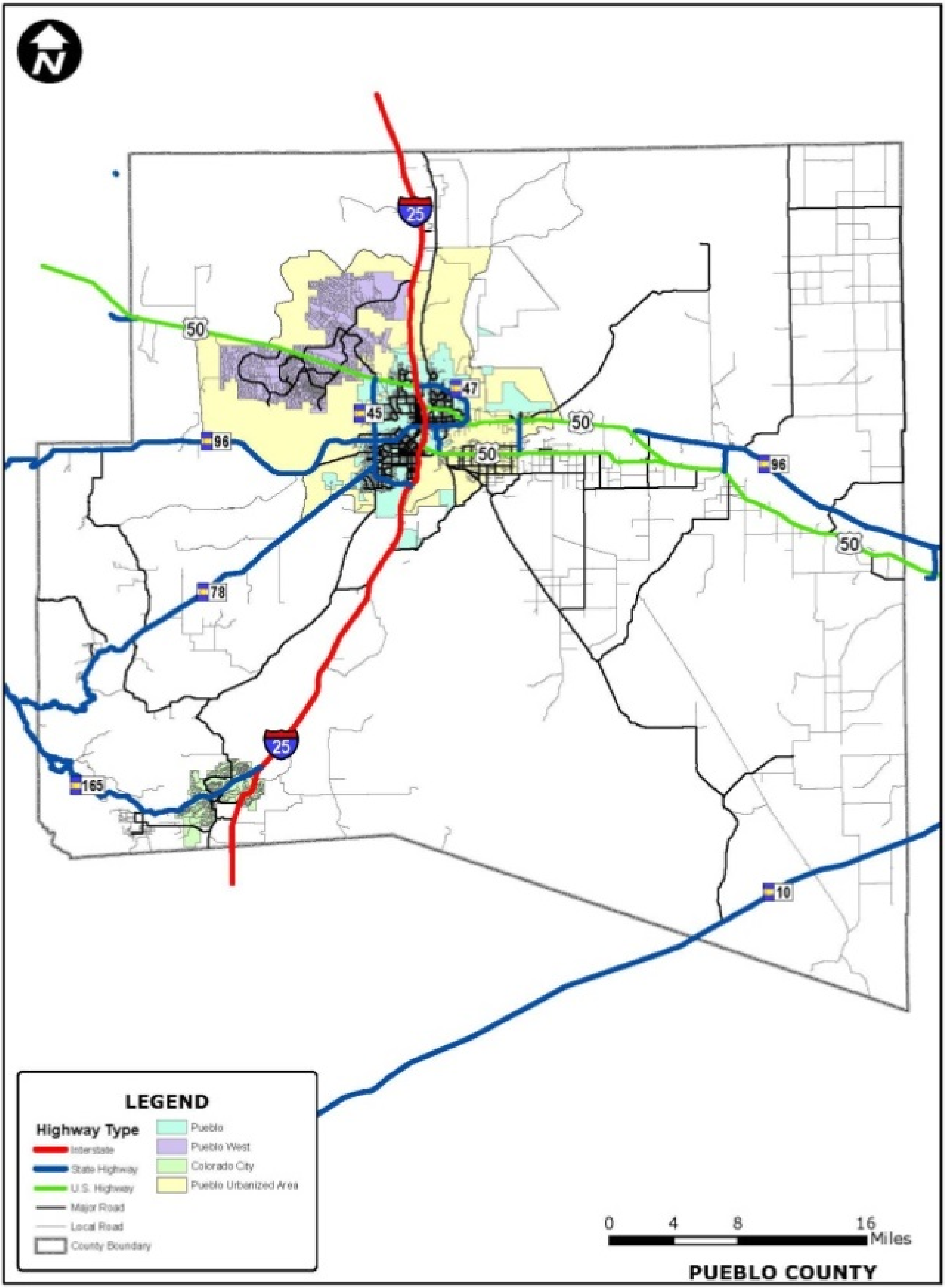
9.5 PACOG Congestion Management Program

The PACOG CMP begins with a definition of the corridors of focus in the region. CMP corridors are defined by the degree to which a corridor provides mobility and capacity for regional traffic. The CMP corridors carry - or are projected to carry in 2040 - at least 30,000 vehicles per day (vpd). The volume threshold was selected as it approaches the point where six-lane urban and suburban arterial streets with at-grade intersections are generally necessary. The CMP utilizes posted speed and corridor lengths to establish priority corridors within the region. It has been the experience of engineers and planners that when volume thresholds lower than 30,000 Vehicles per Day (vpd) are considered the result is almost universal coverage in the region of CMP corridors. Following is a summary of the thresholds used in defining the CMP corridors:

- **Strategic Corridors** – Serve regional traffic; projected to carry at least 30,000 vehicles per day on at least one segment of the corridor, posted speed of 55 mph on at least one segment of the corridor and a minimum of 10 miles long.
- **Significant Corridors** – Serve regional traffic; projected to carry at least 30,000 vehicles per day on at least one segment of the corridor, posted speed of 45-55 mph on at least one segment of the corridor and a minimum of 5 miles long.

Based on these criteria, the information set forth in the Existing Conditions section of this report, PACOG Travel Model runs for 2040, and local knowledge, the Strategic CMP corridors in the PACOG region have been established as I-25 and U.S. Highway 50. These facilities cross the county north-south (I-25) and east-west (U.S. Highway 50). These are shown in **Figure 9.2** and **Table 9.3**.

Figure 9.2: PACOG CMP Corridors



9.5.1 CMP Data Collection

Data related to transportation are collected to develop performance measures used to assess the effectiveness and efficiency of the transportation system. Traffic data such as travel time, speed and delay are often used to describe mobility in a less technical way. Performance measures are derived from the vision, goals, and objectives established for the plan. The CMP is designed to put into action the visions and goals relating to congestion of the planning process by transforming the goals into specific objectives, identifying where goals are not being met, and coming up with strategies to achieve the goals. One of the first means of presenting the importance of I-25 and U.S. Highway 50 in the region is to show how much daily VMT each generates in 2040. **Table 9.4** shows the 2040 projected Vehicle Miles of Travel (VMT) for the two strategic corridors as well as the percentage of regional VMT that they carry.

Performance measures may be used either at a system-wide scale or at a corridor or transportation-facility level in order to determine where deficiencies exist and to prioritize strategies and funding to the most critical problems.

For instance, by identifying locations with the greatest recurrent and non-recurrent traffic congestion using performance measures in the CMP, an MPO can help to direct funding toward facilities with the greatest scope, extent, or duration of congestion.

For the PACOG region, the performance measures selected is volume/capacity of the CMP corridors. The V/C ratio is a measure of the amount of traffic on a given roadway in relation to the amount of traffic the roadway was designed to handle. This measure provides an indication of the extent to which a road segment's capacity has been utilized. In the PACOG region as shown in **Figure 9.3** and **Figure 9.4**, recurring congestion takes place in both the morning peak hour and the evening peak hour. U.S. Highway 50 emerges as a facility congested in 2010 with worsening congestion in the future year. The congestion has a high degree of directionality – inbound in the AM and outbound in the PM. I-25 has lighter but persistent congestion also by direction, inbound in the AM and outbound in the PM.

Table 9.3: PACOG Strategic Corridors

Facility Name	From	To	Centerline Length (mi.)
Interstate-25	Pueblo County Line (north)	Pueblo County Line (south)	48
U.S. Highway 50	Pueblo County Line (west)	Pueblo County Line (east)	65

Table 9.4: 2040 Projected VMT on Strategic Corridors

Strategic Corridor	Daily VMT	% of Regional VMT
Interstate-25	1,989,231	31%
U.S. Highway 50	1,035,060	16%

Figure 9.3: AM Peak Hour Congestion Level on CMP Corridors (2040)

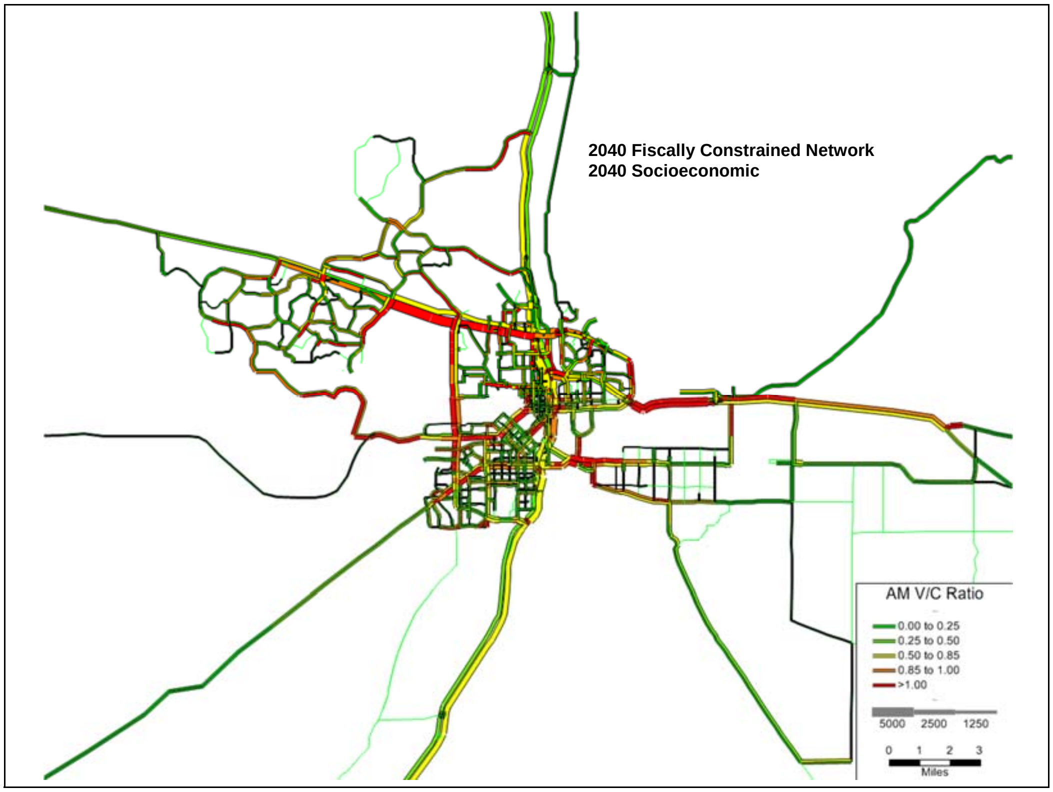
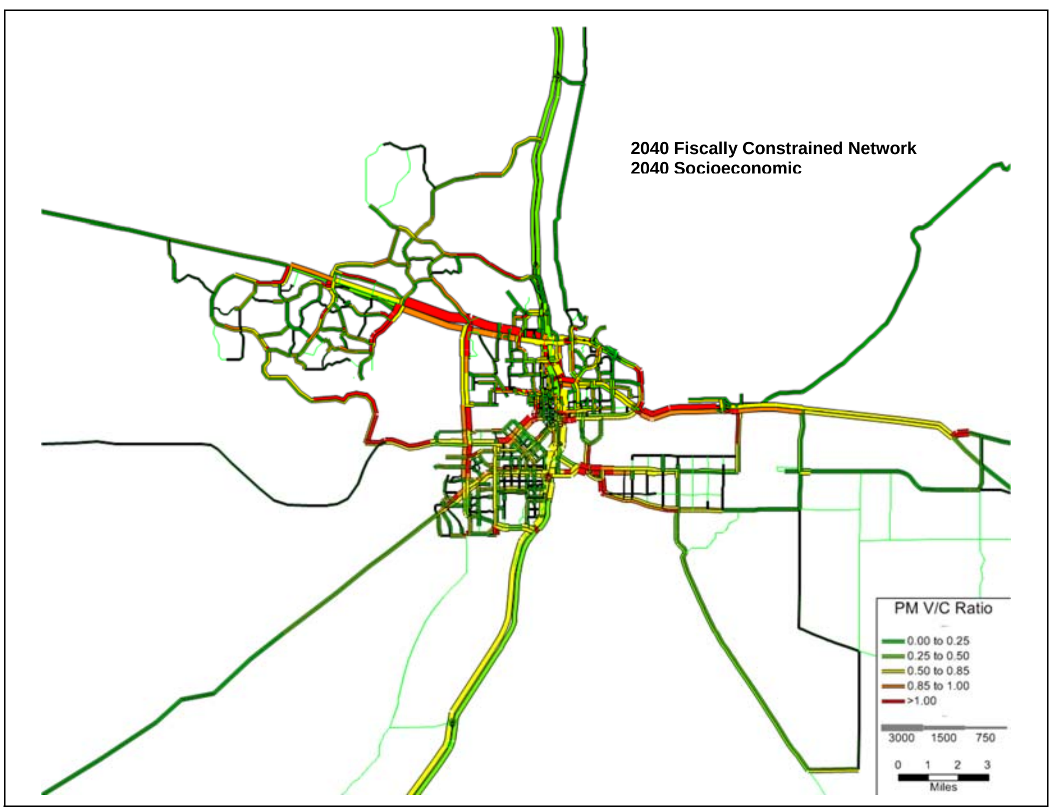


Figure 9.4: PM Peak Hour Congestion Level on CMP Corridors (2040)



9.5.2 CMP Corridor Plan

The starting point for congestion relief is to organize and tabulate a set of tools. **Table 9.5** shows the strategies and specific details for managing the congestion on the two CMP corridors. The table contains both system-related and capacity-related strategies, which include Roadway Capacity Improvements, TSM, TDM, Bicycle and Transit.

The tools described in **Table 9.5** are an important start to the CMP process. It must be understood that CMP corridor plans are to be developed in collaboration with local communities with a guiding philosophy that corridor plans include only tools and projects that are appropriate for representative corridors. The proposed plans for each CMP corridor are regional in nature and will assist local communities and PACOG in developing projects to manage congestion.

The Congestion Management Plans for the two CMP corridors, I-25 and U.S. Highway 50 are presented in **Table 9.6** and **Table 9.7**.

Table 9.5: Congestion Management Plan Tools

Type	Tool	Summary Description
Roadway Capacity Improvements	Construct new Roads and Bypasses	New roadway construction that will provide traffic congestion relief to a parallel or complementary facility.
	Arterial Grade Separation	Add travel lanes to existing roadways to increase their carrying capacity thereby relieving congestion.
	Freeway Ramp or Interchange Reconstruction	Reconstruct a freeway ramp or interchange where an existing facility is operating over capacity and where improvements to alternative facilities cannot provide relief.
	Connectivity / Gap Elimination	New roadway construction that eliminates gaps in the transportation system while improving connectivity to other corridors.
Transportation System Management	Access Management	Minimize conflict points and improve traffic flow by limiting the number of curb cuts and median cuts along a roadway.
	Intersection Improvements	Improve traffic flow through an intersection by constructing or extending right-turn and/or left-turn lanes or other geometric improvements that increase operational capacity. Projects may include turn-lane construction, signal removal, roundabout construction, or continuous-flow intersections.
	Signalization Optimization	Enhance signal operations for emergency response, automobiles and buses through technological upgrades and integration of traffic control devices at congested intersections.
	Reconstruction or Widening of existing lanes	Improve traffic flow by widening substandard traffic lanes.
	All Modes Roads Reconstruction	Reconstruct existing roadways to accommodate multi-modal transportation.
	Bottleneck Removal	Construct additional capacity at "hot-spots" to improve traffic flow.
	One way paired streets	Conversion of bidirectional streets to one-way paired streets to improve traffic operations.
	Freeway Ramp Monitoring	Facilitate freeway traffic by regulating the amount of traffic entering the facility from on-ramps.
	Intelligent Transportation Systems	Technological improvements that enhance the operations of the existing transportation system. Projects many include incident detection and response, motorist information assistance, real-time routing, and enhanced bicycle/pedestrian systems.
	Incident Management and Mitigation	Construct improvements at high accident, high volume locations to address recurring delay due to crashes and emergency response.
Travel Demand Management	Parking Management'	Encourage multi-occupant vehicle trips by providing preferential parking for carpool vehicles.
	Carpool/Vanpool Programs	Develop programs that encourage and support increased vehicle occupancy.
	Employer-Based Programs	Implement programs that provide incentives for employers to allow employees to telecommute, stagger work hours away from peak traffic periods, use flex time and compressed work weeks.
Bicycle	Non-Motorized Infrastructure Development	Develop programs and construct projects that enhance the bicycle and pedestrian infrastructure.
	Non-Motorized Optimization	Encourage the use of the non-motorized mode by removing barriers. Work to develop a regional and sub-regional unimpeded bikeway.
Transit	Non-Motorized Infrastructure Development	Improve transit service by reducing headways, providing longer hours of service, expanding the service areas or providing more days of service.
	Non-Motorized Optimization	Implement technological advancements and improve transit facilities to encourage "choice" ridership.

Table 9.6: Interstate 25 Congestion Management Plan

Congestion Management Summary – Interstate 25 Corridor			
Strategic Corridor Interstate 25 is the primary corridor un the PACOG region. It carries the highest volume of traffic of any road in the area and is the key roadway for linking commerce with the Front Range and the rest of the country. I-25 traverses all of Pueblo County from north to south. The CMP tactics recommended for I-25 are Roadway Capacity Improvements, TSM, TDM, bicycle and transit.			
2010 Congested Extent			
2010	Segment Location	Highest Link Total Volume (PM hourly)	V/C Ratio (PM Peak Hour)
	Southbound Interstate 25 just south of First St Exit	2,504	0.74
2040 Congested Extent			
2040	Segment Location	Highest Link Total Volume (PM hourly)	PM Peak V/C
	Southbound Interstate 25 just south of First Street Exit	3,165	0.93
CMP Tools			
Roadway Capacity	• I-25 through Pueblo (RAMP) - from Ilex to City Center Drive		
	• I-25 North 13th Street to US 50 B Interchange		
	• I-25 Eastside Frontage Road		
TSM	• I-25 Corridor Access and Hazmat Study		
	• I-25 - ITS Traffic Cameras		
	• Investigate dynamic message signs and motorist information assistance		
TDM	Investigate Carpool and Vanpool programs to adjacent county work locations.		
Bicycle	Investigate bicycle facilities that use potential Right-of-Way in the expanded I-25 corridor, including connections north along Fountain Creek.		
Transit	Remain active with the CDOT Bustang Interregional Express Bus service to get extension of service to Pueblo.		
	Provide more frequent service, longer hours of service, greater service area or additional days of service for transit.		
	Implement a real-time information system for bus arrival at stops.		

Table 9.7: U.S. Highway 50 Congestion Management Plan

Congestion Management Summary – U.S. Highway 50			
Strategic Corridor U.S. Highway 50 is the second most important roadway in the PACOG region. It carries the second highest volume of traffic of any road in the area and is the key roadway for linking commerce through and within the county as well as to points west and east. U.S. Highway 50 traverses all of Pueblo County from west to east. The CMP tactics recommended for U.S. Highway 50 are Roadway Capacity Improvements, TSM, TDM, bicycle and transit.			
2010 Congested Extent			
2010	Segment Location	Highest Link Total Volume (PM hourly)	V/C Ratio (PM Peak Hour)
	Westbound U.S. Highway 50 from just west of Pueblo Boulevard	2,294	0.94
2040 Congested Extent			
2040	Segment Location	Highest Link Total Volume (PM hourly)	PM Peak V/C
	Westbound U.S. Highway 50 from just west of West Fortino Boulevard	3,163	1.17
CMP Tools			
Roadway Capacity	• U.S. Highway 50A West (EB) - Add the third lane and trail facilities, improve pedestrian crossings at signalized intersections (RAMP)		
	• U.S. Highway 50A West (WB) - Complete the EA from Wills to McCulloch Blvd., Add the third lane from Wills to the hill just West of Pueblo Blvd., Realign to be Parallel to the EB alignment, Construct a New Bridge, and Rebuild the Signal at US50/Pueblo Blvd to Accommodate the new WB alignment and traffic flow, as well as Improve pedestrian crossings at signalized intersections		
TSM	• U.S. Highway 50B (between 332.1 and 333.9) (Continuous left lane where US 50C and US50B meet)		
	• U.S. Highway 50 Access Management Plan		
	• U.S. Highway 50/Bonforte Boulevard./Hudson Avenue		
TDM	Investigate Carpool and Vanpool programs to adjacent county work locations.		
Bicycle	U.S. Highway 50A West (EB) - Add the third lane and trail facilities, improve pedestrian crossings at signalized intersections (RAMP)		
Transit	• Provide more frequent service, longer hours of service, greater service area or additional days of service for transit.		
	• Implement a real-time information system for bus arrival at stops.		

9.6 Summary

PACOG, as the MPO for the Pueblo region, recognizes that implementation of the majority of congestion management strategies must rest with local operating agencies. Many of these agencies are indeed already making progress towards their diverse goals. There is much to be gained by working together on common goals aimed toward the resolution of regional problems. PACOG will continue refinement of congestion performance measures. Data collection, model improvement and work with the CMP metrics will continue. PACOG and associated local governments in the metropolitan planning area will participate in the identification of activities to address congestion problems on individual facilities through established planning processes: TIP, long-range plan development, congested corridor feasibility studies, and the Congestion Mitigation Air Quality (CMAQ) program and other. Appropriate strategies will be selected and implemented.

The PACOG region can improve performance and reduce congestion using an objective-driven and performance-based transportation planning process that specifically considers Congestion Management strategies that address safety, security, mobility, recurring and nonrecurring congestion, and other issues. These strategies will result in a mix of infrastructure and operational strategies founded on measurable, regional, performance-based objectives.