Congestion Management Process: A Case Study

U.S. Department of Transportation
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Capital Area Metropolitan Planning Organization

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The Capital Area Metropolitan Planning Organization (CAMPO) in Austin, TX, has been engaged in congestion management planning since 2001 with continued improvement over the past decade. A primary element of the current Congestion Management Process (CMP) is a database that includes information on travel times, crashes, and transit performance; it serves the region for many purposes. In addition, CAMPO provides a yearly "State of the System" report, and integrates the most recent data into each update of the metropolitan transportation plan (MTP). The CMP, like many other CAMPO planning activities, is a collaborative effort. The members and staff rely heavily upon the use of committees and working groups to lead transportation decision making.

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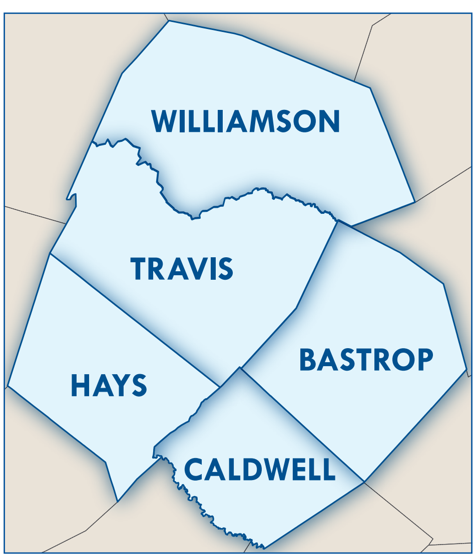


Source: CAMPO.

Background on CAMPO

Austin is located along the Colorado River in Central Texas. Based on the July 2009 U.S. Census estimate, it is the fourth largest city in Texas and the 15th largest in the United States. Austin was the third fastest-growing large city in the Nation from 2000 to 2006, and is home to the main campus of the University of Texas. The metropolitan region that CAMPO supports includes Bastrop, Caldwell, Hays, Travis, and Williamson Counties and is the 35th largest in the country. The MPO is designated in attainment with regard to air quality conformity, but is actively preparing for potential designation as non-attainment under the anticipated change to the ozone standard.

CMP Process Model

The congestion management process used by CAMPO represents a cooperative regionwide program for data collection and system performance monitoring. The Congestion Management Process/Intelligent Transportation System Working Group (CMP/ITS WG) is composed of diverse stakeholders within the region and oversees the system monitoring process. The goal of the CAMPO CMP as stated in the *2035 Regional Transportation Plan* is to provide an "objectives-driven and performance-based" approach to managing congestion. The CAMPO CMP is organized into four basic steps that occur within a 2-year cycle. The steps are: (1) CMP network validation/update, (2) data collection and analysis, (3) congestion management strategy selection, and (4) monitoring implemented strategies. Information provided within the CMP is available for use by local jurisdictions and decisionmakers, the CAMPO planning staff, Texas Department of Transportation (TxDOT), and others in the region for a variety of purposes.

Step 1 – CMP Network Validation/Update

Traffic data collection for congestion management began in 2001 and was conducted again in 2002 to provide the basis for the initial CMP (called a Congestion Management System at the time). Collected traffic data in 2003 (Travis County) and 2004 (Williamson and Hays Counties) established the first CMP network for the entire region. This network and the supporting historical data have been evaluated and updated every 2 years. Roadways may be added or removed from the network during this evaluation period in consultation with member jurisdictions and the CMP/ITS WG. This network is the basis for CMP data collection and monitoring.

Congestion on the network is identified by the Congestion Index (CI). The CI is the ratio of actual average speed to posted speed as identified by travel time runs. Roadways are categorized based on CI as indicated in figure 1, and those that fall into the congested range are considered a priority for congestion relief projects. The CMP/ITS WG reviews the staff recommendation on the CMP network and provides final approval.

Step 2 – Data Collection and Analysis

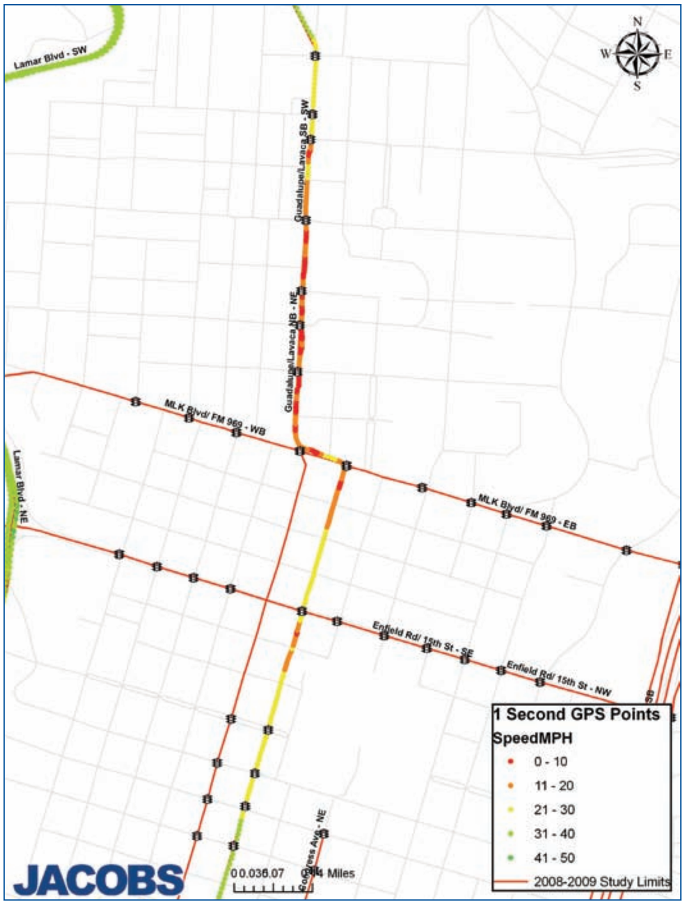
Data collection and analysis is the core of the CAMPO CMP. Data are compiled, analyzed, and reported within the Roadway Congestion Analysis: Performance Report and Information System (RCA). Travel time data collected are based on three travel time runs in each direction during defined peak periods. The 2007 study collected data over 860 miles of roadway and the 2009 data represent 925 miles: representing more than 1,800 directional miles during each peak period. It is anticipated that future analysis will expand to cover Bastrop and Caldwell Counties as well. Travel time runs are conducted under contract and represent a significant expense for the CMP program. The ArcGIS database that supports the CMP is updated with this information so that comparisons can be made to previous data collected and analysis can be conducted. Using GIS also ensures that information can be displayed online or in printed maps for further dissemination of the information (see figure 2).

Figure 1: Summary of Congested Roadways for A.M. and P.M. Periods

Peak Period	Measure	Roadway Condition			Total
		Free Flow	Stable	Congested	
A.M.	Number of Miles	510	824	497	1,831
	Percentage of Miles	28%	44%	28%	100%
P.M.	Number of Miles	524	794	513	1,831
	Percentage of Miles	28%	43%	29%	100%

Source: Jacobs Engineering Group, Inc., *Roadway Congestion Analysis: Performance Report and Information System, Fall 2008/Spring 2009*, prepared for CAMPO, September 10, 2009.

Figure 2: Example of Travel Time Collected Data from the Roadway Congestion Analysis Program



Source: Jacobs Engineering Group, Inc., *Roadway Congestion Analysis: Performance Report and Information System, Fall 2008/Spring 2009*, prepared for CAMPO, September 10, 2009.

Although travel time runs with their associated video component represent the most reliable data source available for measuring congestion, CAMPO considers other data from secondary sources as well. ITS sensor data are collected on freeways in the region and provides specific information for those facilities. Other data include volume/capacity ratio from the travel demand model, crash rates from the TxDOT CRIS database, and transit performance statistics provided by Capital Metro.

Real-time data collected from ITS sensors are supported by the MPO and represent both a benefit and a challenge to staff for use in the planning process. Sensor data are provided as continuous records with a considerably higher level of detail than other available data. This requires data to be extracted at an appropriate level of detail in order to be useful. The MPO does not have sufficient staff resources with the required skills to handle this task. In addition, sensor data have not always been consistent with travel time data collected, bringing both the accuracy and the adequacy of the sensor data into question.

Both TxDOT and the Texas Transportation Institute (TTI) are strong partners with CAMPO in data collection and analysis. In consultation with TTI, CAMPO is considering purchasing global positioning system (GPS) data to supplement or eventually replace the need for travel time runs. As the congested network expands, the benefit/cost ratio must be considered in data collection efforts. TTI has also consulted with the Houston-Galveston Area Council (H-GAC) to purchase GPS data. CAMPO intends to consider the results of this effort prior to changing its data collection protocol. TxDOT District staff provides support for some analysis related to congested areas through the use of CORSIM and other tools. The CAMPO travel demand model is a 24-hour model and supports the CMP in scenario comparisons and volume to capacity (v/c) comparisons, but is not sufficient for detailed segment analysis.

Historically, data collection indicates that less than 30 percent of the major arterials and freeways in the region are congested. Many of the congested areas are categorized as bottlenecks because they occur at an intersection, interchange, or small roadway segment. In some instances dealing with several bottlenecks along a corridor can relieve congestion on the entire corridor. Bottleneck areas of congestion are considered specifically within the Bottleneck Committee that is composed of representatives from CAMPO, TxDOT, and individual jurisdictions. This committee meets on a regular basis to discuss individual bottleneck locations, identify potential strategies as well as funding to support improvements, and prioritize implementation.

Step 3 – Strategy Selection

The application of congestion management strategies within the CAMPO CMP is most routinely applied at the project level. CAMPO requires that all Transportation Improvement Program (TIP) projects have at least two associated congestion management strategies. Because project funding can be from several different sources including local funding, the project sponsor is provided with a menu of strategies from which to select the specific way to address congestion within a transportation improvement project. Figure 3 provides the current list of strategies.

Figure 3: Congestion Management Mitigation Measures Identified in 2035 MTP

Measure Number	Measure Type	Measure Description
1	Access Management	Limit the number of driveways and intersections on arterials and highways and/or construct medians to control turning movements.
2	Bicycle Improvements	Provide paths and bike lanes, provide bike parking, integrate bicycle facilities with transit, and/or ensure a safe and secure system for bicyclists.
3	Commuter Trip Reduction Programs	Encourage commuters to use alternative models for trips to work and school (using financial incentives or parking pricing incentives).
4	Congestion Pricing	Charge motorists directly for driving on a particular road or in a particular area during congested periods.
5	Motorist Information Systems	This can include changeable message signs, radio reports, and/or Internet information about traffic conditions.
6	Express Lanes	Provide dedicated lanes for travel from suburban or urban areas to suburban or urban areas that have limited access and egress points.
7	Freight Movement Management	Shift freight to less congested routes and/or restrict freight travel in congested corridors during peak periods.
8	Grade Separation	Change traffic flow by providing grade separations for rail and/or vehicular travel.
9	HOV/HOT Lanes	Give rideshare and/or transit vehicle priority over general traffic through special lanes, traffic control devices, and/or charge tolls for single occupant vehicles.
10	Incident Management	Provide centralized traffic management centers, video traffic surveillance, emergency response teams, and/or special resources for dealing with specific problems, such as tow-trucks for stranded vehicles.
11	Intersection Improvements	Provide additional lanes at the intersection approach, left- and right-turn lanes, and/or improved signal synchronization.
12	Intelligent Transportation Systems	Provide driver information, vehicle control and tracking systems, transit improvements, and/or electronic charging of tolls.
13	Land Use Planning	Establish land use controls that encourage the use of transit, bicycle and pedestrian facilities, and/or ridesharing.
14	Multimodal Facilities	Provide a facility that links multiple modes of transportation (such as a bus, carpool, and bicycle facility in one location).
15	Park and Ride Facilities	Parking facilities at transit stations, bus stops, and highway onramps, particularly at the urban fringe intended to facilitate transit and rideshare use. Some include bicycle parking. Parking should be free or significantly less expensive than in urban centers.

Measure Number	Measure Type	Measure Description
16	Parking Management and Pricing	Charge a fee for parking in urban centers. Manage the amount of parking added to urban centers through land use controls.
17	Pedestrian Improvements	Improve sidewalks, crosswalks, and paths; accommodate special needs (such as people in wheel chairs); provide street furniture (such as benches) and/or safety facilities (such as lighting).
18	Ramp Metering	Control the number of vehicles that can enter a highway ramp during congested periods.
19	Rideshare Programs	Promote people sharing a car or van to get from home to work and back.
20	Traffic Calming	Provide facilities that cause motorists to drive at slower speeds (such as speed humps) and/or encourage motorists not to idle (such as roundabouts with yield signs instead of stop signs).
21	Transit Improvements	Promote and improve various types of services using shared vehicles to provide mobility to the public (such as fixed route transit bus, express commuter bus, mini bus, shuttle services, light rail, and/or heavy rail).
22	Other Improvements	Improvements not listed in this table.

Source: CAMPO, *2035 Regional Transportation Plan* Appendices, May 2010.

Although this method of identifying strategies provides assurance that congestion is addressed in the planning process, there is currently no specific connection to these identified strategies when projects move into the environmental review stage. CAMPO staff have an established relationship with TxDOT's National Environmental Policy Act (NEPA) practitioners from efforts to integrate planning and NEPA. Ongoing interface and exchange of documentation to support the NEPA process will ensure that strategies are considered within project funding and therefore become implementable along with any capacity improvements.

Step 4 – Monitoring Implemented Strategies

The primary method of monitoring the CMP network for improvement is through the RCA. Historical trends on individual roadways support an understanding of the effectiveness of individual strategies. The CAMPO staff have identified that this system of monitoring can be greatly improved through direct feedback from project sponsors and implementing agencies. This use of feedback has been identified as a potential future enhancement to the CMP.

In the past performance measures such as congestion index, intersection delay, and v/c ratio have been used in studies and reports. The *2035 Regional Transportation Plan* contains a broader list of performance measures identified for incorporation into the CMP. The new measures consider crash rates, transit performance, and ITS data as inputs to system performance monitoring. The new measures will be implemented during the next planning cycle through coordination with TxDOT and Capital Metro.

The CAMPO region employs several ITS technologies on both freeways and major arterials, including ITS cameras, dynamic message systems, lane control signs, and signal systems. The Regional ITS Architecture and Deployment Plan provides a framework for implementing projects and sharing resources among agencies. Collaboration is evident in the

ITS Architecture as well. CAMPO participates in a regional working group to develop the plan and is the responsible agency for tracking changes to the architecture. CAMPO has also developed a set of standard ITS requirements for transportation projects. Within the menu of strategies for congestion management, ITS improvements can be selected; however, the implementing agency must document and certify how the project will comply with regional ITS requirements.[1]

Integration with Other Processes

The CAMPO CMP exists as a separate process with connections to each of the other planning functions. Because the CMP has a 2-year update schedule, other planning efforts draw supporting data as needed based on what is currently available. Both the MTP and the TIP are on an update schedule that differs from that of the CMP.

MPO Regional Transportation Plan and TIP

The *2035 Regional Transportation Plan* was adopted in May 2010. This plan contains information related to the CMP that is significantly more robust than in previous plans. For example, the 2035 plan identifies a specific goal for the CMP: "to develop an integrated approach to congestion management that utilizes defined performance measures, an integrated analysis approach, and a plan for system monitoring and evaluation." The CMP integrates and supports the identified goals for the long-range plan.

The CMP is integrated into the planning process during the selection of a preferred scenario through the evaluation of how individual alternative scenarios impact congestion. During this plan update, the two scenarios that were considered represented a "business as usual" condition and a more concentrated land use format. The travel demand model has been used to support this analysis with the v/c ratio as the benchmark to measure congestion. Congestion management is therefore one performance measure used in the evaluation of plan scenarios.

As discussed previously in Step 3, the identification of congestion management strategies to support individual projects is a requirement for project programming and represents the primary link between the CMP and the TIP.

Project Planning and NEPA Documentation

TxDOT relies heavily on the use of programmatic approaches to highway and bridge improvements, and therefore projects are often grouped in the TIP without specific individual projects easily discernable. The realities of project development and environmental review will necessitate greater coordination between CAMPO and TxDOT along with supporting documentation. CAMPO projects are currently required to be consistent with the regional plan. CAMPO has actively worked with TxDOT NEPA practitioners to more closely link planning and NEPA. The intent is to further this integration by providing documentation on the selected strategies identified for each TIP project. This documentation is intended to support purpose and need as well as the selection of alternatives.

Reporting and Visualization

CAMPO currently uses its Web site to provide information about the data collected and analysis performed as part of the CMP. Transportation related data are stored in GIS shapefiles and available to all member jurisdictions. All CMP related studies and reports are also available on the Web.

CAMPO has recently launched a new GIS Viewer intended to provide easy access to data of interest to the public. The data elements available at this time do not include CMP information, but this information may be added in the future. TIP projects are represented within the Viewer. In general, GIS mapping is the primary visualization medium within the MPO at this time.

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[1] CAMPO *2035 Regional Transportation Plan*, p.55.

Lessons Learned and Challenges

A central feature of the CAMPO CMP is the extensive use of working groups and committees to support all aspects of the process. This collaborative approach allows the pooling of resources; eliminating of conflicting plans, projects, and goals; and establishing buy-in from all partners. Figure 4 identifies the current list of working groups.

CAMPO has demonstrated that steady improvement in its core process of data collection and analysis has also facilitated stronger regional buy-in to the CMP. In particular, the decisionmakers have often become strong supporters of the CMP analysis in the prioritization of TIP projects. The Bottleneck Committee is an example of regional collaboration to address congestion where individual participants bring available resources in a noncompetitive environment. Incremental improvements have provided consistency, credibility, and cooperation.

CAMPO is currently preparing its MTP to meet the requirements of air quality conformity should they be designated within this planning period. This is typical of the approach in this region. The organization is continually planning for anticipated or desired changes to current practices.

The challenge for CAMPO, as with most small to medium-sized MPOs, is the availability of funding. Within the CMP program there is a constant tradeoff between the need for increased data collection and the ability to support individual improvements. Austin is a growing metropolitan region, and the congested network continues to increase. These funding constraints will require consideration of new data sources and supporting technology as a potential alternative to travel time runs. The amount of funding available from local, State, and Federal sources will shape the range of data collection and analysis options that the MPO can consider in developing its CMP.

Figure 4: CAMPO Working Groups Related to the CMP

Working Group Name	Description
CAMPO Congestion Management Process / Intelligent Transportation System Working Group	Ongoing committee to assist in identifying congested roadways, in developing the RCA, and in developing ITS for the region. Members include planners and engineers in the region.
Bottleneck Committee	Planners and engineers tasked with identifying bottleneck projects that can be implemented and that have the most impact for the region. The committee utilizes the RCA and local data to identify projects.
The Austin-Area Incident Management for Highways (AIMHigh) Team	Representatives from police, fire, emergency medical services, communications, ITS, and planners. Originally formed to improve cooperation and coordination between response agencies and to implement strategies to enhance traffic incident management efforts in Austin and Travis County. Now includes Williamson and Hays Counties also.
Regional ITS Infrastructure and Deployment Plan Working Group	Tasked with developing and updating the regional ITS plan. The most recent plan was completed in 2007. CAMPO is responsible for tracking changes for the next plan update.
Managed Lanes Working Group	Planners and engineers coordinate managed lane development in the region as well as develop draft managed lane policies for the region.