NEW TMA…NEW REGULATIONS…WHAT ARE MY OPTIONS FOR THE CONGESTION MANAGEMENT PROCESS?

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ABSTRACT. With the soon to be released population numbers of the 2010 Census, many areas that have seen growth over the last 10 years will find themselves crossing the 200,000 population threshold. One of the many new elements that MPOs will have to address includes the Congestion Management Process. "What is expected?"…"What is required?"…"Why do I need to do it?"…and the biggest one, "What can I do that brings my MPO the most value and not just another report to sit on the shelf and check the box?"

FHWA has prepared various resources in anticipation of these questions and offered training sessions for all who ask, but sometimes it needs to be boiled down to more hands on options and tools that can be customized for each MPO help define scope, budgets, expectations, and to build support within their organization for the "new" way to develop the planning process.

The Brownsville MPO in South Texas is going through this process for the first time and offers many lessons learned to share with others that will need to complete the CMP in the next year and a half. The MPO will likely be notified of attaining TMA status in the Federal Register in July 2012. But the Brownsville MPO decided to advance the development of the CMP earlier. This should help ease the transition in meeting these new requirements. Also, it will enable the CMP to become integrated into the planning process sooner.

Key Words: MAP-21, MPO, TMA, Congestion Management Process, CMP, Planning and Operations, system management, management and operations, GIS, GPS, travel time, pavement condition, pavement roughness, and linear reference system.

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INTRODUCTION

Planning agencies view congestion management in the context of the overall transportation planning process. On-going MPO activities should include operational and management strategies to improve performance, relieve vehicular congestion, and maximize mobility. Further, for Transportation Management Areas (TMAs) (those planning areas with population greater than 200,000), the planning process must include the development of a congestion management process (CMP) that provides for effective management of new and existing transportation facilities through the use of travel demand reduction and operational management strategies.

The Federal Register, defines congestion as “the level at which transportation system performance is no longer acceptable due to traffic interference.” Moving Ahead for Progress in the 21st Century Act (MAP-21) requires the transportation planning process to address congestion management through a process that provides for effective management and operation.

This paper will outline how the CMP can lead to better management and improved functioning of the MPO’s transportation system. Planning agencies will learn about to organize a CMP methodology that is developed and implemented as part of the overall planning process. The actions below, and elements of this paper, are taken directly from the 2011 FHWA-sponsored “*Congestion Management Process: A Guidebook*”. This publication should be consulted by MPO staff at new TMAs, when developing their inaugural CMP. Guidance provided by FHWA includes eight (8) “actions” that comprise a well-developed CMP. The CMP elements are referred to as “actions” to indicate that the process is not to be thought of as a linear methodology. At times the MPO may need to revisit or reexamine previous steps as a result of feedback from another (subsequent) step.

1. **Develop Regional Objectives for Congestion Management** – What is the desired outcome? — What do we want to achieve? It may not be feasible or desirable to try to eliminate all congestion, and so it is important to define objectives for congestion management that achieve the desired outcome.

2. **Define CMP Network** – What components of the transportation system are the focus including both the geographic scope and system elements (e.g., freeways, major arterials, transit routes).

3. **Develop Multimodal Performance Measures** – How do we define and measure congestion? This action involves developing performance measures that will be used to measure congestion on both a regional and local scale.

4. **Collect Data/Monitor System Performance** – After performance measures are defined, data should be collected and analyzed to determine, —How does the transportation system perform? Data collection may be on-going and involve a wide range of data sources and partners.

5. **Analyze Congestion Problems and Needs** – Using data and analytical techniques, the CMP should address the questions, — What congestion is present or anticipated in the region? — What are the sources of congestion?

6. **Identify and Assess Strategies** — What strategies are appropriate to mitigate congestion?

7. **Program and Implement Strategies** — How and when will solutions be implemented? It typically involves including strategies in the MTP, determining funding sources, prioritizing strategies, allocating funding in the TIP, and implementation.

8. **Evaluate Strategy Effectiveness** — What have we learned about implemented strategies? This action is designed to inform future decision making about the effectiveness of transportation strategies.

Congestion management is the use of strategies to optimize operations of a transportation system through management of the existing system. As such, a congestion management process (CMP) is a systematic approach coordinated regionally that evaluates the current performance and proposes strategies to mitigate congestion that meet the local objectives.

By definition, the CMP is not to be a stand-alone study…it is to be an integral component of the metropolitan transportation planning process. Once an MPO exceeds a population of 200,000, the CMP is required according to MAP-21. Federal regulations do not dictate the methodology or approach that is to be followed. This flexibility is intentional to allow the MPO to develop a living methodology that will evolve with local objectives and needs.

The CMP, as defined in federal regulation, is intended to serve as a systematic process that provides for safe and effective integrated management and operation of the multimodal transportation system. The process includes:

- ***Development of congestion management objectives***
- ***Establishment of measures of multimodal transportation system performance***
- ***Collection of data and system performance monitoring to define the extent and duration of congestion and determine the causes of congestion***
- ***Identification of congestion management strategies***

This process involves developing congestion management objectives, developing performance measures to support these objectives, collecting data, analyzing problems, identifying solutions, and evaluating the effectiveness of implemented strategies. Thus, the CMP provides a structure for responding to congestion in a consistent, coordinated fashion.

The Brownsville Metropolitan Planning Organization (MPO) is developing its' inaugural CMP to monitor the transportation network in the Brownsville, Texas study area. The study area includes a portion of Cameron County and all of the City of Brownsville. The goal of the monitoring system is to ensure optimal performance of the transportation system by identifying congested areas and related transportation deficiencies.

CONGESTION MANAGEMENT BACKGROUND

Between the 2000 and 2010 decennial censuses, Cameron County's growth rate (21.2%) was more than double the nation's overall growth rate of 9.7 percent. In addition to having a growing population, the Brownsville MPO's study area population can be characterized as being a young one. Regions with a younger population have more residents who are either in or available to join the workforce. The Brownsville MPO's Hispanic population is over 90 percent.

For the last two decades the Brownsville MPO has directed funding towards adding lanes on existing arterials within the MPO study area. Of late, funding constraints and limited available right-of-way for widening projects has severely curtailed the "added-capacity" response to local mobility problems. Accordingly, the use of CMP has been of keen interest in exploring other methods for improving mobility and addressing local congestion issues. Past use of the facility-based (widening) approach has meant that some streets were left out of the analysis, thus their potential contribution to improve overall transportation functions has been missed. CMP offers another chance for local decision-makers to address such deficiencies.

The Brownsville MPO has initiated the CMP to monitor the transportation network in the region. The goal is to ensure optimal performance of the transportation system by identifying congested areas and related transportation deficiencies. This information will be used to improve and maintain the performance of roadways at a system level.

The 2011 study was conducted in the Fall 2011. The primary tasks included:

- Mapping of the routes included to the CMP network
- Travel time data collection
- Delay Calculations

The fall study was conducted on approximately 211.8 centerline miles of roadways in the MPO region. **Figure 1** shows the study area and roadways.

The study included 41 different roadways, divided into 629 separate segments that ranged from 158 feet to 2.5 miles in length in the rural area. For added functionality, each segment was assigned a jurisdiction (City / County) depending on its location within the MPO boundaries. This attribute will allow the MPO and its members to query data within the database for each respective jurisdiction.

All of the study roadways are evaluated during the AM and PM peak periods between the hours of 7:00 AM-9:00 AM and 4:00 PM-6:00 PM respectively.

Action 1 – Develop Regional Objective for Congestion Management
The starting point for the CMP is to develop regional objectives for congestion management. These objectives draw from the regional vision and goals that are articulated in the MTP.

It should not be a goal to eliminate congestion. Responsible leaders rarely seek to reduce economic activity; so usually congestion is associated with a healthy economy. What should be a goal is to manage this activity while balancing community livability, access, and pedestrian safety. Therefore, the objective is to manage congestion and identify those roadway segments with "unacceptable" congestion and establish objectives for congestion management in line with regional goals.

Stakeholders and participants in this study were part of a Congestion Advisory Committee. The committee included representatives of local governments and TxDOT.

Traffic Flow

The Highway Capacity Manual 2010 defines capacity as "…the maximum hourly rate at which persons or vehicles reasonably can be expected to traverse a point or a uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions."

The capacity of a roadway, and its operational characteristics, is a function of a number of elements including: the number of lanes and lane widths, shoulder widths, roadway alignment, access, traffic signals, grades, and vehicle mix. Generally, roadways with wider travel lanes, fewer traffic control devices, straight alignments, etc. allow faster travel speeds.

Level of Service

The Highway Capacity Manual 2010 defines level of service as "…a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience.

"Six Levels of Service (LOS) are defined for each type of facility that has analysis procedures available. Letters designate each level, from A to F, with LOS A representing the best operating conditions and LOS F the worst. Each level of service represents a range of operating conditions and the driver's perception of those conditions."

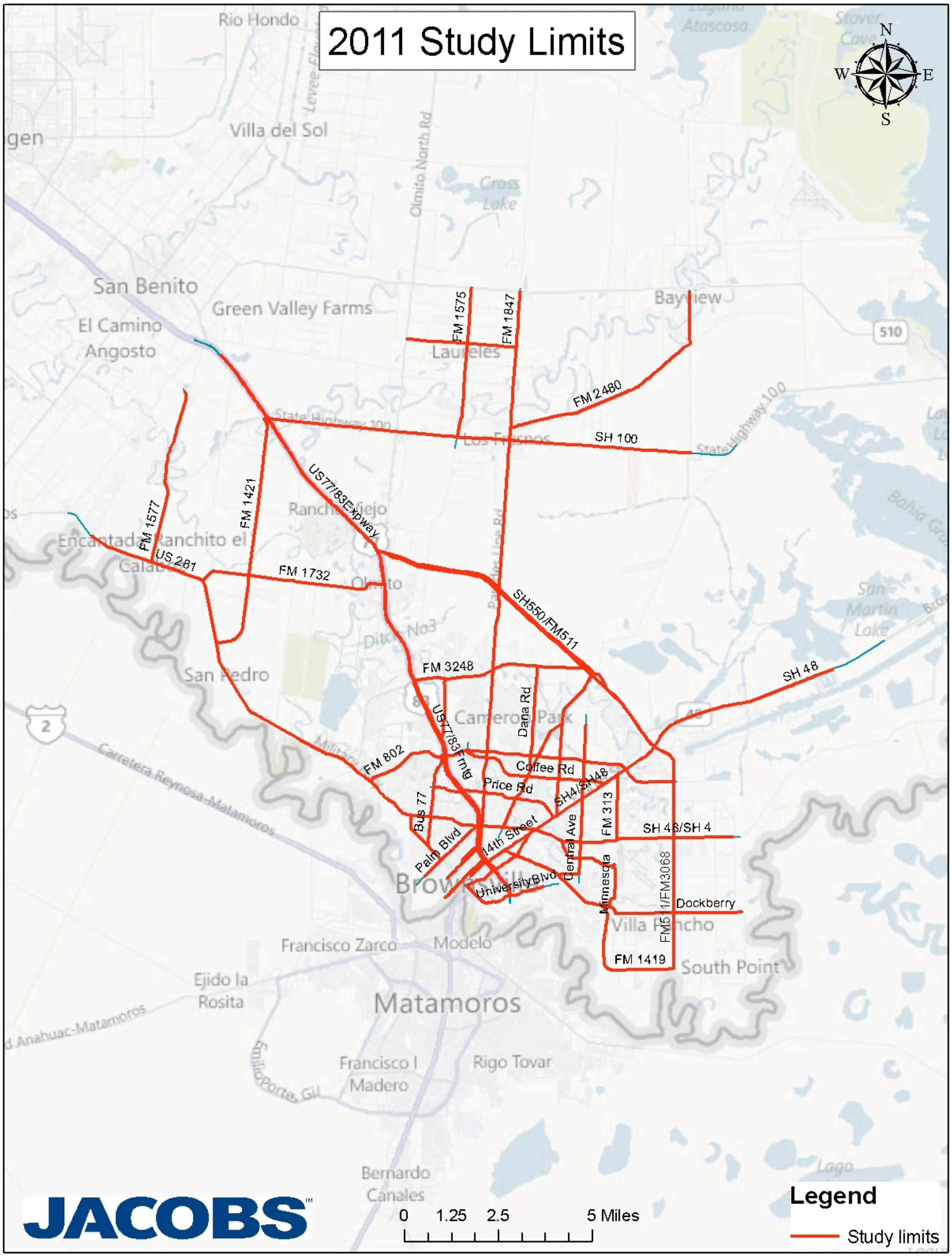

Figure 1 – 2011 Study Routes

Congestion Index (CI)

A CMP should reflect performance measures that are clearly understood and relatable by the public, decision makers, and technical practitioners. Many times the public do not immediately relate to Capacity or Level or Service. What they do relate to is travel time and speed. The one performance measure that brings all stakeholders together is Congestion Index (CI).

The Brownsville MPO chose to use CI as the primary performance measure in the inaugural CMP. This performance measure allows easy comparison of the efficiency of roadways as a ratio of average travel speed to the posted speed limit. Being the inaugural study, the MPO technical committee evaluated thresholds to define what will be used as “unacceptable” congestion. In order to narrow the focus on those roadway segments that need attention and commonly have recurring delay, a CI rate of 0.60 or 60% of posted speed has been established. Those with a ratio of 0.60 - 0.99 will be considered stable and those ≥1.00 will be considered as free-flow.

In future years, as the MPO CMP matures, other objectives can be added to compliment the ones established as the baseline this year. In addition, the MPO should establish goals for improving CI, reducing delay, etc. as a goal to guide implementation of congestion mitigation. Other performance measures may not be as quantitative as CI, travel time, delay, or travel time reliability and be more qualitative.

The MPO quickly reached a consensus in defining congestion for CI. In updates to the CMP, the technical committee will develop objectives for the performance measure goals. In effect, the MPO will measure progress in addressing congestion and delay. Developing regional congestion management objectives is a critical starting point for getting decision-makers to work together.

Action 2 – Define CMP Network

To help establish the CMP network, the MPO staff invited representatives of local agencies to a kick-off meeting in October 2011. The initial goal of the meeting was to have a CMP workshop to provide an overview of the CMP objectives. This discussion served to help guide the local approach for the inaugural CMP. The second goal was for the committee to identify the study network.

The 2011 CMP network included a large portion of the roadway network functionally classified as an arterial. This allowed a baseline to be established of the existing delay. The MPO can use this for comparison with future updates. Within the overall network, a subset of roadway segments were identified as “preserved”. By making this determination, the MPO committee wanted to maintain the character and low speeds of these corridors. This applies to areas with high density of pedestrians, on-street parking, minimum ROW, etc. These corridors, located primarily in the CDB area, were evaluated, but were not included in the congestion analysis.

The Brownsville MPO maintains an accurate, up to date regional transportation model in order to conform to State and Federal regulations. The MPO updates the model and TxDOT calibrates it using information on the roadway network, area development, and other characteristics.

For this 2011 study, the base conditions (collected data) of the selected corridors included: roadway characteristics, field-measured travel time, and speed data for use in calibrating and validating the regional transportation model.

Mapping and travel time runs were conducted on arterials and freeways. The breakdown of mileage by peak period is shown below:

- 211.8 centerline miles AM and PM peak periods

In future years, the MPO may consider analysis of a subset of the overall network based on these results.

Action 3 – Develop Multimodal Performance Measures

This year's network also reflects the existence of the transit network. Details on the transit operations are not currently included in the analysis. The MPO needs to continue building on the system created so the CMP can truly be multi-modal not only with transit, but also account for bike and pedestrian accessibility The CMP can and should reflect various performance measures to evaluate the components of an integrated multimodal transportation system.

According to Federal regulation, the CMP must include *"appropriate performance measures to assess the extent of congestion and support the evaluation of the effectiveness of congestion reduction and mobility enhancement strategies for the movement of people and goods. Since levels of acceptable system performance may vary among local communities, performance measures should be tailored to the specific needs of the area and established cooperatively by the State(s), affected MPO(s), and local officials in consultation with the operators of major modes of transportation in the coverage area."* - 23 CFR 450.320 (c) 2

The Brownsville MPO's primary performance measure on the intersection segment level is Congestion Index (CI). Being the inaugural study, the MPO technical committee evaluated thresholds to define what will be used as "unacceptable" congestion. In order to narrow the focus on those roadway segments that need attention and commonly have recurring delay, a CI rate of 0.60 or 60% of posted speed has been established. A 0.60 CI relates to an average speed through a segment of 24 mph when the posted speed is 40 mph. With relation to travel time, if a commuter was able to drive through a corridor at the posted speed and arrive at the destination in 20 minutes, the delay encountered with a CI of 0.6 would result in a travel time of 33 minutes. Those with a ratio of 0.60 - 0.99 are considered stable and those ≥1.00 are free-flow. Over time, with future updates, the committee will be able to revisit these thresholds and adjust if desired. FHWA encourages the MPO to be flexible with the process and customize the methodology and performance measures to respond to the local and regional objectives.

Based on the local conditions in the Brownsville region, attention was focused on the peak periods and intersection level delays. The duration of congestion and other performance measures were not as much of a concern with the short peaking of congestion within the region. Most delay occurs at the node level and is not a link problem.

The MPO can also consider adding other performance measures in future updates. This multi-modal approach will reflect the accessibility of transit, bike, and pedestrian facilities. For example, one might consider the % of jobs or households within ¼ mile of transit. This serves as an indicator of accessibility to transit and will correlate to transit ridership.

Action 4 – Collect Data / Monitor System Performance

The CMP is data intensive and a study of this sort requires a large effort in terms of overall resources and time. The MPO can serve as the clearinghouse of data from the various components of the transportation system. Data flow should be continuous and not only limited to the update cycle of the CMP. The MPO can use the GIS created with this study to host and integrate all available datasets.

This inaugural CMP has established a foundation for the MPO to build on over time. Through the methodology developed and the additional data assembled, the data collected in this study has a variety of additional uses outside of or beyond the CMP. Because the information is all housed in the GIS system, queries can group data by area for use in individual planning processes. Within the GIS, the MPO has access to the following:

CMP Routes	Speed Limits	School Zones	Intersection Control
Number of Lanes	Median Type	Jurisdiction	Transit Routes
Transit Stops	Average Speed	Congestion Index	Free Flow Travel Time
Peak Period Travel Time	Segment Delay	Pavement Roughness	

The primary source of performance results are a statistically significant dataset of floating car GPS travel time runs for each peak period. The GPS units collected speed and position every 1-second to help in pinpointing the congested locations.

Action 5 – Analyze Congestion Problems and Needs

Given the data collected and dataset assembled, the primary performance measure that is used in this CMP is Congestion Index (CI). CI is the ratio of the actual average speed to the weighted average posted speed limit.

CI = Actual Average Speed / Weighted Average Posted Speed Limit

CI = Congestion Index
Actual Average Speed = Average speed of all runs on a segment
Weighted Average Posted Speed Limit = Average of all posted speed limits on the segment weighted by length

According to the MPO thresholds developed by the technical committee in consultation with the CMP Advisory Committee, a CI less than 0.60, indicates a congested segment.

The travel speeds on congested segments are slower than drivers typically want to drive, and there may be less opportunity for lane changing and maneuvering. Stable sections are accommodating volumes less than capacity. Travel speeds are somewhat slower than the speed limit, but generally acceptable to drivers. Lane changing and maneuvering is less difficult than in congested segments. Free-flow sections are operating well below capacity. Travel speeds equal or exceed the speed limit and traffic can maneuver without interference.

Utilizing the roadway attributes, the CMP corridors were divided into segments with the endpoint or nodes being represented by controlled intersections or major cross-streets. In addition to these segments, they were further broken down into common unit lengths of approximately 0.1 mile to allow for direct comparisons between sub-segments.

The roadway segment endpoints are defined at each traffic signal or stop sign. This allowed the segments to be evaluated on a detailed level and then combined, as appropriate, to make corridor recommendations. In addition, the 211.8 miles of roadways, including 41 different roads, were further divided into 629 directional links for detailed evaluation. These segments either had a traffic signal, stop sign, or a major cross street in rural areas with limited controlled intersections, as the end points.

The methodology developed and applied specifically for this project resulted in a calculated CI for each 1-second GPS data point. The actual speed between successive points provides detailed results that can highlight the problem areas. This is in contrast to other performance measures that are primarily link based (volume, v/C) and do not include assessment of the intersection delays. These other performance measures may categorize a segment as congested when actually the intersection created sufficient delay to pull the full segment down. A detailed intersection segment and 0.1 mile sub-segment level CI were used to develop the appropriate recommendations for the congested segments. In addition to the intersection segment CI analysis, one-tenth mile segmentation was included to better highlight local areas of delay.

The method of recording roadway information and travel times using GPS results create large amounts of data that require manipulation into a useable format. City limits were added directly into the database. Each roadway was defined as a “route” in both directions and beginning and ending points were determined in order to calculate travel time for the segment. All information can be sorted by jurisdiction. The travel time information and associated CI’s were formatted into tables, graphs, and in ArcGIS. ArcGIS is a geographic information system (GIS) software that allows the user a quick, easy-to-understand graphical reference. ArcGIS reads the study data files, stored in geo-databases, and presents the information graphically allowing the user to group and summarize data for specific purposes.

The 1-second data points are color coded according to the criteria for free-flow, stable, and congested conditions. These 1-second points can be used to determine at what point along a segment a traveler experiences delays or congestion.

When congestion occurs during one time period, the user can study the detailed information to determine the cause of the delay. Thus, improvements can be better focused to ensure the most appropriate use of funds.

ArcGIS can be used to view the information provided in this study for reference and for future projects. Maps and figures can be made for presentations. Information such as speed limits along specific roadways, location and number of traffic signals, the location and number of stop signs, and the location and length of school zones can be summarized and viewed. The information can be summarized for the entire County or broken down and summarized by city, and can be used to identify future improvements. The data combined with the use of ArcGIS gives the MPO a powerful tool.

Action 6 – Identify and Assess CMP Strategies

Of the 380 directional miles of roadways studied in the AM peak period, 101.6 miles were free-flow, 238.1 miles were stable, and 40.3 miles were congested. Therefore, for the 2011 study, 89.4% of the roadways operated within an acceptable range during the AM peak period. Of the 380 directional miles of roadways studied in the PM peak period, 104.2 miles were free-flow, 230.1 miles were stable, and 45.7 miles were congested. Therefore, for the 2011 study, 88.0% of the roadways operated within an acceptable range during the PM peak period. **Table 1** summarizes the number of segments and miles operating under free-flow, stable, and congested conditions.

Table 1 - Summary of Study Roadways in Terms of CI for AM and PM

Peak Period	Measure	Roadway Condition			Total
		Free Flow > 0.99	Stable 0.6–0.99	Congested < 0.60	
AM	Number of Miles	101.6	238.1	40.3	380.0
	Percentage of Miles	26.7%	62.7%	10.6%	100%
PM	Number of Miles	104.2	230.1	45.7	380.0
	Percentage of Miles	27.4%	60.6%	12.0%	100%

A Top 20 worst segments was developed by ranking segments by CI from most congested to least congested. Starting with the most congested, the segments were examined in detail to determine the cause of congestion. Some segments were removed from the list because the congestion was caused by construction or a very short segment length.

In many cases, Congestion Indexes fell below 0.60 due to stop signs or traffic signals. These situations can be clearly seen in ArcGIS. The one-second speeds are green (free-flow) along the length of a segment and then several red one-second speeds (congested) occur while the vehicle is stopped at a stop sign or traffic signal. Traffic may be traveling at good speeds until they encounter a red light. Less than optimal timing or signal progression may be the cause of delay in these areas.

In order to further pin-point the congested segments and provide a common unit length for equitable comparison of segments, the intersection segments were divided into shorter 0.1 mile (~528 feet) segments and the congestion statistics were generated for these 0.1 mile segments.

A total of 3,846 such 0.1 mile segments were analyzed for peak periods. It was found that 344 segments in AM (approximately 8.9%) and 365 segments in PM (approximately 9.4%) were congested. Of the congested segments, 75% include a controlled intersection (Signal, Stop Sign etc.). A majority of the delays are localized within 0.1 miles of a controlled intersections and do not occur mid-block. These delays can be reduced by either signal timing improvements or intersection geometric changes.

Recommendations

Improvements include signal timing optimization / traffic signal progression, access management, additional capacity, and adding signals in place of stop signs. Additionally, the MPO should encourage the use of alternative modes such as public transit, bicycling, and walking to the extent possible. This will not only help divert some vehicular trips but will also minimize vehicular emissions.

Many of the recommendations include signal timing improvements. Signal timing improvements are a relatively inexpensive way to make significant improvements on a transportation network. Improved signal timing can decrease delay by appropriately allocating green time among competing phases. This allows more traffic to pass through the signal with less delay. By adjusting cycle lengths and offsets, drivers can travel longer distances along a corridor before having to stop for a red light. This decreases travel time and improves air quality. Both signal timing optimization and traffic signal progression are low cost improvements to make the best use of existing capacity and optimize allocation of funding. The cost for a signal timing improvement project varies depending on the number of traffic signals, the controller capabilities, the location of the traffic signals and adjacent signals, the number of timing plans required, and implementation and fine-tuning needs.

The U.S. Department of Transportation's Federal Highway Administration (FHWA) produced a video showing that retiming traffic signals is one of the more cost-effective techniques available to state and local agencies in their efforts to manage congestion and growing travel demand. The video, "It's About Time, Traffic Signal Management: Cost-Effective Street Capacity and Safety," demonstrates how signal timing on roads can improve air quality while reducing fuel consumption, decreasing traffic congestion, and saving time for commercial and emergency vehicles. The performance of about 75 percent of them could be improved easily and inexpensively by updating equipment or by simply adjusting the timing.

In the Brownsville region, many corridors could benefit from the application of access management techniques to its developed and currently undeveloped corridors. The Federal Highway Administration defines access management as “the process that provides access to land development while simultaneously preserving the flow of traffic on the surrounding system in terms of safety, capacity, and speed.” It is accomplished by controlling the design of access points, the location of access points, and the number of access points allowed within a given distance. Access management provides benefits related to safety, mobility, the environment, and fuel consumption. While it is possible to retrofit already developed corridors for access management, common problems include lack of right-of-way and landowner opposition. It is less expensive to apply access management techniques to undeveloped corridors as they develop. Consideration should be given to developing an access management program that would define land patterns and traffic flow, program goals, policies, implementation and financial strategies.

Roadway widening is necessary where traffic signal timing and access management are unable to provide enough capacity for heavy traffic volumes. Some segments may improve in the short term with optimized signal timing, but may ultimately warrant additional capacity through widening. Widening could include adding a through lane for a long section of road, or providing turn lanes at intersections. Adding capacity through roadway widening is generally expensive.

Adding signals may be an improvement at four-way stop intersections or intersections with heavy major-street and cross-street traffic. This reduces delay for previously stop-controlled movements but may increase delay for movements that were not controlled. As traffic volumes increase, traffic signals or other types of intersection design such as roundabouts or continuous flow intersections should be considered to efficiently move traffic.

The most often recommended improvement for 2011 study is local operations related to intersection signal timing at 58%. Signal timing deserves attention within the region to allow maximum efficiency of the existing system before costly widening is considered. A regional perspective would produce consistent travel time runs even when crossing from one city / agency to another.

As transportation funding continues to be limited, operations are being highlighted by many MPOs across the country. Operational improvements provide the highest benefit/cost ratio compared to local capacity projects that benefit a smaller portion of the county.

The Brownsville MPO sought to identify some low cost intersection improvements, as a key part of this study. Thus, a case study of eight (8) intersections within a commuter corridor was completed as part of this study. Other MPOs should consider using this approach.

With the implementation of the recommended low cost operational improvements, the LOS of the intersections would improve to no worse than D. Improvement costs are limited to the replacement of controllers, addition of spread spectrum radios, and possible addition of pedestrian amenities. These types of improvements are the foundation of the CMP. Regions are expected to manage their system to get as much capacity out of the existing system prior to capital projects to widen the roadways. Ideally, every effort should be exhausted and documented before getting to the end of the line and adding capacity.

Action 7 – Program and Implement CMP Strategies

A fully integrated CMP not only evaluates the current congestion conditions and recommends mitigation, but prioritizes the improvements and incorporates into the planning process. Those improvements can be viewed as local improvements, corridor strategies, or regional programs / initiatives.

This study will serve as the initial element of the CMP but should not be viewed as a complete CMP. The CMP is a living process that is part of the planning process. This study has documented current conditions, ranked the magnitude of the congestion, recommended possible mitigation, and prioritized improvements. The MPO and its members are responsible for applying these findings and integrating them into the planning process. The MPO will develop an implementation schedule along with funding options.

Many MPOs have adopted policies to establish a “set aside” funding category for localized bottleneck and operational projects. These projects are “quick fixes” and avoid the lengthy process required for capital projects. Also, the prioritization of operational projects compared to the larger capital projects is difficult. Having a separate category for operational projects can lower the time to implement and achieve benefits more quickly.

Action 8 – Evaluate Strategy Effectiveness

This 2011 Congestion and Delay Study is a first step towards development of a full CMP. Therefore, the MPO is not able to evaluate the benefits of implemented strategy this time around. But, the CMP needs to go full circle to identify the conditions, recommend mitigation, prioritize the improvements, plan the schedule and funding, and then evaluate the benefits.

As the MPO integrates the CMP into the planning process, with future updates to the study, be sure to revisit the projects that came about as a result to document the results to adjust strategies going forward for other similar situations.

CONCLUSION

The Congestion Management Process (CMP) plays an essential role within the transportation planning and programming process. It provides decision-makers at MPOs, local governments, and state agencies a clear analytical understanding of congestion in the region. The CMP must be an integral element in well-organized, objectives-driven, performance-based planning approach.

The flexibility of the regulations and guidelines has allowed the MPO to customize the CMP in various ways to reflect regional needs and priorities. MPOs around the country have developed unique methods of implementing the CMP. The MPO needs to continue working with the members of the committee to build on these first steps, by using the performance measures identified herein. In other words, the MPO will use the CMP as a tool to assess potential improvements for inclusion in the TIP. Thus, CMP performance measures help inform decision-making about project prioritization and funding.

Overall, the region has done a good job providing sufficient capacity for the current demand. More attention needs to be given to operations to maximize the benefits of these investments and minimize the overall delays. The MPOs' focus is now on the integration of coordinated signal timing plans so that the priority flows are improved during the peak periods. Similar to the "case study" section of this paper, data collection, design of a timing plan, signal timing optimization, and implementation can be accomplished along a corridor for approximately $3,000 per intersection (not including needed hardware in the signal cabinet).

The methods will vary as to how to accomplish the desired results depending on the signal hardware currently in place and expansion capabilities. It can be as simple as installing a GPS clock at each intersection ($500) to synchronize the controller clocks. Or, more advanced systems may be needed where each intersection requires vehicle detection ($15,000) and wireless communications ($2,500) between signals. Either way, the benefit / cost ratio of this type of work is unmatched in today's funding environment.

Until the system is fine-tuned to operate efficiently within the existing conditions, it is difficult to identify those areas that may need more attention including local geometric improvements, access management, or as a last resort—opting for added capacity.

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