8. Management Systems

The ISTEA mandated metropolitan areas over 200,000 population implement various management systems in conjunction with the Michigan Department of Transportation (MDOT). These transportation management systems include: congestion, pavement, bridge, safety, intermodal and public transportation. The National Highway System Act of 1996 rescinded those broader mandates, but retained a requirement for an approved Congestion Management System (CMS) in Transportation Management Areas (TMA). Lansing/East Lansing and the entire Tri-County region is a TMA, since the region's population exceeds 200,000. In a TMA, no highway project that increases capacity for single occupant vehicles (SOV) can be constructed unless drawn from an approved CMS. This requirement was retained in TEA-21 and SAFETEA-LU legislation.

Congestion Management

As noted in Chapter 1, TCRPC adopted an approved Congestion Management System in March, 2004.

The approved CMS was derived from the Regional 2025 Transportation Plan and results of the **"Regional Growth: Choices for Our Future"** project and is available under separate cover.

The approved CMS document:

- defines congestion;
- describes TCRPC's congestion management process;
- evaluates causes of congestion;
- identifies and evaluates congestion mitigation strategies;
- describes a process for analysis of congested corridors;
- identities responsibilities and division of labor for how these analyses will be conducted;
- identifies extent and severity of current and future congestion by roadway location;
- identifies and evaluates (by time of day) specific alternatives considered to address those congested locations;
- identifies strategies which should be considered for implementation;
- outlines funding sources available to address congestion;
- documents an implementation plan for the CMS process; and
- summarizes relationships between the adopted transportation plan, the adopted transportation improvement program and the approved CMS process.

As also referred to in Chapter 1, in air quality non-attainment areas, the law (23 USC 500.109) requires, in subpart c:

> *(c) In a TMA designated as nonattainment for carbon monoxide and/or ozone, the CMS shall provide an appropriate analysis of all reasonable (including multimodal) travel demand reduction and operational management strategies for the corridor in*

which a project that will result in a significant increase in capacity for SOVs (adding general purpose lanes to an existing highway or constructing a new highway) is proposed. If the analysis demonstrates that travel demand reduction and operational management strategies cannot fully satisfy the need for additional capacity in the corridor and additional SOV capacity is warranted, then the CMS shall identify all reasonable strategies to manage the SOV facility effectively (or to facilitate its management in the future). Other travel demand reduction and operational management strategies appropriate for the corridor, but not appropriate for incorporation into the SOV facility itself shall also be identified through the CMS. All identified reasonable travel demand reduction and operational management strategies shall be incorporated into the SOV project or committed to by the State and MPO for implementation."

The CMS document also provided analysis of travel demand and operational management strategies, identified those reasonable to consider for implementation, identified the process by which those would be considered for all roadway capacity projects in the Regional 2025 Transportation Plan and provides a basis for local project sponsors to document implementation of the CMS process through the project programming process.

The document further identifies the adopted "Wise Growth" land use alternative as the region's primary congestion management strategy, along with ancillary supporting strategies like access management and traffic impact studies in congested corridors. It also identifies an integrated approach to land use and transportation system management and operations as the region's second highest priority for congestion management and analyzes and identifies other strategies for managing congestion in the Tri-County region.

An important part of that analysis is based on modeling of transportation network alternatives evaluated in the Regional 2025 Transportation Plan, as discussed in detail in Chapter 11 and summarized below.

As part of the Regional 2025 Transportation Plan and the Regional Growth project, TCRPC evaluated eight different transportation networks based on alternative assumptions or approaches to address regional transportation problems. Examples of these network alternatives include high and medium levels of transit system improvements, a management and operations/demand reduction option, an unconstrained "highways only" solution and a financially constrained highway project solution. Various combinations or "packages" of these alternatives were also evaluated.

After this analysis, the Commission adopted an alternative package which included a set of strategically applied "medium" transit system improvements, the management and operations/demand reduction option, the financially constrained road project list and the "Wise Growth" land use alternative identified by the **"Regional Growth: Choices for Our Future"** project.

This network alternatives analysis was further integrated in the region's CMS process. Results of this network alternative analysis are shown in Chapter 11. By agreement between TCRPC, MDOT and FHWA staff, due in part to the short turn around time for

completing this Regional 2030 Transportation Plan, TCRPC is not updating this analysis in the current document. Instead, the alternative adopted in the Regional 2025 Transportation Plan will be re-modeled for 2030 and shown along side results from that earlier analysis for comparison purposes. The existing alternatives analysis model runs will remain in place for use in the TCRPC CMS process until the Regional 2035 Transportation Plan is completed in 2010.

Results of comparative network alternative analysis in Chapter 11 and integrated in TCRPC's CMS document may be factored as necessary to extend them to 2030 based on results of the 2030 model run. Fundamental relationships between alternatives would not substantively change if they were re-modeled, hence continued application is considered indicative of relative impacts between options for comparative analysis or CMS purposes.

Additionally, new deficiency analysis model runs for 2005 and 2030 (discussed in Chapter 10) also provide an updated snapshot of extent and duration of congestion. Details from these model runs (not published in this current document) may also be useful to demonstrate projects added to this plan for the 2026-2030 period (or any future amendments) are being drawn from the approved CMS process. Project sponsors and other interested parties are urged to contact TCRPC staff with questions concerning additional figures from these model runs and how they may be applied through the approved CMS process.

The remainder of this section summarizes components of the approved regional CMS process. Readers are referred to the detailed CMS document or to TCRPC staff for specific information pertaining to the process, projects or outcomes of that process and how it is being implemented.

CMS Implementation Plan Status

The adopted CMS document identifies an implementation plan and milestones for measuring TCRPC's implementation of the CMS process. Since the CMS process was approved in March, 2004, about 18 months have passed between approval and preparation of this Regional 2030 Transportation Plan. Most of the focus during this period has been addressing new air quality non-attainment requirements. In spite of this emphasis, it is significant to note the TCRPC has met and achieved four of the first 11 milestones identified for completion within three years after approval of the CMS document, has nearly completed a fifth, work on a sixth will be under contract effective October 1, 2005 and another is an ongoing continuous activity in progress.

With seven of 11 milestones in the first three years of implementation either achieved or in progress, TCRPC is right on target with the approved CMS implementation plan and in addressing all applicable CMS requirements.

MDOT's Congestion Management System (CMS) is designed to monitor and analyze the magnitude of congestion on the multi-modal transportation system, plan actions appropriate to the scope of the problem, implement projects that reduce congestion and enhance transportation system performance.

MDOT monitors potential need for added capacity on the state trunkline system through two processes. First, MDOT monitors overall operation of roads using average daily, peak hour and commercial traffic monitoring, crash data and system condition to identify current deficiencies. Travel demand forecasting models assess future system deficiencies based on population and development trends. Second, MDOT receives direct input from the traveling public, local units of government, legislators acting for constituents and private sector developers whose plans impact existing roadways.

These inputs are analyzed against actual system operation. If priority deficiencies are identified, results of the analysis move forward in the project development process. Priority deficiencies include those in corridors of highest significance and National Highway System (NHS) routes. Corridor and freeway studies are conducted to determine severity and extent of capacity deficiencies on existing highways. The studies develop potential alternatives and coordinate connectivity, intermodal and capacity improvements with pavement and structure rehabilitation. Actions to be considered include changes in the transportation system by:

1. using Intelligent Transportation Systems (ITS);
2. changing characteristics of demand; and
3. providing added capacity.

ITS tools are explored before major capital investments or widening to improve capacity and safety on the transportation system. Changing characteristics of demand can include actions such as flexible work hours to reduce peak flow or actions to increase public transit use or ridesharing. If no action is taken to alleviate congestion, considerable delays impede movement of persons and goods along Michigan's highway system.

MDOT's congestion management strategy is consistent with this Regional 2030 Transportation Plan. MDOT strategy places priority on the freeway system to meet traffic forecast needs to the year 2030. Elements for consideration include interchange reconstruction, right-of-way requirements, environmental impacts and cost of disruption to traffic or business during construction.

Congestion Baseline

MDOT's State Long Range Plan: 2000 - 2025 provided detailed information about current and projected traffic trends on trunklines. To summarize, state trunkline annual vehicles miles traveled (AVMT) under congested conditions is projected to grow from 13 percent in 2000 to 17 percent in 2025. For freeways, AVMT under congested conditions is projected to grow from 17 percent in 2000 to 20 percent in 2025. For the top four major interstate freeways in Michigan's corridors of highest significance ranking (I-94, I-75, I-96 and I-69),

AVMT under congested conditions is projected to grow from 37 percent in 2000 to 41 percent in 2025 based on 2002 data in MDOT's CMS.

Whether along corridors of highest significance or other state trunkline highways, MDOT's strategy for congestion management includes working on an inventory of corridor strengths and deficiencies for infrastructure development, building a sense of common interest along the corridor, creating a forum that fosters economic development opportunities, pursuing physical transportation improvements/enhancements and facilitating international trade.

Strategy for corridors of highest significance include discussion about need to add capacity lanes along identified corridors.

To address additional capacity needs along the corridors of highest significance, a variety of approaches will be used, according to corridor characteristics. Some freeway corridors will need additional lanes along their entire length. Other freeway corridors will need additional lanes only in urbanized areas. To address capacity needs along non-freeway corridors or segments of corridors, lanes may be added, passing relief lanes may be added or access management may be used to preserve and enhance existing capacity.

These critical priorities will be established in MDOT Region plans, companion documents to the State Long Range Plan. MDOT Region plans will be developed based on goals, objectives and strategies contained in the State Long Range Plan: 2000 - 2025.

Additional Strategies

MDOT and TCRPC's congestion management strategy aims to enhance mobility, a component of the long range plan goal of basic mobility. Additional strategies related to mobility follow.

Freeway Modernization

MDOT's freeway modernization strategy is a continuing commitment to apply up-to-date design standards and new technology when rebuilding freeway facilities or designing new facilities. The transportation industry is continually refining design standards and developing new technology for all facility types. These standards encompass a broad range of design elements including pavement type and thickness, structural elements of bridges, configuration of interchanges and traffic volumes. It also includes application of new technology such as weigh-in-motion programs for commercial traffic and Intelligent Transportation Systems (ITS) applications, such as changeable message signs, video monitoring of freeways for incidents and ramp metering to help maintain steady rates of traffic flow at interchanges.

Access Management

Access management is a coordinated development plan and review process requiring a cooperative effort between MDOT and local government agencies that provide or manage access to land development, while simultaneously preserving flow of traffic--mobility--on the surrounding road system. In many instances, capacity and safety concerns can be alleviated through a local program of highway-land use access management. TCRPC also has a long history of encouraging access management throughout the region. Staff developed a model zoning ordinance for access management in the early 1980's, which has been integrated in several local jurisdiction's zoning ordinances. TCRPC and MDOT have generally provided technical assistance to local governments in developing access management plans or ordinances throughout the region.

A recent example includes an access management overlay zone ordinance approved by four jurisdictions on the M-43 corridor from Park Lake Road to M-52 and south on M-52 to I-96.

Interchange Strategy

Improvements to existing interchanges and construction of new interchanges present special needs for state and local coordination. Interchange projects are selected in response to traffic needs on a statewide priority basis and require local coordination and a concurrent local commitment to widen local roads as necessary. Local authorities may choose to widen local roads at an interchange to attract development, even though current traffic volumes do not warrant such improvement. Such improvements may also require improvements to state highway interchange ramps. Interchange improvements prompted by locally encouraged and approved developments are the financial responsibility of local authorities and require coordination with MDOT. Local agencies and/or private sector developers are responsible for all costs associated with a new interchange necessitated by private sector development, including grade separation structures, right-of-way improvements and approach work. An exception to this policy is granted in cases where MDOT has determined that reduction in existing congestion at adjacent trunkline interchanges can be reasonably expected and where FHWA justification criteria warrant an additional break in access. In such cases, MDOT may assume costs for structures and ramps only. Costs associated with local roadway work outside of bridge abutments, including right-of-way costs, remain the responsibility of the local agency.

Intelligent Transportation Systems Strategy

MDOT has been at the national forefront in planning, developing and deploying Intelligent Transportation Systems (ITS) technologies to address transportation and safety issues. Steps are being taken to integrate ITS into MDOT's overall transportation planning process. The process of blending high technology into solutions to transportation problems in an intermodal context is already occurring. Ongoing partnerships with the University of Michigan and Michigan State University support research and evaluation efforts to identify promising statewide uses for ITS technology throughout the State. MDOT, with support from FHWA, is also initiating a unique program of developing an ITS test bed in Michigan.

The program offers an opportunity to private industry to partner with MDOT in testing products, services, concepts and research in Michigan. With support from MDOT, the Tri-County region has developed a regional architecture for ITS applications. Additional information on this architecture and the regional ITS strategy is contained in Chapter 13.

Safety Strategies

MDOT has two specific safety strategies for highways – a trunkline safety strategy and a highway/railroad grade crossing hazard elimination strategy. MDOT is committed to proactively maximizing safety aspects inherent in all projects, from conventional rehabilitation to major reconstruction. This will be achieved by:

1. continuously monitoring crash patterns;

2. maintaining MDOT's role as a recognized leader and innovator (both nationally and within the state) in traffic safety research, hazard elimination and other safety projects;

3. integrating safety into transportation planning at all levels; and

4. integrating safety in elements of roadway project design.

In addition, MDOT will continue responsively funding improvements to trunkline roadways with higher than expected crash patterns. MDOT is committed to improving safety at highway/railroad grade crossings in an effective and cost-efficient manner.

Role of MPO's in Management Systems

Metropolitan Planning Organizations (MPOs) play a role implementing management systems, congestion management strategies and in identification and prioritization of needed freeway improvements in their areas. This process is required by MDOT and FHWA. Any state trunkline project in a metropolitan area must be identified in the MPO long-range plan and must have MPO approval to receive federal funds. Projects located in MPO areas and slated to have federal funds cannot go beyond the planning stage without concurrence of the MPO. MDOT projects funded in the Tri-County region are shown in Chapter 13.

TCRPC's Congestion Management System

TCRPC and MDOT cooperatively developed the region's Congestion Management System and participated extensively in its design and beta testing as reported in the 1995 Regional 2015 Transportation Plan. TCRPC staff also participated on the design team for the Safety Management System.

Monitoring and Forecasting

As noted, congestion monitoring is done using traffic volume, crash and condition data and public input. TCRPC maintains a traffic count monitoring system for traffic volume data collected by MDOT and all local road agencies or governments. This electronic database is regularly updated and contains traffic volume data since 1973 for nearly 3,500 locations throughout the region. This database has been integrated in the CMS database at MDOT and the regional traffic forecasting model. TCRPC and MDOT have a joint memorandum of understanding in place concerning the travel forecasting model, which covers the entire Tri-County Region. More detailed information concerning this model, calibrated and used in developing this Regional 2030 Transportation Plan, is contained in Chapter 9. Model runs are also integrated in the CMS database maintained by MDOT. In addition to these monitoring and forecasting elements, TCRPC's Congestion Management System includes the following strategies.

Land Use Strategy

TCRPC's primary strategy to address congestion throughout the region is land use based. The primary element of this land use strategy is implementation of the adopted "Wise Growth" scenario, developed as part of the shared regional land use vision through the **"Regional Growth: Choices for Our Future"** project discussed in Chapter 2. As noted, implementation of this strategy can reduce congested lane miles to nearly half of what would otherwise occur at build out of the region under densities permitted by current zoning. Implementation of this strategy has been integrated into the project selection criteria identified under the various program categories in Chapter 13.

Additional land use supporting strategies include consideration of access management and traffic impact studies in congested corridors prior to capacity expansions. As noted, TCRPC and MDOT cooperatively work to provide technical assistance to local governments concerning access management. In addition, TCRPC and MDOT cooperatively developed the guidebook Evaluating Traffic Impact Studies as a recommended standard of practice for Michigan communities. TCRPC has distributed over 10,000 copies of this guidebook, now in its third printing. Numerous local communities have integrated its model ordinance in local plans and ordinances.

Management and Operations Strategies

TCRPC's Congestion Management System also includes a "Management and Operations" component, which is further discussed in Chapters 10 and 13. TCRPC has created a new standing Management and Operations Task Force, which also developed the regional ITS architecture, with support and assistance from MDOT. TCRPC's Management and Operations strategy represents a combination or integration of ITS with land use, travel demand management, traditional traffic engineering measures and other techniques to improve operations in priority corridors for all modal users, while integrating land use considerations with traffic management and operations from "building facade to building facade."

Alternative Modes Strategies

TCRPC's active and comprehensive support of transit and non-motorized planning activities on a regionwide basis integrates alternate modal considerations in priority corridors throughout the region. In addition, TCRPC has made an extensive effort to train local officials in techniques to improve walkability, liveability, traffic calming and pedestrian or bicycle treatments throughout the region and in congested corridors. The collective approach of these efforts is to thoroughly integrate transit, bicycling and pedestrian treatments with land use and management/operations considerations in the transportation planning process and is also a very significant component of TCRPC's Congestion Management System.

Wide Nodes/Narrow Roads and Traffic Calming Strategy

This strategy is integrated with and supportive of other congestion management elements and strategies above. It recognizes importance of consideration of such techniques as intersection treatments, such as turning lanes or roundabouts, to improve choke points or restrictions in major corridors (which typically occur at intersections) and to reduce delay, before consideration of major roadway widenings. The result is a system of "widened nodes" (intersections) and "narrow roads." Where appropriate, traffic calming techniques, and even "road diets" (such as removing a lane and adding center left turn lanes and/or bicycle/pedestrian treatments) may also be considered to improve quality of flow at reduced speeds, in combination with widening nodes, which collectively may provide for greater person throughput in a given corridor at safer, lower speeds. Examples of where this strategy has already been applied in the region include M-43 Grand River and Burcham Road in East Lansing. Numerous examples of other traffic calming techniques are now in place throughout Lansing, East Lansing, MSU and other communities regionwide. Examples of intersection treatments or widened nodes are in place throughout the region. Turn lanes, channelizations or other traditional treatments have been routinely used for decades. Modern roundabouts, widely used throughout Europe, Australia and many other states are a relatively new concept in the region, but have recently been constructed in Dimondale and Meridian Township. Numerous others are under active consideration at MSU, Ingham County, Delta Township, Lansing and other locations regionwide.

These and other types of "wide nodes" or narrow road concepts are routinely considered as part of a comprehensive approach to integrating land use, management and operations, ITS and other techniques as alternatives to other types of major widenings or system expansion. As such, this technique is an important component of the region's Congestion Management System.

Investment Strategies

Consistent with the new planning process, TCRPC and MDOT have cooperatively identified twenty and five year investment strategies for 25 categories of programs and projects contained in Chapter 13. These strategies have been extensively reviewed by advisory committees and the general public as part of the **"Regional Growth: Choices for Our Future"** project and were adopted in the Regional 2025 Transportation Plan. Some limited

refinements to those strategies are being made with their re-endorsement and adoption of this Regional 2030 Transportation Plan. As adopted in this plan, along with other elements described above, these strategies collectively are an integral part of the region's Congestion Management System. As such, they are part of (along with other elements identified earlier) an integrated approach to implementing the new planning process and the "approved" Congestion Management System required by federal law from which future capacity improvement projects are drawn. Capacity improvement projects contained in this plan have also broadly and generally been drawn from the elements of this approved process, consistent with the region's approach to implementing Congestion Management System requirements. Future plan updates will continue to report on progress in implementing the approved CMS process for the Tri-County region.

Performance Measures

The following table lists approved performance measures for TCRPC's and MDOT's Congestion Management System in the Lansing-East Lansing metropolitan area. While data for some of these measures exist, others, such as delay rates, will need to be phased in over time and as additional traffic monitoring capabilities are developed. An additional implementation plan milestone for the first three years after adoption of the CMS process is for the Management and Operations Task Force to review the approved performance measures below, identify data needs and to develop long term and short term system monitoring plans. Work on this activity will begin after action on this plan.

Table 8-1: TCRPC Congestion Management System Performance Measures

- Crash rate analysis
- Congested vehicle miles of travel (VMT)
- Congested vehicle hours of travel (VHT)
- Average speed
- Congested speeds
- Delays: duration, extent, severity
- Delay per incident
- Average travel time per trip
- Persons per hour on the facility or in a corridor
- Level of Service (LOS)
- Congested lane miles
- Percent of vehicle miles traveled by functional classification
- Vehicle miles traveled per lane-mile
- Delay per lane mile
- Delay per vehicle miles traveled
- Delay per trip
- Delay per vehicle
- Delay rate
- Travel rate
- Number and percent of signal cycle failures
- Total vehicle delay
- Average and maximum queues

In consideration of movement of people and goods, other performance measures may include:

- Proportion of persons congested or delayed
- Person hours of delay
- Vehicle occupancy
- Other performance measures as integrated in the regional Congestion Management System.
- Person throughput per hour
- Does the project support increases in housing or population density consistent with the Regional Growth project principles?

Other Management Systems

Besides the CMS, MDOT continues to maintain five additional management systems. These include **bridge, intermodal, pavement, public transportation** and **safety**. TCRPC's memorandum of understanding on the new transportation planning process (see Chapter 1) identifies continued use of these other management systems as evaluation tools to assess other system needs or deficiencies.

A short discussion of each of these management systems follows.

The **bridge management system (BMS)** is used for managing inspection, analysis and maintenance of numerous components that make up a bridge. MDOT uses FHWA's PONTIS software for this management system. PONTIS features an inventory of detailed elements such as beams, joints and bearings, as well as the extent of deterioration. The bridge management system is a state-operated system with capability to separately consider needs of bridges in any MPO area or local jurisdiction.

The **intermodal management system** (IMS) is used for data management, analysis and deficiency identification for the state's non-highway transportation assets. It encompasses all public use, modal assets from the smallest carpool lot and intercity bus stop to the largest international air and marine ports.

The **pavement management system** (PMS) consists of data collection on the surface condition of roadways, historical cost and remaining pavement service life. This data is used to perform a variety of engineering and planning functions. These include forecasting future network pavement conditions and costs associated with implementing various pavement strategies. With addition of new state legislation mandating an asset management process, TCRPC, MDOT and local agencies are actively working with the state Asset Management Council to update and collect uniform condition information on all federal aid roads statewide in order to more consistently apply the PMS process. Expansion to include all public roads is anticipated in future years.

The **public transportation management system** (PTMS) was developed to replace the annual paper grant application and reporting process used by transit agencies. It is used to establish vehicle, equipment and facility inventories that can be accessed by interested parties. Performance indicators and asset replacement forecasts are top priorities for PTMS.

The **safety management system** (SMS) is used for analyzing crashes and roads where they occur. Data collection for the highway safety management system consists of vehicle, pedestrian and bicycle crash data. The management system provides for identification, analysis and implementation of engineering improvements at high-crash locations. System users can also summarize data and perform route based, time of return and peer group analyses.

TCRPC continues to support and apply these other management systems (above) to evaluate needs for other types of projects as appropriate.

For example, need for bridge projects contained in this plan have generally been drawn from the Bridge Management System, transit projects from the Public Transit Management System, etc. Additionally, as noted in Chapter 10, efforts are underway to further integrate the Pavement and Safety Management Systems into the region's planning process. As these systems continue to develop and mature, the integrated, cooperatively developed project selection process contemplated in Michigan's planning process redesign memorandum of understanding is being fully implemented in the region.