Congestion Management System

Adopted: October

Revised: December

Revised: May 1998

prepared by

Houston-Galveston Area Council

Prepared by:

Houston-Galveston Area Council

Transportation Department

The preparation of this document was financed in part through grants from the U.S. Department of Transportation under Section 112 of the 1973 Federal Aid Highway Act and Section 8(d) of the Federal Transit Act of 1964, as amended. The United States Government and State of Texas assume no liability for its contents or use thereof.

Acknowledgements:

The staff would like to express its appreciation to all individuals and agencies that participated in the development of this document. A special thank you is extended to members of the Transportation Policy Council, the Technical Advisory Committee, other public or private agencies, and private citizens who attended the public meetings or contributed comments. Public involvement in the development of this plan was a high priority and will continue to be a high priority during the plan's implementation.

Congestion Management System Plan

For the

Houston-Galveston Transportation Management Area

A component of **VISION 2020**

May 22, 1998

Public Meeting Dates:

August 18, 1997
September 10-11, 1997
September 15-17, 1997

Prepared by

Transportation Data Management Group
Houston-Galveston Area Council
3555 Timmons Lane, Suite 500
Houston, Texas 77027
Telephone: (713) 627-3200
Facsimile: (713) 993-4508
Webpage: www.hgac.cog.tx.us

TABLE OF CONTENTS

LIST OF EXHIBITS

GLOSSARY

Average Daily Traffic (ADT) - The average number of vehicles passing a fixed point in a 24-hour period. ADT is a measure of traffic volume on a roadway.

Clean Air Act Amendments (CAAA) - 1990 amendments to the Clean Air Act of 1970, which aims to substantially reduce air pollutants by specified target dates. This federal regulation classified the Houston-Galveston area as a nonattainment area for the pollutant ozone.

Congestion - The level at which transportation system performance is no longer acceptable due to traffic interference. The level of acceptable system performance may vary by type of transportation facility (major arterial, minor arterial, principal, transit), geographic location (metropolitan area or sub-area, rural area) and/or time of day. Congestion can be classified as either recurrent or non-recurrent. Recurrent congestion includes regular work commute or planned event trip delays and accounts for approximately 35% of all congestion; non-recurrent congestion includes minor and major incident delays and accounts for approximately 65% of all congestion.

Congestion Management System (CMS) - A management system or systematic process for identifying traffic congestion, mitigating congestion, and monitoring the effectiveness of congestion mitigation measures.

Congestion Mitigation and Air Quality Improvement Program (CMAQ) - A $6 billion program which helps implement projects designed to reduce emissions in areas not meeting federal health standards for air quality.

Employer Trip Reduction (ETR) programs - Employer-designed programs that minimize employee commuting levels. These programs are federally required in nonattainment areas.

Federal Highway Administration (FHWA) - A part of the U.S. Department of Transportation. FHWA is responsible for approving and funding all federal aid for any highway project or program.

Federal Transit Administration (FTA) - A part of the U.S. Department of Transportation. FTA is responsible for approving and funding all federal aid for any transit program or project.

Geographic Information System (GIS) - An organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information.

High Occupancy Vehicle (HOV) - A vehicle with two or more occupants. Freeways and other roads carrying large traffic volumes may have lanes designated for HOV use such as vanpools, carpools, and transit.

Houston-Galveston Area Council (H-GAC) - The metropolitan planning organization for the Houston-Galveston area. One of its functions is to develop and coordinate the

transportation planning and projects being implemented in the Gulf Coast State Planning Region.

Infrastructure - Term used to describe the physical assets of a society or community including roads, bridges, transit facilities, bikeways, sidewalks, parks, sewer/water systems, communications networks and other capital facilities.

Intelligent Transportation System (ITS) - A computer/communications technology that provides the motorist with information about road conditions as well as monitors and controls vehicle operation on roadways.

Intermodal - Refers to the connections between transportation modes.

Intermodal Surface Transportation Act (ISTEA) of 1991 - A federal mandate that restructures funding for highway and transit programs. The Act also requires those transportation plans and programs developed by metropolitan planning organizations be comprehensive and Intermodal.

Long Range Transportation Plan - See Metropolitan Transportation Plan.

Management System - A systematic process, designed to assist decision-makers in selecting cost-effective strategies/actions to improve the efficiency and safety of, and protect the investments in, the nation's transportation infrastructure.

Metropolitan Planning Organization (MPO) - A forum for cooperative transportation decision making which is responsible for conducting and coordinating a transportation planning process in the region. Development of the Metropolitan Transportation Plan is the MPO's responsibility.

Metropolitan Transportation Plan (MTP) – It identifies existing and future transportation deficiencies and needs, as well as network improvements needed to meet mobility requirements over a twenty-year period. In nonattainment areas, this plan must also address how the transportation system of the region will improve air quality. To receive federal funding, transportation projects must be included in the Transportation Improvement Program (TIP) and MTP, formerly known as the Long-Range Transportation Plan.

Multimodal - Refers to the diversity of options for the same trip; also, an approach to transportation planning or programming which acknowledges the existence of or need for transportation options.

National Ambient Air Quality Standard (NAAQS) - Federally mandated maximum levels (i.e. federal health standards) for air pollutants such as ozone.

National Environmental Policy Act (NEPA) - Federal act requiring a study on any environmental impact a federally funded or permitted project might cause.

National Highway System (NHS) - The network of roads including all interstate routes, regionally significant urban and rural principle arterials, potential strategic defense

routes, critical highway connectors, and access to major ports, airports, public transportation, and Intermodal facilities.

Network - A transportation system with its many paths and routes often shown either graphically or mathematically.

Non-attainment Area - A designation by the Environmental Protection Agency of any place in the United States failing to meet national air quality standards (NAAQS). The Houston-Galveston area is a non-attainment area for ozone.

Performance Measures - Any of a variety of methods that can be used to determine the level at which a transportation system is operating. For congestion management, performance measures include travel time; delay; level of service; speed; and time rate.

Regional Computerized Traffic Signal System (RCTSS) - A centralized traffic signal system designed to improve traffic signal timing efficiency and minimize traffic delays.

Single-Occupant Vehicle (SOV) - Any vehicle where the operator is driving alone to work, school, and other destinations.

State Implementation Plan (SIP) - The CAAA requires the State to prepare a plan demonstrating how its nonattainment areas will reduce emissions from identified sources and achieves national air-quality standards by specified dates. The MTP must comply with or conform to the SIP.

Surface Transportation Program (STP) - A federal program designed to create flexible funding for transit and highway construction.

Technical Advisory Committee (TAC) - Committee which advises the Houston-Galveston Transportation Policy Council (TPC) on technical matters relating to transportation planning within the region. This committee is composed of representatives of local government, transportation modes, environmental interests, and other interests relevant to transportation planning and air quality.

Telecommuting - Using a home computer or a neighborhood work center for work, effectively eliminating the need to travel to a conventional workplace.

Teleconferencing - Using audio, video, and/or computer connections among sites for meetings, eliminating any need to travel to the meeting site.

Texas Department of Transportation (TxDOT) - State agency responsible for construction and maintenance of all Interstate, U.S., and State Highways and Farm-to-Market (FM) Roads within the state.

Transportation Conformity - A requirement of the CAAA that a regional emissions analysis be conducted on transportation programs and plans to ensure that these plans meet the State Implementation Plan's air quality goals.

Transportation Control Measure (TCM) - A transportation management strategy or group of strategies that consist of both Transportation System Management (TSM) and

Transportation Demand Management (TDM) measures. Transportation Control Measures (TCM) strategies are intended to improve the mobility of goods and people with quantifiable air quality benefits. Most TCM strategies are considered relatively low capital cost solutions to congestion mitigation problems as compared to the traditional capital intensive solution of solving operational and travel demand problems with the addition of single-occupant vehicle (SOV) general purpose lanes.

Transportation Demand Management (TDM) - Strategies for easing or reducing transportation demand, specifically aimed at diverting people from driving alone. Programs used to improve air quality and congestion by decreasing vehicle miles traveled and vehicle trips.

Transportation Improvement Program (TIP) - An MPO-prepared document that identifies specific highway and transit projects to be implemented in an area over a three-year period, i.e. this document covers the first three years of the Metropolitan Transportation Plan. To receive federal funding, a transportation project must be included in plan and TIP.

Transportation Management Area (TMA) - An urbanized area with more than 200,000 people.

Transportation Policy Council (TPC) - A body of 21 locally elected officials and area agency representatives which determines the policy direction of Intermodal and multimodal transportation planning in the Gulf Coast State Planning Region, i.e. the Houston-Galveston transportation management area.

Transportation System Management (TSM) - Strategies for improving the operations of the transportation system.

Unified Planning Work Program (UPWP) – It is an annual report prepared by the MPO describing transportation planning activities which will take place within the Gulf-Coast State Planning Region.

United States Department of Transportation (USDOT) – The Principal federal funding and regulating agency for transportation facilities. FHWA and FTA are agencies within DOT.

Vehicle Miles Traveled (VMT) - Term used for describing the total number of miles traveled by a vehicle in a given time in a specified region.

CONGESTION MANAGEMENT SYSTEM PLAN
Houston-Galveston Transportation Management Area

CHAPTER 1: INTRODUCTION

1.0 Purpose

The purpose of the Congestion Management System Plan is to reduce existing traffic congestion and prevent its occurrence in areas that are currently uncongested.

1.1 CMS Policy Statement

It is the stated policy of this plan to apply cost-effective demand and system management measures as the first component of all congestion reduction strategies. Regionally significant added capacity roadway projects are justified only if cost-effective demand management and system management strategies fail to reduce vehicular congestion to acceptable levels. Where demand or system management projects are feasible and cost-effective, project sponsors, or relevant implementing agencies, and the MPO must commit to their implementation or incorporation into a proposed added-capacity project as a pre-condition to both federal and state funding assistance. Project design, concept, and scope must also be consistent with any selected management strategies.

1.2 Overview

Traffic congestion detracts from a region's ability to grow and prosper. High levels of congestion may cause business and residents to relocate due to the delays associated with traffic. The traditional, capital-intensive solution to solving an operational and travel demand problem was the addition of single-occupant vehicle (SOV) general-purpose lanes. The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 addressed metropolitan areas' concerns about traffic congestion by requiring the development of a Congestion Management System (CMS) that reduces travel demand and provides operational management strategies that enhance a region's mobility.

The Houston-Galveston Area Council (H-GAC) is the MPO responsible for implementing the CMS in the Houston-Galveston Transportation Management Area (TMA). The TMA consists of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties.

A CMS is designed to assist decision-makers in selecting cost-effective strategies to manage transportation facilities so that traffic congestion is alleviated. In areas with severe air pollution problems, consideration must be given to strategies that contribute to vehicle emissions reductions. The Houston-Galveston TMA is a non-attainment area for ground level ozone. The transportation management strategies contained in the CMS plan are intended to improve the mobility of goods and people with quantifiable air quality benefits. Most Transportation Control Measure (TCM) strategies are considered relatively low cost solutions to congestion problems, as compared to the traditional capital intensive solution of solving operational and travel demand problems with adding single-occupant vehicle capacity.

1.3 Background

The CMS implementation serves as a response to the long range planning expectations identified in ISTEA, the FHWA/FTA Final Guidance on ISTEA Metropolitan Planning and Management Systems, and the FHWA/FTA Rules on Metropolitan Transportation Plans. The evaluation process began with a detailed assessment of transportation improvements including congestion mitigation strategies, bikeway and pedestrian facilities, rail facilities, high-occupancy vehicle lanes, and toll road facilities. The CMS Plan is an integral part of, and consistent with, **VISION 2020**, the Houston-Galveston Metropolitan Transportation Plan (MTP).

Proceedings from the 1994 FHWA workshop define a CMS as: "the continuous activity of considering and implementing actions that enhance mobility and reduce congestion on designated systems or in targeted areas, appropriate to the magnitude and scope of desired system performance." At a minimum, an effective CMS should contain the following six components:

- Performance measures must be determined to show the congestion effect on the regional transportation network.
- A sufficient CMS network must be identified for the region in order to provide comprehensive analysis and performance measure monitoring.
- Data collection and monitoring systems must be developed to support system analysis.
- Transportation management strategies must be identified and evaluated using adopted performance measures.
- Strategies determined to be effective and feasible must be implemented by the appropriate transportation agency.
- Once transportation control strategies are implemented, their effectiveness must be determined and monitored.

The CMS is being developed concurrently with **VISION 2020**, the Houston-Galveston Metropolitan Transportation Plan. Thus, the steps listed above are not necessarily performed sequentially.

In Chapter 2, H-GAC documents the development of Level of Mobility (LOM) as the index used for the Houston-Galveston TMA to measure congestion initially. This chapter also identifies the Houston-Galveston TMA's 1996 existing-plus-committed network as the base-year "no-build" CMS network. Chapter 3 documents the congestion mitigation analysis (CMA) process that addresses transportation management strategies for the added-capacity projects in **VISION 2020**. It incorporates a process similar to TxDOT's Single-Occupant Vehicle (SOV) Analysis guidelines to assist in performing SOV analysis on previously identified projects. Chapter 4 describes the on-going data collection necessary to monitor and evaluate implemented strategies, both regionally and at the corridor level. It also addresses the evaluation of TCM strategies as independent and grouped scenarios using a state-of-the-practice performance measure (travel rate).

CONGESTION MANAGEMENT SYSTEM PLAN
Houston-Galveston Transportation Management Area

CHAPTER 2: CMS PERFORMANCE MEASURING TOOLS AND STRATEGIES

2.1 Initial Performance Measure – Level of Mobility

Setting mobility standards for the CMS provides a quantitative tool to benchmark system performance and congestion and to analyze the impacts of any change. If actual performance falls below the standard, actions may be warranted to restore or improve the level of mobility. H-GAC has chosen to use the Level of Mobility performance measure as its initial congestion mitigation standard.

Level of Mobility (LOM), which is a ratio of roadway capacity and traffic volume, is based upon directional 24 hour per lane volumes for existing and committed roadways. Three levels of capacity were developed, based on geographic location, to better reflect travel patterns and roadway design characteristics. These capacities were further differentiated to reflect State standards for four facility types as shown in the table below. These "*evaluation*" capacities include facility adjustments for signal greentimes, percent trucks, percent left turns, directional factors, etc.

Evaluation Capacity Table

	Location		
Facility Type	Urban	Suburban	Rural
Freeways	23,500	23,500	16,500
Tollways	18,000	18,000	-------
Expressways	11,000	11,000	-------
Arterials	7,500	6,250	5,000

During the development of the MTP, the effects of certain TCMs were incorporated into the evaluation capacities and volumes in a spirit consistent with CMS guidance. For example, Land Use Densification was accounted for through the adoption of the CBD and inner Loop 610 employment target values. The Transportation Demand Management (TDM) measures that are part of the Existing - Plus-Committed (E+C) network were applied as applicable to the post mode-choice outputs of the model to insure that the evaluation volumes reflected probable results from TDM implementation. TDM measures were incorporated as follows:

- For pedestrian and bicycle improvements, home-based trips were reduced regionally by .09 percent and .47 percent, respectively. The VMT and speed changes resulting due to the reduction of trips are part of the TCM effectiveness.

- Transit service increases, Park & Ride lots, and HOV lanes were accounted for in the mode-choice travel demand analysis as an overall decrease in vehicle miles of travel (VMT) on applicable

facilities. This was documented in "Evaluation Results Report for METRO Regional Transit Plan" and adopted April 1977.

- Transit/Vanpool Subsidies were incorporated by increasing the post-mode choice, work transit mode share to activity centers by 29,000 vehicle trips and non-home-based transit mode share from activity centers by 16,000 vehicle trips across the region. Additionally, the equivalent auto occupancies to and from activity centers for non-transit trips were reduced accordingly.

Four levels of mobility (LOM) used to define congestion were developed by the H-GAC Travel Modeling Committee in 1997 and approved by the Technical Advisory Committee (TAC), they are shown as follows:

LOM	V/C
Tolerable	< 0.85
Moderate	>= 0.85 < 1.00
Serious	>= 1.00 < 1.25
Severe	>= 1.25

Finally, it was determined that signal timing and other traffic management measures could mitigate traffic congestion occurring on facilities with less than moderate levels of congestion. All regionally significant added-capacity projects were screened using the above criteria.

This method of evaluating congestion provides a reasonable interim basis for assessing facilities that may experience congestion in the future, The advantages of this method are:

- Consistency with existing regional modeling efforts;
- Employs readily available data;
- Previously reviewed and adopted regarding its effectiveness;
- Sufficiently broad-based to indicate where further data collection should be directed; and
- Immediate application to existing added-capacity projects to provide an initial assessment of potential for congestion mitigation strategies.

2.2 1996 Existing plus Committed (E+C) Scenario Network

The 1996 Existing-Plus-Committed (E+C) Network, also called the "No-Build Scenario", provides the base-year network for the level of mobility analysis of the CMS. It assumes no roadway improvements beyond those projects programmed in the 1996-1998 TIP, the first 5 years of METRO's 1996-2005 General Mobility Plan, the City of Houston's 1996-2000 Capital Improvement Program (CIP), and Harris County's 1996 Bond Program. The E+C transit system incorporates all elements of METRO's Regional Bus Plan as well as other transit projects identified in the 1996-1998 TIP.

The E+C network is one of four system-level scenarios developed to analyze roadway and transit needs in the region through the year 2020. The level of mobility performance measure is applied

to the E+C base year network as a series of buffers that provide target areas for consideration of congestion mitigation measures. The buffer boundaries have been set at a 1.5-mile radius for the denser urban areas and a 3.0-mile radius for non-urbanized areas. Exhibits 2.1 and 2.2 show the moderate, serious, and severe congestion levels for 2000 and 2020, respectively, overlaid on the 1996 E+C network. Exhibits 2.1 and 2.2 have been moved to the end of this document for viewing ease.

2.3 CMS Roadway System

All existing and proposed principal arterials as adopted by the Transportation Policy Council in the Functionally Classified System shall be decreed "regionally significant" for purposes of CMS monitoring. For this purpose, principal arterials are defined as facilities classified as minor arterials and above in the rural areas and major arterials and above in the urban areas. The CMS shall also monitor other regionally significant transportation facilities; such as fixed guideway transit, major ports and airports, and their associated NHS connectors. A CMS Roadway System was developed to include all the aforementioned facilities and is shown in Exhibit 2.3. (Exhibit 2.3 has also been moved to the end of the document.)

2.4 Other System-Level Scenario Networks

The Build 1, Build 2, and Transportation System Management (TSM) scenarios are networks of projects that form the basis for the travel demand analysis for **VISION 2020**. The Build 1 network scenario contains added-capacity projects that contribute to the completion of logical segments of roadway and they were contained in the 1996-1998 TIP. Pavement extensions and intersection/interchange improvements may be included in Build 1 as well depending on their status of preparation by their implementing agencies. The completion of highway frontage roads along existing highways are considered gap filler projects and are found in this group of projects also. A Build 1 project must meet one of the following conditions:

- The project has environmental clearance as evidenced by a Finding of No Significant Impacts (FONSI) or a Record of Decision (ROD);
- Significant right-of-way has been acquired; or
- The project fills a gap in the system or alleviates a “bottleneck” situation.

Transit strategies include construction of new HOV lanes within existing right-of-way, ramps, and other street improvements to service HOV lanes, and construction of new Park-and-Ride facilities. The Build 2 scenario network contains added-capacity projects that do not meet above criteria but meet H-GAC’s regional CMS analysis criteria. Transit strategies include construction of HOV lanes and fixed guideway facilities that require additional right-of-way.

The Build 1 and Build 2 scenario networks were combined to provide a map of approximately 794 added-capacity projects selected for inclusion in **VISION 2020** at a cost of $9,883,757,293**.** Within this group, $65,412,129 represents carryover projects from previous TIPs. All of these added-capacity projects are shown in red in Exhibit 2.4 against the 2020 congestion buffers. (Exhibit 2.4 has

also been moved to the end of the document.) A preliminary evaluation of the MTP roadway and transit projects indicated there were three types of added-capacity projects considered for analysis:

- Reconstruction projects that add additional lanes of SOV capacity ;
- New Projects where no facility exists today; and
- Additional congested areas where added-capacity projects may be needed.

2.5 TSM/TDM Strategies

The TSM network scenario includes demand management projects (carpool, vanpool, etc.); operations management projects and other transportation control measures (signal synchronization, flow signal, etc.) that affect vehicle miles traveled and/or travel speeds. Transit TSM measures include improving existing High Occupancy Vehicle (HOV) lanes within existing right-of-way, Park-and-Ride lots, and transit centers adjacent to TSM improved corridors.

In 1994, H-GAC contracted with Sierra Research, Inc. to develop tools for evaluating the transportation and emissions effects of TCMs included in the 1996 TIP and the cost-effectiveness of these measures. An analysis tool, called TCM Tools, was developed that enabled H-GAC to perform regional analysis of emissions and congestion mitigation on 28 TCMs. After that effort, H-GAC contracted with ICF Kaiser and RSM Services to expand the scope of regional analysis capabilities of TCM Tools and to develop corridor-level analysis capabilities. The TCM TOOLBOX was adopted in January 1997. It is an integrated system of software modules designed to analyze the travel and emissions impacts of transportation projects, particularly transportation control measures. The enhanced TCM Tools module allows analysts to evaluate projects that are not generally included in regional travel demand models such as ridesharing and transit use. The EXPLORA module, on the other hand, can be applied at regional and/or subregional (or corridor) levels. The Level of Mobility performance measure was quickly assessed at the regional level to determine the significance of potential TCM candidate projects.

There are currently 496 candidate TSM/TDM projects (including those that are part of the existing added-capacity project commitments) in **VISION 2020**. They are shown in Exhibit 2.5 in a contrasting color. This map has also been moved to the end of the document for viewing ease.

Those TCMs that have significant impacts on improving traffic flow and alleviating congestion are classified into six major categories:

- Regional Computerized Traffic Signal System (RCTSS),
- Regional Vanpool Program,
- High Occupancy Vehicle (HOV) Lanes,
- Freeway Traffic Management System,
- Intersection Improvement Projects, and
- Traffic Signal Timing & Coordination Improvements.

Two major multimodal categories are added to Exhibit 2-6 to reflect their importance in regional development, they are the Pedestrian & Bicycle Program and Intermodal Transportation Projects.

Exhibit 2-6 Regional Significant TCMs, Pedestrian, Bicycle, and Intermodal Projects

Major TCM Categories	Total Number of MTP Activities	Total Funding ($K)	Note
Regional Computerized Traffic Signal System (RCTSS)	18	396,780	Most RCTSS projects are bundled together, these 18 activities represent more than 400 intersections.
Regional Vanpool Program (include regional commute alternative program)	9	30,625	
High Occupancy Vehicle (HOV) Lanes	42	347,979	
Freeway Traffic Management System (such as CTMS and incident detection & response program)	35	75,939	
Intersection Improvement Projects (include continuous left turn lane and intersection widening)	59	219,660	
Traffic Signal Timing & Coordination Improvements (other than the RCTSS, contain all the traffic signal timing and coordination improvement projects, ATMS, and TMS.)	38	37,731	
Pedestrian and Bicycle Program	113	132,842	Due to the different impacts between Pedestrian and Bicycle projects, Hike-and-Bike trail is considered as two TCM projects.
Intermodal Transportation Projects (contain ferry, rail, and truck projects)	21	162,141	
TOTAL	335	1,403,697	

2.6 Project Level Analysis

The CMS Plan is an integral part of the regional transportation plan, VISION 2020, as is the 1998 Transportation Improvement Program. The project selection process included the CMS criteria as established in this Chapter. The results of H-GAC's regional CMS strategies and **VISION 2020**'s project selection process identified 69 new added-capacity projects for the 1998-2000 TIP. Each of these projects was subjected to preliminary corridor-level analysis. The new TIP also contains several added-capacity projects from previous TIPs that have not received their environmental clearances. The CMS plan provides a methodology to address all of the proposed added-capacity projects, regardless of status at the time this plan is implemented. The logistics of the CMS process provides a method for sharing the best available project information, tools, and expertise between H-GAC and the implementing agencies. It is described in Chapter 3.

CONGESTION MANAGEMENT SYSTEM PLAN
Houston-Galveston Transportation Management Area

CHAPTER 3: CONGESTION MITIGATION ANALYSIS (CMA) PROCESS

3.1 CMA Process for 1996-1998 TIP Carryover Projects

Prior to the adoption of a CMS plan for the Houston-Galveston TMA, implementing agencies assessed the effectiveness of congestion mitigation using the Texas Single Occupant Vehicle (SOV) guidelines developed for TxDOT by the Texas Transportation Institute (TTI). These guidelines were incorporated into the submission of the Texas application of the National Environmental Policy Act (NEPA) process, as interim measures, until a congestion management plan was adopted. The "Single-Occupant Vehicle (SOV) analysis" of added-capacity projects was submitted for approval with the rest of the environmental documentation. Because this CMS plan has been implemented into an ongoing TIP process, some projects from previous TIPs have not received their final NEPA clearance. Since the conformity determination was made on December 18, 1997, these carryover projects are subject to the H-GAC CMS and the conforming plan, VISION 2020; thus, year 2020 will be the horizon year for justification consideration

3.2 CMA Process for Congested Facilities Not Included in VISION 2020

There are 415 TSM/TDM projects not "tagged" to specific added-capacity projects in **VISION 2020**. This suggests that there may be significant mitigation measures programmed for corridors that were not considered by other implementing agencies. The complexities of implementing a new "SOV process" during this period of document revisions and updates is why H-GAC chose to implement an interagency feedback-loop process. The feedback-loop allows both the MPO and the implementing agency the flexibility to share information at the corridor level on a case by case basis. For the purposes of this document, a corridor is defined as a radius of approximately 2.0 miles around each regionally significant, added-capacity, candidate project.

3.3 The CMA Process for the 1998 TIP

VISION 2020 is both a strategic planning document and a detailed, long-range plan for future investments in the Houston-Galveston TMA. It identifies and prioritizes projects and programs designed to enhance the roadway network, transit services, and goods movement through the year 2020. The MTP also incorporates bicycle and pedestrian improvements identified in the Regional Bicycle Plan. The long-range plan is constrained by available revenues to fund the maintenance, operation, and construction of the transportation system and by vehicle emissions budgets established to attain clean-air standards. Candidate MTP projects have been identified from city, county, state and transit agency submittals. Additional projects have been added to the list based upon needs identified by the Metropolitan Planning Organization (MPO).

In order to make sound programming decisions and to ensure that selected projects conform to air quality and financial planning mandates, it is necessary to evaluate programs and

projects proposed for inclusion in the 1998 TIP. This evaluation process is documented in Exhibit 3.1 and described below in paragraphs 3.3.1 through 3.3.4.

3.3.1 Regionally Significant Added Capacity Projects

As alluded in Section 2.3, added-capacity projects on the CMS Roadway System are considered regionally significant. MPO will perform the SOV analyses on all federal and state assisted added-capacity projects on the CMS Roadway System, except as stated below, with no SOV analyses being required of non regionally-significant projects.

3.3.2 Major Investment Study (MIS) Requirements

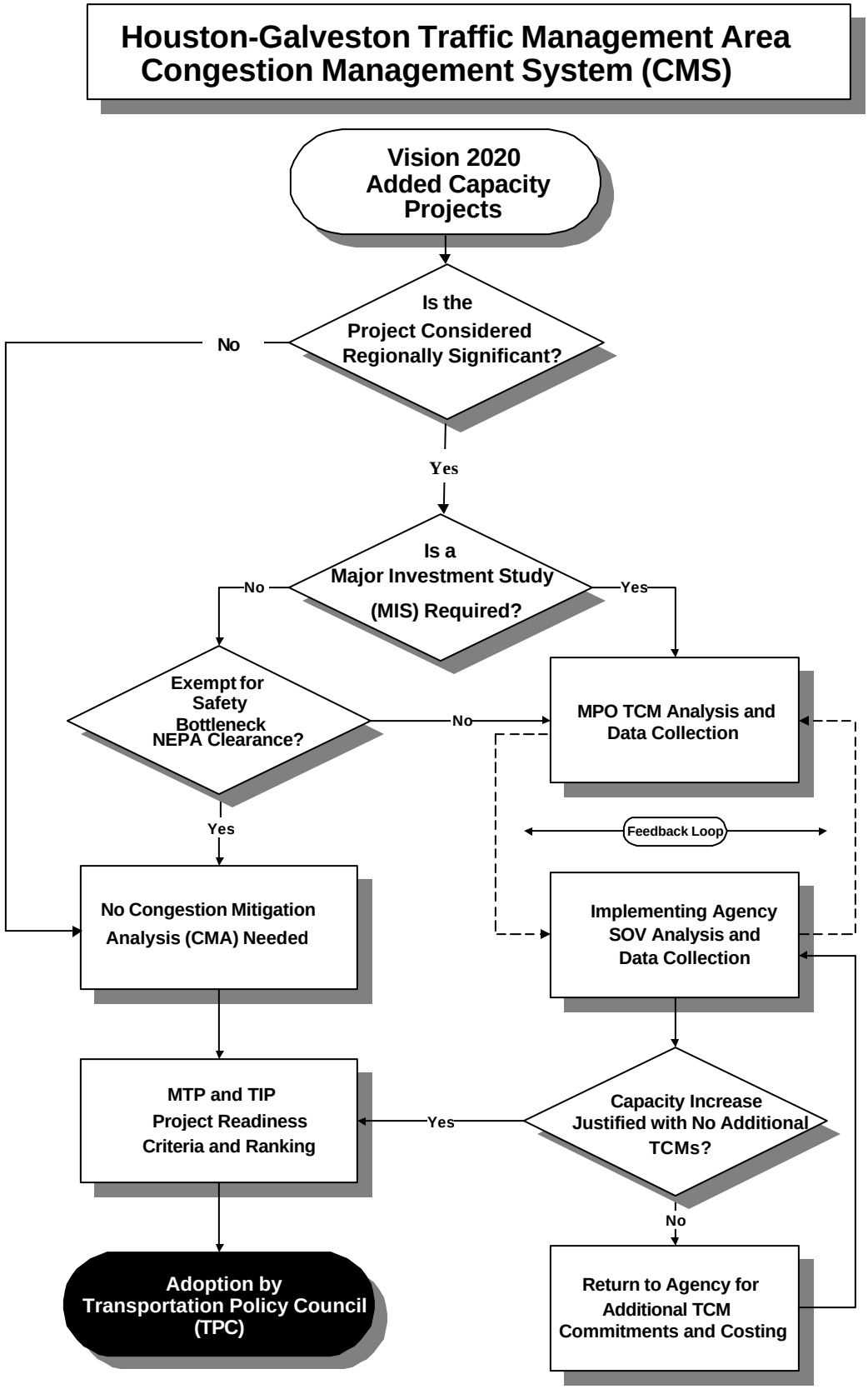
Highway or transit improvements of substantial cost that have significant impact on capacity, traffic, level of service, or mode share in a corridor require a major investment study (MIS). H-GAC expects a congestion mitigation analysis to be an integral part of any MIS process in this region. There are several MIS projects in progress with a significant number programmed in the 1998 Unified Planning Work Program adopted in June 1997.

MIS projects are expensive and have extensive requirements, the least of which is probably its added-capacity justification. The MPO, as part of its ongoing CMS process, will identify other regionally significant added-capacity and TCM projects that may have added-capacity justification implications for the proposed project and share this information with the implementing agency. The MPO will also provide the implementing agency a list of additional data requirements for corridor-level analysis of the proposed project. Any data collection accomplished by the implementing agency should be shared with the MPO, enhancing the capabilities for future preliminary analyses. The MPO will review and comment on the alternatives as to added capacity justification and TCM commitments.

3.3.3 “SOV Analysis” Exempt Projects

There are projects in **VISION 2020** that are classified as exempt from congestion mitigation analysis. Projects that are being proposed to solve a safety problem, such as grade-separations, are exempt unless they include adding capacity. Candidate projects that solve a bottleneck problem by widening or adding lanes and less than one mile in length may be classified as exempt projects. Recent projects that have received their environmental findings are also considered exempt. Those added capacity projects receiving their "Finding of No Significant Impact" (FONSI) or "Record of Decision" (ROD) prior to the 1993 deadline may be considered for SOV analyses on a case by case basis dependent upon level of activities. A "grandfathered" project with a high level of activity toward being let to contract will require no congestion mitigation analysis and can proceed to the normal project-readiness criteria and ranking for the TIP.

Exhibit 3.1 Congestion Mitigation Analysis Process



3.3.4 Capacity Justification Decisions for the 1998 TIP

Section 1.1 of this document stated that "Regionally significant added-capacity roadway projects are justified only if cost-effective demand management and system management strategies fail to reduce vehicular congestion to acceptable levels. Where demand or system management projects are cost-effective, project sponsors, or relevant implementing agencies, and the MPO must commit to their implementation as a pre-condition to both federal and state funding assistance." Since there are some projects in **VISION 2020** which have significant TCMs designed into their proposal, additional TCMs may not be significant to warrant further analysis. However, the number of proposed TSM/TDM projects in the new plan is so large and geographically diverse that the decision of "capacity increase justified with no additional TCMs" is an unlikely path in the first pass.

Many of these TCM projects are not proposed by the same agency nor are they necessarily proposed for the same implementation timeframe. To facilitate this seemingly cross-purpose, the FHWA has provided clarification that the implementation of a TCM, in conjunction with an added-capacity project, need only be programmed by the time its impacted added-capacity project is completed. A TCM being programmed implies being selected for funding and/or having the commitment of its implementing agency. However, if a TCM were determined to have significant impact, a TCM commitment letter should be provided by the implementing agency.

H-GAC performed a preliminary analysis of the **VISION 2020** projects as described in Chapter 2. Sixty-nine (69) new projects were prioritized and selected for the 1998-2000 TIP. Each TIP candidate project was mapped to include up to a three-mile corridor of nearby facilities. All TSM/TDM projects in the corridor were identified. Each project was reviewed for alternative mitigating TCMs by evaluating probable LOM impacts of each identified TCM. There are no additional TCMs that preclude the need for added-capacity in these selected projects. However, there are TCMs, such as signalization and intersection improvements, which the implementing agency should consider during preliminary engineering of these projects. The MPO will provide a corridor level analysis of each selected project and forward the information to the implementing agency.

3.3.5 Significant TCMs

Some TSM/TDM projects lend themselves to fully measurable "rules-of-thumb". There are sufficient empirical data on HOV lanes and signal synchronization to determine vehicle trip reduction or speed increases that increase capacity on a corridor. The MPO believes, however, that a continuous program of data collection and project evaluation is essential to implementing a fully functional CMS. Additional data will enhance the ability of the MPO to provide preliminary analysis information for a targeted corridor thus reducing the complexities of matching/scheduling TCMs to added-capacity projects. Chapter 4 describes the data collection, evaluation and TCM TOOLBOX enhancements that are needed to maintain a fully functional congestion management system.

CONGESTION MANAGEMENT SYSTEM PLAN
Houston-Galveston Transportation Management Area

CHAPTER 4: MONITORING AND EVALUATION

4.1 State-of-the-Practice Performance Measure

The primary purpose of the CMS is to reduce and monitor congestion within the region. Quantitative measures of congestion are needed to provide a historical documentation and a basis for TCM strategy recommendations; and to be used as a guide to the project selection process.

It is desired that the measure of performance used shall be directly applicable to an area-wide level analysis and also measure the movement of people and goods. The Texas Transportation Institute (TTI) in their report entitled " CMS State of Practice" recommends travel rate to be a better measure of performance for not only corridor-level but also area-wide congestion. TxDOT also recommends the use of travel rate, which can be calculated using the formula described in the above-mentioned report and is provided in Exhibit 4.1. This method incorporated Average Daily Traffic (ADT), speed, and vehicle occupancy into one standard equation. It provides a measure for both the automobile and the transit travel in terms of movement of people and goods. However, this formula lacks the important variable of trucks or heavy vehicles. Work is underway to include this significant component of truck traffic into travel rate calculation.

Exhibit 4.1 Performance Measure Calculation

Travel Rate (TR)

$$TR = \frac{\sum t_i VMT_{pi} O_i + \sum (t_i + tTER_i) BMT_{pi} R_i}{\sum VMT_{pi} O_i + \sum BMT_{pi} R_i}$$

- **TR = weighted average area wide travel rate (minute/mile)**
- t_i = **Travel time in section** i **(minute/mile)**
- VMT_{pi} = **VMT in section** i **in peak period**
- O_i = **Occupants on** VMT_{pi}
- $tTER_i$ = **Terminal time**
- BMT_{pi} = **Bus, vanpool, carpool miles of travel in section** i **in peak period**
- R_i = **Ridership on** BMT_{pi}

The initial thresholds for the weighted-average area-wide travel rate (minute per mile) are described in the TTI's report, "State of the Practice" and included in Exhibit 4.2 below. It is suggested in this report that each region should adjust them to suit their own regional conditions.

Exhibit 4.2 Travel Rate Lookup Table

Facility Type	**Travel Rate**		Traffic Condition
	All Others	Transit	
Freeway or HOV	**1.3**	**1.3**	OK
	1.7	**1.7**	Heavy
Arterial	**1.7**	**3.7**	OK
(speed >= 45 mph)	**2.0**	**4.0**	Heavy
Collector	**2.4**	**4.4**	OK
(speed < 45 mph)	**3.0**	**5.0**	Heavy

NOTE: OK = "10 mph below post speed"
Heavy = "15 mph below post speed for 15 minutes"
Add 2 min. on Transit on non-HOV

Special data for critical corridors are required and shall be collected by a collaborative effort by TxDOT, Metropolitan Transit Authority of Harris County (METRO), Houston-Galveston Area Council (H-GAC), and others. These special data needs will typically include vehicle occupancy, speed, mode split (other than transit), and duration of congestion. Data collection is underway to validate the use of travel rate as the performance measure. However, this does not interfere with the interim use of LOM as the performance measure. Once the utilization of travel rate is approved, it can be used along with the LOM criteria to provide sufficient information for the system monitoring.

4.2 Data Collection Efforts

The data collection efforts for the Houston-Galveston CMS combine the following three activities:

- Monitoring system performance: In order to monitor projects, pre and post implementation data is needed. Project sponsors should share project-monitoring information with the MPO and other implementing agencies. The minimum requirements of such information may include project status, traffic counts, occupancy counts, and travel time runs. The MPO shall maintain an inventory of previously implemented TCMs and continuously evaluate their performance for congestion mitigation and cost effectiveness as defined later in Section 4.3. The data collection effort for monitoring system performance is underway.

- Evaluation of TCMs: Both regional- and corridor-level evaluations of existing TCMs shall be performed to enhance the accuracy of the results and to gauge air quality improvements. The success or failure of implementing and evaluating TCMs will continue to add to the reliability of the evaluation results. The data collection effort for evaluating TCMs is underway.

- Establishing project inventory: TCMs at different locations have different impacts because of location, facility type, and other travel characteristics. For example, the benefit of increasing the transit service in a residential neighborhood will most likely be less than in a major employment center. A speed increase on a highway that will have a larger impact than on a collector street is another example of diversity of application. The TCM inventory includes TSM/TDM projects that are already in place, TSM/TDM projects that have implementing agency commitments, and TSM/TDM projects that are locally funded. When the initial TCM projects are identified by their relationship to added-capacity projects in the region, allowances may be required for these variations by location or function. A database may be created to establish the before-implementation and after-implementation time-lines for evaluation purposes; certain TDM projects may need periodic evaluations. Most appropriately, this inventory can begin from year 1997, however, for transit-related TCMs, it may start earlier than 1997.

4.3 Continuous Process for Monitoring and Evaluation

After a project has been implemented, system performance will be evaluated with the updated before-and-after information to determine if progress on the system wide and corridor level has been made. Cost effectiveness will also be compared with before-and-after data. Those implemented strategies that are effective in mitigating congestion at one location can be recommended for implementation at other locations, otherwise, new strategies will be explored.

In order to streamline the monitoring process, it is established that if a TCM significantly improves the performance of a facility, the MPO will request the implementing agency issue a Letter of Commitment. The Letter of Commitment will show the assurance of the agency to execute the TCM option and also indicate a time-line and the incremented cost to finish the project. This will enable the MPO to systematically review the progress of the agency in implementing the TCM project(s).

Traffic takes a certain period of time to mature after the execution of a new project. The duration differs due to the facility type and the nature of the project. A time-line will be determined by the MPO in consultation with the implementing agency to determine when to collect after implementation data in order to find if the facility's performance has improved. Upon completion of the initial evaluation, the MPO and the implementing agency will ascertain the frequency of future evaluations during the useful life of that TCM. It is suggested to evaluate TSM-type TCMs six weeks and TDM-type TCMs six months after their implementation on the project facilities. Periodic reviews and re-evaluation of TDM-type TCMs shall continue until it is determined that the characteristics of traffic operations suggest subsequent modifications.

Also, there are many possibilities that would suggest the periodic review of the congestion management system and its strategies. Examples of these would be:

- When development occurs, (i.e., building a new baseball stadium),
- New technologies emerge, (i.e., an automated highway system),
- Change in public acceptance of new strategies, (i.e.,VMT tax), and
- Change in the political climate, (i.e. rail/fixed guideway).

The primary objective of a CMS report would be to provide a mechanism for sharing the congestion mitigation progress with all the implementing agencies. It is recommended that a Congestion Mitigation Report (CMR), describing current congestion conditions and the effectiveness of the strategies implemented, be generated in conjunction with any major update of the regional transportation plan or the development of a new transportation improvement program.

In addition to the evaluation of newly implemented TCMs, the report should outline probable data collection needs for the next CMR. A separate chapter will be provided with regards to the TCM commitments in CMR. This chapter will contain all the new TCM commitments that have been implemented and all the projected TCM commitments that are not implemented. A TCM commitment report shall be transmitted to FHWA.