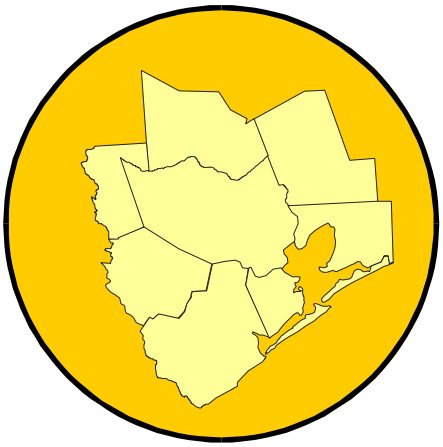
VISION 2020

Metropolitan Transportation Plan



Adopted

October 1997

prepared by

H-GAC

Houston-Galveston Area Council

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MTP INITIATIVES

1,100 NEW freeway lane miles

350 NEW tollway lane miles

5,000 NEW arterial lane miles

190 NEW HOV lane miles

26,000 NEW park and ride spaces

750 NEW freeway traffic management lane miles

775 NEW arterial traffic management lane miles

269 NEW miles of bicycle and pedestrian routes

VISION 2020 TRANSIT PROJECTS

Service Expansion and greater coverage to more locations throughout the region

Service capacity increases and bidirectional service in key corridors

Suburb to suburb expansions

Greater circulator service to provide access within activity centers

Nontraditional service expansions

POLICY INITIATIVES

Increase state share of federal highway and transit revenue **(+$74m/yr to region)**

Reduce diversion of gas tax for other uses **(+$40m/yr)**

Ensure state fuel tax keeps pace with inflation

Maintain fair share of state revenue to the region **(+$62m/yr)**

Increase toll financing for new freeway projects **(+$26m/yr)**

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for the
Houston Galveston Transportation Management Area

Prepared by

Houston-Galveston Area Council
Transportation Department

Adopted October 10, 1997
Revised January 1998

CHAPTER 1.0

INTRODUCTION

1.1 WHAT IS *VISION 2020*?

Vision 2020 is the Houston-Galveston region's Metropolitan Transportation Plan (MTP), replacing its predecessor, *Access 2010:1994 Update*. The MTP is a strategic planning document designed to identify and address the transportation needs of the region through the year 2020. As such, the MTP forms the basis for transportation planning activities within the region and determines the nature of the future transportation system.

The purpose of *Vision 2020* is to define the goals, identify the needs, and recommend strategies for improving the regional transportation system. The transportation needs addressed in the MTP include traditional topics such as improving mobility, preserving existing infrastructure, and enhancing safety, as well as related strategic needs such as supporting goods movement and improving regional air quality.

As the foundation of regional transportation activities, *Vision 2020* reaffirms the tradition of a continuing, comprehensive, and cooperative (3C) planning process. First, development of the MTP is a *continuing* process. The assessment of needs and strategies is a dynamic and ongoing process. The MTP will be updated at least every three years in order to meet transportation needs as they change over time. Furthermore, the projects and programs that are the physical results of the MTP will be programmed into implementation on a continuing basis.

Secondly, *Vision 2020* is a *comprehensive* planning document that addresses a multitude of transportation issues throughout the region. It is a multimodal plan that includes a discussion of needed improvements for modes as various as single-occupancy vehicles, high-occupancy vehicles, buses, bicycles, and even walking. The MTP begins the process of evaluating possible improvements to goods movement, and continues the effort towards the improvement of the regional air quality. To be effective, the MTP is also comprehensive in its area of coverage. The plan examines issues at a regional scale because, while transportation needs may vary depending on the individual and the jurisdiction, the Houston-Galveston area is still an interdependent system and the decisions of one entity will have impacts beyond its jurisdictional limits.

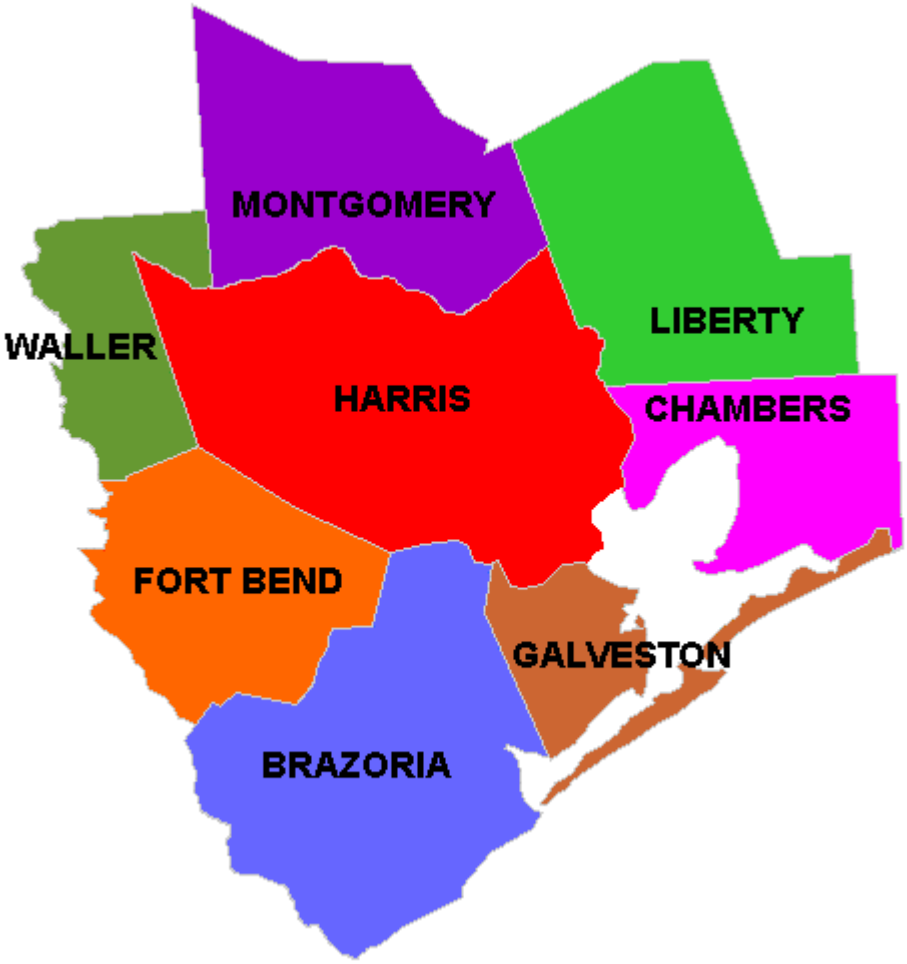
Finally, *Vision 2020* is a *cooperative* venture that began with a public vision, progressed with public identification of needs, and concluded with public review of the document. The document is the result of interagency review and consultation by federal, state and local transportation agencies as well as users of the transportation system.

1.2 STUDY AREA

The region covered by *Vision 2020* includes eight counties: Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller. This region is called the Houston-Galveston-Brazoria Consolidated Metropolitan Statistical Area, as designated by the Census Bureau. For transportation purposes, this same eight-county area is called the Houston-Galveston Transportation Management Area (TMA). A TMA is a metropolitan area of more than 200,000 people that has been designated by the state governor for transportation planning purposes.

The agency responsible for transportation planning within a TMA is called the Metropolitan Planning Organization (MPO). The Houston-Galveston Area Council (H-GAC) is the state appointed MPO providing technical analyses and planning for the region. All regional transportation plans, projects and programs, however, must be approved by the Transportation Policy Council (TPC), the policy board for the TMA. The 21 members of the TPC represent cities, counties and transportation agencies serving the eight-county region. The TPC is supported by a Technical Advisory Committee (TAC) whose expanded membership includes persons representing ports, freight/shipping interests, neighborhoods, bicycling interests and environmental agencies and advocacy groups. The TPC relies on its TAC for analysis and recommendations regarding transportation policy and programming options.

Figure 1.1: Houston-Galveston Transportation Management Area



In accordance with the Clean Air Act Amendments of 1990, the Environmental Protection Agency has designated the TMA as an ozone nonattainment area, a result of the region exceeding the national standards for ozone. This designation places an additional burden on the region since the planned transportation system must *conform* to the state plan for improving local air quality. Thus, in addition to meeting the region's mobility needs, transportation projects must also meet the region's air quality needs.

1.2.1 Overview of the Local Transportation System

The Houston-Galveston TMA already has an extensive multimodal system in place. Much of the region's economic success can be attributed to its transportation system,

which includes roadways, transit facilities, airports, and water port facilities. The region's future will be determined to a large degree by the effectiveness of this system to respond to the region's changing needs. To do this, each component of this system must not only be effective alone, but must adequately link with the other components to form a comprehensive intermodal network.

The development of the regional roadway and transit network has been and continues to be an intrinsic element of regional land use and population distribution. At the core of this network is the Interstate Highway System. Two interstate highways, IH-45 and IH-10, intersect at the center of the region, providing highway access to the north, south, east, and west. US 59, a major northeast to southwest highway, is being evaluated for possible inclusion in the interstate system as IH-69. In addition, IH-610 is a loop circumnavigating the Houston central business district. Other major highways include US 290, SH 225, SH 288, and Beltway 8. All of the state and federal roadways are constructed and maintained by the Texas Department of Transportation (TxDOT). There are two toll roads, the Hardy Toll Road and the Sam Houston Toll Road; both operated by the Harris County Toll Road Authority.

The primary transit provider is the Metropolitan Transit Authority of Harris County (METRO), the ninth largest transit authority in the nation. METRO provides fixed route bus service, express bus service, and commuter bus service. The success of METRO's commuter service is due in part to its extensive network of park and rides, transit centers, and high occupancy vehicle (HOV) lanes. There are approximately 64 miles of HOV lanes, which radiate from the Houston CBD on most of the major freeways, providing dedicated lanes to buses, vanpools, and carpools. Brazos Transit System (BTS) provides transit service outside the METRO service area. It utilizes the HOV lane system for its commuter service from The Woodlands and the City of Conroe in Montgomery County to employment centers within Harris County. BTS also provides fixed route service for the cities of Ames, Cleveland, Dayton, and Liberty in Liberty County and it operates the Galveston Island Transit service. Many operators throughout the region provide specialized transit services like demand-responsive service. The largest such provider is the Gulf Coast Center, which provides paratransit for Brazoria and Galveston counties.

Both transit and highways benefit from intelligent transportation systems (ITS). ITS uses computers and technology to improve the efficiency of the existing transportation network. When fully operational, the system will include a series of monitoring devices (such as video cameras, and automatic vehicle identification systems), communication devices (such as changeable message signs), ramp metering devices and other computerized transportation management systems. At the heart of the region's ITS is the Houston TransStar Traffic Management Center, a centralized state of the art facility that pools the resources of several agencies to develop and implement transportation control strategies.

Goods movement is one of the primary purposes of ground transportation. Truck and rail freight operations are a significant factor in the regional economy. The region boasts over 600 motor freight lines and numerous major railroad operations. There are three

major truck/pipeline intermodal facilities, and five major truck/rail intermodal facilities. The primary railroad lines include the Burlington Northern, Union Pacific, Santa Fe, and Southern Pacific, along with two principal switching lines.

The success of the local goods movement industry is intrinsically related to local port facilities. The Houston Ship Channel is a 52-mile inland waterway that connects Houston to Galveston Bay. It ranks eighth in the world in terms of tonnage and includes over 100 wharves and 60 operational steamship lines. The Port of Galveston, the first operational port in the region, the Port of Texas City and the Brazosport Turning Basin in Freeport complement the regional port system.

Three commercial airports comprise the core of the air transportation service: George Bush Intercontinental Airport, Houston Hobby, and Ellington Field. Combined, these airports have regularly scheduled flights for almost ten domestic airlines, more than ten international carriers, and over ten cargo lines. The general aviation community has access to over 30 public airports with active Fixed Base Operators present on a majority of the fields.

1.3 PLAN DEVELOPMENT PROCESS

To ensure the optimal investment in transportation, projects and funding must be carefully planned in advance. FHWA and FTA have jointly required that each urbanized area, as a condition for the receipt of federal capital and operating assistance, have a process that results in a transportation plan consistent with the needs of the area. The legislation that mandates this process is called the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. As the designated MPO, H-GAC, guided by its Transportation Policy Council, coordinates an extensive transportation planning process that balances federal requirements with local needs.

There are three primary products produced by this process: the Unified Planning Work Program (UPWP), *Vision 2020*, the Metropolitan Transportation Plan (MTP), and the Transportation Improvement Program (TIP). These three documents are interrelated, with each of the resulting products being a critical component of the other two products. The MTP provides the plan for the region's transportation needs, the TIP implements the projects and programs of the MTP, and the UPWP outlines the tasks necessary for the development of the MTP and the TIP. The development of all three products is conducted in accordance with the adopted Public Involvement Plan and the Transportation Policy Council (TPC) approves each.

1.3.1 Unified Planning Work Program

The UPWP outlines proposed tasks and estimated costs associated with conducting the region's transportation planning and research for the year. This document is prepared annually by H-GAC, with the coordination of TxDOT and METRO. H-GAC, TxDOT, and METRO implement the UPWP.

By its nature, the UPWP determines the constitution of the other two primary documents, the MTP and the TIP. It does this by delineating the specific tasks and subtasks necessary for developing these documents and by providing an outline for their design. The UPWP also affects their development by identifying other research, planning, and administrative activities. The results from these efforts have impacts--either individually or collectively--on the design and conclusions of the MTP and the TIP. The UPWP is updated annually.

1.3.2 Metropolitan Transportation Plan

The MTP is a long-range transportation planning document that provides a twenty-year framework for addressing the region's transportation needs. It affords an overview of the existing system, identifies existing needs, forecasts future needs, and defines strategies to help the region meet those needs. In addition, the MTP ensures that the transportation system does not contribute to worsening the region's air quality. Furthermore, the system must meet established financial constraints, which is to say that the cost of implementing the solutions has to be realistic and cannot exceed expected financial resources. The MTP influences both the TIP and the UPWP. It includes the projects and programs that will be programmed and implemented by future TIPs, and identifies activities that will become tasks in future UPWPs. The MTP is updated at least every three years.

1.3.3 Transportation Improvement Program

The TIP is a short-range programming document, which allocates funding for all transportation and air quality projects and activities within the TMA. The TIP must include all roadway and transit projects that receive federal funds. Locally funded projects of regional significance must also be included for the air quality conformity analysis required by the Clean Air Act Amendments of 1990 (CAAA). The TIP defines the implementation schedule for the first 3 years of the MTP. It is updated at least every two years and is included in the State TIP.

1.4 PUBLIC INVOLVEMENT

One of the objectives of the MTP development process is to increase public participation in the early stages of transportation plan development and provide opportunities for continued participation throughout the plan development process. In May 1994, H-GAC adopted the *Transportation Public Involvement Plan*, which provides consistent, comprehensive, and identifiable ways for the MPO to seek public participation and input. The document provides the framework for the public involvement process that guided development of *Vision 2020.*

1.4.1 *Vision 2020* Public Involvement Process

Vision 2020 is the product of a three-phased public involvement process that included public outreach meetings in the early, intermediate, and final stages of plan development. The process reflects the education, outreach, and participation goals outlined in the *Transportation Public Involvement Plan*. H-GAC relied on a variety of mechanisms to involve the public in the development of the MTP, including the production of an MTP video and the distribution of newsletters, press releases, and advertisements involving diverse media.

Visioning Meetings

Public input was sought at the earliest stages of plan development. A total of eleven public "visioning" workshops were held in March 1995. At each meeting, a professional facilitator initiated a series of three exercises to elicit public comments and ideas. The exercises were designed to stimulate thought on (1) the trends that will affect the future transportation system, (2) the visions of that future transportation system, and (3) the barriers to attaining the vision. The three exercises produced a profusion of public ideas and observations on the trends, expectations, and obstacles pertaining to the regional transportation system. The MTP Development Task Force, a technical committee assembled to guide the development of *Vision 2020*, used the public comments from the "visioning" meetings to establish both vision and mission statements for *Vision 2020* and to develop goals and objectives for the plan.

Meeting venues included seven of the eight counties in the H-GAC region, with Liberty and Chambers counties combining their efforts at a single meeting. The remaining four meetings were devoted to specific issues: Economic Development, Intermodalism, Transit Dependency, Neighborhood and Environment.

Mobility Assessment Meetings

In December 1995, H-GAC prepared a *Mobility Assessment* document for each of the eight counties in the Houston-Galveston region. The *Mobility Assessment* identified

transportation issues facing the region and gave elected officials and transportation agencies the opportunity to comment upon transportation project needs and priorities for their respective communities and the region as a whole. The Mobility Assessment also included project nomination forms for *Vision 2020.*

In January 1996, H-GAC staff held nine meetings throughout the region to discuss the transportation issues addressed in the *Mobility Assessment*. The meetings were heavily advertised and served as a kick-off to the *Vision 2020* project prioritization process as members of the public joined with elected officials and transportation agencies to provide their input regarding transportation project needs and priorities.

Venues for the mobility assessment meetings varied. Meetings were held in Brazoria, Galveston, Harris, Fort Bend, Liberty and Waller Counties as well as in the Cities of Baytown and Conroe. One meeting was organized in conjunction with the Clear Lake Transportation Partnership, a transportation management organization that fosters transportation planning coordination among member municipalities and businesses in the Clear Lake area.

1.4.2 Public Involvement in Transit Planning

To solicit input and feedback on transit concepts that were to be studied in the development of its 2020 Plan, METRO convened a series of community forums and focus groups. A community form was held in each quadrant of METRO's service area. The general public and area community groups were encouraged to participate.

Five focus groups were also organized to provide input on specific METRO services. One focus group session was aimed at getting input from park and ride patrons. The remaining two focus group session solicited input from non-transit users to determine what facilities or services could be provided that might make transit more appealing to them.

1.4.3 Other Opportunities for Public Involvement

Vision 2020 was developed by the H-GAC Metropolitan Transportation Planning staff with input, review and approval by the Transportation Policy Council. *Vision 2020* was reviewed and discussed at regularly scheduled TPC meetings that adhere to federal open meeting requirements. The public is encouraged to provide comments at all TPC meetings.

Two technical subcommittees of the TPC, the Technical Advisory Committee (TAC) and the MTP Development Task Force, guided the development and review of *Vision 2020*. These committees include members representing a number of communities and

transportation related interests throughout the eight-county region. As with TPC meetings, the public is encouraged to provide comments at all technical subcommittee meetings.

An official public comment period was observed 30 days prior to the adoption of *Vision 2020* by the TPC. Draft copies of *Vision 2020* were available for review so that comments from the public could be considered for the final document. A third round of public meetings was held in August and September of 1997 to discuss MTP recommendations. Six meetings were held in Harris, Brazoria, Fort Bend, Galveston and Montgomery Counties.

In addition to the public meetings, four newsletters were widely distributed throughout the MTP development process to libraries, local governments, transportation providers and private citizens. The newsletters served to update the public on the progress of development of *Vision 2020*. All public outreach efforts were conducted in accordance with H-GAC's "Transportation Public Involvement Plan".

1.5 ORGANIZATION OF THE PLAN

Vision 2020 is organized in a manner that parallels the steps of the transportation planning process. It begins with an examination of regional transportation issues. The issues lead directly to the vision and goals that resulted from public input. The next step is a determination of where the transportation system operationally falls short of the desired goals. This "needs analysis" identifies where resources should be concentrated and leads directly to the identification strategies for improvement.

"Strategies" is a generic term applied to all techniques used to compensate for a transportation deficiency. It includes projects, programs, and policies needed to enhance the existing transportation system. Unfortunately, limited resources restrict the number of solutions that can be realized. The financial plan forms the basis for balancing revenues with expenditures.

Regional trends, issues, needs and strategies are detailed in the following chapters:

Chapter 2: Regional Trends. This section provides an overview of the socioeconomic trends that face the region. It includes population, employment and household growth projections through the year 2020. The implications of current development patterns are also discussed in this chapter.

Chapter 3: *Vision 2020* Framework. The vision of the future transportation system sets the framework for the MTP. The vision is the region's overarching statement of purpose for the 2020 transportation system. The vision is supported by a series of goals developed in cooperation with transportation providers and users of the system.

Chapter 4: Regional Transportation Issues. The regional transportation system refers to all modes of travel and issues intricately linked to their usage. This chapter examines a number of factors that influenced the development of MTP strategies for the future system.

Chapter 5: System Management. One of the objectives of *Vision 2020* is promote the implementation of systems and strategies that contribute to the cost-effective and efficient operation of the transportation system. This chapter identifies some of those programs.

Chapter 6: Financial Analysis. As with any effective plan, *Vision 2020* must be realistic in order to be sound. For this reason, the MTP includes a Financial Plan, an estimate of the future revenues for the region, anticipated expenditures and strategies for bridging the gap between the two.

Chapter 7: Strategies and Performance. The recommendations for transportation system improvements through 2020 are based upon analysis of regional needs and priorities. All recommendations are in accordance with the goals and financial constraints.

Appendices. The appendices include a glossary and a list of acronyms, an account of how the plan meets the 16 planning factors established by ISTEA, and a listing of recommended programs and projects for the MTP.

As stated at the very beginning of this chapter, *Vision 2020* is a continuing, comprehensive, and cooperative plan for the future transportation system. It should not be viewed simply as a document, but as an evolving process of goal setting, deficiency analysis, and solutions identification. It began and concluded with public comments, and it depends on the community for the eventual programming and implementation of the projects.

The future system will change over the years as regional priorities evolve, demographics shift, and new technologies develop. *Vision 2020* can only provide a glimpse of the future from today's perspective. As the continuing process it was designed to be, the MTP will evolve along with our transportation system; a fact that will be reflected in future updates.

CHAPTER 2.0

REGIONAL TRENDS

2.1 THE ROLE OF TREND ANALYSIS

The regional transportation system is a massive multimodal network of roads, ports, bicycle and pedestrian paths, and transit routes. It is both responsible for and responsive to our social and economic well being. Consequently, while the area benefits from an efficient transportation system, the characteristics of the area also affect the nature of the system itself.

The task of developing the future transportation system began by analyzing the trends that affect local transportation. Trends are an indicator used to estimate current conditions and forecast future conditions. Demographic analysis is the process that is the most reliant on trend analysis and extrapolation. Demographics, specifically population and employment, affect the amount and distribution of transportation demand and provide a convenient indicator of travel patterns. Thus, demographic trends are important to the identification of future needs.

2.2 POPULATION AND EMPLOYMENT

Population and employment are the two of the principal factors that influence the transportation system. Population determines the overall demand for transportation services and facilities.

The distribution of population and employment determines travel patterns by establishing where many trips will originate and terminate. The location of persons and jobs also determine the preferred mode of travel. Areas with concentrated population may depend on mass transit, walking, or bicycling while low-density population areas may depend more on automobiles or commuter transit more frequently.

2.2.1 The Process

Regional demographic forecasts were based upon econometric and cohort component techniques, using 1990 as the base year. The techniques tie the regional forecast to statewide and national economic trends and also tie employment opportunities to the available labor force. The techniques acknowledge the importance of age in household formation. The results of the regional forecasts acted as the control totals for the subsequent allocation of the totals into the 199 subareas, known as Regional Analysis Zones (RAZs). The H-GAC Data Services Department's report, *Small Area Allocation Forecast 1990-2020,* contains more information on the process and includes a more detailed tabulation of the final demographic numbers.

2.2.2 Demographic Outlook

The regional demographic forecast shows that population and households are expected to grow at an average annual rate of 1.4 and 1.7 percent, respectively. By 2020, the region's population will reach 5.6 million, distributed among 2.2 million households. Harris County will lead the eight county area in total population growth, adding slightly more than 1 million residents by 2020. The seven adjacent counties, however, will experience much greater percentage increases with some more than doubling in population.

The forecasted increases in employment tell a similar story. Region-wide employment will grow at an average annual rate of 1.8 percent, reaching approximately 3 million workers by 2020. While Harris County will remain the predominant location for jobs, capturing 31,000 of the anticipated 41,000 jobs added annually, its share of the regional job market will decline. Conversely, all of the adjacent counties will have greater percentage increases in employment. Fort Bend, Liberty, Montgomery and Waller Counties in particular will more than double their civilian labor force participation.

Table 2.1: Regional Population, 1990 and 2020

County	1990	2020	Change	
Brazoria	191,707	373,313	181,606	95 %
Chambers	20,088	36,940	16,852	84 %
Fort Bend	225,421	523,511	298,090	132 %
Galveston	217,399	366,214	148,815	68 %
Harris	2,818,292	3,837,655	1,019,363	36 %
Liberty	52,726	78,194	25,468	48 %
Montgomery	182,201	412,390	230,189	126 %
Waller	23,297	35,608	12,311	53 %
Total	**3,733,121**	**5,665,845**	**1,932,694**	**52 %**

Source: Bureau of the Census and H-GAC Data Services Department.

Table 2.2: Regional Households, 1990 and 2020

County	1990	2020	Change	
Brazoria	64,018	139,920	75,902	118 %
Chambers	6,930	14,013	7,083	102 %
Fort Bend	70,428	184,031	113,603	161 %
Galveston	81,452	148,849	67,397	83 %
Harris	1,026,484	1,519,323	492,839	48 %
Liberty	18,538	30,394	11,856	64 %
Montgomery	63,560	158,348	94,788	149 %
Waller	7,365	12,397	5,032	68 %
Total	**1,338,775**	**2,207,275**	**868,500**	**65 %**

Source: Bureau of the Census and H-GAC Data Services Department.

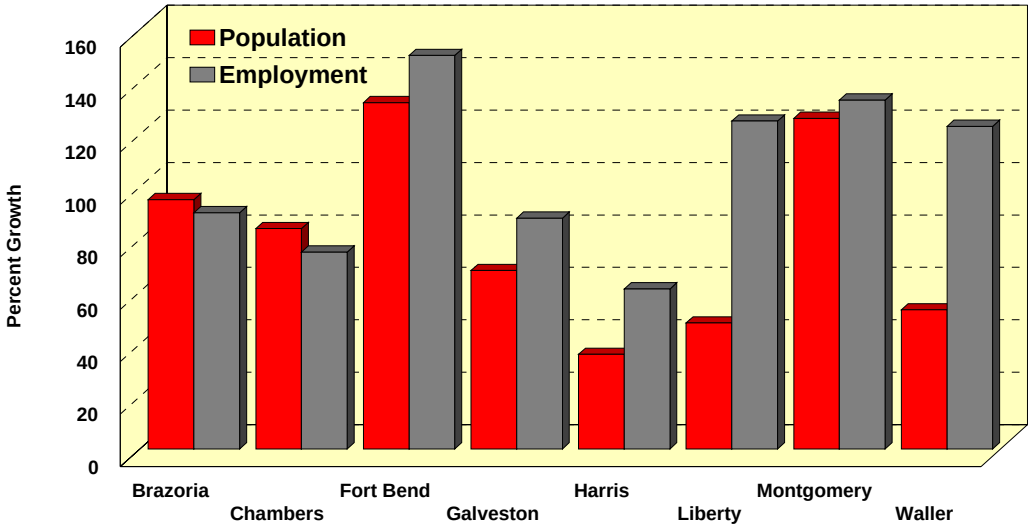
Table 2.3: Regional Employment, 1990 and 2020

County	1990*	2020*	Change	
Brazoria	70,790	134,554	63,764	90 %
Chambers	6,001	10,500	4,499	75 %
Fort Bend	50,214	125,612	75,398	150 %
Galveston	80,190	150,561	70,371	88 %
Harris	1,537,883	2,475,064	937,181	61 %
Liberty	14,300	32,240	17,940	125 %
Montgomery	42,789	99,592	56,803	133 %
Waller	7,689	17,155	9,466	123 %
Total	**1,809,856**	**3,045,278**	**1,235,422**	**68 %**

* Total wage and salary jobs, excluding private households.

Source: US Bureau of Economic Analysis and H-GAC Data Services Department.

**Figure 2.1: Population and Employment,
Percent Growth 1990-2020**



2.2.3 Target Demographics

One notable exception to the suburban growth trend is evidenced by a resurgence of employment in the inner urban area (inside IH 610) of Harris County since 1990. Recent forecasts suggest that the area will attract more than 176,000 new jobs by 2020. At the same time, the number of households will increase by over 12,000 in this area largely due to redevelopment activities.

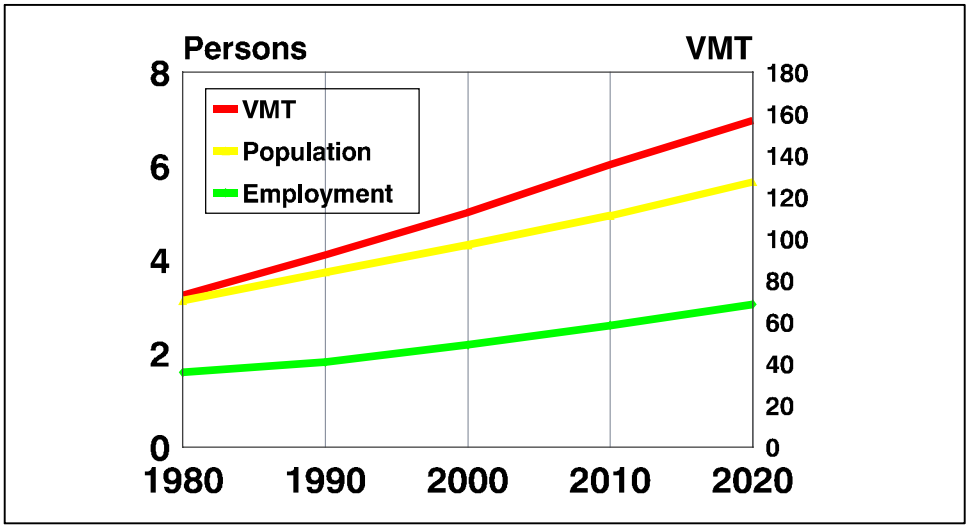
In order to reflect the expected outcomes of public investments and policies that continue to encourage growth and redevelopment within IH 610 the MPO, in conjunction with the City of Houston and METRO, developed 'target demographics' to use for transportation planning purposes. This effort is supported by the *Vision 2020* goals (see Chapter 3), one of which is for the coordination of land use and transportation development. The TPC representatives from across the region agree that a strong regional core is a necessity for the regional economic vitality.

The target numbers were used in the travel demand modeling analysis of the transportation system. Using the 1995 H-GAC demographic forecasts as a basis, the growth targets are for an additional 23,000 jobs in the Houston CBD and 12,000 households within IH 610 by the year 2020. The target demographics do not affect the forecasted totals, only the distribution of those totals within Harris County. Harris County is the only county affected by this redistribution.

2.3 GROWTH IN VMT

By 2020, vehicle miles traveled (VMT) is expected to reach 160 million miles annually, an increase of 77 percent since 1980. The growth in VMT can be attributed to several factors including population, job, and income growth, access to motor vehicles, and residential and job location changes. Employment and income growth in particular have significant impacts on travel. Nationwide, the civilian labor force increased more than twice as fast as the population between 1970 and 1994. Much of the employment growth is attributable to women entering the labor force in large numbers during that period. Women now constitute 46 percent of the U.S. workforce, up from 38 percent in 1970. The inclusion of women in the workforce has implications for household income and household size. Both of these factors are related to an increase in the number of trips per household for recreational, business, and other household activities.[1]

Figure 2.2: Growth and Travel Trends



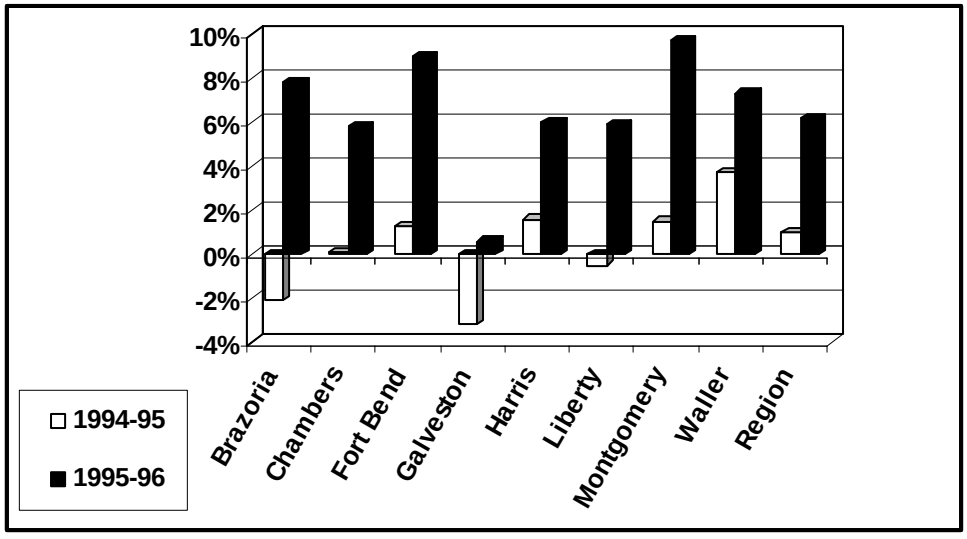
[1] "Transportation Statistics Annual Report 1996," Bureau of Transportation Statistics , United States Department of Transportation, Washington, 1996.

Table 2.4: Growth in Vehicle Miles of Travel

County	1990 VMT	2020 VMT	% Change
Brazoria	1,164,187	9,296,088	8.98
Chambers	1,227,015	3,199,447	3.61
Fort Bend	1,411,542	11,946,174	8.46
Galveston	1,160,875	7,204,326	6.20
Harris	31,943,686	111,629,663	3.49
Liberty	262,594	3,130,263	11.92
Montgomery	2,283,000	12,501,935	5.48
Waller	274,124	2,505,189	9.13

Growth in vehicle registrations also drives increases in VMT. In the Houston-Galveston TMA, vehicle registrations increased significantly in last year (see Figure 2.2). Data reveals that during 1994-95, vehicle registration in the region increased by 32,114 (or 1%). The largest increase of 35,563 (or 1.6%) in registered vehicle occurred in Harris County. Interestingly, the remaining seven counties indicated a combined loss of 3,449. During 1995-96, however, no county indicated any decline. The combined gain for the region during this period was 195,951 (or 6.2%).[2]

Figure 2.3: Vehicle Registrations



Source: Texas Department of Transportation, Houston-Galveston Regional Transportation Study

[2] "1996 Population Estimates," Budget and Finance Division, Texas State Data Center, Bureau of Census.

Whatever the cause, the result is that by 2020 more people will be utilizing the region's roadways more often than ever before. By necessity, the future transportation system will be more multimodal and diverse in order to accommodate the projected increase in demand.

2.4 DEVELOPMENT PATTERNS

The Houston-Galveston region has a developmental pattern similar to many metropolitan areas in America, a pattern especially apparent in those cities that witnessed their primary growth after World War II. This pattern began with a strong central employment center surrounded by residential and retail development. Peripheral development was spawned by advances in automotive technology and by increased investment in roadways, specifically the Interstate Highway system. The peripheral development was not only created by the increased roadway investment, but it also increased demand for further investment in roadways.

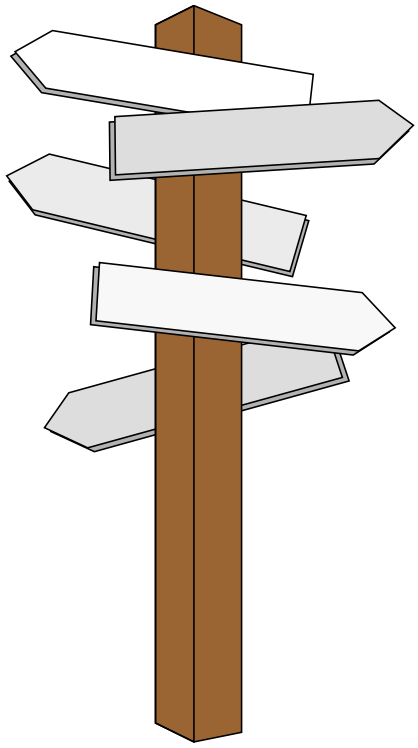
At the turn of the century, Houston and Galveston both had inner-city trolley systems to provide transit services for the centrally populated cities. Gradually these systems disappeared as the cities--and their highway networks--grew. (Houston street car operations ended in 1940 after serving the city for 49 years, while Galveston restarted its trolley service in 1988.) The expansion of both cities and of the region as a whole coincided and depended on the expansion of the highways, and development was designed to be served by the automotive mode of travel.

Decades after flight to the suburbs began, the concentration of suburban residential and retail land uses reached a point such that they began to generate a significant employment base of their own. Major employment centers and other significant activity centers began to develop on the periphery of the central business district (CBD), especially to the north and west of Houston. After having its residential and retail base stripped from it, the Houston CBD began having its employment drawn away as well. Today the CBD is still the greatest single employment center in the planning region, but it is less dominant than it once was.

Developmental patterns are dynamic by nature, and while the suburbs are still being developed at a fairly quick pace, there is also a movement of people back into the city. This group of people is primarily composed of upper middle class families and single professionals. These development trends have significant implications for the transportation system. Population and employment dispersion from the central business district has the propensity to increase demand for arterials and other roadways, driving growth in vehicle miles traveled and increasing public and private costs for regional transportation. Continued decentralization of housing and employment coupled with low-density patterns of development, results in increasing difficulty in meeting travel demand, especially in suburban and rural portions of the region.

CHAPTER 3.0

VISION 2020 FRAMEWORK



3.1 INTRODUCTION

The regional trends discussed in the previous chapter are indicative of the factors that forged *Vision 2020*: a combination of technical analyses, regional priorities, and legislative requirements. These issues are the foundation of the framework for *Vision 2020*. The framework itself is organized in a hierarchy composed of one vision and eight goals.

3.2 THE VISION

A "vision" is a statement of the preferred future or outcome for a group. It defines the ultimate end that a group would like to attain and, as such, it serves to guide the actions of the group. In the most difficult times, the vision should serve as the touchstone that allows the group to work together for that common purpose.

In an effort to develop a collective vision for *Vision 2020*, H-GAC held a total of eleven public workshops in March 1995. At each meeting, a professional facilitator initiated a series of exercises designed to stimulate thought on the trends, expectations, and obstacles pertaining to the regional transportation system. The MTP Development Task Force, a technical committee assembled to guide the development of *Vision 2020*, used public comments from the

"visioning" meetings to establish both vision and mission statements for the MTP. The resulting vision states:

> *The Houston-Galveston regional Metropolitan Transportation Plan will enhance mobility by providing an efficient, affordable, and environmentally responsible transportation system for both people and goods.*

This means that the primary mission of *Vision 2020* is to develop a system of transportation facilities that allows for the movement of people and freight. The system should seek to be affordable, for the user as well as for the providing agency, and should be environmentally responsible, particularly in terms of the impact transportation has on regional air quality.

3.3 GOALS

The next step in establishing a framework involved the development of goals. The goals provide the means for attaining the vision. While the vision is intrinsically general in nature, the goals must be more specific to serve as milestones towards the ultimate objective.

Taking components of the vision and incorporating the additional issues discussed in the previous chapter formed the goals. This resulted in a list of eight goals to serve as milestones towards the completion of the vision. The goals describe a preferred condition and are stated as nouns. The eight goals are listed below in no particular order.

- A multimodal transportation system.
- Enhancement and maintenance of existing infrastructure.
- Coordinated land use and transportation development.
- Seamless connections.
- Efficient movement of people and goods.
- An environmentally responsible system.
- Active citizen involvement.
- A cost effective and affordable transportation system.

The first goal, *a multimodal transportation system*, reflects the desire to provide a variety of travel alternatives to users of the system. This will enable transportation providers to meet the varying needs of the populace, whose transportation choice will be affected by

their particular situation, which was partly identified in the regional population and employment forecast. Multimodalism will also ensure the use of alternative modes that could help the region meet its air quality goals.

The *enhancement and maintenance of existing infrastructure* will help the region maximize the benefits from the current transportation system and reduce the need to build new transportation facilities.

Coordinated land use and transportation development is seen as a means of ensuring that the transportation system is compatible with desired land use and development, not as a way to control the use of land in the region. Ideally, transportation services and facilities will expand and adapt to meet the needs of future development while promoting efficient development patterns.

Seamless connections allow for the easy transfer between transportation options, such as bikeways and bus routes or railroads and trucks. Seamless connections are necessary for an efficient multimodal system, especially one that serves both people and goods.

The fifth goal, the *efficient movement of people and goods,* corresponds directly with the vision statement and the desire to maintain and enhance the region's position in the global economy.

An environmentally responsible system is primarily focused on air pollution issues, but it also includes other concerns such as the preservation of wetlands and abatement of noise pollution. This goal seeks to address regional priorities as stated in the vision and seeks to satisfy the federal requirements established by the Clean Air Act Amendments of 1990.

Active citizen involvement is necessary to ensure the transportation system meets the needs of its users, the regional citizenry.

The final goal, though by no means the least important one, is for a *cost effective and affordable transportation system*. This is necessary to ensure the identification of projects that are reasonable and affordable to build and to use. Thus, affordability pertains to both transportation providers and transportation users.

3.4 INCORPORATING THE GOALS INTO THE MTP

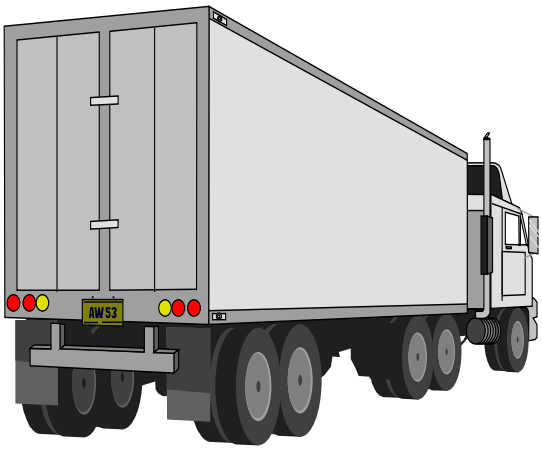
The goals described above provided the reference point for the identification of regional needs and priorities. Whenever possible, performance measures were developed to assess the potential of projects and programs to further the goals of *Vision 2020*. During the project review phase of MTP development, special characteristics of projects were identified such as a project's relationship to intermodal facilities, whether or not it advanced the goal of multimodalism, or filled "gaps" in the existing system to create

more seamless connections. All projects were reviewed for their cost effectiveness in terms of their potential to reduce travel times or emissions.

Financial considerations and public participation were two key elements in the development of *Vision 2020*. Public comment was encouraged throughout the process. Indeed, public comment was the driving force behind the development of MTP goals. The project and programs proposed by the public and regional transportation providers were constrained by the financial realities of revenues versus expenditures.

CHAPTER 4.0

REGIONAL ISSUES



4.1 INTRODUCTION

The goal-based framework discussed in the previous chapter is fundamentally about improving the transportation system to make it safer, more effective, and more environmentally sound. These goals will not be easily achieved, but they provide a direction for the planning effort; and this effort begins with an analysis of the issues involved in development of the future transportation system.

4.2 MAINTENANCE AND PRESERVATION

The regional transportation system is a conglomeration of interconnecting modes and services. The roadway network serves as the foundation upon which these modes and services are provided. As such, the condition and scope of the roadway network directly affect the efficient operation of the entire system; transit services cannot be provided and goods cannot be moved in the absence of an extensive and well-maintained roadway network**.**

Effective maintenance and preservation of the existing transportation system has numerous benefits to users of the system including travel time reductions and enhanced safety. Investment in maintenance and preservation extends the life of existing facilities and is ultimately one of the most cost-effective strategies for assuring adequate capacity for the regional transportation system.

To obtain a better understanding of the region's future roadway rehabilitation needs, an analysis was completed using pavement analysis software developed by TxDOT and METRO. The analysis was conducted to provide insights into the following two scenarios:

- A projection of future roadway condition, keeping the real annual average pavement expenditures for the period 1990-1996 constant; and,

- A projection of necessary pavement budgets, to keep the current roadway condition at a constant level over time.

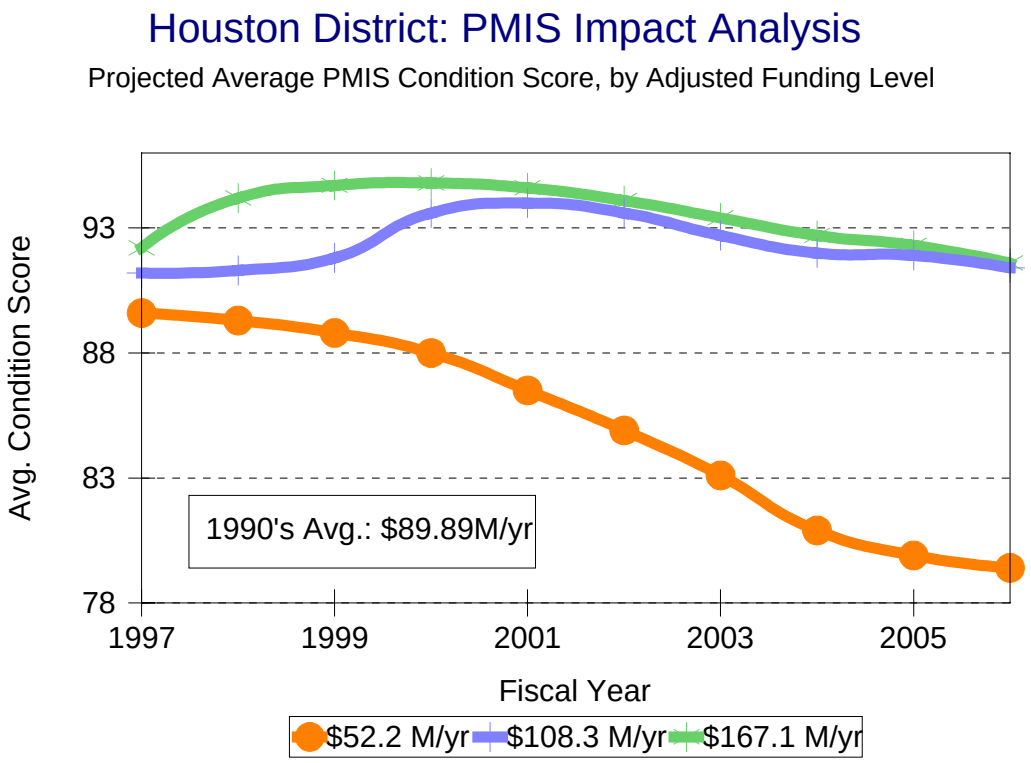
The scenario selection was based on a desire to understand the difference between historical expenditure levels, and the expenditure levels required to maintain the future system as it is today. Results of the analysis are depicted in the Figure 4.1. Three scenarios are shown, corresponding to levels of district pavement preservation expenditures of $52.2, $108.4, and $167.2 million per year over a period of ten years.[3] Based on an average 1996 condition score of about 90.5 (not shown), with 100 representing perfect roadway condition, the results indicate that annual expenditures of $52 million would be insufficient to maintain the 1996 condition. Over time approximately $108 million will be required annually. For reference, taking into account the rehabilitation of pavements that effectively occurs during roadway widenings, the average annual pavement-related expenditures in the region during the 1990s has been approximately $90 million, in 1995 dollar terms.

The implication is that the region will require an increase in pavement preservation expenditures of over 20 percent to prevent state system roadways from deteriorating beyond their present state, over time, to a significant degree. On the other hand, additional expenditures in excess of a 20 percent increase (i.e., beyond the $108 million scenario depicted) provide only marginal returns over time. With regard to the METRO analysis, results indicate that the current pavement-related expenditure average for the 1990s, at approximately $36 million annually would be insufficient to prevent the system from deteriorating further over time, given a base condition score of 74.5.[4] Given the assumptions of the model and the age of the data, the results appear to indicate that a 20 to 25 percent increase per year in local pavement preservation budgets will be required to bring the local streets to the condition of the pavements as evaluated in 1994.

[3] The funding levels shown have been converted from PMIS funding levels of $25, $50 and $75 million. Because the TxDOT Houston district pavement rehabilitation unit costs are generally higher than those used in the PMIS program, factors were applied to the model results in order to provide the proper context for the analysis. In addition, because the scope of the analysis covered only 70 percent of the district's lane miles, expenditures were adjusted upwards by about 43 percent to obtain appropriate district totals.

[4] A score of "100" represents perfect roadway condition, as in the PMIS case. However, because METRO and TxDOT pavement systems use different evaluation tools (i.e., different definitions of deterioration, treatment costs, etc.), the condition scores as evaluated by the models bear no relation to one another.

Figure 4.1: Maintenance Needs



4.3 GOODS MOVEMENT

Trucks, trains, ships and airplanes involved in cargo operations are vital components of the national and regional transportation mix. In 1993 the nation's freight transportation system carried 12.4 billion tons of goods worth more than $6.3 trillion for a total distance greater than 3.7 trillion ton-miles. Nearly three-quarters of the value of items transported moved by truck, followed by, in order of magnitude, rail, water, pipeline and air transport. In 1990, 31.6 % of the total revenue ton-miles of freight were transported on highways compared to 17.9 percent in 1980.[5] The movement of goods within the Houston-Galveston region is made possible by an extensive intermodal network that connects the region's intermodal facilities to distribution routes. By definition, an intermodal facility accommodates and links two or more modes of transportation for intrastate, interstate, and international movement of passengers and/or freight. There are 66 intermodal terminals in the Houston-Galveston TMA including: 1) Commercial Airports, 2) Ports, 3) Truck/Rail terminals, 4) Pipeline Terminals, 5) Amtrak Stations, 6) Intercity Bus terminals, 7) Public Transit Centers, and 8) Ferries as shown in the map at the end of this chapter.

[5]"Annual Report", United States Department of Transportation, June 1992.

In terms of the regional transportation system, mobility and access improvements provide the greatest opportunity to enhance the efficient movement of goods throughout the region. The National Highway System forms the cornerstone of the intermodal network that distributes goods throughout the region by truck. Access to the NHS from the intermodal facilities is the most critical performance measure of the efficient operation of the intermodal network. Access characteristics include direct routing to the NHS, routing to the NHS via connector, route restrictions, vehicle queuing, and signage from the NHS to the facility. Because intermodal facilities vary significantly according to function (passenger or freight), transportation mode, and ownership (public or private), it is difficult to develop standards or performance measures to evaluate the efficiency of the region's intermodal facilities and the routes that connect these facilities to the NHS.

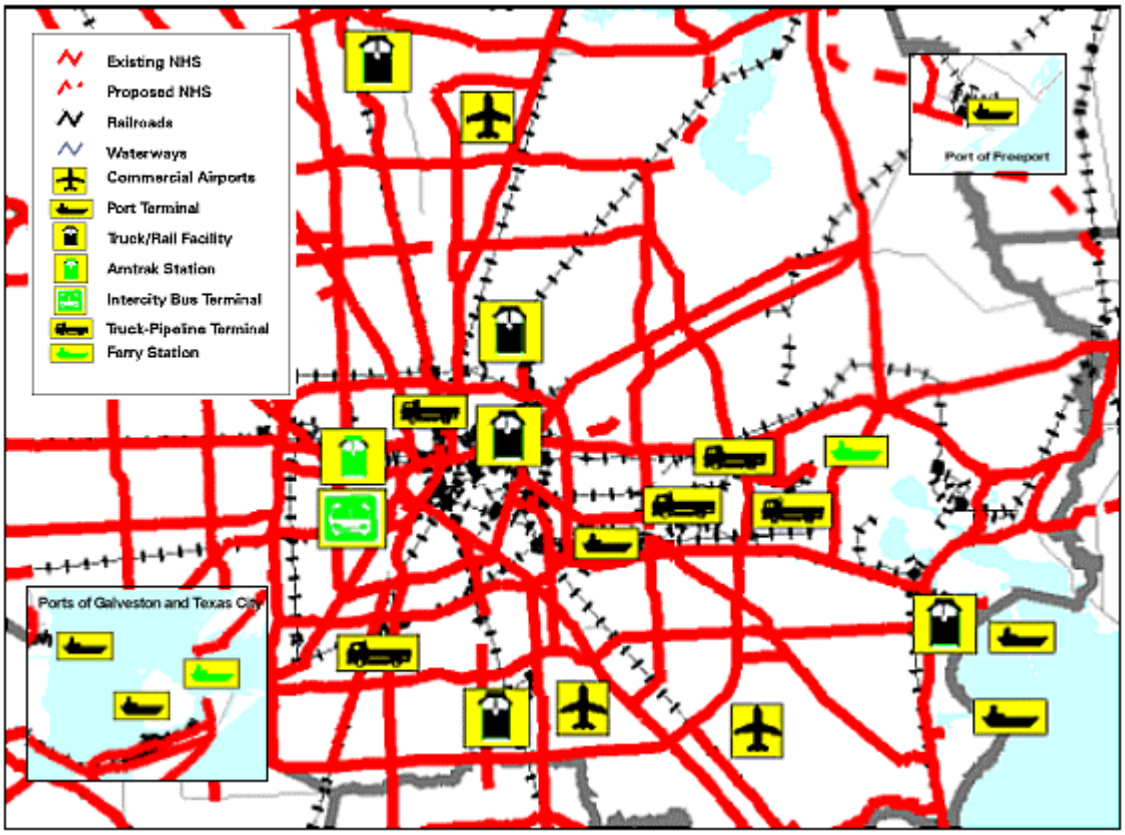
Mobility integrates intermodal and congestion management systems and includes factors such as congestion, traffic signalization, and at-grade railroad crossings. Physical attributes are the actual characteristics of the roads that serve the region's intermodal facilities. These characteristics include road width, number of lanes, turn radii, pavement condition, and height and weight restrictions. The physical attributes of the roads that serve the region's intermodal facilities may impede the efficient flow of passengers and freight. Identifying these attributes will help to rectify intermodal system deficiencies.

In addition to access problems, the intermodal network is subject to passenger and commuter competition. Most highways, railways, airports, and seaports carry both passengers and freight, a source of efficiency and inefficiency. Joint use of the system allows for fuller utilization of the infrastructure. Trucks and cars share virtually all major roads. This overlap between passengers and freight means competition for network space, scheduling conflicts, and possible safety, noise, congestion and environmental problems. Efficiency at ports is further threatened by increasing passenger car congestion on truck routes. Landside access to ports creates conflicts between passenger and freight transportation. Congestion is made worse at many ports by rail lines that intersect local streets. Moreover, ports in many areas cannot expand or be reconfigured because of competition with other land uses.

4.4 TRANSPORTATION SYSTEM SAFETY

Safety is one of the fundamental requirements of any successful transportation system. It was one of the recurring concerns expressed by the members of the public during the MTP "visioning" meetings referred to in Chapter 1. This section examines safety issues related to the regional roadway network and transit services.

Figure 4.2: Intermodal Facilities



4.4.1 Roadway Safety

Statewide, TxDOT and the Texas Department of Public Safety (DPS) are the agencies primarily responsible for addressing roadway safety. The former addresses safety from a facility-based standpoint while the latter is responsible for monitoring and enforcing operational safety. TxDOT is developing a Safety Management System (SMS) in cooperation with Texas DPS as well as regional transportation agencies, local transit agencies, and local jurisdictions. The purpose of the SMS is to establish a systematic process for improving roadway safety by reducing the number and severity of traffic accidents, identifying and improving evacuation routes in coastal areas, and implementing safety measures at railroad crossings.

Traffic Accidents

The core component of the SMS is the identification of locations that have historically witnessed a high number of accidents or crashes. Automotive accidents are the most

prevalent safety issue associated with the transportation system. Thus, the first step is identifying the sites that have a history of a high number of accidents and examining those locations to determine their causes. Table 4.1 lists the top 10 high accident locations on state roadways. Where design flaws, poor maintenance, or other roadway defects are identified, measures can be taken to rectify the problem. Human factors that lead to accidents, however, cannot be impacted as easily.

Railroad Crossings

Accidents that occur at rail crossings are rare, but those that do occur are often calamitous. For this reason it is imperative that at-grade rail crossings are made as safe as possible. TxDOT has developed a railroad safety program to address unsafe railroad crossings. Projects include updating railroad signals and protection device, installation of railroad signals, replacement of planking panels, construction of grade separated crossing, and the placement of concrete traffic barriers and metal-beam guard fences. Approximately $31 million was programmed in TxDOT's 1998 Unified Transportation Program for railroad grade separations in the Houston District.

Table 4.1: Top 10 High Accident Locations on State Roadways

(Combined over a three year period: 1993, 1994, and 1995)

Rank	Total Accidents	Control Section No.	Mile-point	Location
1	349	110-06	37.0	IH 45 (N) at BW 8
2	309	271-07	15.1	IH 10 (W) at BW 8
3	288	500-03	1.7	IH 45 (South) at NASA Road 1
4	271	271-17	34.4	IH 610 (West Loop) at US 59 & Richmond Entrance & Exit
5	251	27-13	9.6	US 59 (S) at Hillcroft
6	233	3256-01	5.4	BW 8 at Bissonnet
7	231	271-16	8.0	IH 610 (South Loop) at Kirby
8	227	27-13	10.8	US 59 (S) at Bellaire
9	225	27-13	8.0	US 59 (S) at Chimney Rock
10	218	3256-01	7.5	BW 8 at Bellaire

Source: Texas Department of Transportation. 1996.

Emergency Evacuation Planning

Four of the eight counties in the H-GAC transportation management area include hurricane evacuation planning zones: Brazoria, Chambers, Galveston, and Harris. These

planning zones are composed of both evacuation zones and contingency zones. Evacuation zones are areas that can be penetrated by storm surge and/or threatened by dangerous winds from hurricanes with sustained winds of 130 mph or less. Contingency zones are areas that can be penetrated by storm surge and/or threatened by dangerous winds from hurricanes with sustained winds over 130 mph. Brazoria County includes five evacuation zones and two contingency zones. Chambers includes three evacuation zones and one contingency zone. Galveston County includes six evacuation zones and one contingency zone. Harris includes five evacuation zones and three contingency zones. The primary and secondary evacuation routes for these four counties are displayed in Table 4.2.

Houston TranStar houses a regional emergency management center. The activities of state and local government agencies that respond during emergencies are coordinated through **TranStar**.

Table 4.2: Key Evacuation Routes

Primary Evacuation Routes		Secondary Evacuation Routes	
Brazoria County			
SH 6	SH 288	*SH 332*	FM-2611
SH 35	BS 288B	FM 523	FM-2917
SH 36	FM 521	FM 1301	*FM-2918*
		FM-1495	*FM-3005*
		FM-2004	
Chambers County			
IH-10	FM-1409	*SH-124*	
SH-61	FM-1406	*FM-562*	
SH-146		*FM-563*	
Galveston County			
IH-45		*SH-3*	FM-2004
SH-6		*SH-87*	*FM-3005*
SH-146		*SH-124*	
Harris County			
IH-10	SH-225	*Red Bluff Road*	*SH-3*
IH-45	SH-330	*NASA Road 1*	*SH-201*
I-610E	BW 8	Fairmont Pkwy	SH-134
US-90	*FM-2100*	*Spencer Hwy*	
SH-146			

Note: Italics denote routes subject to flooding.
Source: Hurricane Contingency Planning Guide. Division of Emergency Management. April 1994.

4.4.2 Transit Safety

Safety, or the perception of safety, is one of the primary determinants that influence an individual's decision to use any mode of transportation. For this reason, the safety and security of transit riders and transit employees is a fundamental concern for the region's transit providers. Each transit operator decides what security measures are appropriate for its service and establishes its own polices and programs to ensure the safety of transit users. All of the transit agencies in the region have programs in place to address safety issues for their employees and patrons. Transit drivers are trained in safe driving practices; they are especially aware of the presence of pedestrians, bicyclists and motorists sharing local roadways. They are also trained to respond appropriately in emergency situations. METRO and BTS buses are equipped with radios used by drivers in emergency situations. When a security problem occurs, the driver contacts the operational center for assistance. If a problem cannot be resolved over the radio, local law enforcement agencies are contacted for support.

METRO police oversee the safety of the HOV lanes, all streets that have bus routes, transit facilities, and ride stores. The METRO bicycle police patrol downtown areas to ensure security for pedestrians and transit patrons. Park and ride lots are patrolled by contracted security guards during primary hours of operation, usually 6 a.m. to 9 p.m. depending on the specific facility. METRO police provide regular patrols throughout the day and night. Ample lighting is provided at park and rides. Access is controlled by limitations on the number of open gates. METRO police patrol transit centers as well. Some of the transit centers include a full time street supervisor for traffic management. The street supervisor maintains radio contact with the operations center and reports any security problems to METRO police. METRO police continuously patrol HOV lanes during regular hours of operation. All gates are secured along the HOV lanes after hours. METRO is investigating the potential of ITS traffic surveillance cameras for use in securing the HOV lanes.

In addition to adhering to fundamental principles of transit safety, METRO has initiated a number of innovative safety programs including Crime Prevention Through Environmental Design (CPTED). The premise of CPTED is that the placement and design of facilities and routes should incorporate an awareness of the area in which the facility or route will be located. Certain designs are more inherently safe in some areas than others. Factors that may affect security are taken into consideration in the design of everything from bus routes to bathroom facility placement.

4.5. ENVIRONMENTAL CONSIDERATIONS

Environmental factors can have a major impact on regional development patterns and the resulting transportation system. Environmental considerations affect the location, type and design of new facilities, and the redevelopment of old ones. This section outlines the key

environmental issues in the Houston-Galveston TMA that have the potential to affect transportation planning. Because individual projects are subject to environmental assessments or impact statements as required by the NEPA process, the elements considered in the MTP are presented at a regional level.

4.5.1 Wildlife and Vegetation

The eight counties of the TMA contain portions of eight ecological zones. These ecological zones encompass upland forest, both post oak woodlands in the north and Big Thicket pine hardwoods in the east. Extending to the southeast are the hardwood bottomland forests of the Trinity, Brazos, and San Bernard River valleys. Toward the Gulf, coastal prairies and marshes constitute two more distinct habitat areas. The Gulf is formed by an extensive zone and bay-estuary system. The ecological zones provide habitat for many different species throughout the TMA.

Endangered and Threatened Species

Several endangered and threatened species have been identified in specific locations in the TMA. The U.S. Fish and Wildlife Service (FWS) Clear Lake Field Office provides federal agencies in the region with a complete inventory of species officially listed as threatened and endangered and of candidate species which are currently under consideration for listing. Any project with federal involvement will have to include a study to identify if any endangered species in the project area.

Migratory Birds

Ducks and geese have long used areas within the TMA as major wintering and feeding areas. The largest wintering area begins in Harris County around Addicks and Barker Reservoirs, out along IH-10 west to an area past Brookshire to the west and running north to south from Waller proceeding to US 90A near the Richmond-Rosenberg area. Other significant areas where ducks and geese winter include:

- virtually all of Chambers and southern Liberty counties;
- Galveston County from the coastline to Hitchcock;
- Brazoria County from the coastline up Chocolate and Austin Bayous to near the Fort Bend county line and from Freeport to the southern county line; and,
- Fort Bend County around Lake George.

Recent growth and development in the western portion of Harris County and eastern Fort Bend County has eliminated a portion of the migratory bird wintering and feeding areas. The Texas Parks and Wildlife Department (TPWD) reports that the birds have been moving

westward along the IH 10 corridor to Austin, Wharton, and Colorado counties, where more rice farms are located. Development plans in the area will continue to threaten their habitat.

4.5.2 Water Resources

Water resource issues in the TMA have always impacted the transportation system. Surface streams and water bodies, such as lakes, ponds, bayous, bays, and wetlands, must be traversed or worked around. Drainage patterns also have to be considered to protect adjacent land uses. Groundwater recharge zones must be protected to maintain water quality. Actual groundwater usage will affect transportation projects as well. Large amounts of groundwater withdrawal lead to subsidence, shifts in drainage patterns, and shifts in the bearing capacity of soils. However, the most important facets of hydrology affecting new transportation projects are floodplains and flooding, water quality, and wetlands.

Floodplains

The coastal area in which the TMA is located has a high natural potential for flooding. The Houston-Galveston area is characterized by relatively flat terrain, poorly drained easily eroded soils, and numerous slow moving streams, creeks, and bayous. Moreover, this part of the coast is subject to intense periods of rainfall from thunderstorms, occluded fronts, tropical storms, and hurricanes. Urbanization increases the magnitude of stream discharge and consequently increases the frequency and extent of flooding. Impermeable surfaces and structures resulting from development in flood plains have constricted many of the floodways, causing a backup of water. This results in the flooding of previously safe areas. As such, the effects of urbanization on the hydrology of streams must be continually assessed with regard to floodplain delineation for the TMA.

Wetlands

Wetlands represent less than 5% of the total land area in Texas, but they are critical to the state's environmental quality and biodiversity. Along the Texas Gulf Coast, wetlands provide many economic and recreational benefits to the region’s residents including, protection of shorelines from erosion, improvement of water quality through filtration of pollutants, and the propagation of fish and wildlife. The increased level of human activity in sensitive areas affects wetlands and the natural coastal environment. These impacts heighten as land less suitable for development is drawn into use at the fringe of expanding urban areas.

4.5.3 Environmental Considerations in Project Planning and Development

The environmental impacts of specific projects recommended in the MTP are assessed during project development. All federal aid projects must complete an environmental assessment. Projects that involve construction on new locations generally need an environmental impact statement (EIS) that looks at all of the factors listed above as well as a few others. Projects may not proceed to implementation prior to completing all necessary environmental review.

Transportation plans must consider the environmental impacts of projects early in the planning process. Significant opposition to certain projects on the grounds of environmental degradation can be expected. For example, plans for the construction of portions of SH 99, the Grand Parkway, have faced considerable opposition from a number of interested groups. The roadway would encroach upon the habitat of thousands of migratory birds that reside in an area known as the "Katy Prairie" in western Harris County and southern Waller County. Until this issue is resolved, the further development of the project is in question.

CHAPTER 5.0

SYSTEM MANAGEMENT

5.1 INTRODUCTION

Vision 2020 emphasizes the need to improve mobility by reducing congestion both today and in the future. Rather that simply relying on adding roadway lane miles as a means to reducing congestion, the MTP focuses on a variety of modal alternatives including transit service expansion and new bicycle routes. Another key congestion reduction strategy is better management of the existing and future transportation system. This chapter focuses on transportation strategies that contribute to improving regional mobility, safety, and air quality by enhancing capacity without adding roadway lane miles.

5.2 CONGESTION MANAGEMENT SYSTEM

One objective of Vision 2020 is to create strategies that reduce existing traffic congestion and prevent its occurrence in areas that are currently not congested. Implementation of a congestion management system (CMS) is one means of achieving this objective. A CMS is an ongoing process that is designed to systematically evaluate, select, and implement cost-effective strategies to manage new and existing transportation facilities. The CMS identifies appropriate Transportation Control Measures (TCMs) for implementation in various congested areas, today and in the future.

A TCM is a transportation management strategy or group of strategies that consists of both Transportation System Management (TSM) and Transportation Demand Management (TDM) measures. Most TCM strategies are considered relatively low cost solutions to congestion mitigation problems, when compared to adding roadway lane miles. Some of the TCMs that have been implemented in the Houston-Galveston region include TDM and TSM activities described in the following sections.[6]

5.3 TRAVEL DEMAND MANAGEMENT (TDM)

One of the simplest ways to reduce congestion is to reduce the number of vehicles vying for space on the region's roadways. Travel demand strategies are designed to do just that. In addition to the public transit system, the region is fortunate to have a number of TDM programs already in place. H-GAC's Regional Commute Alternative Program, operated in junction with METRO, provides vanpooling and ridematching services for the region. Under the auspices of the RCAP program funding is also provided for the operation of Transportation Management Organizations (TMOs).

The **Regional Vanpool Program** is one component of RCAP. The purpose of the program is to establish a voluntary commute alternative vanpool system within the region. Currently, the vanpool program operates a total of 218 vans carrying over 2700 riders daily. The goal of the program is to add 15 vanpools each year through 2020 thereby achieving a projected ridership of 7200 riders daily.

Transportation Management Organizations began to emerge as public private partnerships designed to address traffic congestion and air quality problems throughout the United States during the 1990s. The geographic scope of a TMO varies with each organization. In this region, TMOs are vital components that link the vanpool program to the employees within the more densely populated employment centers of the region. There are four TMOs in the H-GAC area: North Houston Association, Clear Lake Transportation Partnership, TREK in the Galleria area, and the West Houston Association. Additional TMOs are being considered for the Texas Medical Center and for the Houston CBD.

Other travel demand management options that are being studied are telecommuting and peak spreading. **Home-based telecommuting eliminates** or reduces daily work trips by allowing employees to perform their work duties at home. Telecommuting can be a full- or part-time arrangement for employees, and in many cases can be implemented without purchase of extra office equipment. In some instances, however, telecommuters may need access to a microcomputer, fax machine, modem, etc., at home to carry out their work duties. Telecommuting works best for employees who do not require face-to-face

[6] For further information on the CMS refer to "Congestion Management System" prepared by H-GAC, September 1997.

interactions with others. H-GAC is scheduled to implement a three-year telecommuting pilot program starting in 1998.

Peak spreading is a travel demand strategy that is relatively inexpensive to implement but requires a great deal of cooperation from employers and commuters. One of the reasons that commuters experience congestion when using the transportation system is that everyone wants to use it at the same time. Weekday morning and evening congestion levels on the region's freeways and arterials are the highest of any period. One option for relieving "rush hour" congestion is to spread out demand over a longer time period. Minor changes in work hours could relieve morning and evening congestion by as much as 25 percent.

5.4 TRANSPORTATION SYSTEM MANAGEMENT

While TDMs reduce travel demand, Transportation System Management (TSM) strategies are designed to enhance the capacity of the transportation systems by improving traffic flow and reducing traffic delays. The overall objective of TSMs is to improve the efficiency and effectiveness of the existing transportation system. TSMs include a variety of Intelligent Transportation Systems (ITS) options such as:

- Incident Detection & Response Programs
- Courtesy Patrol, Motorist Assistant Program
- Changeable Message Sign (CMS)
- Traffic Operation Centers
- Motorist Information Center
- Traffic Signal Timing & Coordination Improvements
- Automated Traffic Management System
- Computerized Traffic Management System

ITS are advanced transportation technologies designed to make the movement of goods and people along the transportation system safer, more effective, and more efficient. The Houston-Galveston TMA is one of four regions in the U.S. designated by Congress as an ITS Priority Corridor. Some relatively new programs are being implemented as demonstration projects to determine their feasibility and effectiveness. The ITS Strategic Plan adopted by the Transportation Policy Council in August 1997, documents "high-tech" projects under study in this region over the next 10 years.

H-GAC, METRO, and TxDOT commissioned the development of this Regional Intelligent Transportation System Strategic Plan (RITS Plan) for ITS deployment in the Houston-Galveston TMA. The RITS Plan defines the long term goals and objectives of ITS development in the region. Harris County already has significant ITS infrastructure

in place and plans for projects that reach out to the other areas of the TMA, but a regional ITS deployment requires the participation of the other seven counties.[7]

The cornerstone of ITS deployment is the new regional transportation management center, known as **Houston TranStar**, designed to coordinate the collection, processing, and dissemination of traffic, transit, and transportation information. In addition, there are nine components of ITS deployment outlined below that form the basis for the proposed RITS Plan.

Advanced traffic signal control systems are being developed under the Regional Computerized Traffic Signal System (RCTSS) program to integrate and manage the control of more than 2,800 signals from Houston TranStar. METRO, the City of Houston, Harris County, and TxDOT are cooperatively developing the RCTSS. At a cost of approximately $465 million, the RCTSS is planned for implementation over the lifetime of the MTP, with the majority of the system planned for implementation in the first ten years. Other jurisdictions, such as the cities of Bellaire and Pasadena, with traffic signal systems that adjoin those in the RCTSS, will continue to operate their systems from locations they specify, but communication linkages with TranStar will be provided to exchange information. Figure 5.1 graphically displays the transportation control measures.

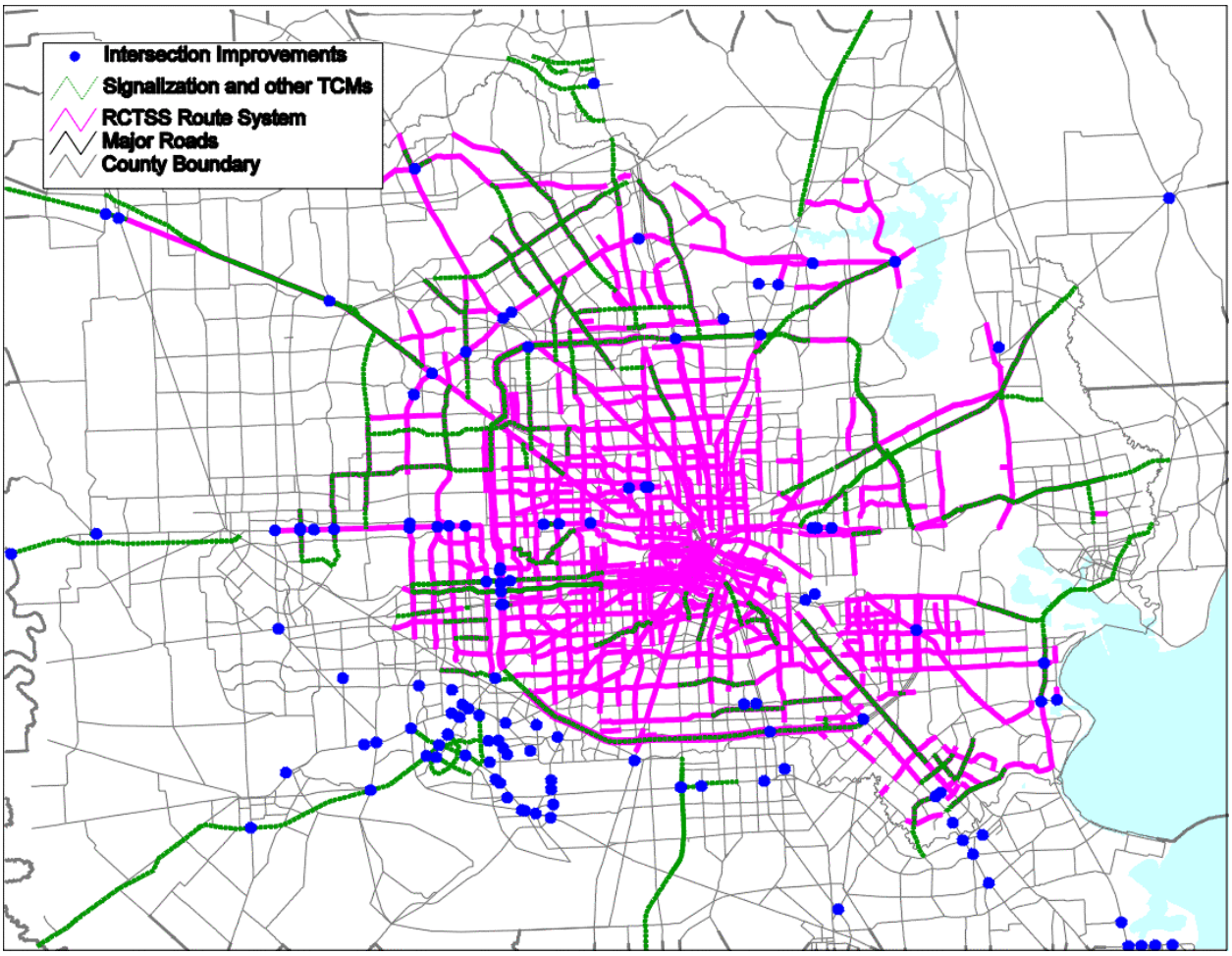
Freeway and tollway management systems are being developed under the Computerized Transportation Management System (CTMS) Program to be monitored and operated from Houston TranStar. CTMS systems include closed circuit television, vehicle sensors, flow signals, variable messages signs and signals, and automatic vehicle identification and location systems.

Traveler information systems are developed from the information collected from the TranStar systems. Traveler information is disseminated in a variety of methods by both public and private organizations, such as Metro Traffic and Shadow Traffic, which provide reports on local radio and television stations. TranStar also operates 90 roadside variable message signs to provide traveler information for route guidance, incidents, travel conditions, and HOV network status advisories. Traffic conditions are posted on the Internet, and plans are being developed to display travel conditions on public computer displays, kiosks, and the Houston Municipal Television Channel.

Advanced public transportation systems, being developed by METRO, include such services as METROLift, Charter/Special Event Services, and a Rideshare Matching Program. METRO and TxDOT have constructed an extensive system of 100 miles of reversible HOV lanes, which is operated from TranStar by the freeway and transit management systems of CTMS. METRO=s *Smart Bus* and *Smart Commuter* projects are

[7] "Developing a Regional Intelligent Transportation System Strategic Plan for the Houston-Galveston Transportation Management Area," Texas Transportation Institute, 1997.

Figure 5.1: Transportation Control Measures



testing and implementing numerous on-vehicle systems that provide information on current bus system data for more efficient operations.

An incident management program is one of the most important functions of Houston TranStar. The CTMS and RCTSS installations detect and verify incidents, and TranStar operators dispatch the appropriate resources, which includes the Motorist Assistance Program, jointly sponsored by METRO, TxDOT, Harris County, Houston Cellular Inc., and the Houston Automobile Dealers Association. METRO has developed a Regional Traffic Incident Management Plan and a manual of operations for TranStar staff. The plan includes a rapid removal policy to change the current reactionary mode to a coordinated responsive mode.

METRO has an **electronic fare payment system** which accepts weekly, monthly, annual, and transfer magnetic-strip cards. The system is being converted to devaluating cards. In the *Smart Bus* Project, an electronic fare payment system is being developed in

conjunction with automatic passenger counters and vehicle locators to relate METRO's ridership in geographical terms.

Electronic toll collection systems are operated by Harris County Toll Road Authority on three toll facilities in the Houston area. The main lane toll plazas are being reconfigured to allow high-speed passage for vehicles with EZ Tags to increase capacity and to reduce travel delays. The EZ Tags and AVI technology used for electronic toll collection on these facilities also provide support for the freeway vehicle probe system that measures travel times and average speeds.

Railroad grade crossing controls are monitored using AVI readers to determine position and identification of trains and to measure travel times of trains, and automated highway-railroad intersection enforcement systems. Advanced warning/information systems will be deployed on approaches to selected intersections.

Emergency management services are provided in Harris County through the staff and facilities of the Harris County and City of Houston Offices of Emergency Management in TranStar. Other regional OEMs are coordinated through the Houston TranStar.

Another TSM that has not been widely implemented in the region that could provide significant traffic congestion mitigation benefits is access control. **Access control** would restrict left turning movements along major arterials into commercial establishments. Results from the implementation of this strategy in Denver suggest that travel speeds along major arterials could increase by 5 to 10 percent. There are also safety benefits associated with this strategy.

5.5 MAJOR INVESTMENT STUDIES (MIS)

Major investments are highway or transit improvements of substantial cost that are expected to have a significant effect on capacity, traffic flow, level of service, or mode share in a transportation corridor or subarea. As an integral part of the metropolitan transportation planning process, the MIS is used to define mobility solutions in the region's most congested transportation corridors.

The purpose of the MIS is to produce information for decision making. This information results from an evaluation of various conceptual alternatives to determine the degree to which those alternatives meet the goals found in the MTP and local mobility plans, as well as the degree to which those alternatives help to attain the emissions requirements for the region. The recommendations of Major Investment Studies must be approved by the Transportation Policy Council, which may do so when it adopts the MTP or by subsequent amendment of the MTP.

The preferred alternative must fall within the air quality conformity requirements and financial constraints of the MTP. Once the alternative is included as a project or group of

projects in the MTP, it awaits the completion of the necessary "readiness" measures (FHWA/FTA environmental clearance, ROW acquisition, preliminary engineering, etc.). Following this, the alternative is ready to be included in the Transportation Improvement Program for implementation.

During FY 1997 a MIS was completed for the Katy corridor.[8] The recommended alternative from that study is included as part of the MTP's transit and highway strategies. METRO is currently conducting a MIS for the IH 610 (W) corridor from Westpark to IH 10 (W). Proposed MIS projects are shown in Table 5.1.

Table 5.1: Proposed Major Investment Studies

Corridor	Limits	Proposed Year
CBD	CBD to Astrodome fixed guideway transit corridor	Undetermined
IH 45 (N)	Loop 336 (N) to FM 1375 BW 8 to IH 610	FY 2000
IH 45 (N)	CBD to IH 610 (N)	Undetermined
IH 45 (N)	FM 830 to Walker County Line	Undetermined
IH 45 (S)	BW 8 to FM 518 and FM 518 to 61st Street in Galveston	FY 1998
IH 45 (S)	IH 10 to US 59	FY 2000
IH 610 (W)	W. Bellfort to Westpark	Undetermined
SH 122	US 90A to SH 6	Undetermined
SH 122	SH 6 to SH 99	FY 2000
SH 249	FM 149/Pinehurst to Grimes County Line	FY 1999
SH 35	Bellfort to Almeda Genoa Almeda Genoa to BW 8 BW 8 to FM 518 FM 518 to BS 35 (Alvin)	FY 1999
SH 6 Bypass	US 90A to McKeever Rd.	Undetermined
US 290	IH 610 to FM 1960	FY 1999
US 59	Spur 527 to IH 45 with SH 288 Interchange	FY 2000
US 59 (S)	SH 6 to SH 99 SH 99 to Spur 10 (west of Rosenberg) Spur 10 to Wharton County Line	FY 1998
Westpark	IH 610 (W) to SH 6	FY 1998

[8]The MIS was conducted for IH 10 (W) from the Houston CBD to Katy, Texas. For more information contact: Texas Department of Transportation, Houston District.

CHAPTER 6.0

FINANCIAL ANALYSIS

6.1 INTRODUCTION

In order to evaluate the financial feasibility of *Vision 2020* transportation needs, an analysis was undertaken of the region's projected transportation finances. In the analysis, the potential future costs of operation and preservation of the existing system, expansion costs, and other planned local expansion expenditures were reviewed. Costs were then compared to projected regional transportation revenue that will be available to fund them.

The financial estimates for the 1998-2020 planning period include:

- the cost of operating, maintaining, and preserving the region's existing surface transportation system, by mode;[9]
- the cost of expanding the existing system, by mode, including the cost of new facilities and the increase in operating and maintenance costs associated with a larger system, as well as,
- funding levels that can reasonably be expected over the 23-year period; and, potential funding shortfalls, based on cost and funding estimates.

[9]All costs have been categorized according to their effect on the region's transportation system (operation/preservation versus system expansion), not by type of cost (O&M versus capital). Some capital costs are therefore included in the operation/preservation figures (*e.g.*, bus replacement, road resurfacing, etc.).

These forecasts were developed separately for each major transportation provider in the region. For most providers, forecasts were based on historical (1990-1995) data and assumptions developed in direct coordination with the provider. Where specific provider forecasts of costs and funding were already available, these were incorporated directly into the analysis.[10]

In addition, the Transportation Policy Council approved the recommendation of the Technical Advisory Committee that the base analysis reflect several critical assumptions and policy recommendations. The analysis reflects an assumed continuation of the funding of transportation infrastructure programs in Harris County at historical rates of expenditure. The analysis also assumes that, over time, the state and regional entities will increase the taxation rates of revenue streams that fund transportation, in order to keep up with inflation. In addition, the analysis adopted by the TPC acknowledges a recommendation to increase pavement maintenance and preservation expenditures by 25 percent.

Figure 6.1 presents a graphical summary of the final financial analysis results. Forecasted expenditures are categorized by the effect of the expenditure: operations and maintenance of the existing system (O/M); capital preservation of the existing system; and expansion of the system. These costs are then compared to the revenue forecast to be available to the region over the planning period. System O/M and preservation must be funded before system expansion, and this is reflected in the allocation of the shortfall amount.

The table illustrates many of the principal findings of the analysis (all figures in 1995 dollars):

- The region's expected average annual expenditures on transportation are an estimated $1,911 million for the 1998-2020 period, based on projected needs. Of this $1,911 million per year, $626 million is required to operate and maintain the system, $379 million is required for capital preservation, and $906 million is required to complete planned system expansions.

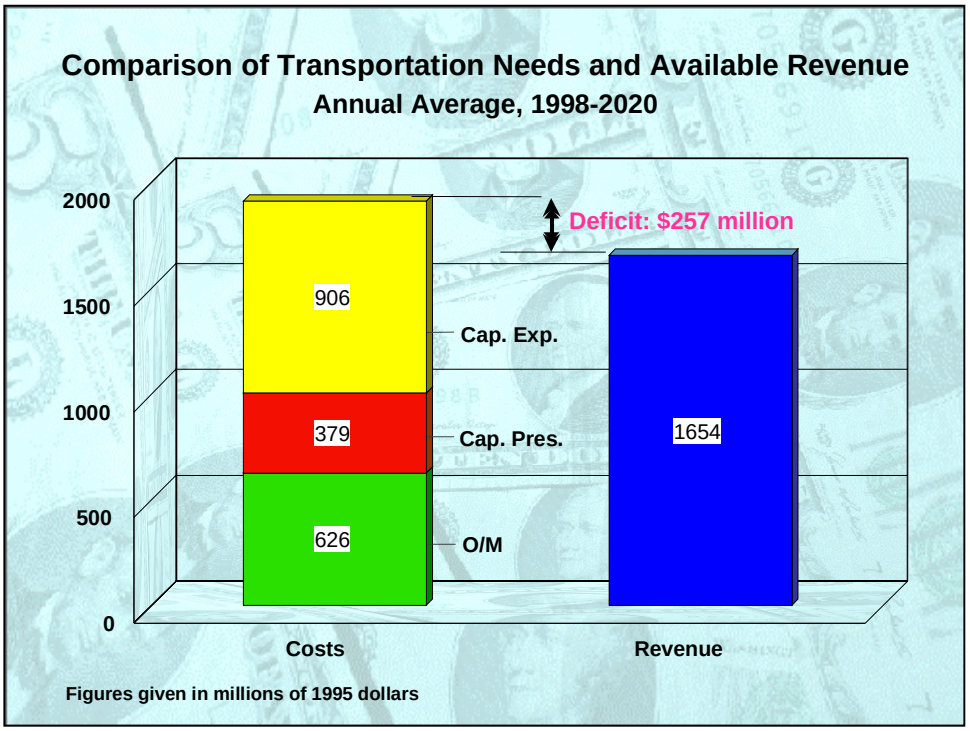
- The average annual revenue available for transportation from Federal, State, and local sources is an estimated $1,654 million over the 1998-2020 period.[11]

- Based on the estimated expenditures and revenues, the region faces an average potential funding shortfall of $257 million per year during the 1998-2020 period.

[10] These estimates were prepared based on data provided by H-GAC, the Texas Department of Transportation (for the Houston District and part of the Beaumont District), the Counties of Brazoria, Fort Bend, Galveston, Harris, and Montgomery, the Cities of Houston, Conroe, La Porte, and Texas City, the Harris County Toll Road Authority, the Metropolitan Transit Authority of Harris County, the Brazos Transit System, the Gulf Coast Center, and Colorado Valley Transit Incorporated.

[11] The Harris County Toll Road Authority (HCTRA) generates an annual operating surplus of approximately $43 million per year. However, this surplus is not available to fund the transportation needs of other providers in the region due to bond covenants that currently prohibit HCTRA funds from being used for non-HCTRA needs. Therefore, the surplus has been excluded from the total annual revenue available to the region presented in Figure 6.1 and all other tables and graphs in this report.

Figure 6.1



6.2 REGIONAL TRANSPORTATION COSTS

The region's transportation costs may be separated into two major types: those costs required to operate and preserve the existing system (operations and maintenance [O/M] and capital preservation costs) and those costs which add new capacity to the system (capital expansion costs). System operations and preservation activities include running transit systems, maintaining signals, keeping regional pavements in acceptable condition, and many other ongoing functions. The estimated cost of operating and preserving the region's transportation system is estimated at approximately $1,005 million annually (in 1995 dollars), for a 23-year total of $23.1 billion.

New capacity activities include the construction of new roads, roadway widenings, the acquisition of additional buses, and construction of transit centers, among others. For *Vision 2020*, the total projected cost of regionally significant expansion projects over the planning period is approximately $19.1 billion. In addition to regionally significant projects, local providers anticipate undertaking local expansion projects estimated to total

$1.7 billion by 2020, giving a total expansion cost of $20.8. The system costs are broken down graphically in Figure 6.2 below.

Figure 6.2

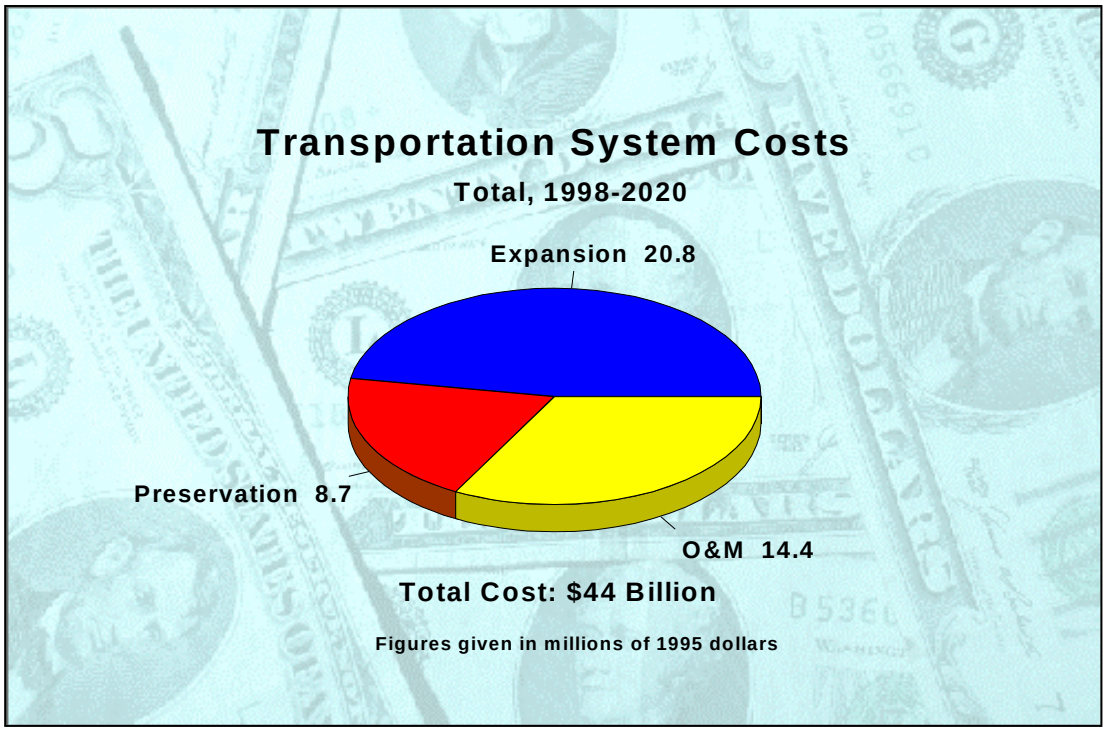


Table 6.1 summarizes the region's projected transportation expenditures for the 1998 to 2020 period. The region's projected transportation expenditures are presented by mode (*i.e.*, Road/Bridge, Transit/HOV, and Bicycle/Pedestrian), as well as by effect on the transportation system (*i.e.*, operations and maintenance, capital preservation, and capital expansion). Results are presented as annual cost totals for the entire region, in millions of 1995 dollars.[12] These annual totals represent an estimate of the region's planned future spending based on the MTP and forecasts of preservation expenditures for the existing system (as well as system expansions as they are constructed).

[12]These annual totals are average expenditures for the 1998-2020 period, *not* cash flow estimates. Projections were annualized by taking total figures in current dollars, deflating them to 1995 dollars, and dividing by the number of years in the planning period.

Table 6.1: Costs by Mode and Effect, 1998-2020

(Millions of Annualized 1995 Dollars)

	Operations & Maintenance	Capital Preservation	Capital Expansion	Total Annual Cost
Roadway	340	322	767	1,429
Transit	286	53	135	474
Bicycle/Ped.	0	4	4	8
Total Annual Cost	**626**	**379**	**906**	**1,911**

Figure 6.3 illustrates the breakdown of projected expenditures by mode. The total annual cost of the proposed transportation system (including operating and maintenance, capital preservation, and capital expansion costs) is almost $1.9 billion:

- Roadway/bridge expenditures are approximately three-quarters of total projected expenditures of the transportation system ($1.4 billion);
- Transit/HOV expenditures are approximately one-quarter of total projected expenditures ($474 million);
- Pedestrian/bicycle annual expenditures are approximately 1 percent of total projected expenditures ($8 million).[13]

Over the 1998-2020 time period, the total projected cost of the region's transportation system is almost $44 billion.

Figure 6.4 categorizes the uses of funds within each mode by effect. Operations and maintenance and capital preservation expenditures preserve the existing system but do not add substantial new capacity.[14] Capital expansion expenditures add new capacity to the system.[15] Capital expansion accounts for 47% of total projected expenditures at approximately $906 million per year. Projected operations & maintenance and capital preservation expenditures constitute the other 53%, at over $1 billion annually.

[13]Some pedestrian/bicycle expenditures may be included as part of larger roadway projects.

[14]Operations and maintenance expenditures include ordinary activities such as pothole repair, sign painting, fuel, driver salaries, and similar items. Capital preservation expenditures include major rehabilitation activities such as road repaving, replacement bus purchases, and similar projects.

[15]Capital expansion expenditures include the construction of additional lane-miles of road, the purchase of non-replacement buses, and other projects. Because many capital preservation and capital expansion projects are very similar (and may be let as part of the same contract), some preservation expenditures may be included in the expansion category and vice versa.

Figure 6.3

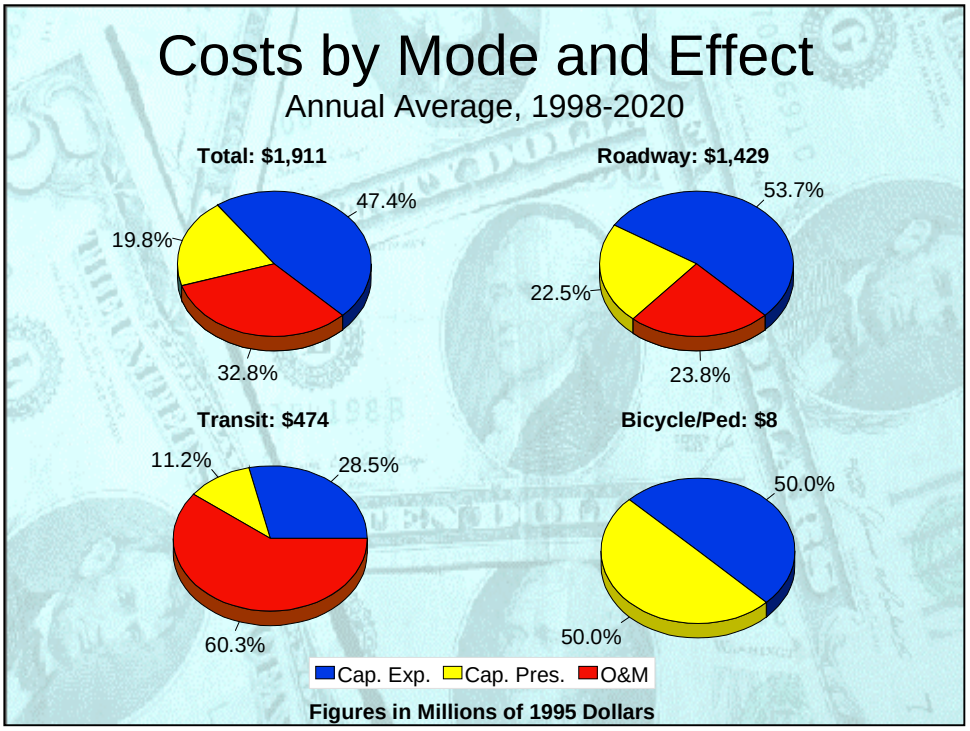
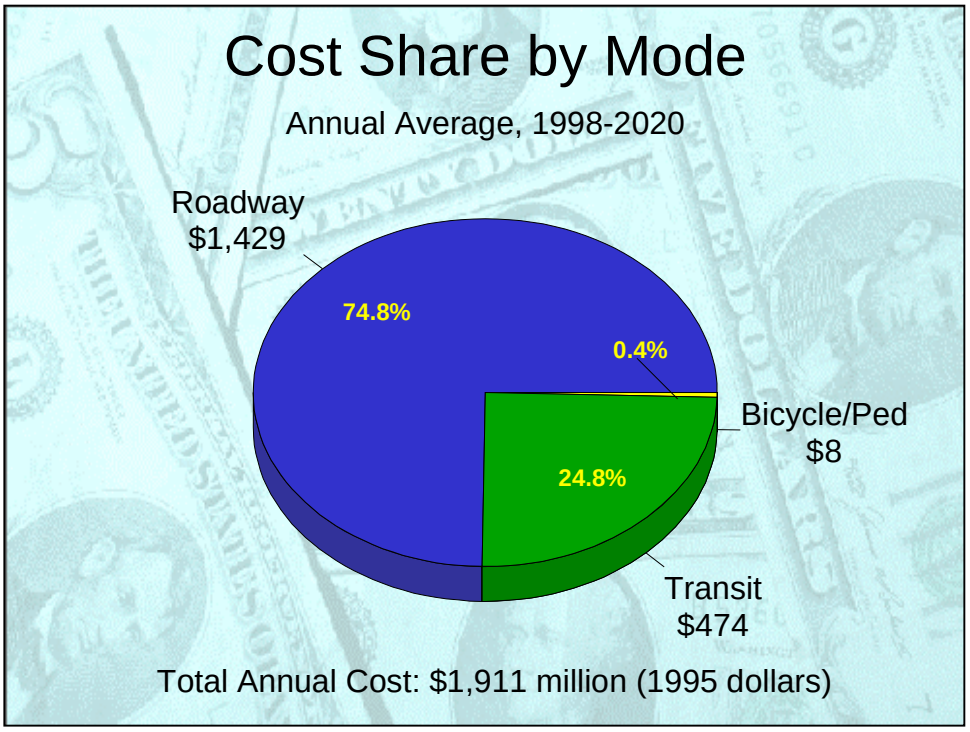


Figure 6.4



6.3 REGIONAL TRANSPORTATION REVENUES

Regional revenue includes federal, state, and local government funds, as well as user fees in the form of fares and tolls. Transportation providers in the H-GAC region receive funding from a wide range of sources. For purposes of this analysis, funding sources were divided into six types:

- Local funds of a general nature, including monies raised by the region's local transportation providers for transportation. Local sources dedicated to transportation (*e.g.*, METRO sales tax revenue) as well as general fund allocations (*e.g.*, from County general funds) are included in this category.

- Local toll revenues collected by the Harris County Toll Road Authority.

- Local fare revenues including user fees and contract revenues collected by the region's transit agencies.

- Local private contributions by developers and others.

- State funds raised for expenditures on transportation in the Houston-Galveston region.

- Federal funds raised for expenditures on transportation in the Houston-Galveston region.

Table 6.2 and Figure 6.5 display the distribution of anticipated regional revenues among the sources described above. The revenue sources were allocated to modes based on historical data obtained from each provider and on data in the MTP.

Local funds from property taxes, sales taxes, fees, and other general fund revenues compose over 45% of total projected transportation funding in the region. Harris County, the City of Houston, and METRO raise the majority of local funding. State and Federal funds constitute approximately 40% of projected future funding for the region. The remaining funding for the region’s transportation needs is derived from tolls, fares, and private contributions. Bond revenues are not included as a funding source because they do not represent "new money," but are loans against future revenues.

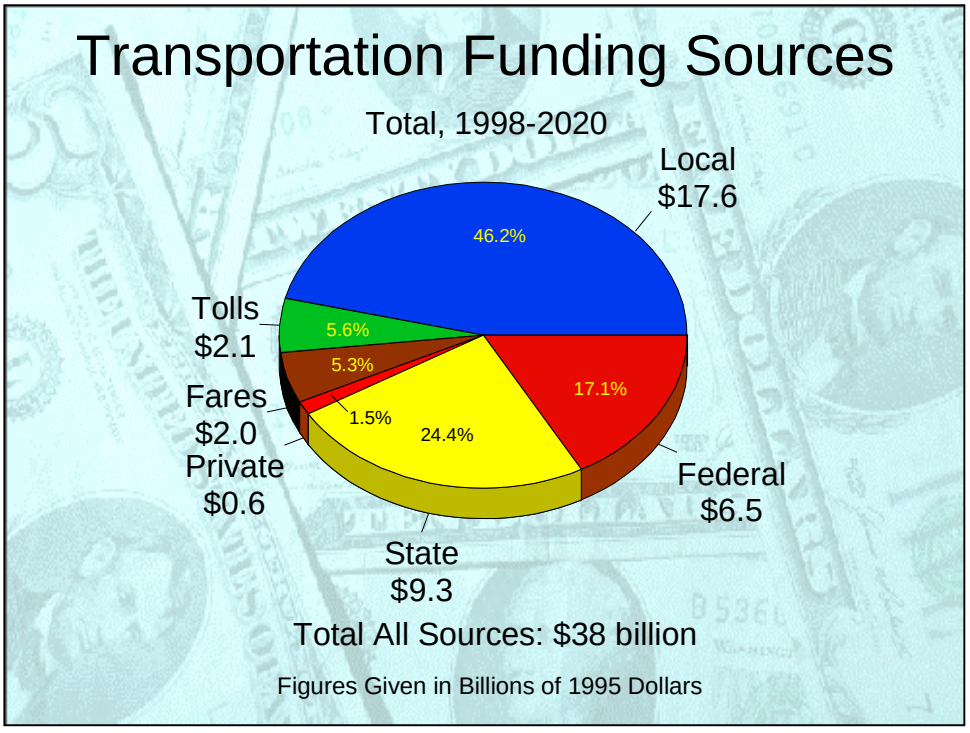
Revenue raised from all sources total approximately $1.70 billion per year or $39.0 billion over the 1998-2020 period. Excluding the non-fungible HCTRA surplus of $43 million per year, revenue raised from all sources total approximately $1.65 billion per year or $38.0 billion over the 1998-2020 period.

Table 6.2: Revenues By Source, 1998-2020

(Millions of Annualized 1995 Dollars)

	Local Funds				State Funds	Federal Funds	Total Revenue
	General	Tolls	Fares	Private			
Road/ Bridge	489	92	0	0	401	189 [16]	1,195
Transit/ HOV	275	0	88	24	2	94	459
Total Revenue	764	92	88	24	403	283	1,654

Figure 6.5



[16] Includes some flexible funds that may be used for other modes.

6. 4 COST AND REVENUE SUMMARY

Table 6.3 summarizes the region's projected transportation expenditures and revenues for the 1998 to 2020 time period. Results are presented as annual cost and revenue totals for the entire region, in millions of 1995 dollars.[17] The region's projected annual funding shortfall is the difference between the region's planned transportation expenditures and available revenues.[18] As per approved financial planning methodology, system preservation costs (operations and maintenance and capital preservation) are funded before expansion costs.

Table 6.3: Costs & Revenues by Effect
1998-2020

(Millions of Annualized 1995 Dollars)

	Operations & Maintenance	Capital Preservation	Capital Expansion	Total
Total Annual Cost	626	379	906	1,911
Total Annual Revenue	626	379	649	1,654
Annual Surplus/ (Shortfall)	0	0	(257)	(257)

6.5 POTENTIAL FUNDING SHORTFALL

Based on transportation needs over the next several decades, the region faces an average annual funding shortfall of $257 million, or $5.9 billion for the 23-year period (see Figure 6.6). A substantial surplus ($43 million/year) generated by HCTRA that will not be available to fund non-HCTRA projects is netted out of the region's available revenues. Over the 1998-2020 period, the annual shortfall represents approximately 13% of projected total expenditures, and over 28% of planned expansion expenditures.

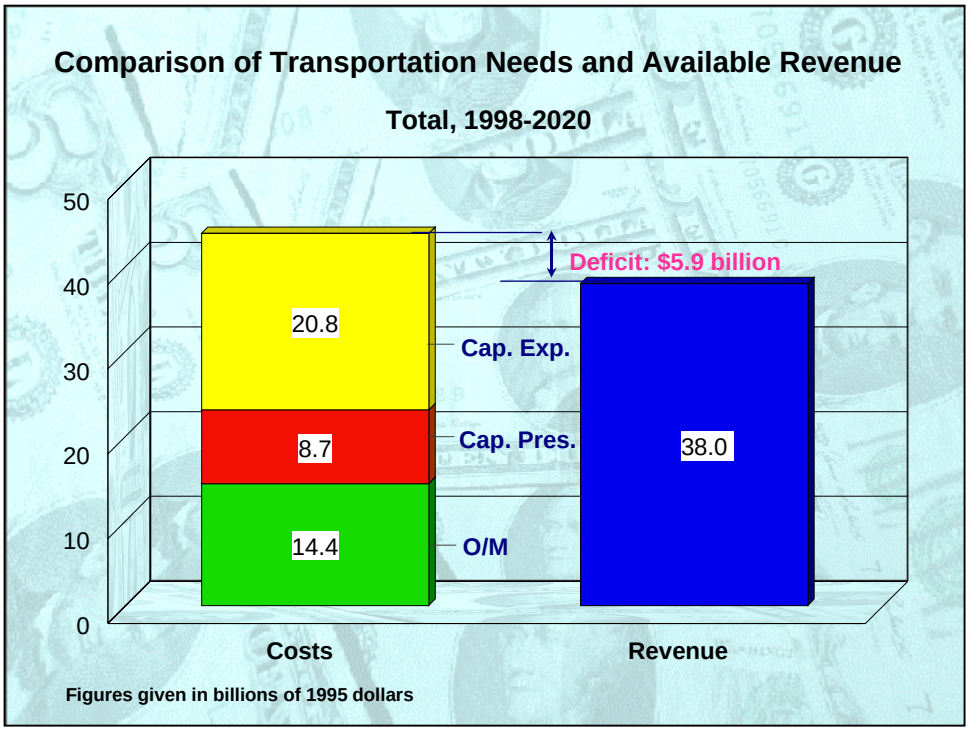
[17]These annual totals are average expenditures and revenues for the 1998 to 2020 period, *not* cash flow estimates. Projections were annualized by taking total figures in current dollars, deflating them to 1995 dollars, and dividing by the number of years in the planning period.

[18]For reasons stated in footnote 1 on page 1 of this report, the region's actual total transportation revenues, expenditures, and funding shortfall will deviate from the annual average estimates presented in this report. In addition, the totals presented in Table 6.3 are annualized averages, rather than cash flow estimates, and are not intended to represent actual costs, revenues, or funding shortfalls for any particular year in the planning period.

The present financial planning approach assumes that system preservation expenditures will be funded before system expansion. For the Houston region as whole, projected annual revenue is greater than projected annual preservation costs. However, for particular providers, even with population growth over time, there will be insufficient funds to cover the minimum pavement maintenance needs addressed by the baseline financial analysis. In some cases, it may be necessary to take steps at the jurisdiction level to ensure that adequate funds are made available to accommodate both growth and the maintenance of existing roadway assets.

The challenge facing the region will be felt most acutely in the counties outside Harris where there have been little or no large-scale capital infrastructure programs. To address expected growth, developing suburban areas will be unlikely to continue to rely on existing funding streams or on TxDOT, which itself faces an imposing deficit.

Figure 6.6



6.6 ADDRESSING THE SHORTFALL

The region has chosen a multi-tiered approach to mitigate the transportation funding shortfall in order to meet projected transportation needs. The approach is based in part on an expanded use of user-based financing and in part on the pursuit to obtain funding levels from state and federal sources that are proportionate to the region's population and economic base. There are four components to the approach:

- Adoption of a toll-financing policy to support new freeway projects;
- Pursuit of reduction of diversion of state transportation funds to non-transportation uses.
- Pursuit of a commensurate share of state revenue for the region; and,
- Pursuit of an increased share of federal highway revenue at the state level.

These measures would permit the region to accomplish almost ninety-four percent of its projected mobility needs through 2020. To fully constrain the MTP, the other 6 percent of the expansion projects would be deferred to the years beyond the plan horizon. Each of the measures is discussed briefly below.

Toll-Financing Policy for New Freeway Projects

While the region has used toll financing with success in the past in particular cases (the Sam Houston and Hardy Toll Roads), the Transportation Policy Council has now embraced a more encompassing policy. The TPC seeks to implement all new freeway construction proposed for the region (where appropriate) through toll financing. It is not presumed that user fees would fund all of the construction, or even a majority, of any one proposed freeway. More realistically, the goal would be to offset 50 percent of the aggregate construction cost of all projects considered, acknowledging that additional federal, state, and/or local funding may be a necessary part of the financing in some cases.

Currently, the toll financing policy would apply to the projects proposed for Westpark, SH 122, the northeastern section of the Beltway 8 mainlanes and the connectors from the Hardy Toll Road to the central business district and to Intercontinental Airport. Toll financing/congestion pricing is also likely to apply to the reconstruction of the IH-10/Katy Corridor if the draft results of the major investment study are approved. For planning purposes, the implementation of the policy in the cases indicated would result in savings to the region of $26 million on an average annual basis.

Reduction of Diversion of State Transportation Funds

Currently, over eight percent of transportation-dedicated funds at the state level are allocated to fund the state Department of Public Safety and other non-transportation activities. In addition, TxDOT has also provided analyses to indicate that only about a third of the state transportation needs are being currently met with the moneys actually

received. The TPC has adopted a position in support of, and plans to work with the region's legislative representatives for, the elimination of such a diversion of funds from Fund 6, the state transportation revenue fund.

If the funds that were diverted from Fund 6 for DPS were instead used for transportation, TxDOT would receive an additional $200 to $260 million per year. The Houston region could then stand to gain an additional $40 million annually in state funding.

Increase in Share of State Funds

In the recent past, the Houston-Galveston region has received less than nineteen percent of the total transportation revenue collected by the state, even though the region's population and employment share is over twenty-one percent. The TPC has resolved to pursue the more commensurate level of twenty-one percent for the region, through working with the region's legislative delegation and TxDOT officials. A twenty-one percent share of state funding would boost state revenue coming to the region by approximately $62 million per year on an average basis.

Increase Share of Federal Funds

The current plans for the reauthorization of the Intermodal Surface Transportation Efficiency Act (ISTEA) include an increase in funding of $2.5 billion nationwide on an average annual basis. In addition, a coalition of state representatives called Step 21 has proposed that no state be returned less than ninety-five cents on each dollar of gasoline taxes and other federal revenue sent to Washington, DC. As Texas currently receives only eighty-three cents on each dollar sent to the nation's capitol, the TPC has adopted the position of aggressively pursuing a change in funding allocation methods at the national level, in support of its Congressional delegation's position.

If Texas were to be returned ninety-five percent of the revenue it sends to Washington for transportation purposes, and Houston were to receive a commensurate share, the region would receive an additional $73.5 million on an average annual basis.

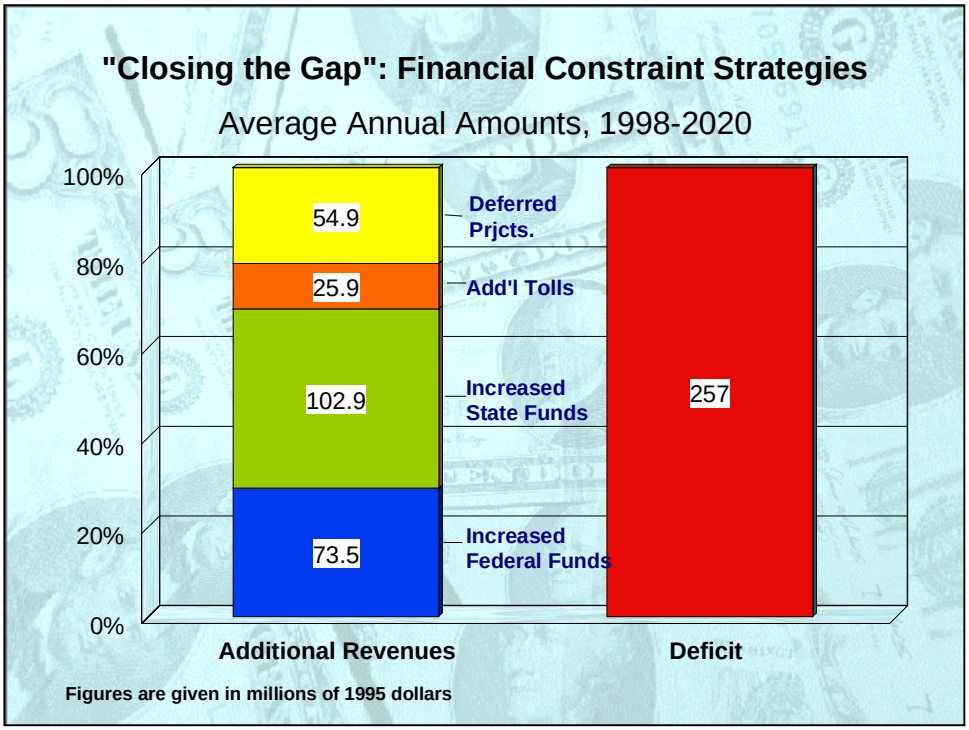
Deferment of Some Projects

In order to meet remaining financial constraints, the TPC has elected to defer some projects beyond the time horizon of *Vision 2020*. For the projects that would be deferred, preliminary analysis has suggested that the estimated impact of their removal on regional mobility would be minimal during the MTP time frame. The average annual cost savings of the projects deferred is $55 million. If the region were not able to realize the increased funding strategies discussed above, it is likely that an even greater level of projects would need to be deferred.

6.7 FINANCIAL CONSTRAINT OBTAINED

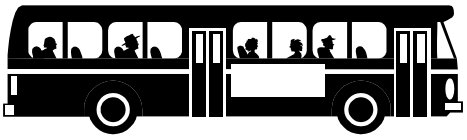
Figure 6.6 indicates the effect of the region's multi-tiered funding approach for the MTP. By engaging a broader user-fee policy and by obtaining commensurate support from the federal and state governments, the region stands to fund $1,855 million of its projected transportation needs on an average annual basis. Only four percent, or an annual $55 million of projects, would be deferred to the years following the plan time frame. By these measures, *Vision 2020* represents a financially constrained plan for the region's surface transportation for the next 23 years.

Figure 6.7



CHAPTER 7.0

STRATEGIES AND PERFORMANCE



7.1 INTRODUCTION

The MTP is comprised of individual components that provide the framework for future investments in the regional transportation system. Each component is one piece of an overall structure that operates in tandem to achieve system performance objectives.

One of the first steps in the metropolitan transportation planning process is the evaluation of congestion levels in various geographic areas and along specific transportation routes. While roadway congestion is one of the most obvious indicators of system performance, lack of access to employment, shopping and recreational centers, few travel mode alternatives, and facilities in need of repair are also indicators of how the transportation system is performing. This chapter examines the modal elements of the transportation system in terms of existing conditions and future needs. The analysis begins with a look at the transit system.

7.2 REGIONAL TRANSIT SYSTEM

Four public transit agencies serve the Houston-Galveston TMA: the Harris County Metropolitan Transit Authority (METRO), Brazos Transit System (BTS), Island Transit, and Connect Transportation. METRO and Island

Transit are public transit agencies providing fixed route and ADA paratransit services in the City of Houston, Harris County, and the City of Galveston, respectively. Connect Transportation and BTS provide demand-responsive transit service in predominantly rural areas.

BTS provides service for Montgomery and Liberty Counties. Its commuter service, using the HOV lane on IH 45 North, connects Montgomery County to three major activity centers in Houston: the CBD, the Texas Medical Center, and Greenway Plaza. The service is operated from two existing park & ride lots located in The Woodlands and Conroe with 1,300 parking spaces. An additional facility at Research Forest, with 600 parking spaces is under construction to meet additional demand for commuters to Houston activity centers. Other activity centers are served by vanpools, with vans chartered from private van leasing companies. A parking facility with 200 car spaces across from The Woodlands park and ride lot serves as the staging and parking area for carpoolers and vanpoolers from Montgomery County.

Island Transit is a public transit agency providing fixed route service in the City of Galveston. It also operates a demand response service for the disabled and elderly. The service has been contracted out to different service providers over the years. Currently, the Brazos Transit System is operating the Island Transit routes.

Connect Transportation Provides demand-responsive service in Brazoria County under the rural transit program and the Texas City-LaMarque urbanized area of Galveston County. Most trips provide for medical and social service needs for the elderly and disabled.

METRO is the largest public transit agency in the region, covering a 1,281 square mile service area comprising most of Harris County and small portions of Fort Bend and Montgomery Counties. There are 15 cities in METRO's service boundaries, the largest being the City of Houston. METRO provides the most comprehensive transit service in the region, serving about forty percent of its service area with fixed routes and complementary paratransit service.

METRO has made substantial investment in infrastructure and services since its formation in 1979. Total ridership increased to a peak of 84.4 million passenger boardings in 1991. From 1991 to 1996, ridership declined slightly due to a decline in fixed route transit use. The ridership data for 1997 shows a reversal of this trend with a healthy increase for the first 11 months of the year. The use of high occupancy vehicle (HOV) lanes continues to grow since METRO has invested quite heavily in the construction of HOV lanes on many of the freeways that serve the region. METRO is also seeing an increase in demand for special services such as METROLift and special event shuttles.

The existing transit system includes 67.7 miles of HOV lanes operating in five freeway corridors. Another 22.7 miles are under construction and will add service in a sixth travel corridor. Design is underway on 12.8 miles of HOV lanes that will extend service on the

existing HOV lanes, plus add a new HOV facility in the southwest part of the region. Approximately 24 park and ride centers serve the HOV lane system, with 5 more planned for near term construction.

While the HOV lane system has been and should continue to be a successful transit strategy, changes in transit service will be required to address changing demographics in the region. Much of the increase in population will take place in suburban areas surrounding the City of Houston, particularly in the unincorporated areas of Harris, Fort Bend and Montgomery Counties. By 2020, the labor force is expected to reach 3 million in the Houston metropolitan area. While Harris County will be the predominant location for employment, an increasingly large percentage of jobs will be located in the seven adjacent counties. While employment projections suggest that the inner city activity centers will continue to grow modestly through the year 2020, substantial growth will continue in the suburban employment centers creating multi-directional traffic flows from home to work, between many destinations.[19]

With the increase in suburban residential development and the shift of employment to various locations throughout the region, more cross-town and non-CBD service will be needed. Also, more transit centers may be required to provide connectivity between suburban communities. Service adjustments that may be warranted by changing demographics include the following:

- Service expansion and greater regional coverage to more locations throughout the region;
- Service capacity increases and bi-directional service in key corridors;
- Suburb-to-suburb service expansions;
- Greater circulator service to provide access within activity centers;
- Non-traditional service expansions.[20]

7.2.1 Recommended Transit System

METRO Service Enhancements

During much of 1995 and 1996, METRO developed a "recommended" concept for future service improvements through 2020[21]. While capital, operating and maintenance costs were taken into consideration in the development of the recommended concept, projects were included based upon their potential to accommodate future travel patterns, improve regional mobility, and provide faster travel times. The recommended concept is also designed to address future travel patterns by improving existing service with shorter

[19] Westchase, Greenspoint, Bay Area, and the Energy Corridor
[20] "Evaluation Results Report for METRO Regional Transit Plan (Horizon 2020)", prepared by ICF Kaiser/georgia wilson, inc., April 1997.
[21] Ibid.

headways, extending service hours and offering more off-peak service. Highlights of the recommended concept for METRO service improvements through the 2020 are detailed below.

Service will be expanded to high growth areas such as the Northwest, Bay Area, and FM 1960 areas. New park and ride service will be provided to non-CBD activity centers including direct service to Westchase and the Energy Corridor from each travel corridor. Direct service from the Bay Area to Texas Medical Center will be added. The recommended concept includes new crosstown service along SH 6 and West Airport Boulevard. Activity center circulator routes are also proposed for Westchase, Greenspoint, Uptown and Bay Area. In the Katy and Southwest corridors, two-directional HOV lanes are proposed to accommodate the demand for nonpeak direction travel.

The recommended concept is designed to improve regional mobility by implementing pulsed service. Pulsed service will provide additional Transit Center Flyer service to link the transit centers, using the regional transit centers for connection to activity centers, such as from the Hillcroft Transit Center to Greenway Plaza and from Hobby Transit Center to NASA. The recommended concept also proposes to provide faster travel times with the augmentation of limited-stop service inside Loop 610 and along high-density corridors on a number of existing routes.

METRO is aggressively implementing high technology transportation improvements that will benefit transit as well as auto traffic. Programs such as the Regional Computerized Traffic Signal System (RCTSS), Intelligent Transportation System (ITS), Automatic Vehicle Locator and Passenger Counter Systems, and Congestion Pricing are programs aimed at managing congestion and improving travel times, particularly for transit patrons.

Capital projects in the recommended concept include the construction of new HOV lanes on portions of the West Loop and South Loop, and the extension and expansion of existing HOV lanes. Along the CBD to Dome Corridor high capacity transit service is proposed. A high capacity guided busway is recommended for the SH 249/Burlington Northern Corridor.

In general, the recommended concept reflects a balance of improved local and express service, enhanced connectivity to activity centers, moderate expansion of the HOV network, high speed bi-directional HOV facilities in three heavily congested corridors and high capacity transit in another two congested corridors. In October 1996 METRO's board of directors officially adopted the recommended concept as the METRO Regional Transit Plan (Horizon 2020). The transit network system statistics for this plan are summarized in Table 7.1.

Table 7.1: Regional Transit Plan (Horizon 2020)
Transit Network System Statistics

REGIONAL TRANSIT PLAN (HORIZON 2020) TRANSIT NETWORK SYSTEM STATISTICS	
NUMBER OF ROUTES	278
Local *	176
Express	12
Commuter	90
ANNUAL PASSENGER MILES	701,663,034
Local *	407,025,638
Express	39,475,968
Commuter	165,918,428
Special Bus Services	89,243,000
PEAK HOUR VEHICLES	3,076
Standard Buses	1,994
Mini Buses	120
Articulated Buses	262
Special Bus Services	700
ANNUAL RIDERSHIP (TOTAL DAILY BOARDINGS)	225,632,013
Local *	99,732,805
Express	6,072,320
Commuter	18,305,280
Special Bus Services	6,253,000
Carpools (daily passengers)	95,268,608
PARK & RIDE FACILITIES	39
TRANSIT CENTERS	25
HOV LANE MILES	240
BUS OPERATING FACILITIES	8

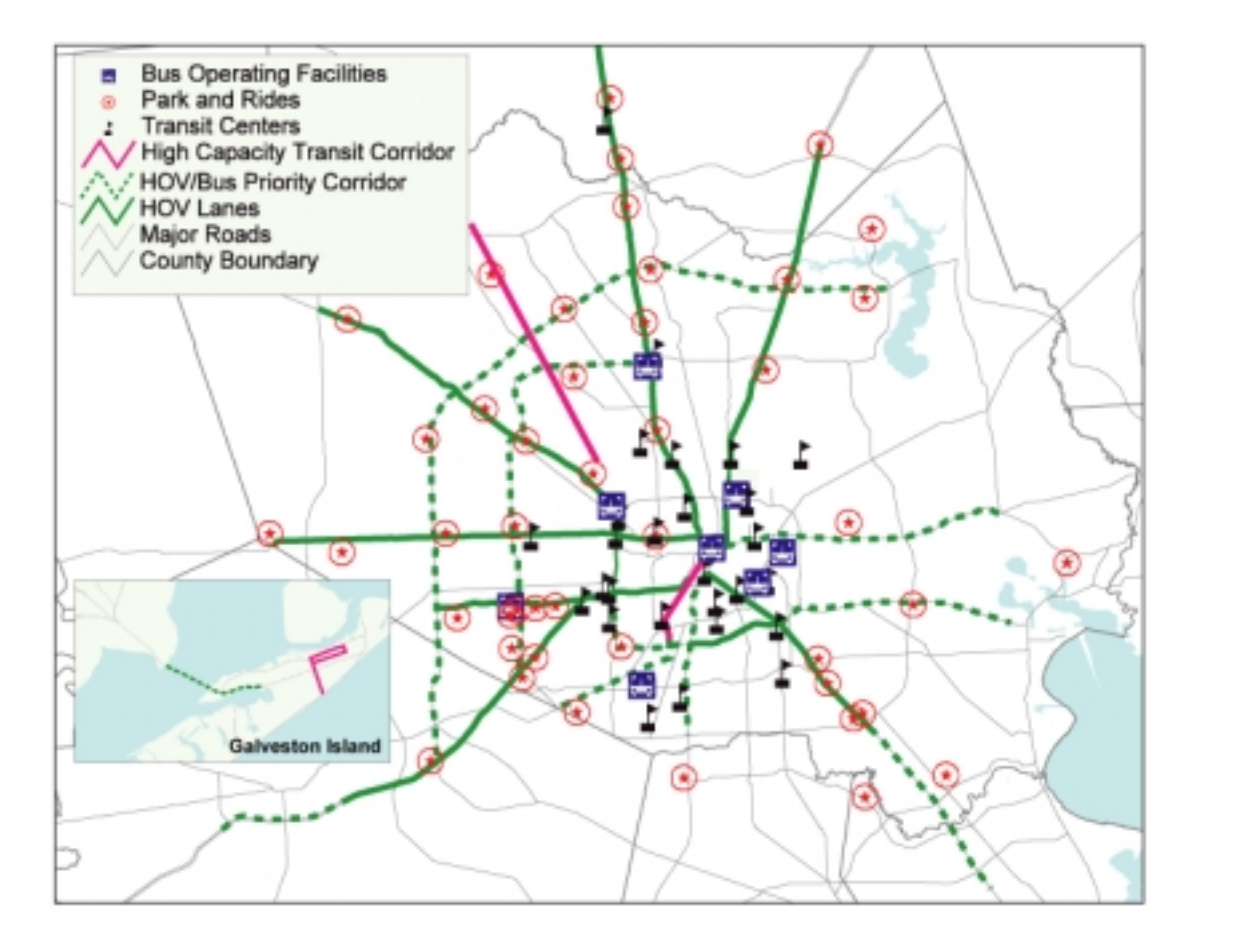
- "Local" includes Cross-town, Circulator, and Shuttle routes.

NOTE: Local passenger miles and ridership figures have been annualized to reflect weekday and weekend service, while Express and Commuter reflect weekday service only.

Other Transit Service Enhancements

METRO's service area extends into most of Harris County, the most densely populated county in the region. The adjacent counties have much more limited transit service. As noted earlier, BTS and Gulf Coast Center provide demand response transit service in less urbanized areas of the region. As these areas continue to grow and the need for public transportation increases, fixed route service will become a viable transit option. Demand response service will in turn become an option for counties that need transit service but cannot support fixed route transit at this time. Transportation providers in these areas will focus on alternatives such as general use Dial-a-Ride programs, vanpooling and carpooling. Transit improvements outside METRO's service area contained in *Vision 2020* rely on enhancements to existing services, several new park and ride lots to support planned HOV lane extensions, and expansion of regional vanpooling services. Figure 7.1 illustrates the recommended future transit system for the region.

Figure 7.1: Recommended Transit System Improvements



7.3 REGIONAL ROADWAY SYSTEM

Traffic management and transit system improvements alleviate a significant amount of congestion and go a long way toward improving mobility throughout the region. Even with the implementation of these improvements, however, the need for new roads and added capacity on existing roads still exists. According to recent statistics, if current trends continue the number of motor vehicles registered in the eight-county TMA will increase from 3.3 million in 1996 to 10.6 million in 2020.[22] That means that for every 1,000 cars registered today, there will be 3,200 cars in 2020 competing for road space and looking for a place to park. Travel delays resulting from the increase in vehicles, people,

[22] Assuming an average annual increase of 9%.

employment centers, shopping centers and recreational facilities will affect all modes of transportation and the services they provide.

Costs incurred due to congestion will be substantial in terms of dollars, air quality and overall quality of life in the region. According to a study conducted by the Texas Transportation Institute, the annual cost due to congestion in the Houston urban area was estimated at $1.75 million in 1991.[23] That was $780 per registered vehicle or $570 for each of the region's residents. These statistics do not measure the reduction in quality of life due to longer commute times for work and leisure, or, the potential health impacts of increases in vehicular emissions.

Given these impacts, the development of *Vision 2020* began with an assessment of the level of mobility (LOM) on the region's roadways today.[24] LOM refers to the ratio of traffic volume and traffic capacity of a roadway, with a higher ratio indicating increased levels of congestion. Volume to capacity (V/C) ratios are partitioned into four levels of mobility based on 24-hour weekday per lane volumes: tolerable, moderate, serious, and severe. By this definition, severe levels of congestion occur when the volume to capacity on a roadway is greater than 1.25 percent (see Appendix C for specific breakdown of levels of mobility).

In order to simplify the analysis of roadway congestion, a set of evaluation capacities was developed for urban, suburban and rural roadways. Roadway capacity is based on the number of vehicles per lane per weekday and varies for each type of roadway (refer to Appendix C). The LOM for a roadway is its V/C ratio based on modeled traffic volumes and evaluation capacity.

The roadway congestion analysis looks at congestion levels in the near-term (year 2000) and long-term (year 2020). The year 2000 roadway network includes the existing roadway system plus roadway improvements that are scheduled for completion by the year 2000. The congestion analysis for both years is based on the forecasted growth in population and employment for the region as described in Chapter 2 of this document.

As indicated in Chapter 2, much of the growth in population and employment will occur in what are now suburban and rural areas of the region. Because the existing transportation system will be unable to accommodate future travel demand, new major thoroughfares will be needed in those areas. Many of the existing two lane collector roads will need to be widened and upgraded as well to accommodate increased traffic volumes. Since the Harris County major thoroughfare system is essentially in place, most of the improvements inside Beltway 8 are roadway widening projects and projects to complete "missing" sections of existing roadways. Several new thoroughfares, however, have been identified for construction outside Beltway 8 to accommodate growth primarily in the north and western sections of the county.

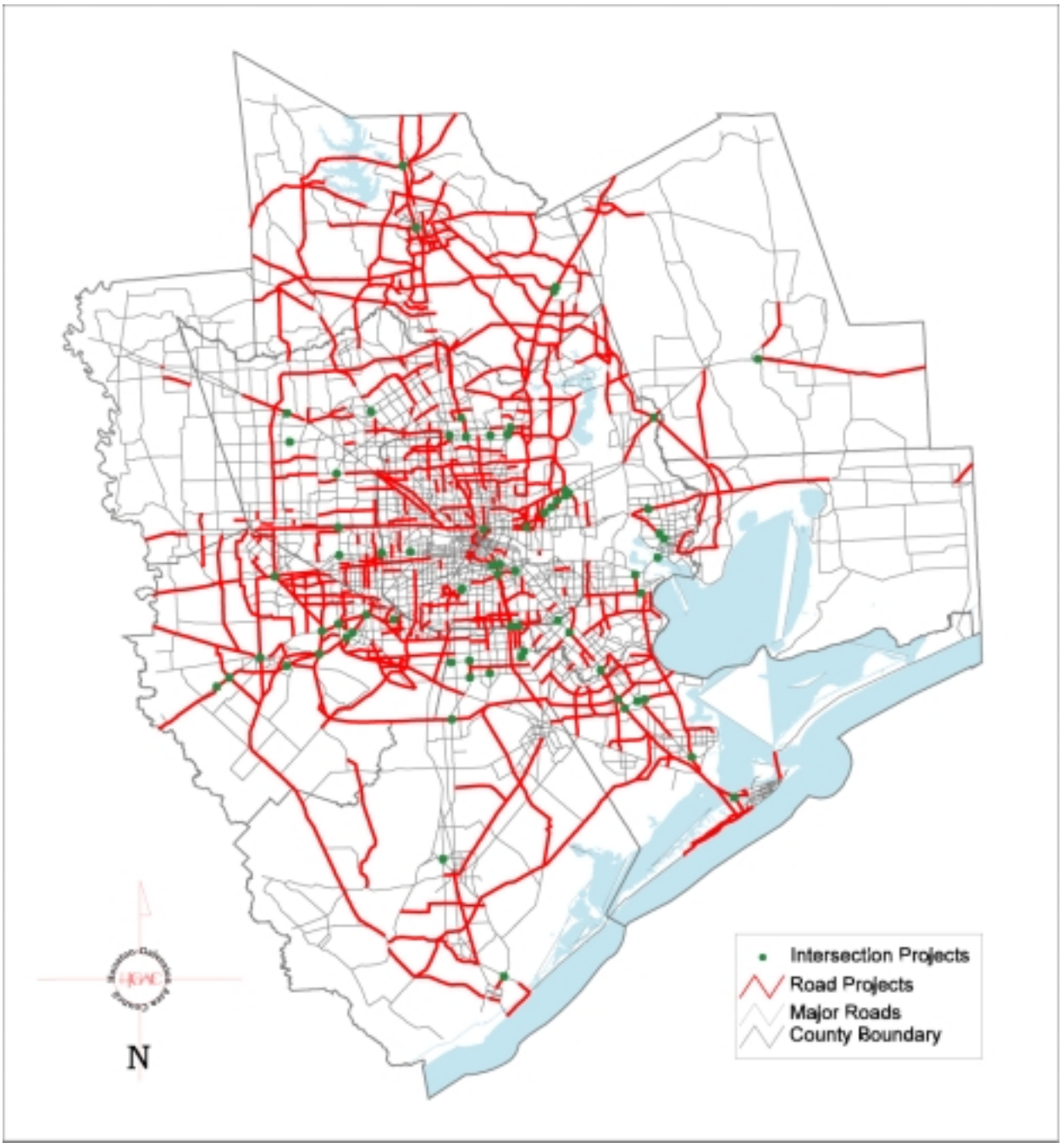
[23] Trends in Urban Roadway Congestion 1982 to 1991, Volume 1: Annual Report, Texas Transportation Institute Research Report, College Station, September 1994, pp. 1131-6.
[24] Level of mobility standards and evaluation capacities were designed by H-GAC travel modeling staff.

The roadway element of *Vision 2020* identifies roadway widening and new roadway projects that will be needed as the region's population grows and today's undeveloped areas become residential, business, and commercial centers. The roadway system in the urban core of the region will also need to be upgraded as redevelopment takes place. Growth in lane miles and centerline miles by roadway type that would result from implementation of the recommended roadway projects is shown in Table 7.2. From 1996 to 2020, freeway lane miles will increase by 1,017 miles but centerline miles will increase by only 93 miles or 4 miles annually. The relatively small growth in centerline miles is indicative of freeway widenings rather than the construction of new freeways. With the completion of SH 249 as a freeway from BW 8 to the Montgomery county line, the regional freeway system will be substantially complete. The vast majority of roadway improvements will be to the arterial street system. Arterial lane miles will increase 44 percent from 1996 to 2020, an increase of approximately 204 lane miles or 50 centerline miles annually. Approximately half of the increase in arterial lane miles will occur outside of BW 8 in the northern and western parts of the region, particularly Fort Bend and Montgomery Counties were several new thoroughfares, such as SH 122 (the Fort Bend Expressway), are planned.

Table 7.2: Roadway Centerline/Lane Miles

Year	*Miles*	*Freeway*	*Tollway*	*Arterial*	*Total*
1990	Centerline	448	56	3,037	3,541
	Lane	2,549	278	9,944	12,771
1996	Centerline	501	62	3,264	3,827
	Lane	2,698	626	11,273	14,597
2020	Centerline	594	131	4,475	5,200
	Lane	3,655	1,030	16,191	20,876
Total	**Centerline**	**1,543**	**249**	**10,776**	**12,568**
	Lane	**8,902**	**1,934**	**37,408**	**48,244**

Figure 7.2: Recommended Roadway System Improvements

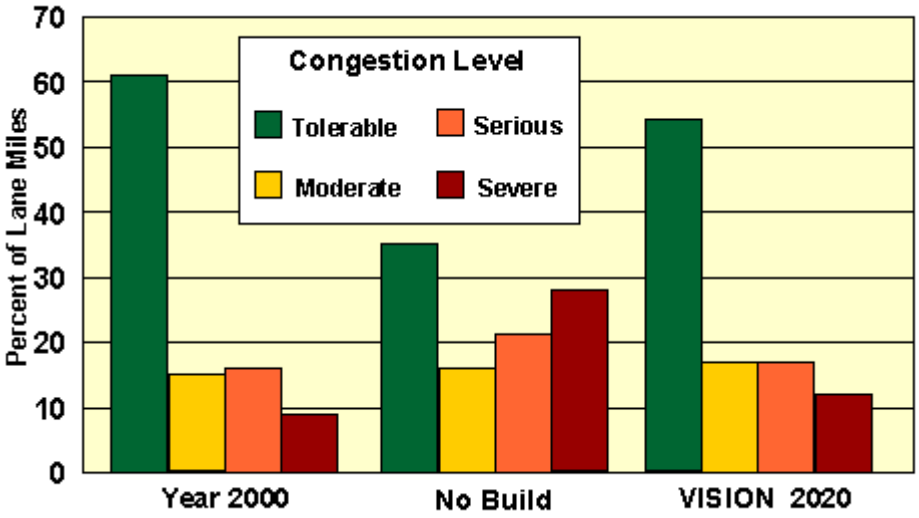


7.4 SYSTEM PERFORMANCE

The MTP is designed to guide investment in the transportation system to mitigate congestion on the existing system and prevent congestion from occurring in the future. Without *Vision 2020's* roadway improvements, congestion costs will exceed $1.75 billion per year by 2020. Population and employment growth in Fort Bend, Montgomery and Galveston Counties will strain the capacity of the existing system. Travel times for motorists and transit riders will increase significantly. Much of Harris County will be congested in the year 2020 making it increasingly difficult for businesses to function efficiently. The quality of life of the region's residents will also be impacted as travel times for work, shopping and other personal business increase.

Due to a 60 percent increase in vehicle travel, serious and severe levels of future congestion will be substantially greater despite *Vision 2020's* recommendations for increased public transportation and traffic management. However, these recommendations in combination with the roadway recommendations included in *Vision 2020* will prevent congestion from getting a lot worse and will significantly reduce congestion levels from those that would be experienced in the absence of any improvements to the existing system. Figure 7.3 illustrates this point. The columns for *Vision 2020* indicate congestion levels closer to 2000 levels than congestion levels that would result from no roadway improvements ("No Build").

Figure 7.3: Levels of Congestion



System performance may also be viewed in terms of vehicle hours of travel (VHT), a function of the number of vehicles traveling the region's roadways and the number of hours they spend reaching their destinations. A comparison of 1995 peak hour VHT to projected 2020 levels shows that VHT would increase by 73% in the absence of transportation improvements beyond those currently underway. By contrast, implementing the recommendations for both transit and highway improvements contained in Vision 2020 would lead to a relatively small increase in VHT of ten percent.

Table 7.3: System Performance

YEAR/PERIOD	*VEHICLE HOURS OF TRAVEL (VHT)*	*PERCENT INCREASE IN VHT FROM 1995 PM PEAK*
1995 PM peak*	628,300 hours	
2020 "No Build" PM peak	1,089,700 hours	73.4 %
2020 "Action" PM peak	692,600 hours	10.2 %

*PM peak is a 3 hour period.

Another performance measure is the comparison of areas of serious and severe congestion. Figure 7.4 shows areas of serious or severe congestion in the year 2000. Figure 7.5 shows areas throughout the region that will experience serious or severe congestion in the year 2020 if no improvements are made to the existing system, the no-build condition. Figure 7.6 shows areas of serious or severe congestion with the recommended roadway system in place, the build condition, in 2020. In 2000 the transportation system will look much as it does today. The only change will be the completion of projects already underway by state and local governments. Serious congestion will afflict approximately one-third of the TMA, with many areas experiencing severe congestion levels. If no transportation projects are completed beyond 2000 and population and employment increase at projected rates, most of the region will be seriously or severely congested by 2020. Travel demand will far exceed the capacity of the system to cope with it. The overburdened transportation network will deteriorate far more rapidly due to overuse, further contributing to travel delays.

Throughout the region, *Vision 2020* will prevent increases in serious and severe levels of congestion by 2020. However it will not eliminate congestion completely. The northern and western areas the region and parts of Galveston and Brazoria Counties will continue to experience travel delays along many major thoroughfares. Preliminary estimates suggest that an additional $1 billion in added capacity improvements would be required to eliminate serious and severe congestion in all areas of the region. Even if revenues were sufficient to solve the most serious congestion problems, the environmental and

land use implications would still be prohibitive. This analysis points to the need to invest in alternative modes of travel, travel demand management strategies, and traffic management strategies as well as rethinking traditional concepts of travel, work and recreation.

Figure 7.4: Areas of Congestion (Year 2000)

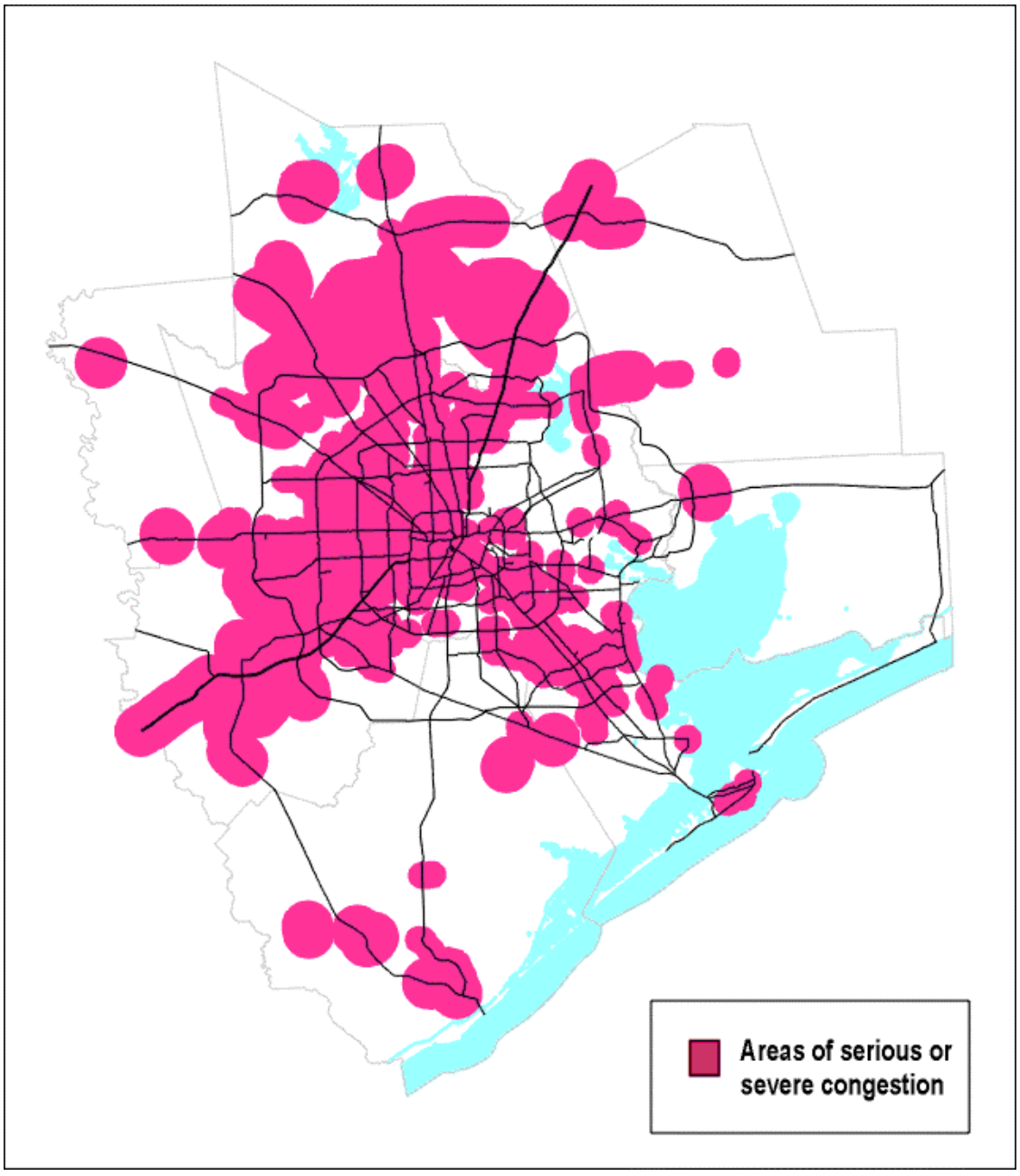


Figure 7.5: Areas of Congestion (Year 2020 "No Build")

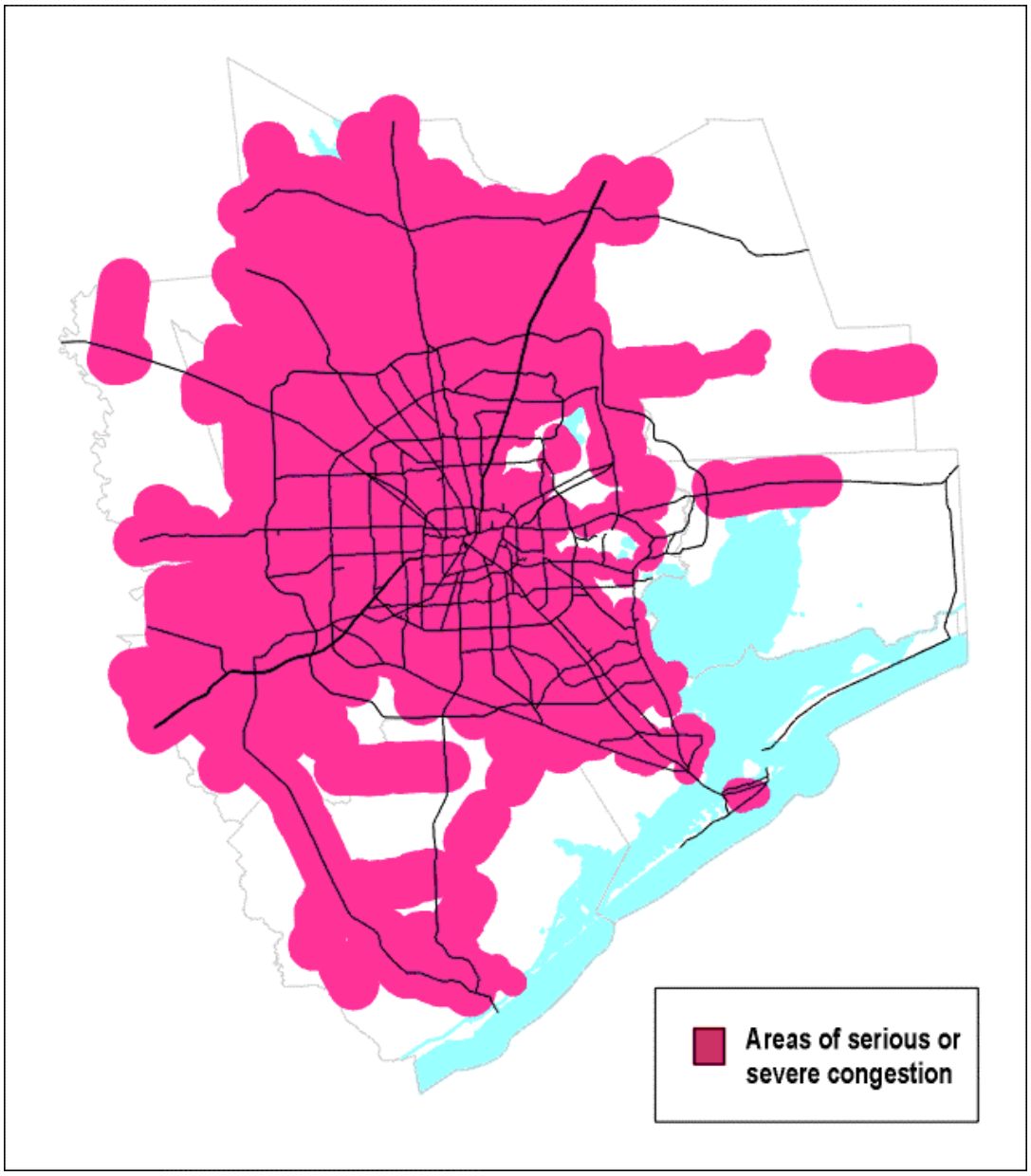
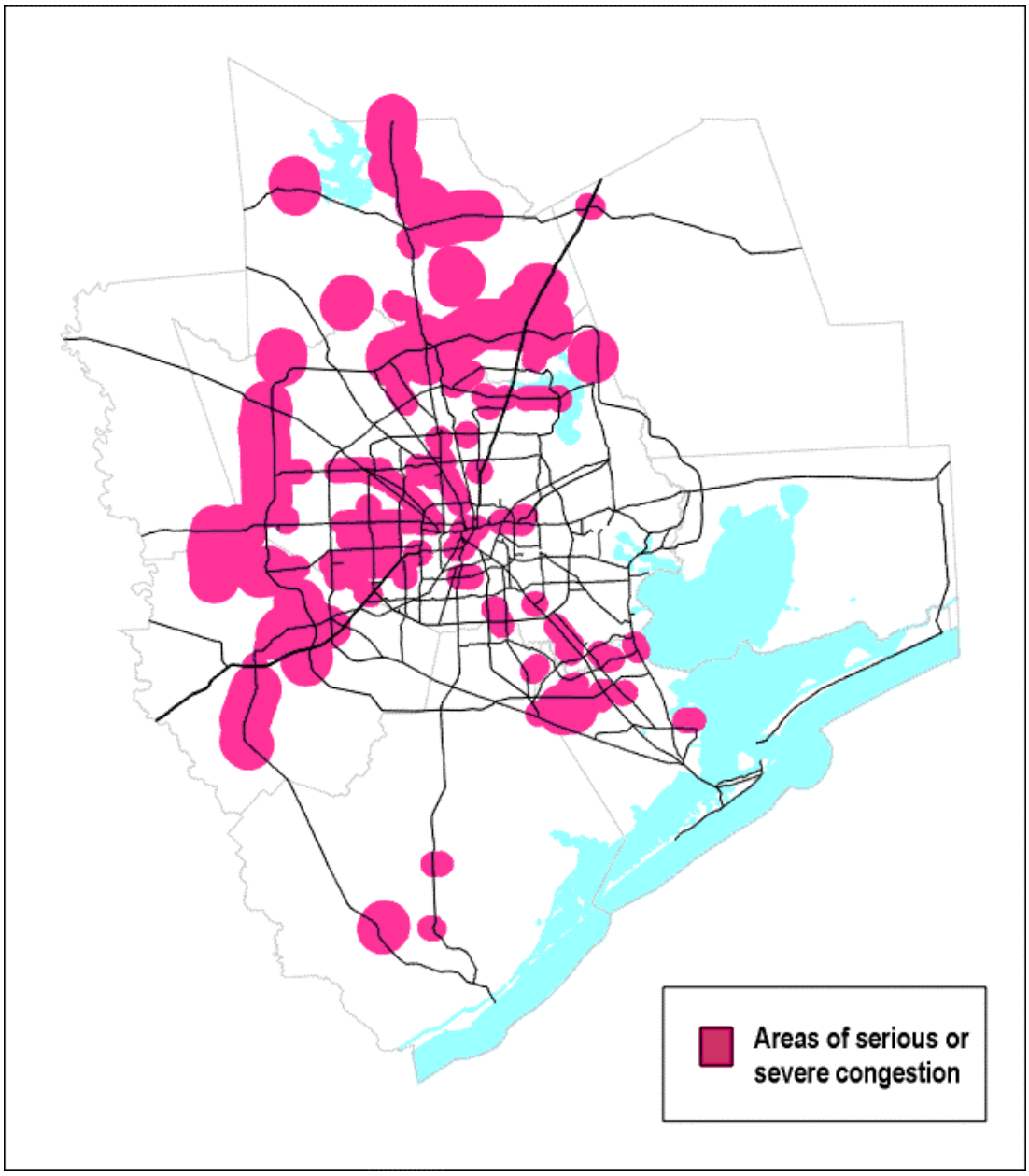


Figure 7.6: Areas of Congestion (Year 2020 "Build")



7.5. BICYCLE AND PEDESTRIAN IMPROVEMENTS

Bicycling and walking have numerous benefits: they afford an opportunity for exercise, help reduce congestion on roadways, and provide quiet, pollution-free transportation. Local citizens have shown an increased interest in bicycling, and their efforts have culminated in the development of several local bicycle plans, most notably the City of Houston's *Comprehensive Bikeway Plan* adopted September 1993 and H-GAC's *Regional Bicycle and Pedestrian Plan*, adopted April 1996.

The *Regional Bicycle and Pedestrian Plan* includes: an overview of bicycle and pedestrian modes of travel; maps of existing and planned facilities; recommended design standards; and a guide for local jurisdictions interested in developing a bicycle and/or pedestrian plan. The focus of the *Regional Bicycle and Pedestrian Plan* is to build on the funded projects with the construction of new bikeways. The plan began with a survey of the bicycle and pedestrian plans of the counties, municipalities, and master planned communities in the region. The bicycle plan serves as the primary source of information for this section of *Vision 2020*.

Bicyclist and pedestrian commuting rates have historically been quite low; but such travel is far from nonexistent. As reported by the US Census, approximately 5,000 trips are made by bicyclists while pedestrians make 40,500 trips daily within the Houston-Galveston region. Combined bicyclists and pedestrians account for approximately 2.6% of the total work trips. The national figures are only slightly higher, with 4.0% of the daily work trips being by pedestrians and 0.4% being by bicyclists. Almost half of all trips and fifteen percent of all vehicle miles traveled are less than five and a half miles in length, well within the range of a comfortable bicycle ride. Almost three-quarters of all trips and thirty-five percent of the vehicle miles traveled are within 10.5 miles, still a reasonable distance for more ambitious bicyclists.

Bicycle and pedestrian travel could increase quite significantly with adequate infrastructure. Currently there are approximately 160 miles of bicycle and pedestrian facilities, most of which are in 'master planned communities' in the unincorporated areas of the region. These are a fragmented series of paths primarily suited for recreational users. The Houston-Galveston TMA has received over $31 million to construct and rehabilitate approximately 350 miles of on- and off-road facilities, most of which are within the City of Houston. Once completed, this should result in approximately 500 miles of bicycle and pedestrian facilities (not including sidewalks) that would be interlinked in a comprehensive, cohesive network. The completion of these programmed projects is the first necessary step in the establishment of a usable system.

Table 7.4: Existing and Committed Bicycle Projects

Facility Type	Total Miles
Existing facilities	161
On-street	13
Hike and Bike	148
Programmed Facilities	357
On-street	303
Hike and Bike	54
Total (Existing + Programmed)	518

Source: H-GAC inventory of bicycle and pedestrian facilities. 1995.

Vision 2020 recognizes that a balanced approach to transportation provides people with choices that are desirable, practical, and safe. Bicycling and walking should be viable alternatives for many local trips and for combining nonmotorized trips with transit services. The TPC has endorsed a policy of phased investment in bicycle and pedestrian improvements contained in the Regional Bicycle and Pedestrian Plan. The TPC established a target funding level of $33 million over a ten year period to fund improvements identified in the *Regional Bicycle and Pedestrian Plan* and *Vision 2020*. These projects would build on the 500 miles of existing and committed bikeways. As project development and planning proceeds, additional projects will be moved from the bicycle plan to the MTP. Bicycle-friendly amenities, such as bike racks and lockers at park & rides and transit centers, are also planned to improve the travel range for bicyclists and make bicycling a more attractive mode of travel. For greater detail regarding proposed improvements refer to the *Regional Bicycle and Pedestrian Plan*.

7.6 OTHER IMPACTS

The transportation system has significant positive economic impacts. It is used to transport billions of dollars of goods and provides services to millions of consumers each year. There is no question about its value to users; however, it may have negative social and environmental impacts as well. This section addresses the potential impacts to human health and well being of implementing transportation system recommendations described earlier in this chapter.

7.6.1 Socioeconomic Implications

There is a history in many metropolitan areas of roadway and transit planning and construction that has paid little attention to neighborhood and social impacts. Transportation planners and providers have been criticized for a perceived indifference to the sometimes deleterious impacts of transportation systems on communities. Another criticism is that the transportation dollars are not equitably distributed among different geographic areas and income groups.

The "Metropolitan Transportation Plan Socioeconomic Analysis" prepared by H-GAC focuses on the latter issue. Specifically, the analysis focused on the question of whether transportation projects proposed in the MTP represent a reasonable distribution of transportation benefits among the TMA's geographic areas and income groups. Two measures of project benefit were employed in the analysis: project mileage and project expenditures. To assess the distribution among low-income groups, the measures were used to assess benefits to federally designated Community Development Target Areas (CDTAs) in Brazoria, Fort Bend, Galveston, and Harris Counties. The target areas were chosen because they contain a majority of low to moderate-income households.

Interestingly the geographic analysis revealed an equivalent distribution of transportation resources among geographic areas when compared to population distribution. Within the broad scope of the analysis, the study also indicated an equitable distribution of resources in low-income to moderate-income areas. Overall, the study found that the proposed program of projects was meeting the MTP goals.[25]

7.6.2 Land Use and Energy Implications

Transportation systems undoubtedly impact how land is developed and used. By making access between places easier, faster, and cheaper transportation improvements can change travel behavior and influence residential, industrial and commercial growth. Over time, changes in land use may generate new travel demands and potentially new areas of congestion, which in turn encourage additional transportation capacity. It is a pattern that has been demonstrated across the nation and certainly in the Houston-Galveston region.

Vision 2020 attempts to balance the demands of growth in the region with the need to minimize the negative impacts of urban sprawl to society and the environment. In the financial analysis for the MTP, funding emphasis is placed on maintaining and preserving the existing system rather than capital expansion. As the region's transportation network ages, maintenance and preservation should continue to be of the utmost importance. The transportation management systems described in Chapter 5 will serve to manage the

[25] For further information, refer to the "Metropolitan Transportation Plan Socioeconomic Analysis for the Houston-Galveston Transportation Management Area" prepared by H-GAC, Spring 1997.

system more efficiently and thereby reduce the need for expansion. The recommended system of traffic signalization and synchronization and freeway surveillance system discussed earlier in this chapter will further the objective of reducing congestion. Overall, the transportation system should operate more smoothly and efficiently as improvements recommended in the MTP become operational. Greater efficiency should ultimately result in relatively lower energy consumption in the future.
One of the other important steps taken in the development of *Vision 2020* the recognition that redevelopment of the urban core is vital to the continued growth and prosperity of the region as a whole. The target demographics discussed in Chapter 2 reflect a commitment to redevelopment goals established initially by the City of Houston.

7.6.3 Air Quality

One of the most studied and regulated environmental impacts of transportation is air pollution. Emissions from vehicle engines have significant impacts on air quality, particularly in urban areas. Vehicle emissions include a variety of pollutants such as carbon monoxide (CO), volatile organic compounds (VOCs), and particulate matter. Nationwide mobile sources accounted for nearly thirty-seven percent of all VOC emissions in 1994.[26] Internal combustion engines also oxidize nitrogen, the principal constituent of air, thereby producing various oxides of nitrogen (NO_x). Ground-level ozone, the major constituent of smog, is formed when VOCs and NO_x react to sunlight. The TMA is designated as a severe non-attainment area because pollutants contained in the region's air, specifically VOCs and NO_x, exceed safe limits as defined by the National Ambient Air Quality Standards (NAAQS).

Air quality is monitored continuously to track changes in ozone levels throughout the region. According to data provided by TNRCC there are several air monitoring sites in the Houston-Galveston area that have historically exceeded the National Ambient Air Quality Standards (NAAQS) for ozone.[27] While the majority of those sites, as expected, are located near the heavily monitored industrial areas close to the Houston Ship Channel and Texas City, there are also other high incidence sites in non-industrial parts of the region in far southwest and northwest Houston. This pattern seems to indicate that the ozone exceedance areas are not necessarily associated with industrial sites, but may be related to other factors such as traffic congestion as well.

[26] "Transportation Statistics Annual Report 1996", Bureau of Transportation Statistics, United States Department of Transportation.
[27] Data is from the Texas Criteria Pollutant Summary, Percentage of NAAQS 1993-1995, based on design values for 1993-1995, TNRCC, 12/6/96.

Transportation Conformity

Transportation conformity is an analytical process that establishes the major connection between transportation planning and emission reductions from transportation sources.[28] ISTEA links compliance with the conformity requirements of the CAAs of 1990 to continued FHWA and FTA funding of transportation plans, programs, and projects. Under ISTEA's metropolitan planning requirements, projects cannot be approved, funded, advanced through the planning process, or implemented unless those projects are in a fiscally constrained and conforming transportation plan and transportation improvement program. States and MPOs must demonstrate, through the conformity process, that the transportation investments, strategies, and programs contained in the MTP have air quality impacts consistent with those contained in State Implementation Plans (SIPs) for achieving the NAAQS. Emissions may not exceed SIP targets for emissions from mobile sources. In short, the transportation system must do its part to attain national air quality goals by reducing vehicle emissions. The conformity analysis demonstrates the MTP's compliance with state air quality control strategies.

The demonstration of conformity includes several categories of tests, all of which must be passed for all milestone years through the plan horizon year 2020. The milestone years are 1999, 2007, 2010, and 2020. Vehicle emissions in each milestone year are divided into baseline and action scenarios. The baseline scenario for each year is comprised of projects that were included in a previously conforming MTP and TIP. The action scenario is an operational transportation system in which all planned improvements, not previously included in a conforming MTP or TIP, have been implemented and are operating as planned. Vehicle emissions resulting from the implementation of transportation projects and programs must not exceed emission budgets established in the State Implementation Plan in each milestone year. Specifically, the region must demonstrate:

- The action scenario results in less volatile organic compound (VOC) emissions than the baseline scenario, in all milestone years.
- Projected emissions from the action scenario in each of the milestone years must be lower than the emission budgets established for 1996 and 1999. (Emission budgets have not yet been established for any subsequent years.)
- VOC emissions in the action scenario for all modeled years must be less than 1990 VOC emissions.

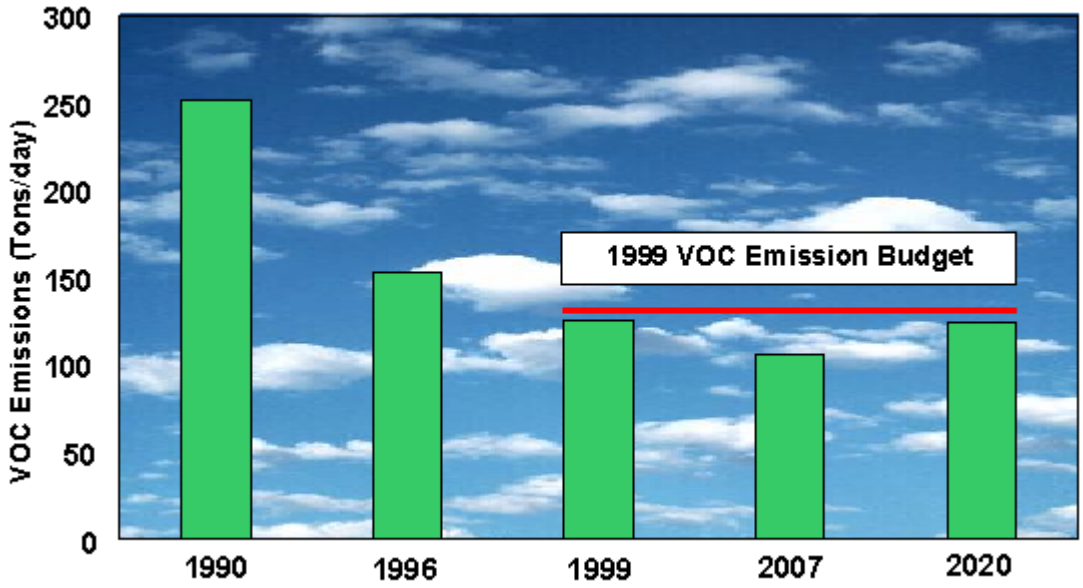
In addition to the above tests, the region must demonstrate that transportation control measures (TCMs) commitments are being met.

Figure 7.7 shows that the conformity analysis conducted for *Vision 2020* transportation improvements will result in vehicle emissions reductions below that required in the state air quality implementation plan. The conformity analysis also demonstrates that the MTP supports timely implementation of transportation control measures (TCMs) designed to

[28] Excerpted from "Transportation Conformity: A Basic Guide for State & Local Officials" U.S. Department of Transportation, Publication No. FHWA-PD-97-035

reduce traffic congestion and vehicle emissions. Therefore, *Vision 2020* will not increase the number or severity of ozone exceedances in the eight-county region.[29]

Figure 7.7: Conformity of the MTP



7.7 CONCLUSION

During the last decade significant gains were made in the prolonged battle against congestion. Travel delays on many of the region's freeways and principal arterials decreased due to the completion of a number of regional roadway improvements such as the reconstruction and widening of the Southwest Freeway and construction of the Sam Houston Tollway. However, roadway congestion remains one of the most vexing problems of the transportation system.

Many of the region's roadways are reaching or exceeding their design capacities due to increases in population and vehicle miles traveled. Continued suburban development in previously undeveloped areas perpetuates the need for new roads. At the same time, increases in travel demand lead to increasing maintenance and rehabilitation needs on existing roads. Each of these events places a greater demand upon the transportation system. Limited revenues to both expand and maintain the transportation system further

[29]For details of the conformity analysis refer to Appendix E, "Conformity Determinations for *Vision 2020*, Metropolitan Transportation Plan and the 1998-2000 Transportation Improvement Program," H-GAC.

exacerbate the problem. The recommendations of *Vision 2020* seek to alleviate the strains that these and other patterns will place on the transportation system.

In order to continue a positive trend in congestion reduction, regional transportation providers must focus on capital improvements that incorporate a number of alternative strategies to reduce congestion. Further expansion and enhancement of transit alternatives including demand response and light rail systems, increased usage of carpooling and van pooling, telecommuting and flexible work schedules that reduce peak hour congestion, and implementation of intelligent traffic management systems are the keys to a balanced transportation system.

Vision 2020 was developed through a combination of public involvement and intergovernmental cooperation. It provides a practical and responsible set of recommendations for improvements to the regional transportation system through 2020. It is a multimodal plan that emphasizes the efficient movement of people and goods. The recommendations it provides maintain and enhance the existing infrastructure in a cost-effective manner, and encompass many modes of transportation. The recommendations of *Vision 2020* also help in the continuous effort toward cleaner air with the implementation of transportation control measures. *Vision 2020* is a framework that we can follow as we expand our regional transportation system to meet the needs of our ever-changing community.