2025 RTP

Regional Transportation Plan
Houston-Galveston Area

Approved June, 2005

www.h-gac.com/transportation

HOUSTON-GALVESTON AREA
2025 Regional Transportation Plan

PREFACE

The 2025 Regional Transportation Plan (RTP) is presented in separate sections for the ease of the reader. The following Executive Summary provides a very brief overview of the major components of the plan. The RTP Main Document follows and presents more in-depth summary information for several transportation plan topical areas. The major areas are further discussed in more details in a series of appendixes which are available separately, or from the 2025 RTP web-site, so that readers can choose the topics they are most interested in exploring.

EXECUTIVE SUMMARY

The Houston-Galveston region will continue to be a dynamic economic center in 2025, with population and job growth 60 percent above 2000 levels. Travel growth is expected to exceed the rate of increase in both population and economic activity. The 2025 Regional Transportation Plan (RTP) helps local governments and transportation agencies identify investments that will improve mobility, increase safety and complement communities' development plans. The vision of the 2025 Regional Transportation Plan (RTP) is to **enhance mobility by providing an efficient, affordable, safe, and environmentally responsible transportation system for both people and goods**.

Figure 1

Year	Population
1900	181,762
1920	329,787
1940	735,553
1960	1,581,137
1980	3,119,831
2000	4,669,571
2025*	7,662,000

Source: US Census
* = H-GAC estimate

Based on the best estimates of the financial resources available, the 2025 RTP has identified $65 billion in priority transportation investments for our region's roadway and transit systems. An additional $12 billion has been identified for the region's ports and airports. Without the improvements contained in the 2025 RTP, annual congestion costs would exceed $11 billion. Over the life of the plan, compounded annual congestion costs would be reduced over $95 billion.

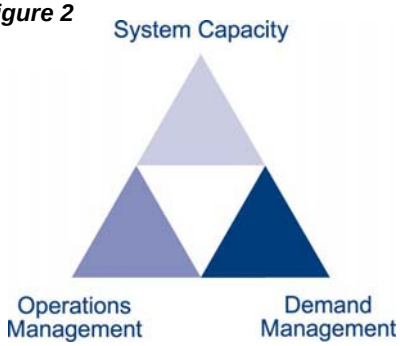
Potential benefits of the RTP are significantly greater than the cost of the system improvements. Benefits include:

- Reducing future congestion by 60%, saving $1.6 billion in travel time each year - almost $17 billion in congestion reduction will result from facilities funded by toll revenue included in the RTP
- Improved business productivity through increased travel time reliability and reduced travel time for goods and services
- Significant increase in transit system usage (from 350,000 to over 725,000 daily passenger boardings) due to:
  - Expanded access (more bus and rail transit services)
  - Transit connectivity to multiple employment centers
  - Faster, more reliable transit services from bi-directional, high occupancy vehicle lanes, "signature" bus services on "express" streets and completion of the 72 mile commuter and light rail transit services contained in the METRO Solutions transit plan
- $390 million annual reduction in the cost of vehicle crashes
- Reduced air pollution from on-road mobile vehicles in compliance with the State Implementation Plan

Three Major Policies

The 2025 RTP includes a combination of strategies, programs, and projects to improve regional mobility and air quality while enhancing the quality of life for all citizens. Based on public involvement efforts that spanned several years, residents of the region have expressed the urgent need for congestion reduction, improved mobility and greater travel choices.

Figure 2



Similar themes are echoed in recent Houston Area Surveys* indicating that traffic congestion is, once again, the highest concern for residents of the metropolitan area. In 2003, moreover, that survey reported that more than 70% of respondents indicated that traffic had generally gotten worse over the past three years.

In response to those citizen recommendations and detailed technical analyses, three major policies are recommended to achieve the vision of the 2025 RTP:

Increase highway and transit system capacity (where feasible and affordable)

Improve operations management of existing facilities

Manage the demand for peak-period travel

These policies include systematic improvements that are applicable in all areas, such as:

<u>System Capacity</u> (Increasing highway and transit system capacity where feasible and affordable):

- provide relief to bottlenecks and gaps through added-capacity
- grade separate congested intersections
- increase freight rail capacity to reduce truck use of highways

<u>Operations Management</u> (Improving the operations management of existing facilities):

- improve traffic incident response
- reduce conflicts with freight operations
- reduce crashes in ‘hot spots’
- improve the management of work zones
- geometric improvements to roads and intersections

<u>Demand Management</u> (managing the demand for peak-period traffic)

- provide incentives to reduce driving during peak-periods of traffic, such as:
    - promote teleworking, vanpooling, carpooling and transit
    - use peak-period pricing through the use of fees in manage lanes

Specific strategies can be recommended and designed for each of the defined areas, (Urban Core, Suburban Area and Rural Area)

There are many different transportation needs across this region and the opportunities to meet these needs vary depending on type and density of land uses. In a large urban core (such as the area within the Central Business District) the travel purpose, distribution of travel over the day and mix of commercial and personal vehicles may differ significantly from those of outlying

employment centers (such as the Westchase area). The travel to, from and within these centers will not be the same as those in suburban or rural areas. Therefore, the transportation facilities and services to meet these needs must also be different. By blending the three fundamental policy strategies (adding system capacity, improving operations management, and travel demand management) in unique ways, the Regional Transportation Plan strives to create transportation investments consistent with the current (or desired future) land use characteristics of an area.

In urban cores, high volumes of commuters are concentrated in relatively short peak travel periods. Mass transit and walk trips are an effective way to move these large volumes of commuters. Therefore, the RTP places greater emphasis on transit system expansion to the Houston central business district, the Texas Medical Center, the Greenway/Galleria area and other employment centers. Because land is intensely developed, adding capacity to the roadway system can only be achieved at great cost and may have undesired land use impacts. Therefore, it is critical in operation of the roadway system that there is recognition for the need of priority movement for transit vehicles and pedestrian access to them. Employer based incentives promoting the use of transit, van and carpooling as well as alternative work schedules can be significant in reducing vehicle travel demand and is supported in the 2025 RTP. Re-use of existing or redevelopment of blighted areas near major employment centers also provides opportunities to create synergy between transit service improvements and new land uses, promoting urban growth with less dependence on auto travel. The 2025 RTP supports key transportation investments coordinated with land investment underway in Tax Increment Reinvestment Zones TIRZ's, in both new urban areas such as The Woodlands and in revitalized urban centers such as historic downtown Galveston and the Houston Central Business District.

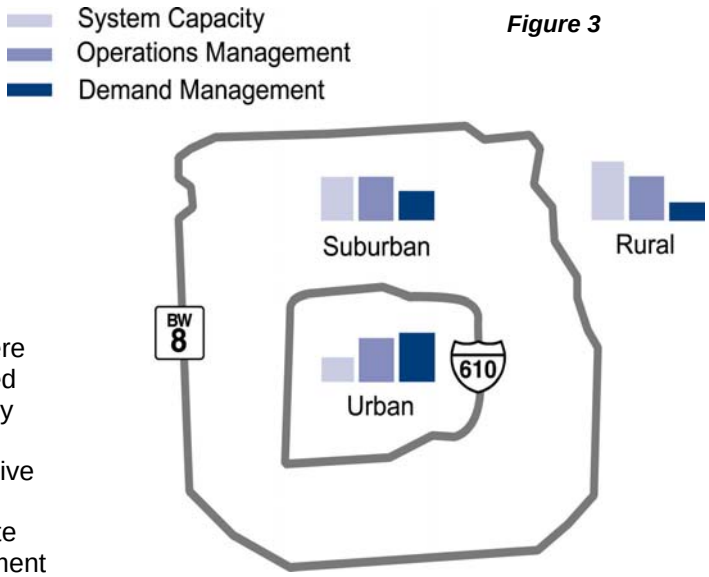


Figure 3

Opportunities to expand roadway capacity are also limited in many suburban portions of the region. However, the 2025 Plan identifies incomplete or missing sections of the thoroughfare system and supports elimination of these transportation "bottlenecks", often providing an opportunity to generate great mobility benefits for a relatively small investment. Based on the level of current or future travel demand, the RTP also recommends consideration of expanding roadways in suburban areas where the expansion may largely be accommodated within existing rights of way. Adding capacity to existing thoroughfares, however, requires careful consideration of the impact on sensitive residential and institutional land uses. This detailed planning work is the next appropriate step for facilities not already under development by local governments or transportation agencies. Because their primary role is serving the local community, aesthetic treatments (landscaping, medians, building setbacks, etc.) in addition to pedestrian, bicycle and transit elements must also be carefully considered. Due to the cost and the potential for adverse impacts associated with expansion of existing roadways, the RTP has identified access and operations management as the primary improvement strategy for major thoroughfares that provide connectivity to the region's freeway, tollway and commuter transit services. The RTP supports the systematic implementation of these operational improvements as a means to improve traffic flow, provide more effective transit services and reduce the frequency and severity of vehicle crashes.

Much of the 8 county region is undeveloped or is used for agricultural purposes. This region has experienced almost a doubling in population every 20 years for a century, therefore cities and counties in the metropolitan region have adopted thoroughfare plans to insure that regional

connectivity is provided as rural areas develop. As a result, the primary mobility strategy used in the 2025 RTP within rural areas experiencing significant development is the construction of new highway and transit facilities and services. Without orderly development of these thoroughfares, provisions for basic public services such as police and fire protection plus access to schools and hospitals would be unacceptably difficult. The 2025 RTP identifies the need for implementation of thoroughfare plans in those parts of the region where the rural character of current land use is expected to change due to residential and commercial development. Growing roadway capacity will be a primary transportation strategy in these areas. The reconstruction and expansion of rural roadways currently designed to carry low volumes of primarily light duty vehicles will also be necessary as the intensity and character of the road use changes with land development. 2025 RTP roadway projects designed to implement local government thoroughfare plans will complement the development of new freeway/tollway facilities and express transit services.

Urban Core – is defined as a city with 50,000 or more population plus incorporated surrounding areas meeting size or density criteria as defined by the U.S. Census[1]

System Capacity: develop urban transit network as approved in METRO Solutions; add-capacity to the transit system (buses, light rail and commuter rail systems); add lanes on major thoroughfares

Operations Management: optimize the timing of traffic signals; improve traffic flow on arterials through access and traffic management, for example by reducing direct driveway access to major thoroughfares and creating backroad access to major attractors; provide adverse travel condition information as well as alternative routes and modes; provide reversible commuter lanes; restrict turns at key intersections

Demand Management: peak-period pricing, for example the use of fees for traveling in managed lanes determined by the number of persons in the vehicle and the time of day; improve and increase pedestrian and bicycle facilities; work with employers to provide teleworking, carpooling, vanpooling, flexible work hours, and transit options; meter traffic onto freeways

Suburban Areas –small urban areas or suburban areas are defined as those urban places having a population of five thousand (5,000) or more and not within any urbanized area

System Capacity: develop commuter transit network; close gaps in arterials through new roadways; add-capacity to the transit system; add travel lanes on major freeways and streets

Operations Management: improve traffic flow on arterials with signal synchronization; implement management by reducing direct driveway access to major thoroughfares, provide backroad access to major attractors, implement coordination with land use and safety measures

Demand Management: promote commuter options such as park and rides, vanpooling, carpooling, and special transit options such as buses for the elderly and handicapped; expand pedestrian and bicycle paths; provide peak-period pricing for example the use of fees for traveling in managed lanes determined by the number of persons in the vehicle and the time of day

Rural Areas – is an area outside the boundaries of small urban and urbanized areas, as defined above

System Capacity: increase mobility through complementing the implementation of major thoroughfare plans, acquire right of way that will facilitate transition to urban design standards and for development of strategic corridors, commuter rail systems and freight expansion opportunities; grade separate unsafe intersections

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[1] *as designated by the Bureau of the Census*

Operations Management: improve safety measures at railroad crossings and highway intersections

Demand Management: freight route considerations and the location of truck stops

Recommended System Expansion

Expected future revenue for transportation improvements will not keep pace with future demand. Congestion levels will grow by 10 percent over today's levels even with the implementation of the 2025 RTP. However, if the RTP were not implemented, future congestion would more than double by 2025. Due to limited growth in traditional funding, other sources like motor fuel taxes and toll roads will play a strategic role in expanding the roadway system.

Similarly, if the 2025 RTP did not include new roads financed by user tolls, congestion would grow by 26%. The expansion of roadways, transit services, and transit facilities contained in the 2025 RTP is limited by estimates of actual funds available to support their construction, operation and maintenance. Expected funding available will not address all congestion in the region.

The following maps illustrate congestion superimposed over population densities for three different scenarios. The first scenario (Figure 4) in the series shows existing congestion and population densities as of 2002. The second map (Figure 5) illustrates congestion projected into the year 2025 if the RTP was not implemented. The third map (Figure 6) demonstrates congestion in 2025 with implementation of the projects in the RTP.

Figure 4

Congestion 2002

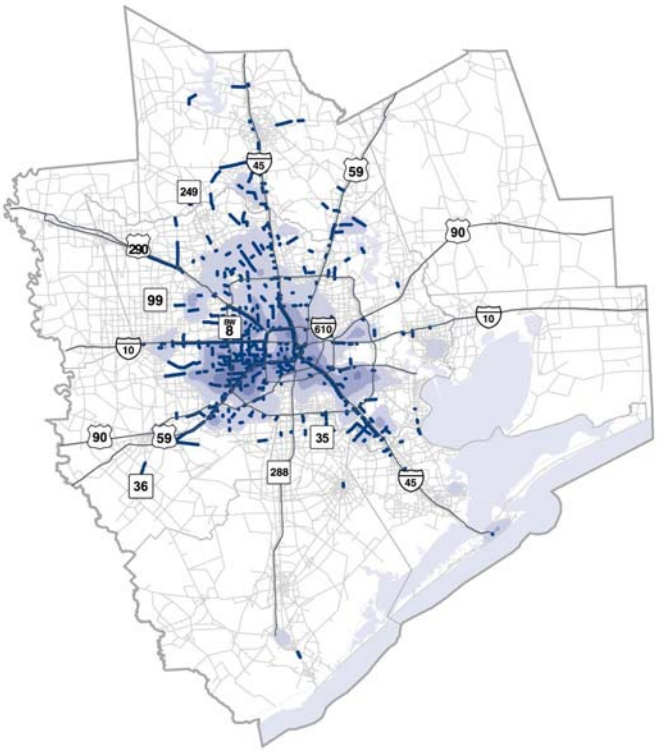


Figure 5

Congestion in 2025 with no-build scenario

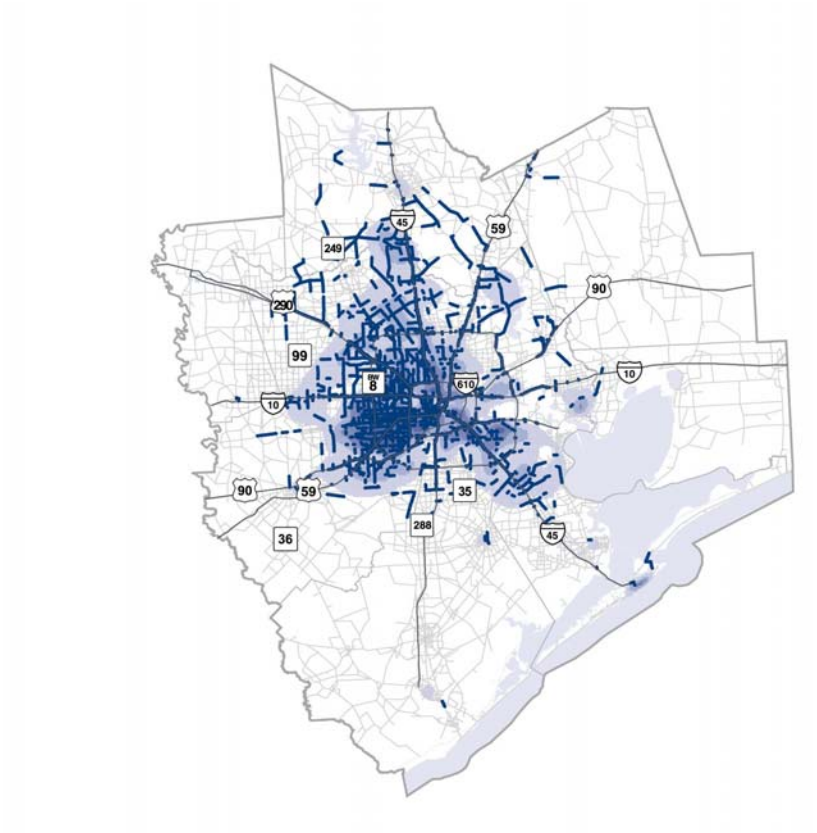
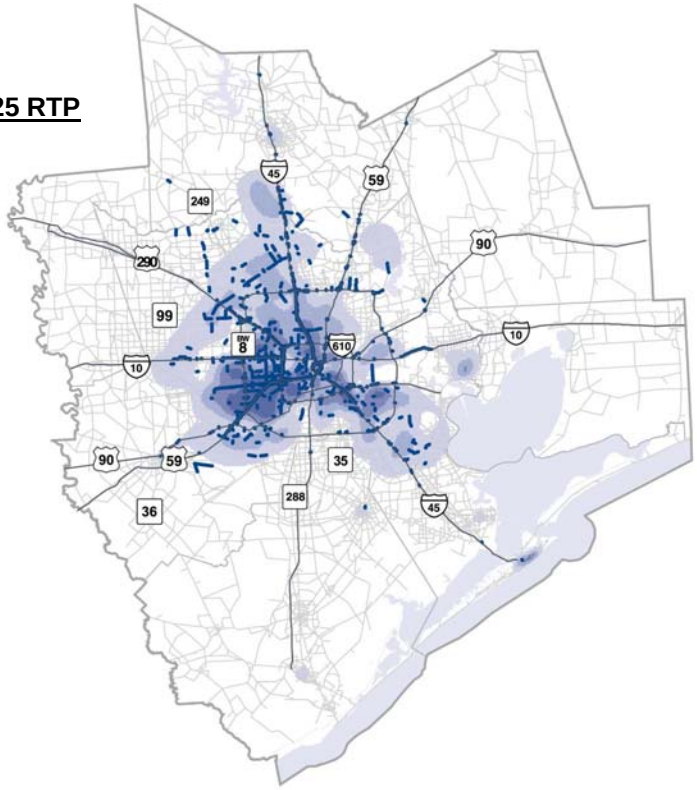


Figure 6

Congestion with implementation of 2025 RTP



One of the major changes to the 2025 RTP include increased use of tolls and congestion pricing to implement and finance new construction. These potential tolled facilities include additions to the SH 99 Grand Parkway, the Tomball Parkway, Fort Bend Parkway and completion of Beltway 8. These facilities and others would result in over 2,400 lane miles of tolled facilities in the region.

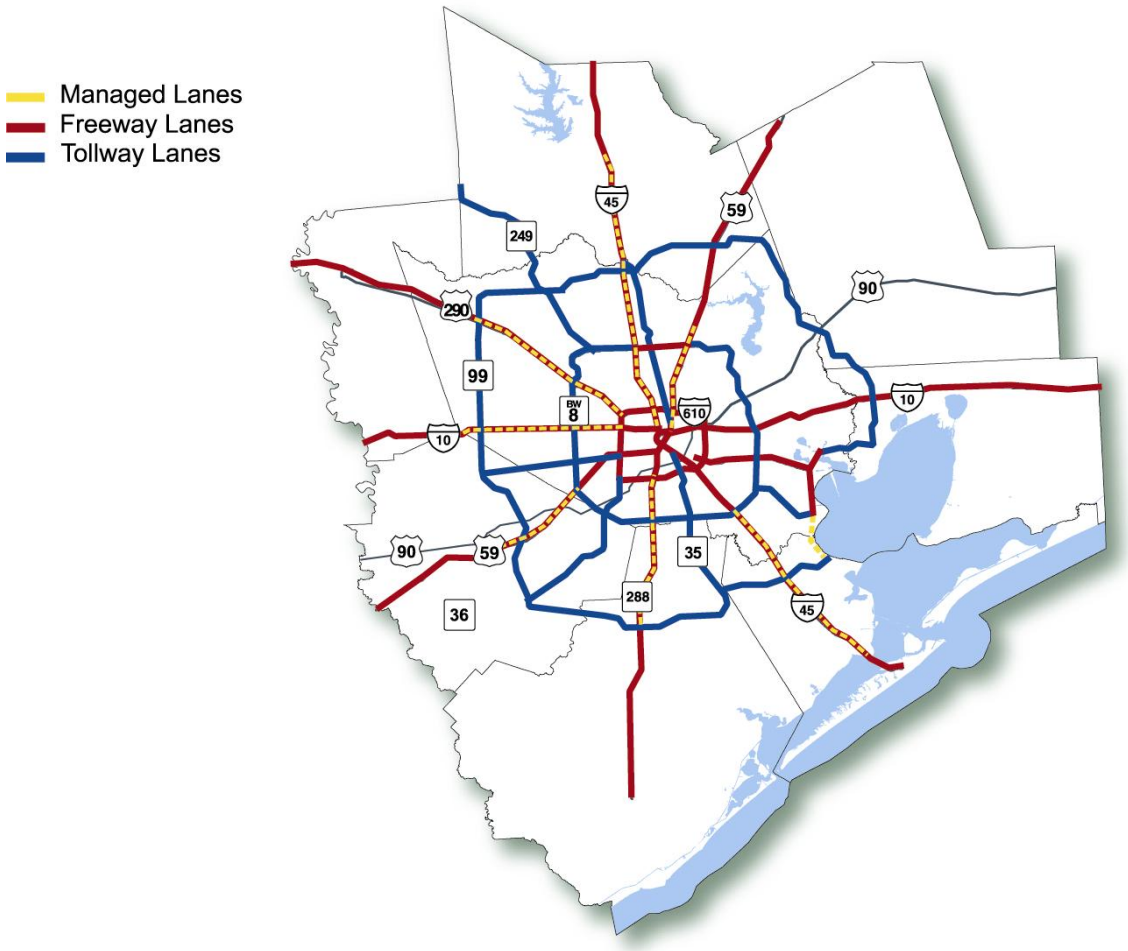
The 2025 RTP recommends significant expansion of the regional roadway system to address current congestion and future growth. Some of these recommendations include major improvement projects that have entailed years of planning in order to initiate the following:

- replace structures that are deteriorating due to age and heavy usage
- upgrade the major facilities in the system to current design standards
- provide better access to and from developing parts of the region

The recommended improvements are strategically focused to add capacity along the corridors where the most significant traffic congestion is today and where it is projected to be in the future. The Regional Roadway System map (Figure 7 below) shows the recommended (completed) system. For more information, please see Appendix B, Chapter 1: Regional Transportation Needs Assessment.

Figure 7

The Regional Roadway System



Transit Expansion

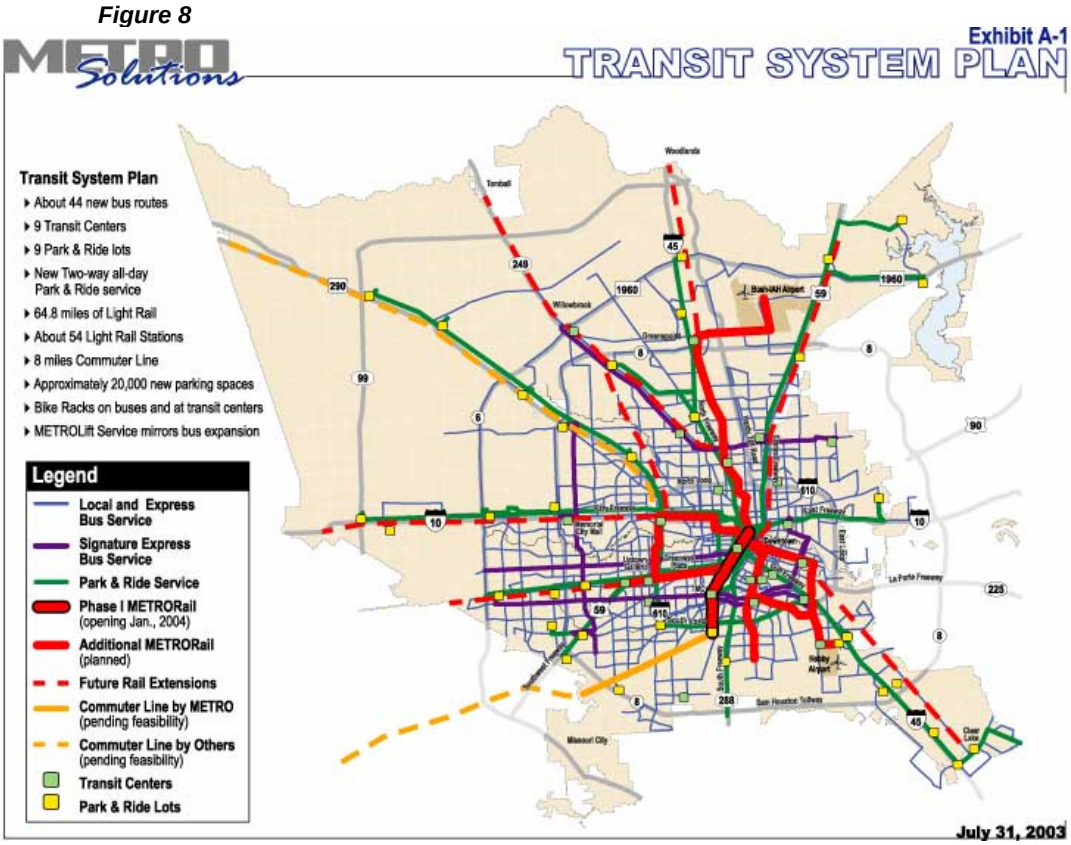
The 2025 RTP also recommends significant expansion of the public transit system in the region. The plan incorporates the 2025 Metro Solutions Plan and recommends some service expansions beyond the METRO Service area based on increasing population densities and the locations of various population groups that have limited mobility options today.

By voter referendum and approval, METRO developed a long-term regional transportation system called METRO Solutions, which is now a main component of the 2025 RTP. The METRO Solutions plan includes:

- Authorization to issue $640 million in bonds for the first 10 years of the plan
- Specific approval of METRORail expansion
- Plans for an additional 64.8 miles of light rail
- Plans for an 8 mile commuter rail line
- 50% increase in bus service, including 1,000 new route miles
- Providing continued funding for road and street improvements through 2014

Outside of a few electric streetcars beginning and ending early in the 20th century, development of public transportation in this region is relatively new. In 1978, voters in Harris County committed to funding and operating public transportation by adopting a one cent sales tax. Today, METRO offers transit services in its 1,285 square mile service area with a fleet of more than 1,500 buses. And in 2004, METRO opened the first component of a 72.8-mile passenger rail system, the 7.5 mile light rail line from Downtown to Reliant Park.

Figure 8

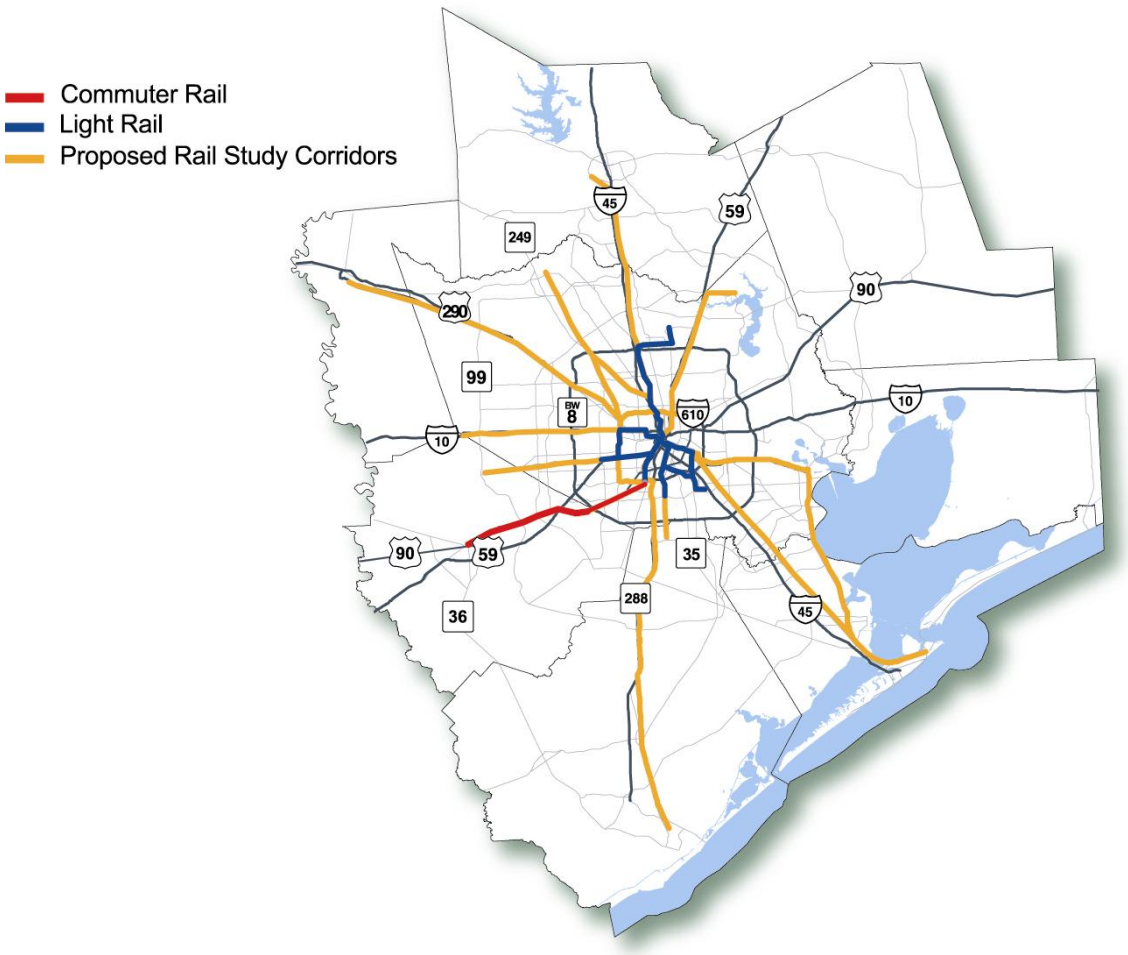


Under its General Mobility Program, METRO invested $1.22 billion on street and road improvements in 2003. Through 2014, METRO will continue to fund street and road improvements and related projects with 25 percent of its sales tax revenues. Current street and roadway improvement projects include a $300 million Downtown/Midtown Transit Streets Project, plus the reconstruction of more than 22 miles of downtown/midtown streets. As part of the Regional Computerized Traffic Signal System (RCTSS), METRO is spending $140 million to replace 1,500 traffic signals throughout the region. In partnership with TxDOT, METRO helped construct more than 100 miles of HOV/bus lanes.

Using the METRO Solutions Transit System Plan as the foundation, (the blue lines in Figure 9), the 2025 RTP analyzed expansion of the regional transit network. The yellow lines in the Regional Transit Rail System Conceptual Plan (Figure 9) map indicates potential commuter rail lines that were analyzed for potential ridership in major travel corridors which were selected for additional study. The red line represents the US 90 A Commuter Rail project, this project is recommended for funding in the 2025 RTP.

Figure 9

Regional Transit Rail System Conceptual Plan



The transit expansion proposal includes both express, local fixed route, para-transit and demand response services. The feasibility of additional commuter rail service across the region is being studied. Adoption of any proposal is contingent on the substantial commitment of cost share by

local governments. Appendix B, Chapter 1: Regional Transportation Needs Assessment contains further data.

Ports and Airports Expansion Plans

In addition to roadway and transit expansion, the ports and airports also are experiencing and projecting increased demand, thereby necessitating growth. Port and airport project expansion examples include:

- A major marine terminal complex called the Bayport Terminal Project, developed by the Port of Houston Authority, with an estimated economic benefit of more than 15,000 jobs by 2015 and nearly $800 million in business revenues
- The Port of Galveston expansion plans reflect increases in their cruise ship business with expectations to spend $35 million revamping two cruise ship terminals plus making improvements to Harborside Drive to accommodate cruise-related truck and passenger traffic
- The Port of Freeport's major expansion plans include cargo handling capabilities on the port's 8,000 plus acres of land, of which 1,400 acres are environmentally mitigated with accessibility for all parcels by water, highway and railroad
- The northeast side of Bush Intercontinental Airport may provide access to the proposed I-69 NAFTA Superhighway
- Expansion of passenger facilities at Hobby Airport

This section briefly described the 2025 RTP outline to expand the region's existing transportation system, through roadway, transit and freight. More details are available regarding each sector within the document and appendixes. However, not all of our region's congestion and mobility issues can be solved with expansion of roadways, transit or freight lanes alone; this is due to land use, fiscal, environmental, and practical constraints. Therefore, transportation planners employ other techniques that assist and aid in the planning of our region's mobility.

Operations and System Management

Smart Streets

The Smart Streets concept was developed and introduced into the 2025 RTP as an additional tool to increase mobility, improve transit access and safety by providing operational improvements along strategic regional thoroughfares. As an aid to regional mobility, the 2025 RTP examined principal arterials as potential facilities to be expanded. This may be accomplished by adding system capacity to some principal arterials in terms of lane miles and/or transit capacity. These expanded principal arterials are anticipated to reduce the need for additional lane miles of free and/or tolled facilities.

Smart Street enhancements will decrease vehicle delay through a range of options such as traffic light synchronization, deployment of roundabouts, medians, constructing or extending (as needed) turn bays, consolidation of duplicate driveways and as appropriate partial grade separation of some traffic lanes at major intersections. The estimated cost for implementing Smart Streets in the eight-county region is roughly $5.2 billion. The following map (Figure 10) shows the locations of potential Smart Streets as well as Intelligent Transportation Systems treatments.

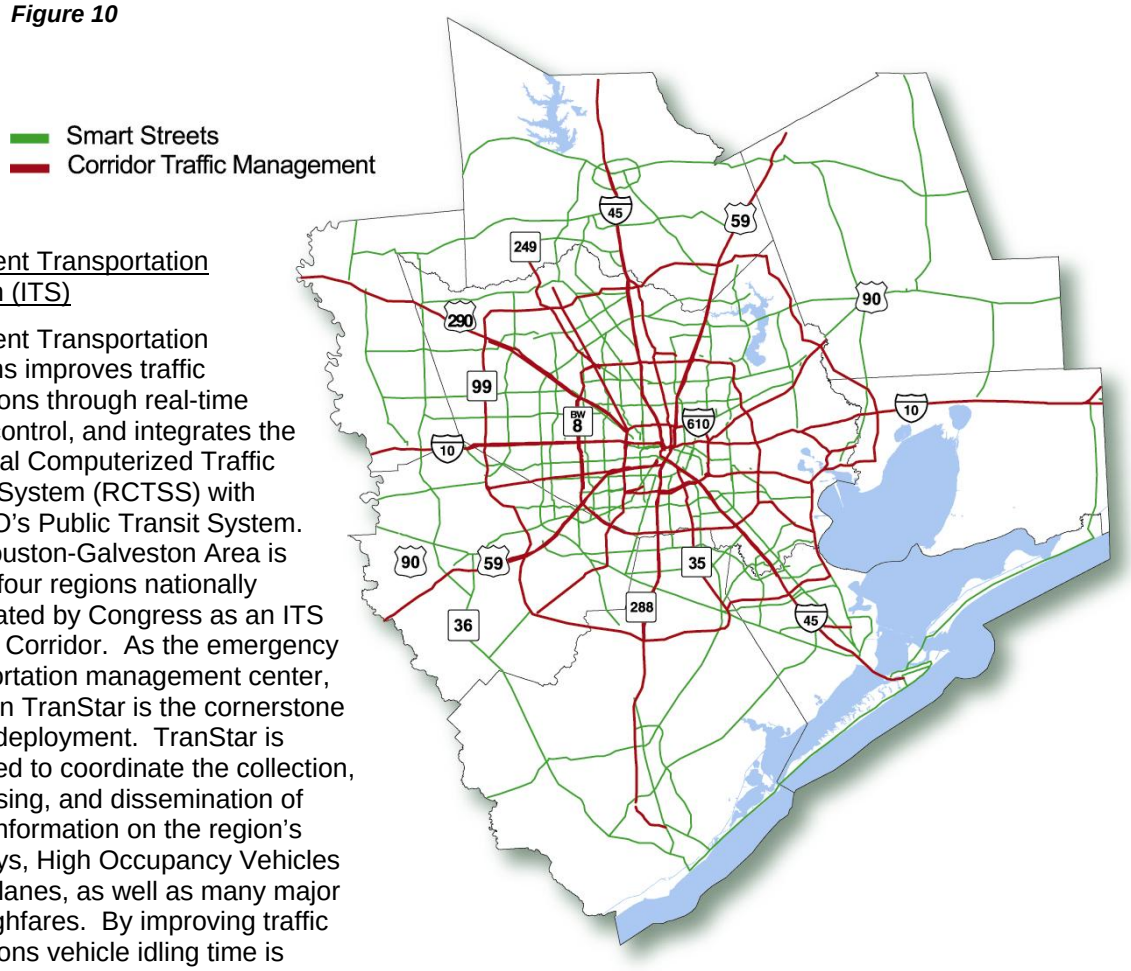
Expected future benefits include:

- Reduced cut-through traffic in neighborhoods;
- Opportunities for economic development along select arterials;
- Improvements to transportation and land use access through the use of back access roads to major traffic generators;

- Increased travel options due to improved arterials and connectivity;
- Enhanced regional evacuation routes;
- Traffic flow improvements at over 3,000 individual intersections via access control aided by traffic signal timing and synchronization, at an estimated cost of $630 million through 2025;
- Improvements to transit applications and reliability of transit trip times resulting from the proposed Smart Street alignment with METRO's Signature Express bus line plans.

Proposed Smart Streets

Figure 10



Intelligent Transportation System (ITS)

Intelligent Transportation Systems improves traffic operations through real-time traffic control, and integrates the Regional Computerized Traffic Signal System (RCTSS) with METRO's Public Transit System. The Houston-Galveston Area is one of four regions nationally designated by Congress as an ITS Priority Corridor. As the emergency transportation management center, Houston TranStar is the cornerstone of ITS deployment. TranStar is designed to coordinate the collection, processing, and dissemination of traffic information on the region's freeways, High Occupancy Vehicles (HOV) lanes, as well as many major thoroughfares. By improving traffic operations vehicle idling time is reduced and stop-and-go conditions are lessened. RCTSS components provide:

- State of the art traffic signal controls: signal synchronization with vehicle and incident detection
- Priority movement for transit and emergency vehicles
- Improvements to intersection turn lanes

Goods Movement

Goods movement as measured by tons in the Houston-Galveston area consists predominately of truck movement followed by water, rail, and then air; and including domestic and international freight. This region is endowed with four ports (U.S. ranking given below), and two main airports

that work to convey goods across transportation modes.

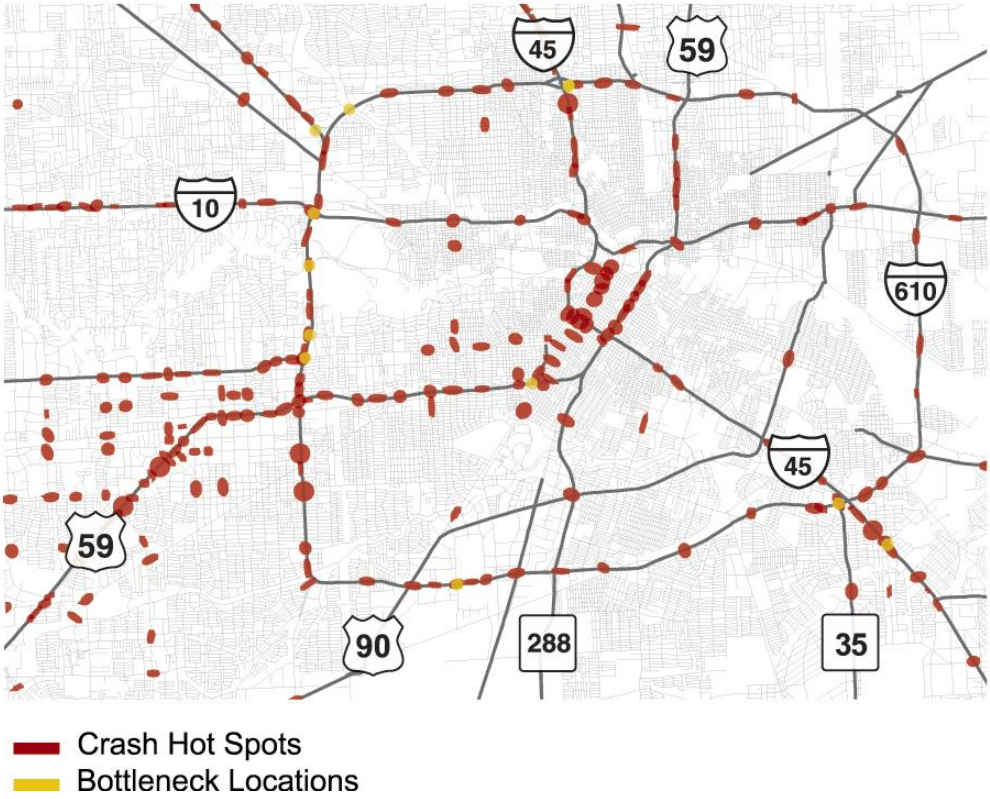
Figure 11

U.S. Waterborne Foreign Trade 2000, Port Rankings	Port of Freeport	Port of Galveston	Port of Houston	Port of Texas City
Volume of cargo total	18	40	1	10
Volume of cargo carried by ocean liner (container and breakbulk cargo)	34	25	5	44
Volume of cargo carried by tanker (bulk liquid cargo i.e. crude oil)	12	28	1	6
U.S. port rankings by cargo volume (total trade 2001)	24	56	2	9
North American container traffic 2002, port rankings (top 40 ranked)	36	N/A	12	N/A

Source: American Association of Port Authorities

To address the large and growing mode share of trucked freight movement in the region, Operations System Management strategies were developed. These recommendations include channeling investments to designated highways that play key network roles in the movement of freight, and incorporating truck movements in the design of transportation systems as well as consolidating Freight/Rail Corridors. The 2025 RTP strategies also include encouraging freight intensive businesses to locate in proximity to railroads or port properties. See Appendix B, Chapter 3: Freight and Goods Movement for more information.

Figure 12 **Regional Safety Plan**



The 2025 RTP recommends a Regional Safety Plan designed to reduce the region's high crash rate, which is the highest in the state of Texas. Several safety studies have been completed and several more are planned throughout the region to identify engineering, enforcement and education activities to help reduce the high number of crashes. To date 344 major crash 'hot spots' have been identified which accounted for roughly 20 percent of all crashes in this region

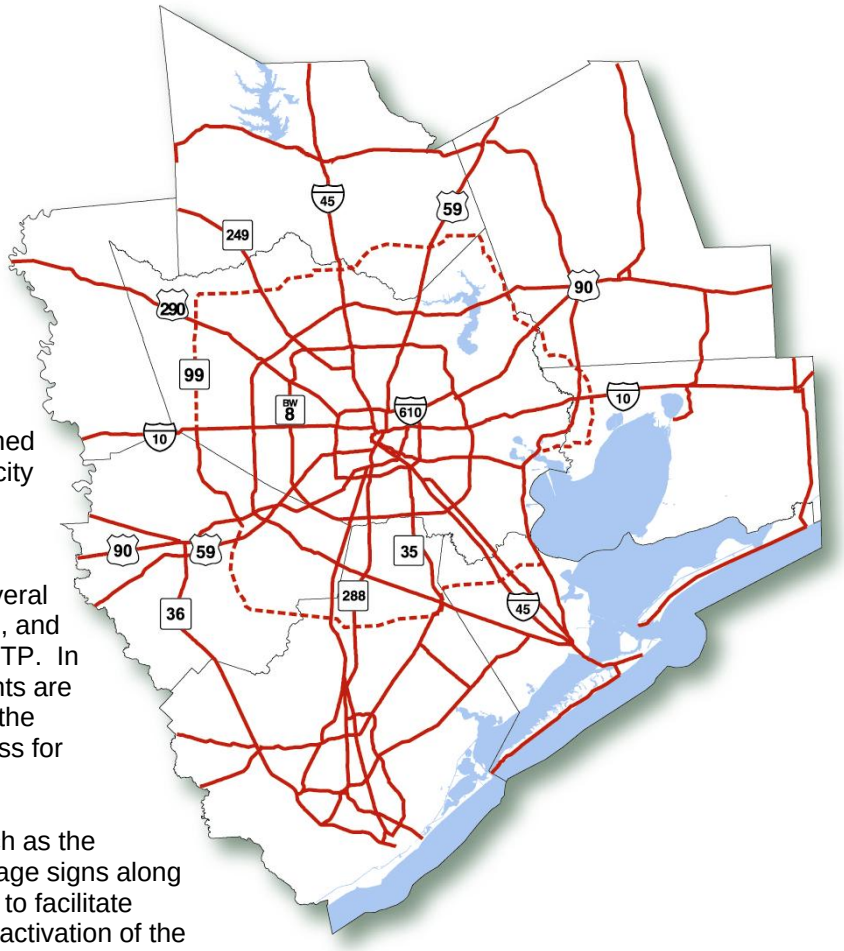
between 1998 and 2000 These hot spots are the focus of safety recommendations to be incorporated into project actions. Many of these hot spots are also congestion 'bottlenecks' and have related roadway improvements in the 2025 RTP. More information about The Regional Safety Plan is available in Appendix C, Chapter 1: Safety and the safety web-page at (www.h-gac.com/transportation/safety).

Significant action proposals include:

- Continued monitoring of the region's safety through the GIS Crash Information System
- Ongoing coordination with TxDOT, local governments and other organizations to identify and implement safety mitigation policies, strategies and projects
- Identify and propose solutions for the region's safety problems, for example, mitigate 344 major crash hot spots at a cost of $172 million to achieve an annual benefit of $123 million
- Provide safety education to local governments, public agencies and the public at large
- Coordinate the diverse safety activities of organizations through a Regional Safety Council

Figure 13

Evacuation Routes



Emergency evacuation in the event of a major storm, hurricane or chemical spill is a primary concern for coastal residents in this region. All of the major hurricane evacuation routes have been upgraded in recent years and more improvements are planned to increase the carrying capacity and the number of options available in an emergency. Improvements along the Gulf Freeway-IH 45 South and several State Highways (SH 36, SH 6, and SH 146) are included in the RTP. In addition, extra evaluation points are given to evacuation routes in the evaluation/prioritization process for ranking RTP projects.

Many 2025 RTP projects, such as the camera equipment and message signs along the freeway system will serve to facilitate evacuation in the event of an activation of the Emergency Alert System.

Managing Travel Demand

Commute Solutions

Commute Solutions is the region's "one-stop" alternative transportation resource. The program includes the Regional Vanpool Program, a telework initiative, plus the promotion of employee transportation benefits and provides construction-corridor commute alternatives. The Vanpool Program ranks in the top 10 for urban areas over 1 million persons for the number of persons using carpooling and vanpooling as alternatives to single occupant vehicles. According to the 2000 Census, this region has the state's highest transit utilization rate for travel-to-work trips. The Commute Solutions program has set the goal of 1,000 vanpools by 2006.

Non-motorized Transportation Access

The 2025 RTP promotes bicycle and pedestrian needs which include infrastructure improvements for sidewalks, bicycle pathways, pedestrian bridges, and compatible open spaces. The 2025 RTP also recommends increasing the share of pedestrian and bicycle trips within the region by calling for documentation. This documentation would include specific considerations from the project sponsors' for bicycle and pedestrian accommodations on transportation candidate projects in the future within the ranking and prioritization process. The RTP recommends allocating $340 million to bicycle and pedestrian improvements. The Bicycle and Pedestrian Plan is located in Appendix B, Chapter 4.

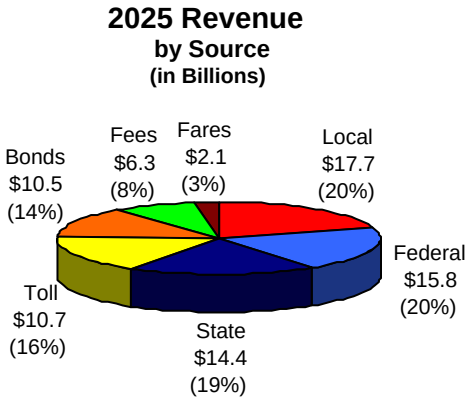
Peak Period Pricing

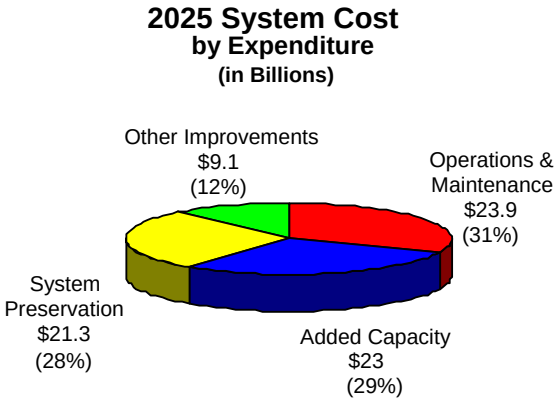
Also known as congestion or value pricing, envisions increasing tolls based on levels of congestion by time-of-day. These high congestion levels or times generally occur during peak periods of travel or rush hour. Fees are generally assessed electronically to avoid delays associated with toll collection facilities. The concept of assessing higher prices for traveling during peak periods is the same for other sectors of the economy that respond to peak-use demands. Examples include the airline industry which offers off-peak discounts and the hotel industry charges more for rooms during peak tourist seasons. Charging for road-use based on the level of congestion provides incentives for drivers to modify behavior by changing some of their trips to off-peak times, other routes or using alternative modes of transportation. A relatively small shift in the proportion of peak-period trips can lead to substantial reductions in congestion. The 2025 RTP includes plans to implement peak period pricing within the managed High Occupancy Toll (HOT) lanes of the major freeway corridors in the region. The benefits of peak period pricing include:

- Incentives for more efficient use of existing capacity
- Improved indicators of potential need for future mobility expansion
- Generates revenue that can enhance urban mobility
- Provides revenue for system expansion, operation and maintenance

Financing the Plan

The total investment in the plan is $77 billion 2025 RTP includes significant expansion of toll financing for limited access roadways and the use of 'surplus' toll funds for other regional transportation needs. The RTP estimates $10 billion toll revenue through 2025 with potential for $6 billion in revenue beyond construction, plus operations and maintenance costs for the toll facilities. Further analysis of tolling options is recommended, such as peak-period roadway pricing and broader application of toll financing to non-freeway projects such as bridges and grade separations.





National transportation policy has prioritized the need to maintain existing infrastructure for more than a decade. In the context of shrinking resources for new facilities and aging transportation systems, it is necessary for the 2025 RTP to prioritize activities that preserve and maintain the current systems.

Preservation, maintenance and rehabilitation is the process of maintaining infrastructure, whether it is roadways, traffic signals, lighting, buses, rail cars, or airport and port facilities. It is a constant activity that is required to keep the transportation system functioning.

Typically, bridges last 30-40 years; freeways last 20-30 years; and arterials last 20-30 years. In addition, many traffic monitoring and control devises may need replacement within 5 years or less, preventive maintenance (such as, repaving a road) is typically implemented every 7-10 years while routine maintenance is an on-going activity.

H-GAC has estimated that the region's system preservation needs will be about $21.3 billion through 2025. This sum includes $14.3 billion for roads, $2.9 billion for transit (mostly equipment replacement), and $4.2 billion for ports and airport. These projected costs have been incorporated into the financial plan of the 2025 RTP to sufficiently fund the preservation of the transportation system. Otherwise, cost and revenue trends of the last few years could present a shortfall in preservation funding through 2025. The plan recommends that local governments and transportation agencies review and where necessary increase allocation towards their maintenance and preservation needs. See Appendix A, Chapter 5: Preservation, Maintenance and Rehabilitation and Appendix D, Chapter 3: The Financial Plan for more information.

Improving Air Quality

To receive federal approval for the expansion of the regions roadway and transit system, the 2025 RTP must demonstrate compliance with specific reductions in the air pollutants caused by on-road vehicles. The ground-level ozone nonattainment area encompasses the transportation boundaries of the Transportation Metropolitan Area Harris County plus the seven adjoining counties. Transportation conformity is obtained by demonstrating that the on-road emissions associated with all projects in the 2025 RTP do not exceed emission limits established in the Texas State Implementation Plan (SIP) for improving air quality in the Houston-Galveston area. Transportation conformity does not equate to reaching attainment of the national health standard. Rather, conformity only measures whether the on-road vehicle emissions are within the on-road vehicle emissions 'budget', as determined by the State Implementation Plan.

Conformity is the process of demonstrating that the region's transportation plans do not adversely impact the goals outlined in the SIP. This is accomplished by demonstrating that the on-road emissions caused by proposed transportation projects do not exceed the motor vehicle emission budgets (MVEB) established in the SIP. The budgets as they appear in the Rate-of-Progress and the Attainment Demonstration SIPs are, in tons per day (tpd):

Rate of Progress* 2005	
NOx	257.3 tpd
VOC	104.2 tpd
2007	
NOx	210.0 tpd
VOC	90.0 tpd
Attainment Demonstration*[2] 2007	
NOx	186.13 tpd
VOC	89.99 tpd

The Conformity analysis will go out for public comment followed by a response to all received comments to be generated at the conclusion of the public comment period. Following this response, the Conformity is submitted to the Transportation Policy Council for approval to submit the document to the federal review agencies.

On-road mobile transportation is one of several broad categories contributing to the formation of ground level ozone. (See Appendix E) To meet the federal air quality standard in this region, reductions are needed from all criteria pollutant sources. The 2025 RTP recommends increased funding for H-GAC's emission reducing programs such as:

- $300 million for the Clean Vehicle Program over the life of the plan
- $40 million for the Vanpool program thru 2025
- $2.5 million for FY 2004-2025 for implementation of Commute Solution's telework initiative

This Executive Summary has been a brief outline of the major issues in the 2025 RTP. Please review the main document and the accompanying Appendixes. For more information, please see our website - http://www.h-gac.com/HGAC/Departments/Transportation/default.htm

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[2] *All numbers are subject to revision based on the latest planning assumptions and response to comments made through the public comment period and review agencies.*

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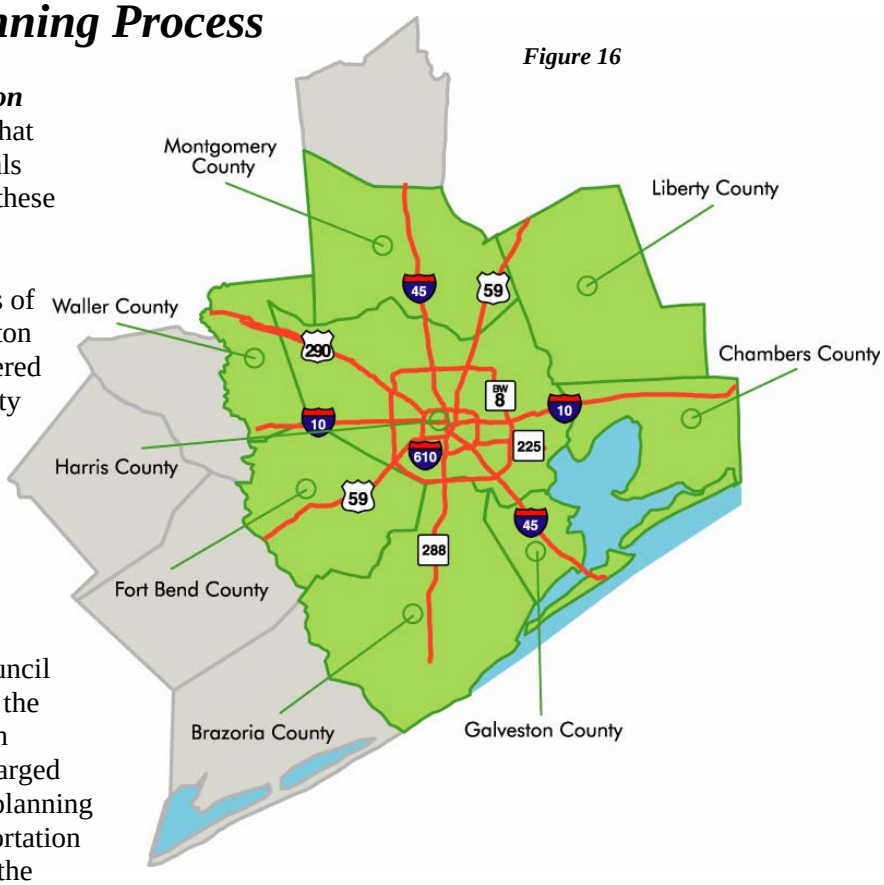
Acronyms

2022 MTP	2022 Metropolitan Transportation Plan
2025 RTP	2025 Regional Transportation Plan
ADA	Americans with Disabilities Act
AERCO	Area Emission Reduction Credit Organization
BNSF	Burlington Northern & Santa Fe Railroad Company
BRDGS	Boardings
BWC	Best Workplaces for Commuters
CAA	Clean Air Act
CBD	Central Business District
CMSA	Congestion Management System
CMAQ	Congestion Mitigation & Air Quality
CMSA	Consolidated Metropolitan Statistical Area
CPTED	Crime Prevention through Environmental Design
E+C	Existing + Committed
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FBI	Federal Bureau of Investigation
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact
FTA	Federal Transit Authority
GRH	Guaranteed Ride Home
HB&T	Houston Belt & Terminal Railroad Company
HBW	Homebased Work
H-GAC	Houston-Galveston Area Council
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
IAH	Intercontinental Airport - Houston
IH	Interstate Highway
IPM	Integrated Pest Management
ITS	Intelligent Transportation System
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
LOM	Level of Mobility
LRT	Light Rail Transit
MEC	Major Employment Center
METRO	Metropolitan Transit Authority of Harris County
MPO	Metropolitan Planning Organization
MPTS	METRO Public Transit System
NAFTA	North American Free Trade Agreement
NEPA	National Environmental Policy Act
NOx	Nitrogen Oxide
O&M	Operations & Maintenance

P&M	Preservation & Maintenance
PM&R	Preventive Maintenance & Rehabilitation
PMIS	Pavement Management Information System
PMT	Passenger Miles Traveled
PTRA	Port Terminal Railroad Authority
QRT	Quick Response Team
RCTSS	Regional Computerized Traffic Signal System
ROW	Right of Way
RTNA	Regional Transportation Needs Assessment
SH	State Highway
SIP	State Implementation Plan
SOV	Single Occupancy Vehicle
STP	Surface Transportation Program
TCEQ	Texas Council on Environmental Quality
TDM	Travel Demand Management
TEA-21	Transportation Equity Act for the 21st Century
TIP	Transportation Improvement Program
TMA	Transportation Management Area
TMO	Transportation Management Organization
TPC	Transportation Policy Council
TxDOT	Texas Department of Transportation
UPRR	Union Pacific Railroad
U.S.	United States
V/C	Volume to Capacity
VHT	Vehicle Hours Traveled
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound

Transportation Planning Process

Figure 16



The ***2025 Regional Transportation Plan*** (RTP) is a long-range plan that identifies mobility and access goals for our region, strategies to meet these goals, and priority actions to be implemented by 2025. The RTP considers the transportation needs of the eight-county Houston-Galveston region. The geographic area covered by this plan includes Harris County and the seven adjacent counties that make up the consolidated metropolitan statistical area (CMSA), a region of more than 7,000 square miles and almost 5 million residents.

The Houston-Galveston Area Council (H-GAC) has been designated by the State of Texas as the Metropolitan Planning Organization (MPO) charged with coordinating transportation planning for the region. H-GAC's Transportation Policy Council is responsible for the development of the long-range, 20-year transportation plan for the eight-county Transportation Management Area (TMA). This plan is updated every three-years. The Transportation Policy Council provides regional coordination with various stakeholders including cities and counties in the eight-county area, the Texas Department of Transportation (TxDOT), transportation agencies, (such as transit, toll and port authorities) plus citizens of the region.

The U.S. Environmental Protection Agency (EPA) has designated the eight-county Houston-Galveston-Brazoria area as nonattainment for ground-level ozone (O_3). While transportation is not this region's primary source of ozone pre-cursor pollutants, continued reductions of pollutants from on-road vehicles is an essential part of our plan to attain clean air standards. Consequently, the RTP is required to conform to emission limits set by the Texas Commission on Environmental Quality (TCEQ) and approved by the EPA.

This document presents recommendations from a regional transportation planning process including many sub-areas and corridor level plans. In depth technical information is provided by topic in the appendixes of this report.

Vision, Goals and Actions

The planning challenge in developing the 2025 RTP was to improve mobility as population growth doubled while remaining within financial and environmental constraints. To meet this challenge the 2025 RTP defined how the forecasted travel demand could affect the region's transportation system. The vision and goals were created by a patchwork of sources that included the 7-Planning Factors as required by the Transportation Equity Act for the 21st

Century (TEA-21), public comments and input from various committee members. The 2025 Regional Transportation Plan (RTP) is governed by the following overriding vision:

Enhance mobility by providing an efficient, affordable, safe, and environmentally responsible transportation system for both people and goods.

Goals - The vision is organized around four goals that provide a framework for the RTP.

#1 - Reduce congestion and improve access to jobs, markets and services

#2 - Preserve and maintain the existing transportation infrastructure

#3 - Improve transportation safety and security

#4 - Be environmentally responsible

Examples of the implementation of these goals found in the RTP include:

Transit Expansion

The transit element of the 2025 RTP builds on the voter-approved METRO Solutions Plan, which includes extensive additional services.

- Light and commuter rail transit (64.8 proposed new miles of LRT)
- ~ 54 Light Rail Stations
- 9 new transit centers & 9 new park & ride lots
- More than 250 miles of two-directional park & ride service
- A 50 percent increase in bus service
- 1,038 new route miles
- approximately 20,000 new parking spaces
- Bike racks on buses and transit centers
- Metrolift Services mirror bus expansion

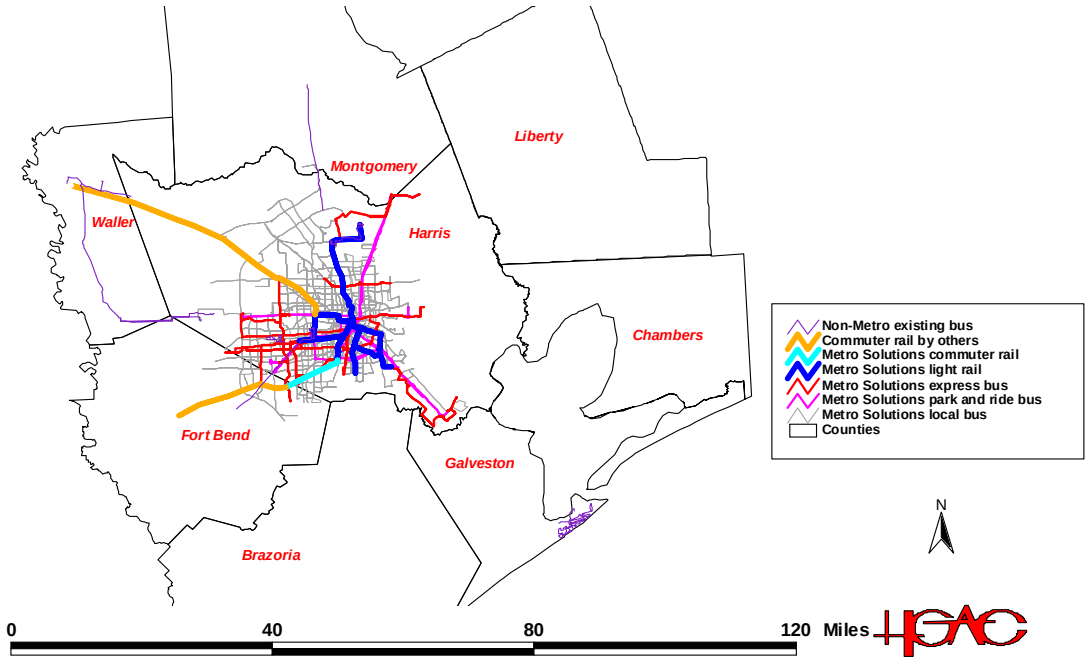
In addition to the Metro Solutions projects listed in the 2025 RTP, there are also recommendations based on overall indicators and results obtained from analyses that are proposed here:

- Extend rail lines beyond METRO's current service area, and encourage transit service plans for outlying areas including implementation of additional transit or para-transit services
- Expand public transportation beyond the METRO service area to meet basic mobility needs for low-income residents where expected population and employment density generate sufficient travel demand
- Develop minimum threshold values, indices and guidelines for transit dependent individuals such as seniors, disabled and poverty households
- Develop plans that encourage concurrent land use and transit development
- Implement fixed-route transit in portions of southwest, southeast and northwest Harris County

- Expand existing transit services in the Woodlands, the City of Galveston and the Lake Jackson/Angleton/Freeport area
- Incorporate the development of new public transit services in Fort Bend County
- Investigate regional high-speed mass transit development with links to future higher-speed, intercity rail lines and multi-modal facilities

Figure 17

2025 Transit Network
Regional Transportation Plan



Roadway Expansion

Tolling

The 2025 RTP includes significant expansion of toll financing for limited access roadways and the use of "surplus" toll funds for other regional transportation needs. The RTP estimates $10 billion toll revenue through 2025 with potential for $6 billion in revenue beyond construction, operation and maintenance costs for the toll facilities. Further analysis of tolling options such as peak-period roadway pricing and broader application of toll financing to non-freeway projects such as bridges and grade separations is recommended.

Smart Streets

Develop a system of Smart Streets or high-grade principal arterials that could significantly mitigate or eliminate the need for the additional lane miles by implementing the following:

- Upgrade targeted existing arterials to 'limited-access' arterials
- Improve traffic operations through the use of signal synchronization, turning bays and driveway consolidation

- Expand within existing right of ways and along new roadways consistent with thoroughfare plans
- To improve corridor mobility add capacity, including grade separations at major intersections where appropriate

A preliminary cost estimate for the Smart Streets system concept for the eight-county region is slightly more than $3 billion.

Regional Computerized Traffic Signal System (RCTSS)

Improve traffic operations through real-time traffic control. The Regional Computerized Traffic Signal System (RCTSS) and METRO Public Transit System (MPTS) are integrated into a common system that operates in real-time at TranStar, the region's emergency management center with an estimated cost of $30 million annually or $630 million for FY 2004-2025.

Non-motorized Transportation Access

The RTP presents specific actions aimed towards increasing the viability and safety of non-motorized travel in the region, such as:

- Designation of bicycle facilities as a consideration in the Transportation Improvement Plan project selection
- Allocation of $340 million to bicycle and pedestrian improvements
- Promoted infrastructure improvements to develop non-motorized transportation including sidewalks, bicycle pathways, pedestrian bridges and compatible open spaces
- Developed a Special Districts study identifying areas with high potential for bicycle-pedestrian improvements, see Appendix B, Chapter 4: for more information about the Regional Bicycle and Pedestrian Plan Update

Goods Movement

Quick Response Team Projects

Quick Response Team Projects (QRT) were developed to address many of the Goods Movement access issues identified by the 2025 RTP. Nine low cost, short range, Quick Response Team projects are included in the RTP for immediate implementation. QRT Projects are used in a variety of ways, one such project in the 2025 RTP is a major project undertaken at various locations in the IH 610/Port of Houston vicinity which include preliminary engineering and design, modification of signal timings, right of way, utility relocations, and construction of grade separation. The cost of the improvements for that project is about $25.2 million dollars.

Interstate 69/Trans-Texas Corridor

- Approximately 1,000 miles in length extending from Texarkana to the Rio Grande Valley
- Transportation types on this corridor include High-Speed Passenger Rail , High-Speed Freight rail, and Commuter Rail, utilities available will be Water, Natural Gas, Petroleum, Fiber Optic, and Telecommunications

Port of Houston Expansion Plans

- Development of the Bayport Terminal Project, a major marine terminal complex on about 1,050 acres to be completed by 2030
- The economic benefits of Bayport are estimated to be more than 15,000 jobs and nearly $800 million in business revenue by 2015, and by 2030, the economic benefit is estimated to be 32,000 new jobs and $2.4 billion in business revenue; while the cost of the project is anticipated to be $1.2 billion

Port of Galveston Expansion

Current plans reflect the recent increase in cruise ship passengers at the port.

- Expenditures to revamp the cruise ship terminals total $35 million
- Improvements to Harborside Drive to accommodate cruise-related goods and passenger traffic

Port of Freeport Expansion Plans

- The port is widening the existing channel from 400 feet to 800-900 feet, and deepening the channel from 40 to 60 feet
- Additional expansion plans at the port include increased Liquefied Natural Gas and crude oil handling facilities
- A 60,000 square foot cold storage facility is in the design phase at the port

Houston Airport System Expansion Activity

- The air cargo handling facilities at Bush Intercontinental Airport have under gone a major expansion encompassing 120 acres on the northeast side of the airport, including ramp space for up to 20 wide body aircraft simultaneously, providing more than 550,000 square feet of cargo building space, and providing easy access to the proposed I-69 NAFTA Superhighway
- Approximately $250 million is being spent modernizing Hobby's terminal building and other airport facilities

Rail Related Expansion Plans

Expansion of rail capacity is focused primarily on improvements and expansion of port rail terminal facilities. The following improvements were identified in the Draft State Rail Plan.

- The lead track at Barbours Cut westward will be increased to add capacity of the three-mile single-track section used by both UP and PTRA
- A new intermodal facility at Bayport in southeast Harris County will include access by highway, rail and waterways

Strategies to Address Increased Truck Trips on Area Roadways

Strategies that have been implemented in other jurisdictions to address increasing mode share of

trucked freight movement are recommended for consideration in the Houston region

- Designate network roles for freight routes, such as through routes, arterial stem routes and local connectors, then use these designations to channel investments to the highways that play key network roles for movement of freight
- Incorporate truck dimensions in the design of the traffic system, such as traffic signalization, intersection design and turning radius design
- Require freight access for commercial and business establishments (off street delivery bays and loading zones)
- Implement Intelligent Transportation System solutions, such as travel management systems and traveling information systems
- Consolidate Freight/Rail Corridors, such as the Alameda Corridor in Los Angeles or the one envisioned for the Trans Texas Corridor

Strategic Investments for Domestic and International Trade

- Include the Houston/Harris County region in the federally-recognized South Central High Speed Rail (HSR) Corridor, to include this portion of the state's 78 % population referred to as the Texas T-Bone or the Brazos Express Corridor
- The Texas T-Bone or the Brazos Express Corridor alignment would serve Fort Hood, TX, the largest military installation in the free world, in deployment to ports of embarkation
- The Texas T-Bone or the Brazos Express Corridor would also serve as a FEMA evacuation route, providing an effective multi-modal evacuation system for millions of Americans during times of natural disaster and provide much-needed relief to our state's deteriorating highways

Maintaining the existing roadway network

- $14.2 billion for reconstruction, resurfacing, and rehabilitation projects focused on preventive maintenance and life extension of existing facilities, including all activities necessary to implement infrastructure preservation
- $8.9 billion for roadway operations and routine maintenance, which typically includes filling potholes, cleaning and patching streets, applying crack sealant, maintaining signs, signals, lighting, and right-of-way
- $2.9 billion for transit replacement and rehabilitation expenditures for the preservation of existing infrastructure, including Park & Ride and Transit Center facilities, buses, and bus barns
- $10.0 billion for transit operations and maintenance to maintain adequate service
- $4.2 billion for port and airport rehabilitation to rebuild deteriorated infrastructure
- $5.0 billion for port and airport operations and maintenance

Safety

- Increase funding to reduce high crash levels in the region, to secure a more proportionate share of federal safety funds to the region
- Undertake safety studies in the Cities of Galveston, Sugar Land, Conroe, and throughout the region in order to implement roadway improvements that will reduce the high number of crashes as have been conducted at high crash locations on Westheimer Road, in the East End of Houston, and in the City of Pasadena
- Mitigate 344 major crash hot spots at a cost of $172 million and with an annual benefit of $392 million

Security

Recommendations include:

- Building an information system that will identify crime incidents on transportation facilities

Air Quality

- Conducts conformity analysis of the RTP for Clean Air Act requirements

Clean Vehicle Program

- Continued implementation and growth of the Clean Vehicle Program, a National prototype, aimed at reducing on-road vehicle emissions cost-effectively
- At an estimated cost of $14.3 million annually or $300 million for FY 2004-2025, this program uses Federal Congestion Mitigation and Air Quality funds to subsidize the incremental cost of eligible vehicles to help reduce the costs to public and private entities for the acquisition of clean vehicles

Commute Solutions Program

- The Regional Vanpool Program, known as METROVan, is the fourth largest Vanpool program in the nation, and allows financial incentives that reduce monthly fares for all vanpoolers in the Houston-Galveston area with an estimated cost of $1.9 million annually or $40 million for FY 2004-2025
- Commute Solution's telework initiative works with regional employers to create incentives for employers to allow the practice of teleworking; at an estimated cost $120,000 annually or $2.5 million for FY 2004-2025
- Transportation Management Organizations are provided with ongoing technical support services for Commuter and Transit Services Pilot Projects within major employment centers, at an estimated cost of $110,000 annually or $2.3 million for FY 2004-2025

Figure 18

Long Range 11-25 Years

Activities
- Regional, county, and corridor-level planning studies
- Preliminary environmental assessment
- Formal public review and comment
- Project feasibility studies, Major Investment study, Alternatives Analysis

Agency Responsibility
- TPC inclusion in financially-constrained Regional Transportation Plan
- Local sponsor inclusion of concept/project in long-range plans and comprehensive plans

Short Range 4-10 Years

Activities
- Alignment Study
- Environmental assessment
- Corridor preservation and R-O-W acquisition
- Project financial plan

Agency Responsibility
- Local sponsor identifies project or service in bond program, comprehensive or expansion plan
- TPC approval or locally-preferred alternative
- Provide funding for engineering and environmental work

TIP 1-3 Years

Activities
- Complete final design, R-O-W acquisition and environmental work
- Receive environmental approval
- Complete utility relocation
- Complete environmental mitigation
- Construct project or implement service

Agency Responsibility
- TPC approves use of federal funds by state and/or municipalities
- State and local funding authorized by governing council, board or commission

Project Development

The RTP groups projects into three timeframes: long-rang, short-range and the Transportation Improvement Program (TIP). Generally, all RTP projects begin in the long-range plan. Any given project identified as 'long-range' will require additional planning to understand the project's purpose, need, and scope. The time-frame for implementation may be eleven to twenty-five years in the future. Long-range projects, which are based on forecasted needs, are often concepts to assist comprehensive community planning and identify needed corridor preservation. These conceptual projects are subject to public comment in a variety of ways, such as Feasibility and Corridor Studies, both of which include discussions focusing on sub-areas as well as whole corridor issues. Public meetings are held with various local community and business groups for Corridor Studies, and during the Preliminary Design stage as well as through the formal RTP public outreach program.

Short-Range projects are those under development for implementation within four to ten years. This timeframe is the beginning of the project implementation process. Short-Range projects go through a number of steps including environmental assessment, EIS, preliminary engineering and design, financial planning and additional public outreach. Public outreach activities include opportunities for comment during environmental assessment phases as well as through the formal RTP public outreach program. In this stage, project sponsors, upon approval of environmental work, can finalize alignment and, can begin the right-of-way acquisition process.

TIP projects are authorized to be implemented. These projects here have met all the requirements for project readiness, including reliable cost estimates, financial commitments, and substantial right-of-way acquisition. TIP projects can be scheduled for implementation within the next one to three years. The projects listed in the TIP are the only 'fully funded' roadway projects within the RTP. There must be reasonable opportunity for public comment prior to approval of the TIP, thus a thirty-day public comment period is observed prior to approval of the final TIP document. Ensuring adequate

public involvement in the TIP development process is the Technical Advisory Committee (TAC) consisting of public and private sector representatives in the eight-county area. This Committee is responsible for recommending TIP projects to the Transportation Policy Council (TPC), which in turn provides policy guidance and overall coordination of the transportation planning activities within the region, and consists of local elected officials, the Texas Department of Transportation, and METRO. The TPC meetings are open to the public, with opportunities for public comment on each agenda.

Public Involvement in the Regional Transportation Plan

The 2025 RTP reflects the results of citizen involvement during the RTP development and with the Public Involvement Plan (PIP). This process was initiated with focus groups and supplemented with public meetings in neighborhoods and business groups throughout the eight-county region. In this process, citizens expressed the desire for more travel choices, added capacity to selected roadways and expanded mass transit. Public groups vocalized their desire for greater balance in the transportation system through multi-modal travel choices that are safe, convenient, effective and efficient for people and goods movement. In addition, the public indicated a desire to promote transportation alternatives that have more positive environmental (air and water) impacts than the traditional transportation modes associated with major roadway/freeway expansion. A comprehensive summary of the public involvement process and comments received is provided in Appendix C, Chapter 3: Public Involvement.

Environmentally-Responsible

The eight counties of the TMA contain eight distinct ecological zones and 16,000 miles of rivers, lakes, streams and bayous. This rare confluence of waterways, marshes, swamps, ocean, prairies and forests, all in relatively close proximity, make the region home to an abundance and diversity of plant, bird and aquatic life. Special consideration is given to preservation of our important environmental resources, such as Galveston Bay which is an important fishery and recreational attraction. Also chief among these resources are wetlands, which protect shoreline areas from erosion, serve as buffers from flooding, filter polluted storm water, and provide habitat for fish and wildlife. With proper stewardship, these resources will provide opportunities for tourism and help ensure that the region provides an attractive quality of life for existing and new residents.

While transportation facilities are essential to daily life, they can have direct and indirect negative impacts on the environment. The minimization of both of these types of impacts on environmental features can be avoided by project planning and design. While the plan is consistent with requirements of the National Environmental Policy Act, the Clean Air Act, and the Clean Water Act potential mitigation measures may be identified and implemented to reduce:

- Destruction or alteration of wildlife habitats
- Erosion, sedimentation, and soil compaction
- Gaseous and particulate emissions from vehicles
- Contaminated roadway runoff
- Waste generated by construction (such as asphalt, concrete, metals, wood)
- Road debris (such as worn brake linings, scrap tires, litter) and other debris
- Chemical pollution from roadside pest management

- Development demand generated by major transportation facilities.

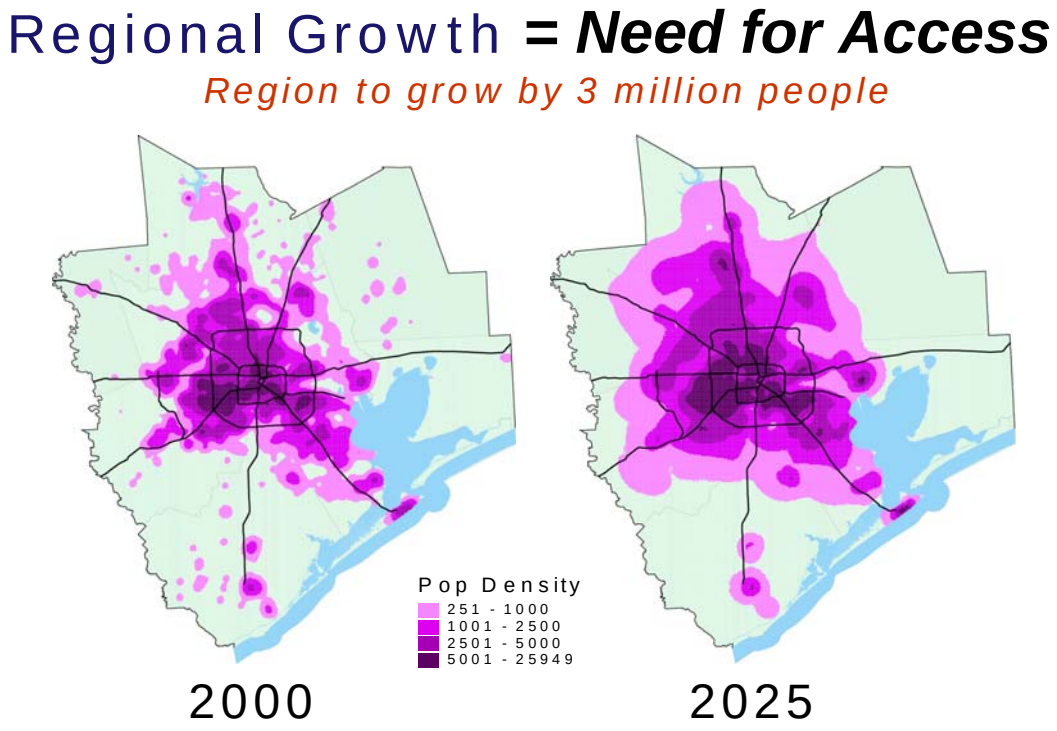
Foundations of the RTP

Regional Growth in Population and Vehicle Travel

The eight-county region continues to be one of the fastest growing areas in the state and the nation. The increasing population and economic growth puts substantial pressure on existing infrastructure. According to the 2000 Census, regional population grew during the 1990s by nearly 1 million persons. In 2000, regional household population had grown to 4.6 million persons residing in 1.64 million housing units.

H-GAC forecasts that the regional population will grow to around 7.7 million persons by 2025, an increase of 65 percent from 2000. Although the majority of this forecasted growth is projected to occur outside of Beltway 8, approximately 3 million persons are predicted to reside within the beltway by 2025.

Figure 19



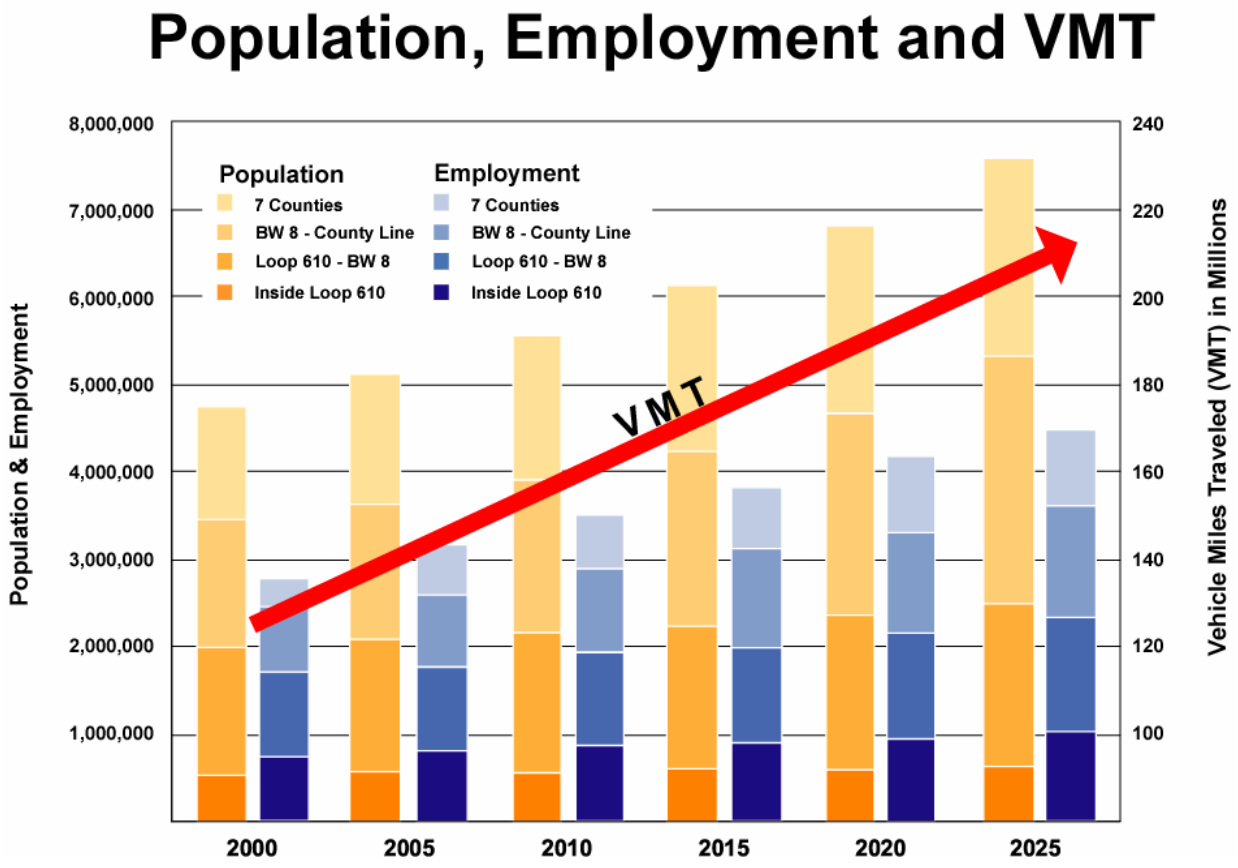
The regional employment forecast predicts an increase of over 1.3 million jobs in the region's labor force by 2025, an increase of 60 percent from 2000. Approximately 50 percent of all jobs are projected to be inside Beltway 8 and 20 percent within Loop 610. Regional employment will continue to decentralize, with the strongest employment growth rates expected between Beltway 8 and SH 6/1960. The strongest growth rate percentage is between SH 6/1960 and the Grand Parkway.

Today, more people drive longer distances both regionally and nationally. As a result, the growth of daily vehicle miles traveled (VMT) has increased at a significantly faster rate than population or employment. In 2000, there were 125 million daily vehicle miles traveled in the Houston-Galveston region. That number is expected to increase to about 185 million daily VMT by 2025.

Changing Regional Travel Patterns

The region's VMT is growing both in size and complexity, as a reflection of the region's growing population and employment base. Over time, decentralized development patterns have contributed to an enlarged urbanized area that is characterized by multiple major employment centers and employment corridors. Today there are four major regional employment centers - Central Business District (CBD), Uptown/Galleria, Greenway Plaza and the Texas Medical Center - with more than 500,000 total work trips each workday, thus contributing to peak-period congestion levels. There are also a number of smaller employment centers, such as Midtown, Westchase, West Houston, Sharpstown, U.S. 290, Greenspoint, Clear Lake, and the Universities areas. In addition, there are some major employment corridors along major freeways and arterials. Among these are the IH 610 loop, US 59 W, IH 45 S, IH 45 N, IH 10 W (the Energy Corridor), US 59 E, and Westheimer Road. Appendix A, Chapter 3: Regional Travel Patterns provides additional information on the region's major activity centers and their impacts on transportation.

Figure 20



RTP Development Process

H-GAC staff initiated a Regional Transportation Needs Assessment (RTNA) ***process*** to augment the standard call for projects from stakeholder agencies in the region. During the call for projects, local governments, transportation agencies and the State Department of Transportation submitted projects for inclusion in the regional plan. Based on criterion developed by the Transportation Policy Council these potential projects were prioritized for funding. Three additional sources of information were used to help identify the regional transportation needs for the 2025 Regional Transportation Plan (RTP):

- Public comments from meetings, focus groups, interviews and survey results
- Roadway System Deficiency Analyses
- Transit System Service Analyses

It is important to note that the public involvement process that led to the 2025 RTP has spanned several years beginning in the late 1990s and continued into 2004. There was an interruption in the process due to legal actions related to the air quality conformity determination of the 2022 Metropolitan Transportation Plan (MTP) and 2022 MTP Update. However, the comments and suggestions from the earlier public involvement efforts have been incorporated into this 2025 plan, along with more recent input.

This RTP specifically identified current and future transportation needs, based on more aggressive forecasts for population growth and related travel demand (congestion) levels. The demand analysis provided the following benefits to the regional transportation planning process:

- A clearer understanding of needed (derived from performance-based measures) transportation investments beyond those identified in the financially constrained 2025 RTP*
- A multi-faceted picture of current and projected transportation scenarios including the 2025 METRO Solutions Transit Plan and potential demand for an expanded commuter rail system
- A view of transportation elements from both a local and regional basis
- Opportunities to prepare for future needs and investigate available options

Roadway Deficiencies

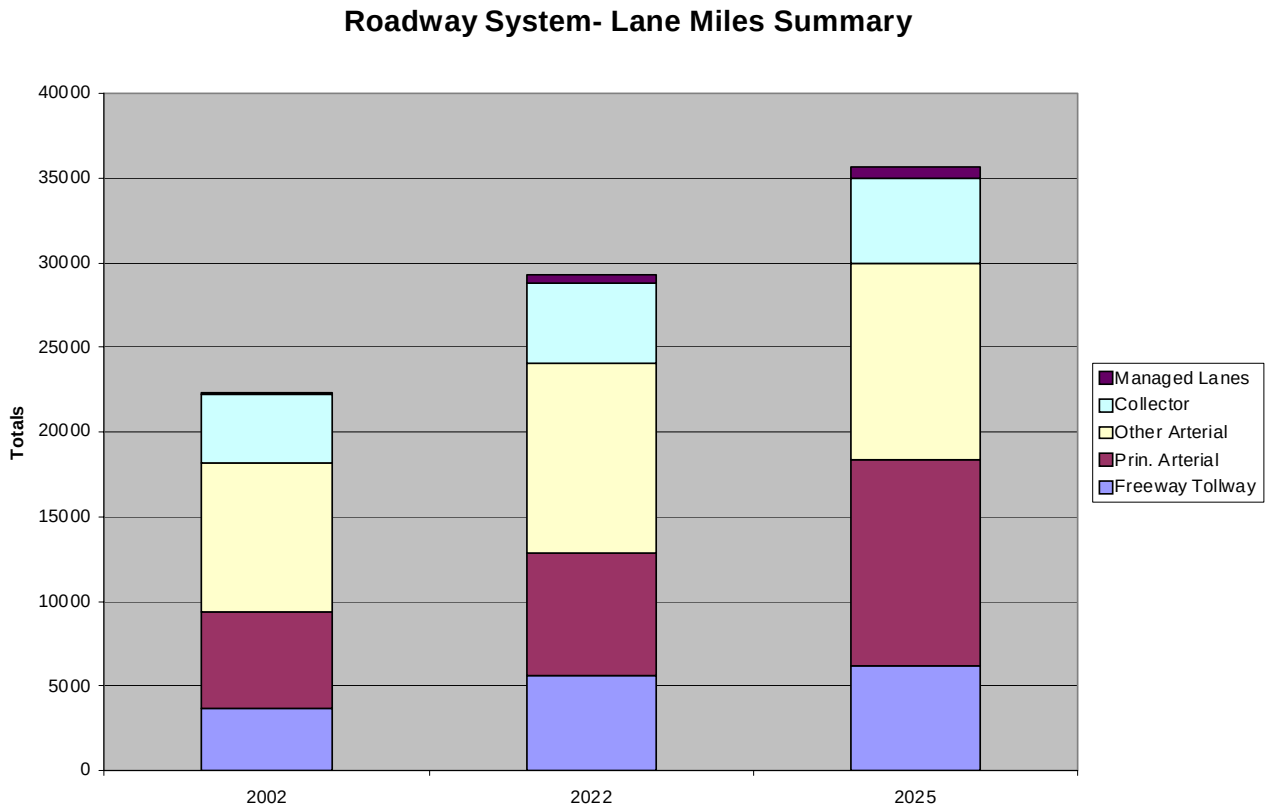
The roadway system deficiency analyses are based on reviews of current and projected travel demand on existing and planned roadway facilities. The first analysis focused on the most congested roadways. Future (2025) travel demands were assigned to the planned 2020 roadway network. This enabled the identification of roadway segments in need of additional capacity, above the level included in the 2022 MTP. The results of this analysis indicated a need for 6,370 total lane miles over the 2022 MTP. (See figure 21).

*Those investments are discussed further in the Texas Metropolitan Mobility Plan

Figure 21

Year	Miles	Freeway/ Tollway	Principal Arterial	Other Arterial	Collector	Managed Lanes	Total Miles
2002	Centerline	610	1897	3023	1751	111	**7,393**
	Lane	3628	5790	8790	3979	146	**22,333**
2022	Centerline	926	2165	3293	1804	228	**8,415**
	Lane	5625	7257	11218	4645	488	**29,234**
2025	Centerline	972	3122	2940	1690	223	**8,947**
	Lane	6187	12135	11585	5106	591	**35,604**

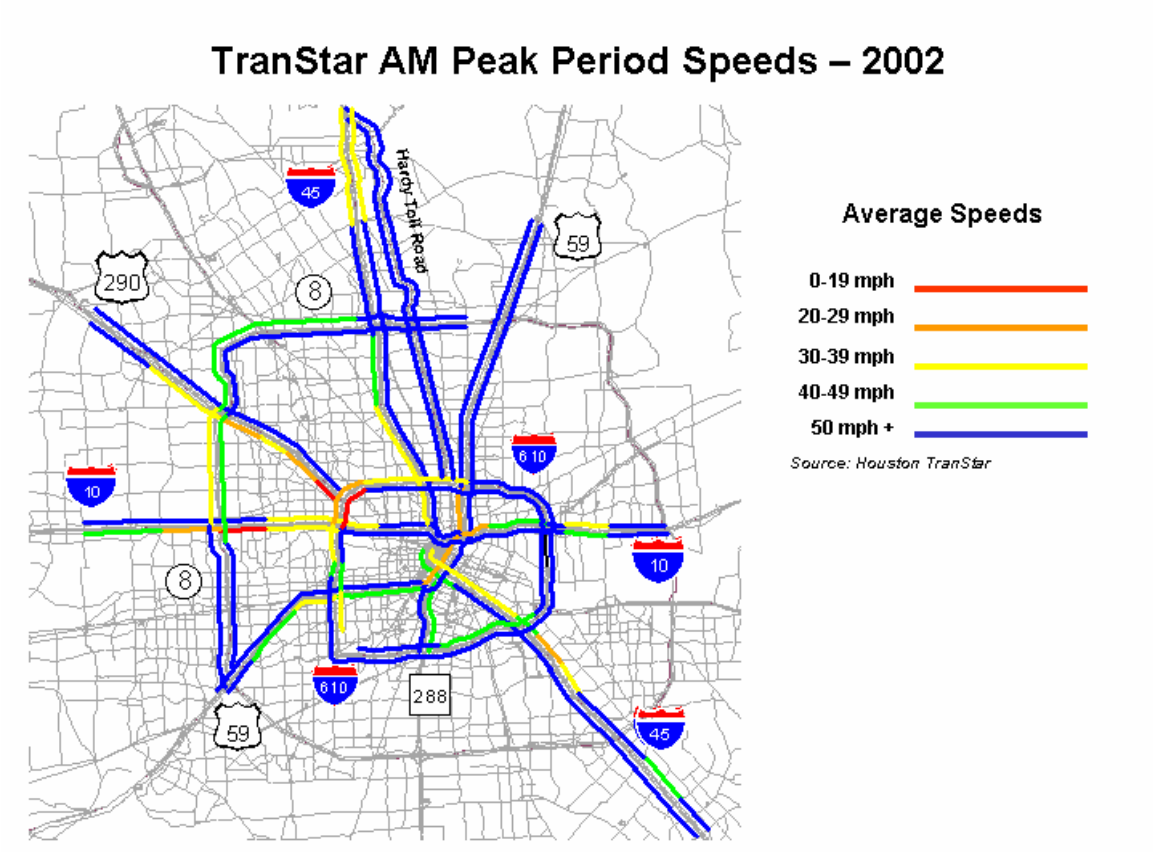
Figure 22



Travel Speed Deficiencies

A second deficiency analysis was based on historical (one-year) speed profiles for major freeway segments during peak-travel periods in 2002. The next figure indicates those locations that had recurring levels of serious congestion. The most severely congested locations are near Loop 610 West and the U.S. 290 interchange, along I-10 West (Katy Freeway) and along U.S. 290. Several locations are highlighted near downtown along U.S. 59 (Eastex Freeway), I-10 East and I-45 South (Gulf Freeway) south of Loop 610 South. Construction projects in 2004 on Loop 610 West and U.S. 59 (Southwest Freeway) inside Loop 610 have temporarily decreased the mobility in those corridors (although this is not reflected in the 2002 observed data.)

Figure 23



Level of Mobility Deficiencies

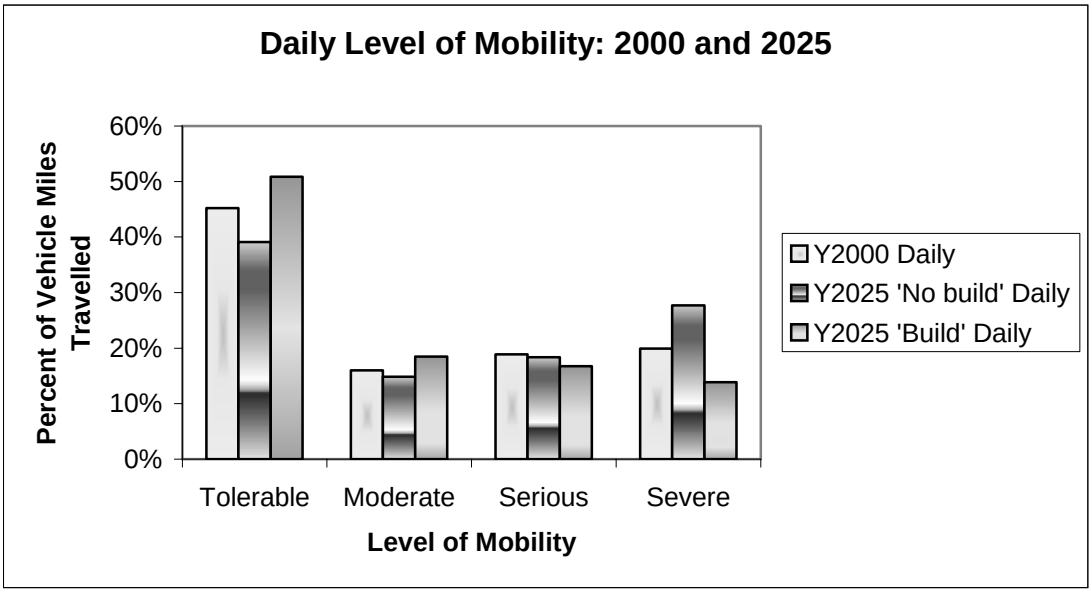
This analysis considered the regional freeway and arterial roadway systems with serious and severe levels of congestion measured by the Level of Mobility (LOM). The LOM was developed to graphically illustrate the degree of congestion on roadways within the region. The LOM is comparable to the standard engineering Level of Service (LOS) measure which is based on volume-to-capacity (V/C) ratios. The LOM incorporates local adjustments to account for facilities that carry higher volumes than they were designed to carry.

Figure 24

Level of Mobility	Volume to Capacity, V/C Ratio
Tolerable	V/C less than 0.85
Moderate	V/C between 0.85 and 1.00
Serious	V/C between 1.00 and 1.25
Severe	V/C greater than 1.25

The LOM for the majority of the daily (24-hour) vehicle miles traveled (VMT) in the Houston-Galveston region is within the tolerable to moderate levels. That regional proportion is not expected to change significantly in future years and some improvement is expected if the projects in the RTP are implemented as planned.

Figure 25

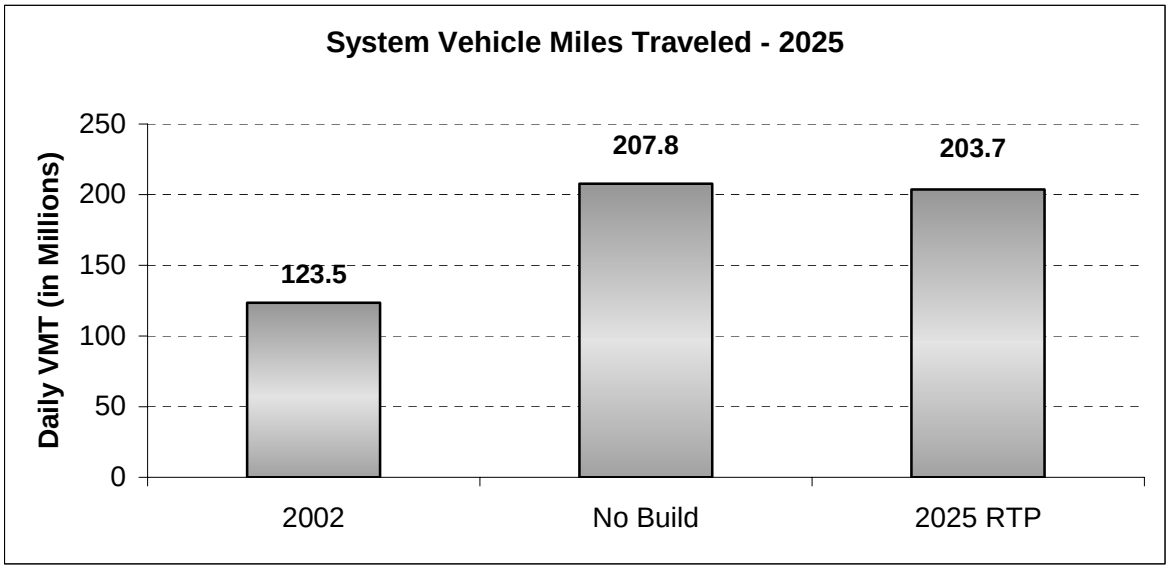


These analyses (and others) have enabled the development of a comprehensive transportation plan for the Houston-Galveston area. The analyses provide objective and quantifiable bases for the RTP recommendations.

Summary of 2025 RTP System Benefits

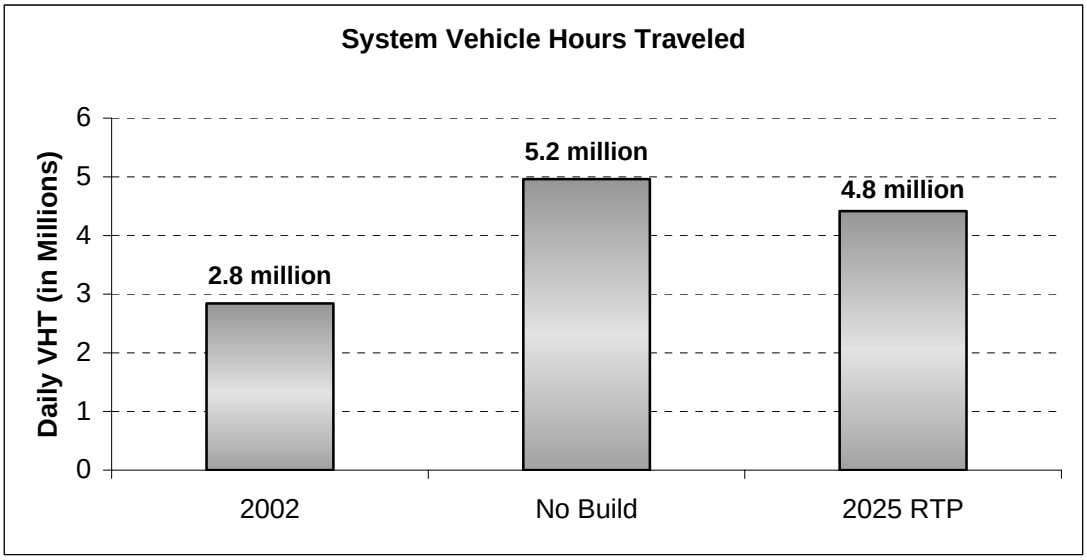
The preliminary results of the system-wide analyses are presented in terms of regional vehicle miles traveled (VMT); vehicle hours traveled (VHT), system-wide average speeds, and transit patronage. In 2002, the regional Vehicle Miles Traveled (VMT) on the transportation demand model network was approximately 124 million daily VMT for the major roadway facilities in the Houston-Galveston eight-county region. By 2025, VMT is expected to increase to about 204 million daily VMT, an increase of 65 percent.

Figure 26



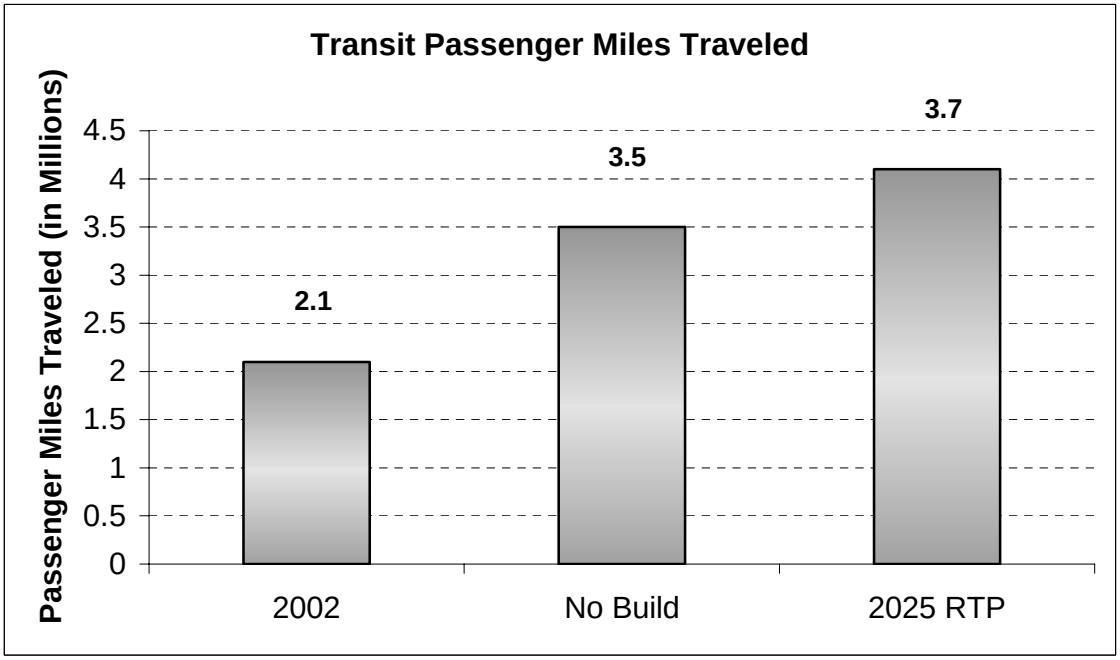
The chart below depicts regional vehicle hours traveled (VHT) estimated at close to 3 million daily in 2002. By 2025 under a no-build scenario, the region's daily VHT would increase to over 5 million. However, by implementing the projects contained in the 2025 RTP, a significant reduction in vehicle hours is estimated, close to 400,000 daily. That reduction in VHT would equate to roughly $2 billion per year in the value of time saved. This estimate does not include benefits from reduction in vehicle crashes and other non-recurring congestion.

Figure 27



Transit passenger miles traveled (PMT) is expected to increase significantly (almost double) with the implementation of the 2025 RTP. The 2025 RTP includes the 2025 METRO Solutions Plan and commuter rail in the US 90 A corridor.

Figure 28



The average daily speeds for the region's roadway system were estimated based on the VMT

and VHT totals (VMT/VHT). These average system speeds show that with the implementation of the 2025 RTP, travelers would experience a slight improvement in average travel speeds, compared to the No Build scenario. That indicates some improvement in future mobility while the region continues to grow, with the investments in the 2025 RTP.

Figure 29

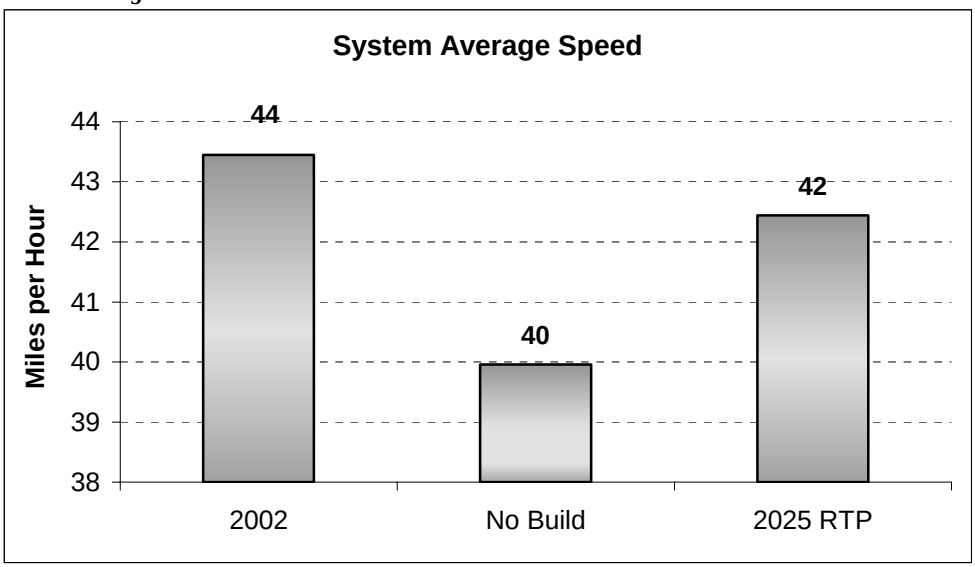
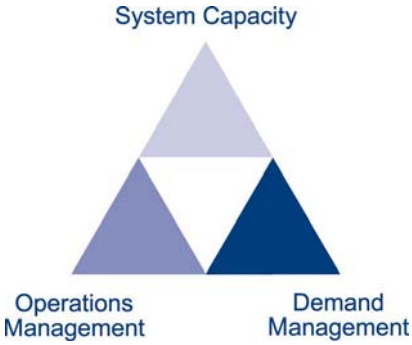


Figure 2



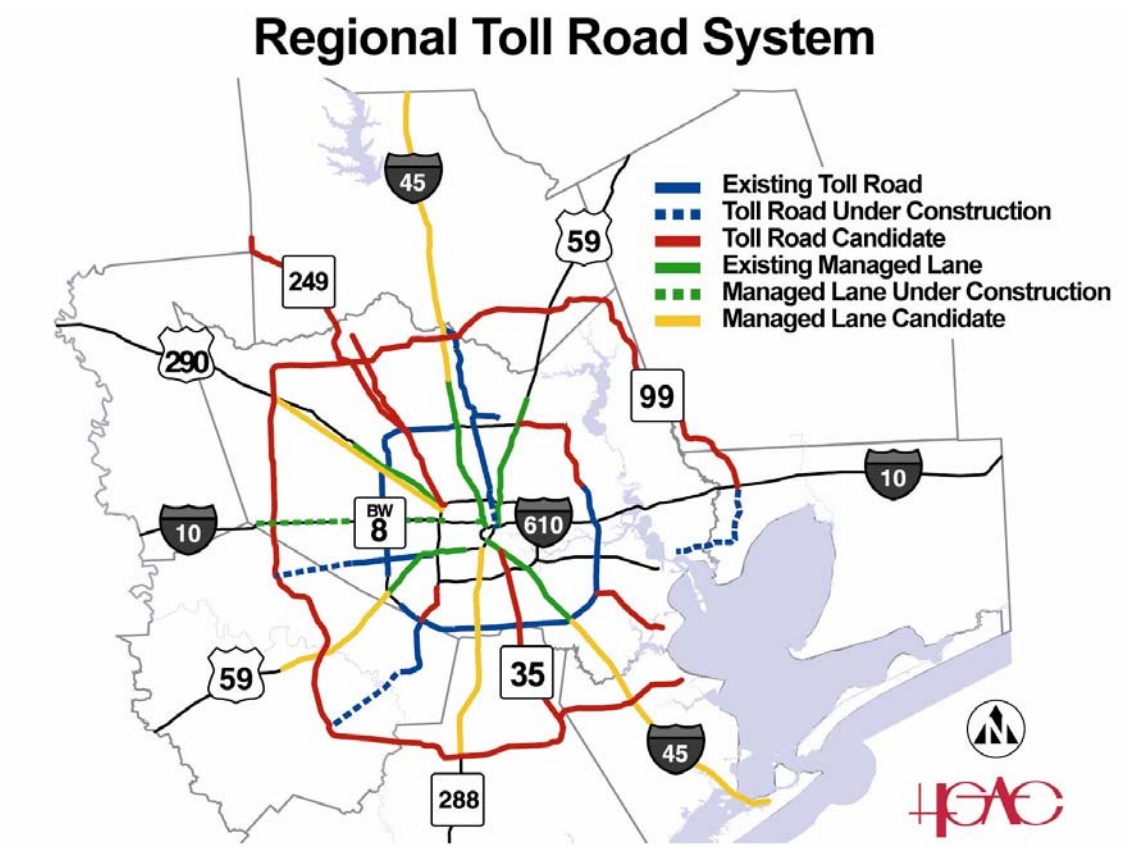
Three Strategies of the 2025 RTP

The 2025 RTP has three fundamental policy strategies for managing mobility: operations management, system capacity (both roadway and transit), and travel demand management (TDM). Operations management focuses on **optimizing the efficiency** of the existing transportation system. Added system capacity provides new roadway and transit capacity to the transportation network to meet current and future demand that cannot be met through operations management or travel demand management (TDM) tools. TDM strategies provide alternatives to solo commuting such as using transit, vanpools and carpools and also promote tele-working, alternative work schedules, parking management and non motorized travel such as walking and bicycling.

System Capacity

The RTP proposes to add system capacity in roadways, toll roads, transit, port and airport facilities.

Figure 30



Toll Roads

Federal and state revenues for building and maintaining freeways are not keeping pace with the region's travel demand. One method of generating additional resources is through the creation of toll facilities. Over the last several years, Harris County Toll Road Authority experienced a growth in revenue of approximately 7 percent per year. Given a reasonable growth rate of 3 percent annually, revenue estimates through 2025 would equal $10.0 billion or approximately $434 million per year. Actual revenues collected in 2002 were $235 million. Additional revenues are expected from the construction of the Westpark Toll Road and expansion on the Sam Houston and Hardy toll roads. These additional sources of revenue will provide the necessary funding for constructing additional highway capacity.

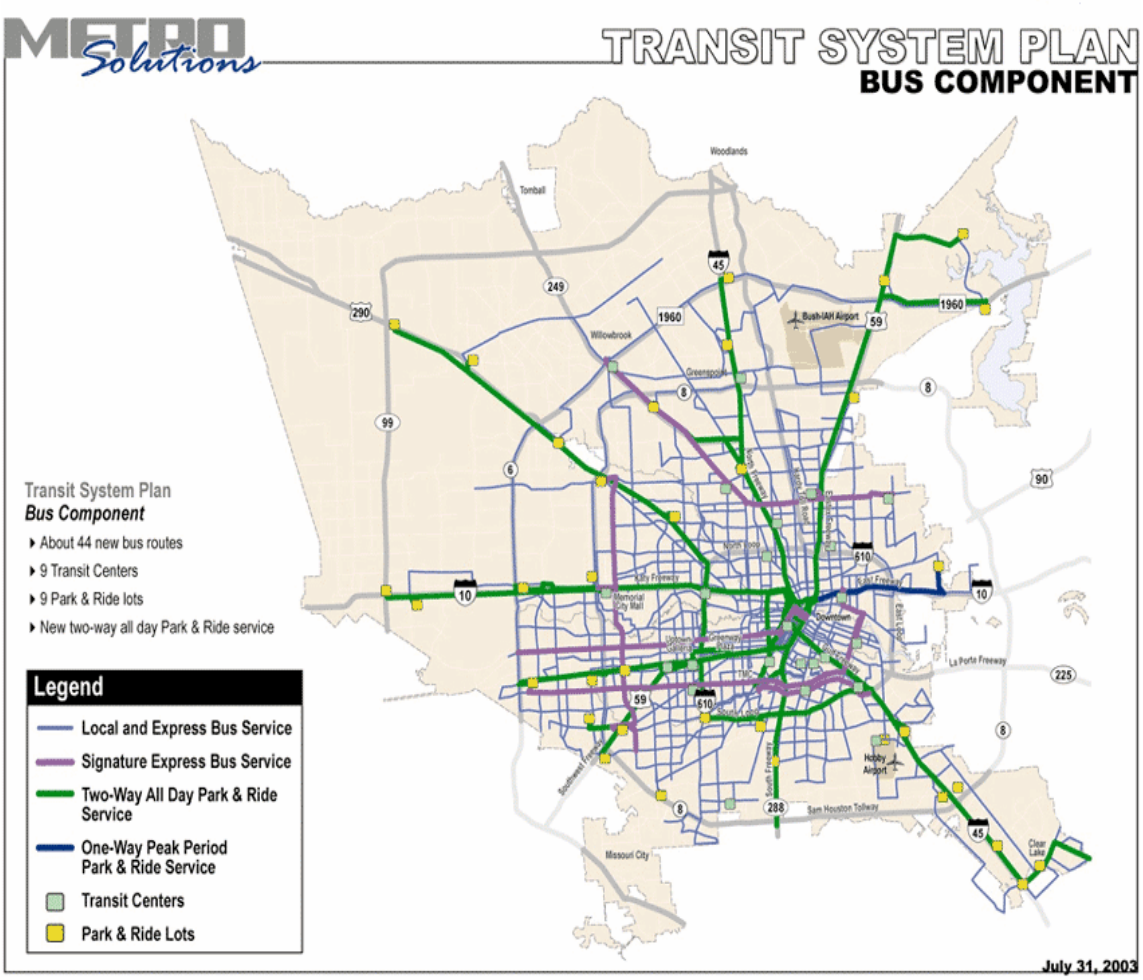
Forecasted revenues generated by the Fort Bend County Toll Road Authority from two proposed toll road facilities (extension of the West Park Toll Road to the Grand Parkway and the Fort Bend County Parkway with future expansion to the Grand Parkway) were estimated at $558 million through 2025 (or $24 million a year). Creation of a toll authority has been authorized by Brazoria County. Similar authorities may be considered in other counties. The following

projects may be supported with toll revenue:

I-10 West (Katy freeway)	HOT lane (under construction)
SH 99 (Grand Parkway)	Full corridor (proposed)
Northwest corridor (new facility)	New corridor (proposed)
SH 35	New corridor (proposed)
U.S. 290	HOT lane (proposed)
SH 288	HOT lane (proposed)

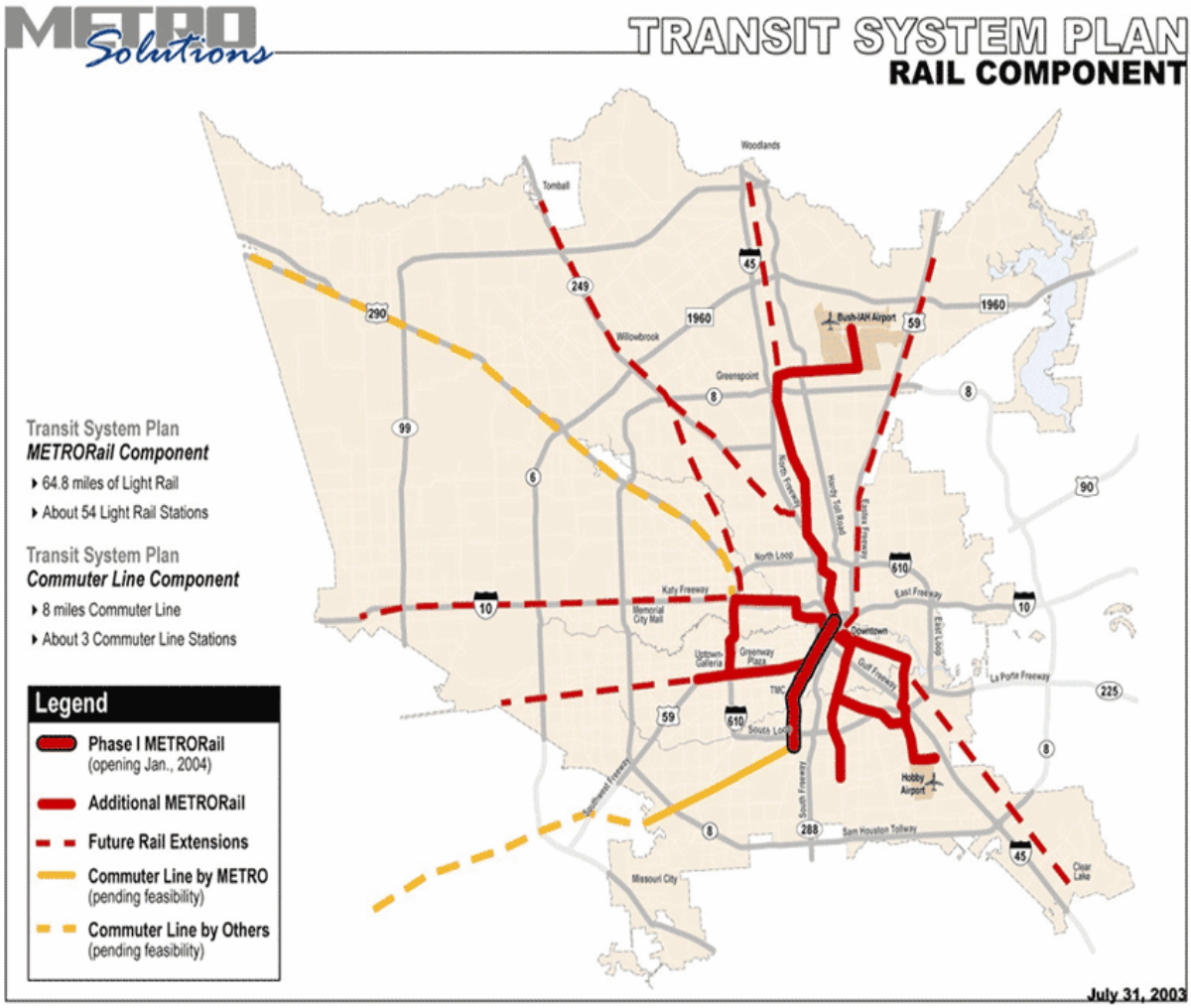
Transit

Figure 31



The METRO Solutions transit plan calls for the creation and improvement of numerous transportation options over the next 20 years. METRO Solutions will be paid for with existing sales tax, fare revenue and available federal transit funds. Bond financing, authorized by voters in November 2003, will help accelerate the transit improvements. METRO will also extend funding for road improvements to Harris County, the City of Houston and the Multi-Cities through FY 2014.

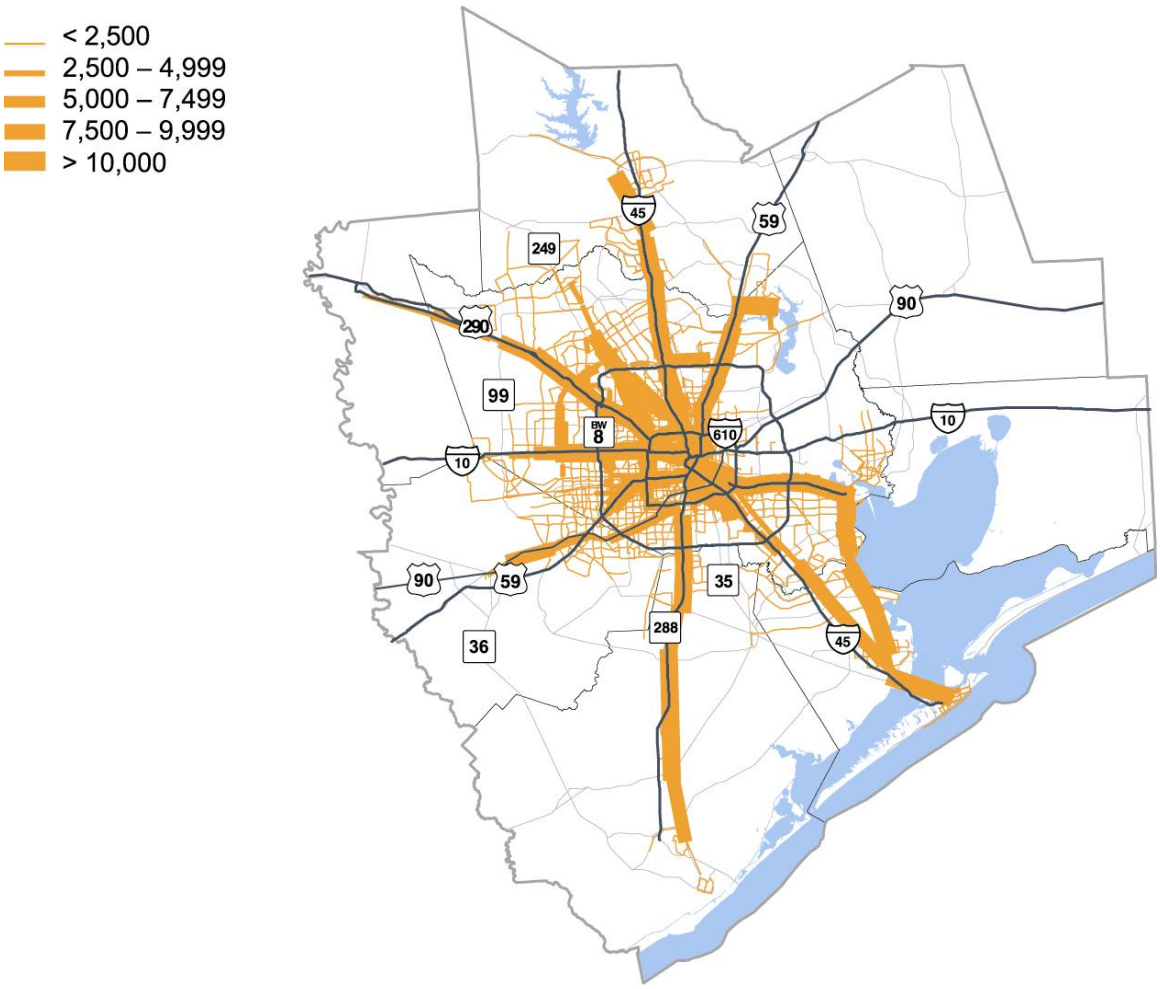
Figure 32



The 2025 RTP contains a significant expansion of the regional transit network, including the METRO Solutions Transit System Plan, and a preliminary service plan for transit expansion outside METRO service area. The METRO Solutions Transit System Plan calls for the creation and improvement of numerous transportation options over the next 20 years. METRO Solutions funding comes from existing sales tax, fare revenues, available federal transit funds, as well as $640 million in finance bonds authorized by voters in November 2003 to help accelerate the implementation of the transit projects. METRO will also continue funding of road improvements to Harris County, the City of Houston and multi-Cities through FY 2014. METRO Solutions was developed based on the findings of several corridor planning studies, technical analyses and public input.

In addition to the METRO Solutions Plan, H-GAC is starting to explore the potential for public transportation investments beyond the METRO service area. Potential investments might include expanded dial-a-ride services, cab voucher programs, local and express buses and extension of light rail or new commuter rail lines in high density corridors. A comprehensive transit system analysis is presented in Appendix B, Chapter 1: as part of the Regional Transportation Needs Assessment. The following map shows the preliminary results (in passenger miles traveled) of the extended rail system that was modeled as part of a regional transit system scenario. The simulation that was modeled assumed a high level of rail service (6-12 minute headways) and the replacement of park- and- ride express bus service with long distance rail service.

Figure 33 **Conceptual Rail Transit Plan - Daily Passenger Miles Traveled**



Expanding the transit system (bus and rail) beyond the current Metro Solutions Plan has the potential to absorb a sizeable share of commuters along particular corridors. The work being done on the Regional Transit Plan is in its early stages. No specific project recommendations are offered at this time. The 2025 RTP recommends conducting additional feasibility studies, which explore the costs and benefits of adding new (or expanded), transit services beyond the Metro Solutions Plan.

Ports, Airports, and the Movement of Freight and Goods

The quality of life of any metropolitan area is enhanced by a strong and vibrant economy. A common by-product of a strong local economy is the generation of increased truck trips and associated stress on the local transportation system. A manufacturing based economy such as Houston's adds additional impacts to the transportation system, and results in significant truck traffic on area roadways.

The prospects for increased freight activity to Houston-Galveston area are strong. Freight facilities in the region will continue to attract growth. Intercontinental Airport, IAH ranks fourth nationally in terms of passenger volume and is the 12th largest international cargo gateway in the United States. Growth forecasts for IAH indicate a six percent annual growth rate. The

ports of Houston, Freeport, Galveston and Texas City combined handled 286 million tons of cargo in 2001, which is more than any other single port in the nation. Latin American trade is predicted to increase threefold in the next 20 years, and legislation such as NAFTA has in effect made it easier to trade with Mexico and Canada. Now the potential exists to expand economic markets, resulting in increased trade with those countries. Given Texas' close proximity to trade partners, such as Mexico and other Latin American countries, the Houston area should expect the number of trucks to increase on area roadways.

According to the statewide transportation plan, the percentage of trucks on major roadways in and around Houston in 2000 was 11.3 percent of total traffic on average, with I-10 east of Houston having over 30 percent trucks trips. By 2025, the percentage of trucks on major roadways in and around Houston will increase to 13.6 percent on average, with some roads carrying as many as 36 percent trucks.

Traffic projections indicate that traffic for all types of vehicles will increase by 64 percent by 2025. That news, coupled with what appears to be a modest increase in the average percentage of truck trips by 2025, will result in a dramatic increase in truck trips on the major roadways in the Houston-Galveston area. If alternative solutions are not implemented, the Houston area will see a more than doubling of trucks on the major roadways between 2000 and 2025.

The time to plan for the safe and efficient movement of freight in the Houston-Galveston area is prior to the time that congestion begins to negatively impact the economy due to excessive delay costs and increased costs of doing business. Strategies that address unique circumstances along with targeted solutions have already been implemented in the Houston area. In a study by the Texas Transportation Institute, researchers evaluated a policy restricting trucks to certain lanes on an eight mile stretch of I-10 East. After implementing the lane restrictions, the study recorded a dramatic 68 percent reduction in crashes along the test section of the corridor.

Another strategy targeted specifically for the Houston-Galveston area is to assist freight intensive businesses that process raw materials to locate in proximity to freight facilities, such as railroads or port properties.

Strategies that have been implemented in other jurisdictions to address increasing mode share of trucked freight movement should be considered for the Houston region. Such strategies could include many of the following recommendations:

- Designate network roles for freight routes, such as through routes, arterial stem routes and local connectors, then use these designations to channel investments to the highways that play key network roles for movement of freight
- Incorporate truck dimensions in the design of the traffic system, such as traffic signalization, intersection design and turning radius design
- Require freight access for commercial and business establishments (off street delivery bays and loading zones)
- Implement Intelligent Transportation System solutions, such as travel management systems and traveling information systems
- Consolidate Freight/Rail Corridors, such as the Alameda Corridor in Los Angeles or the one envisioned for the Trans Texas Corridor

Operations Management

Operational Improvements include the continuation of Computerized Traffic Management Systems (CTMS) with video camera surveillance and incident detection and response, ramp metering and Arterial Traffic Management Systems (ATMS) that will inter-connect traffic signals along specific corridors. Additional strategies are recommended related to Intelligent Transportation Systems (ITS) and the smart streets concept.

The RTP includes operational strategies that will reduce existing traffic congestion and slow the rate of growth of congestion in areas that are currently not significantly congested. Implementation of a congestion management system (CMS) is one means of achieving this objective by monitoring the implementation of transportation control measures (TCM) and transportation system management (TSM) improvements in advance of added capacity.

Federal Intelligent Transportation System Priority Corridor

The Houston-Galveston TMA is one of four regions designated by Congress as an Intelligent Transportation System (ITS) Priority Corridor. Houston TranStar, the regional transportation management center, is the cornerstone of ITS deployment. It is designed to coordinate the collection, processing, and dissemination of traffic information on the region's freeways, HOV lanes and many major thoroughfares.

Regional Computerized Traffic Signal System (RCTSS)

The region's largest transportation providers have developed traffic signal coordination and synchronization plans for many of the major thoroughfares within the region. These systems are collectively referred to as the Regional Computerized Traffic Signal System (RCTSS). Improved traffic operations can reduce vehicle idling time and lessen stop-and-go conditions on major thoroughfares. RCTSS components include:

- State of the art traffic signal controllers with vehicle and incident detection Signal synchronization
- Priority movement for transit and emergency vehicles
- Improvements to intersection turn lanes

The operations management component of the RTP is mainly represented by Smart Streets. Smart Streets on existing or proposed arterials have been upgraded through a variety of enhancements to improve their levels of mobility. By improving mobility on the arterials, highway congestion will be lessened, and the need for adding capacity to the region's highways will be reduced. Other benefits include improved air quality, and improved regional mobility.

It is important to note that most arterials that would be considered for Smart Street treatments are already in existence. H-GAC is proposing that most arterials be widened within existing rights-of-way. In some instances, additional rights-of-way will be needed or may require the construction of an entirely new roadway facility.

Appendix B, Chapter 2: Operations Management contains maps that indicate the locations for potential roadway expansions during the 25-year horizon of the RTP. Some of these locations may require acquisition of additional right-of-way. Future travel demand cannot be accommodated solely through the expansion of existing or planned roadways. Preliminary

modeling results provide a starting place for the investigation of solutions that fit overall needs and expectations.

Travel Demand Management

Travel Demand Management (TDM) is a set of strategies designed to make best use of existing transportation facilities, as well as enhance transportation improvements. TDM initiatives help increase the efficiency and effectiveness of the transportation system. TDM approaches can include:

- Promoting alternative modes of travel, such as vanpooling, carpooling, transit and rail, biking and walking
- Maximizing the efficient use of parking resources
- Shifting travel demand to non-peak periods, by promoting flexible work schedules and variable work hours
- Eliminating demand for some trips through teleworking, teleconferencing, etc.

Incorporating TDM elements into corridor projects can mitigate construction impacts, extend the useful life of transportation facilities, enhance community mobility, and lessen environmental impacts of transportation. Commute Solutions programs are also used as an air pollution reduction strategy for the State Implementation Plan. TDM strategies and related support strategies rely on incentives and disincentives to influence travel behavior and are based on participation from both public and private sectors.

Since the late 1970s, TDM elements have played a key role in corridor projects. The idea was to encourage shared forms of travel, as well as promote a balanced transportation system with a focus on multi-modal travel. This trend has continued and taken on a more formal role in how H-GAC addresses major transportation public investments.

TDM strategies include a relatively new tool called peak period pricing. Peak period pricing is the tolling of a roadway or segments of a roadway during peak travel periods in an attempt to encourage commuters to shift their travel activities to an off-peak period. Many of our region's roadways routinely experience more demand than can be accommodated during peak travel hours, while the transportation system has significant unused capacity during off-peak periods. Peak period pricing tries to shift some of the demand from the peak period, to off-peak times. Peak period pricing can be an effective strategy in our region, because, we do not have the resources to build roads indefinitely, nor would unlimited roadway expansion be desirable to the region.

H-GAC's implementation program for TDM initiatives is "Commute Solutions". Designed to make the best use of existing transportation facilities and help increase the efficiency and effectiveness of the transportation system, these strategies can help mitigate construction impacts through the use of vanpools, carpools, and teleworking. H-GAC proposes to build upon existing TDM strategies by expanding the number of vanpools throughout the region, promoting increased transit usage and teleworking.

TDM and Corridor Planning Guidebook

The Commute Solutions' *Houston Area TDM and Corridor Planning Guidebook* is a guide for transportation planners, engineering professionals and policy makers to develop TDM strategies as an integrated component of all corridor planning efforts. The handbook also provides a methodology for the application and evaluation of TDM elements.

TDM and Construction Mitigation Pilot Program

H-GAC's TDM and Congestion Mitigation Pilot Projects will initiate and implement new rideshare services in four major corridors undergoing major construction in Harris and Fort Bend counties. These corridors include U.S. 59 South from west of Montrose to east of Spur 527; Loop 610 West between South Post Oak and I-10 West; I-10 West between Loop 610 and the Fort Bend County Line; and U.S. 59 South from SH 6 to Richmond/Rosenberg. The program will focus on seven and eight-passenger vanpools and offer financial incentives to all van riders.

Peak-Period Pricing

Peak-period pricing, is a way of harnessing the power of the market and reducing the waste associated with congestion. Projects in the 2025 RTP that include peak-period pricing include the Westpark Tollway and the Katy Highway. This technique entails fees or tolls for road use which vary with the level of congestion. Fees are typically assessed electronically to eliminate delays associated with manual toll collection facilities.

A shift in a relatively small proportion of peak-period trips can lead to substantial reductions in overall congestion. And, while congestion charges create incentives for more efficient use of existing capacity, they provide improved indicators of the potential need for future capacity expansion. They are also generating revenues that can be used to further enhance urban mobility.

Managing congestion through the selective use of tolls is to reduce traffic on congested highways during peak travel times. During the evening rush, 25% or more of the cars on the road are not people coming home from work. A peak-period toll would encourage some of these discretionary travelers to make their trips off-peak, or to use less congested routes. Because congestion grows exponentially as roads near capacity, even a small reduction in the number of cars on the road can substantially reduce congestion-related delays and crashes.

Peak-Period Pricing Complements Transit and Highway Expansion

Selective tolls used alone can reduce traffic during peak periods, but their effectiveness can be greatly enhanced when the revenues are used to improve the system by improving transit and other options, and by highway expansion where appropriate. By providing a financial incentive to use transit, peak-period tolls could provide both a revenue source and a market for transit, neither of which might be as firm otherwise. And by creating a source of location-specific funding, tolls could accelerate the construction of highway expansions that otherwise could be delayed for years waiting for funding.

HOT lanes

The phrase "High Occupancy Toll lane" refers to a situation where solo drivers are allowed to

buy access to special lanes that are free for carpools and buses. On HOT lanes, low occupancy vehicles are charged a toll, while High-Occupancy Vehicles (HOVs) are allowed to use the lanes free or at a discounted toll rate. Vehicles not meeting HOV occupancy requirements buy the right to use the HOV lanes. HOT lanes have been facilitated by the emergence of electronic toll collection technology. This is the most common current application of value pricing in the U.S. The 2025 RTP has HOT lane projects scheduled for I-10 (Katy Freeway) and Hempstead Road as well as possible HOT lane projects noted for I-45 North and South.

Over the last 15 years or so, there has been a very wide range of success on HOV lanes in the United States. Some HOV lanes have been so successful that they became overloaded, requiring the operating agencies to increase occupancy requirements. Conversely, many HOV lanes have experienced substantially less use than anticipated. Among the best known of these cases is the perceived underutilization of HOV lanes that led to the decommissioning of the lanes in northern New Jersey. That action stemmed from political pressure generated by strong attacks from the press and from a public concern about perceived "empty" HOV lanes in the peak periods while adjacent regular lanes were severely congested.

HOT lanes use price to manage demand. In essence, peak period pricing creates an additional category of eligibility: vehicles with a certain minimum occupancy plus those paying a toll. This allows for more fine tuning of HOV lane eligibility because tolls can be varied to find the appropriate price to generate only sufficient additional demand to utilize any spare capacity. Allowing single occupant vehicles paying a toll to join the toll-free HOVs resulted in substantial improvement in the use of the HOV lanes. In Houston, the HOV lane on I-10 (Katy Freeway) had experienced over-utilization as an HOV-2 eligible facility, and had become congested.

Consequently, the eligibility criterion was raised to HOV-3 in the peak hours. However, the HOV-3 criterion severely limited the number of vehicles that could use the HOV lane, resulting in underutilization of the lane. Pricing of HOV-2 vehicles was used as a means to allow a controllable number of HOV-2s back into the lane.

Variable Tolls on Toll Facilities

In this form of pricing, tolls on congested toll facilities are varied by time of day with the intention of encouraging some travelers to use the facility during less congested periods or shift to other modes or routes. Any shift of travelers will benefit the remaining peak period travelers since travel delays will decrease. Ultimately, such shifts will result in less need for additional capacity on the toll facilities.

Travel time savings due to reduced congestion and anticipated environmental benefits have been major attractions. Other potential benefits include:

- Reduced frustration and delay
- Increased travel choices
- More efficient modal choices
- Revenue generation
- Increased economic productivity
- Improved highway investment decisions

The Appendixes and Chapters of the 2025 Plan

The RTP has many elements that evolved together, and in some cases independently. These elements, contained in the appendixes, available under separate cover, include many different disciplines covering a multitude of subjects endowing with a wealth of background and an abundance of documentation. This portion of the RTP identifies and briefly summarizes this information. They are:

Appendix A: **Analysis**-analytical foundation of the RTP

Appendix B: **Summary of Recommendations**-an assessment of needs

Appendix C: **Special Topics**-other important transportation issues, and

Appendix D: **Setting Regional Priorities** -federal mandates of the RTP

Appendix E: **Air Quality Conformity**

The summary of the appendixes are only intended to give a brief synopsis of their contents. Please refer to the actual appendix for a full discussion of the respective topic.

Analysis - Appendix A

Chapters:

1. 2025 Regional Growth Forecast
2. Systems Evaluation
3. Regional Travel Patterns
4. Corridor Summaries
5. Preservation, Maintenance and Rehabilitation
6. Travel Forecasting Procedures

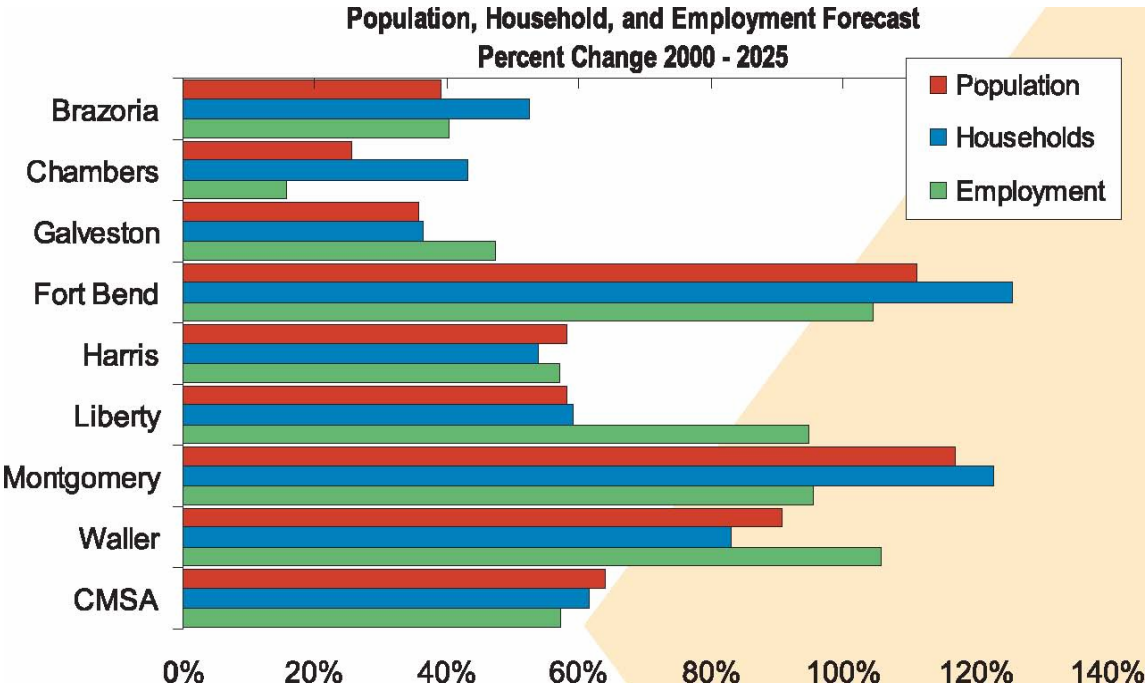
Analysis - Appendix A
Chapter 1: 2025 Regional Growth Forecast

The region is expected to grow by another three million people, reaching a population of more than 7.6 million in 2025. H-GAC developed two forecast scenarios. The moderate scenario assumes growth that parallels the economic trends of the 1990s, and the aggressive scenario assumes increased growth in the regions' energy sector. H-GAC is using the aggressive scenario for creating the RTP.

According to the aggressive scenario, by the year 2025, the Houston-Galveston metro area will add:

- 1.3 million new jobs
- 3 million new people and
- 1 million new households

Figure 34



In terms of population, the region in the base analysis year 2000 was the country's tenth largest, with over 4.6 million persons. With an additional 3 million persons, the region will have a population comparable to the current size of Washington D.C., or the San Francisco metropolitan areas. The forecast predicts growth in urbanized areas spurred by redevelopment, and continued new development in suburban areas.

For employment patterns, the population increase has the effect that all areas within the region will increase in employment, but traditional major activity centers, such as the Houston Central Business District (CBD) or the Uptown/Galleria area will grow less quickly. Currently 41 percent of the employment is located in one of the four major activity centers, CBD, the Medical Center, Greenway Plaza and Uptown/Galleria. However, by 2025, only 35 percent of the jobs will be located in these established areas. This means that employment is dispersing. For example, while CBD is projected to experience a 16 percent employment increase, other well-established major activity centers are expected to grow by 25 percent. Areas outside Beltway 8 are expected to see 50 percent increases in employment.

This forecast represents H-GAC's first attempt at using two new modeling resources for making small-area population projections. The first resource is a regional econometric model acquired from Regional Economic Models, Inc. (REMI). REMI is a nationally established model that

considers the economic interaction between the region as a whole and the rest of the nation. REMI also considers how each county's demographic profile will change over time.

The second resource is the UrbanSim model, developed by the Center for Urban Simulation and Policy Analysis at the University of Washington. UrbanSim is designed to help metropolitan areas study interactions between land use and the transportation network.

Analysis- Appendix A

Chapter 2: Systems Evaluation

This chapter analyses the results of various measures used to describe the effectiveness of the region's transportation system as it exists today and as it is planned for the future. It uses a variety of measures to assess the ability of the current and future regional roadway and transit system's ability to meet forecasted travel demand.

The Texas Transportation Institute (TTI) index shows that the level of congestion in Houston has been fairly flat and comparable to several other very large metropolitan areas, such as Dallas/Ft. Worth and Philadelphia, Pennsylvania. Although the Houston area has implemented projects and programs that have had a beneficial impact, more effort is needed to maintain mobility improvements and to optimize all of the strategies outlined in the 2025 RTP.

The Transit Choice Ratio (TCR) measures the relative availability of transit as an alternate mode of travel. According to the ratio, the Houston region lags behind several other regions of similar size. This lag is due in part to higher-density population areas in eastern Harris County which opted out of the referendum to extend transit services to them in the late 1970s.

The Level of Mobility (LOM) analysis measures the level of congestion of regional freeway and arterial roadway systems. The LOM was developed to graphically illustrate the degree of congestion on roadways within the region. As the graph below shows, tolerable levels of mobility will increase by 2025, while very serious congestion levels will decrease, if the 2025 RTP is implemented.

Another way to measure regional accessibility to downtown Houston by automobile is by the peak travel time contours. According to Census Bureau estimates, the mean (weighted average) perceived travel time to work in Harris County increased from about 26 minutes in 1990 to 28 minutes in 2000. For both years those values are about 3-4 minutes higher (i.e., travel times are longer) than the mean travel time to work for the state of Texas. Travel times to downtown can be depicted as contours based on average travel times. The following figure shows that most areas, once all projects contained in the 2025 RTP are built, will have similar travel times to downtown; while some areas, such as the SH 290 corridor, will improve their access.

For users of transit, the future is mixed. Compared to today, the number of people that will have access to the CBD by transit within 30-60 minutes will decrease for patrons walking to local and express bus routes. Accessibility will improve for those able to drive to access the park and ride system, primarily because of travel-time savings by using high-occupancy vehicle (HOV) lanes. Implementing the METRO Solutions 2025 Transit Plan will have beneficial impacts for those transit users in the City of Houston and most of Harris County, (except eastern Harris County). Transit users in adjacent counties with access to park and ride transit services will experience some improvements is their travel times.

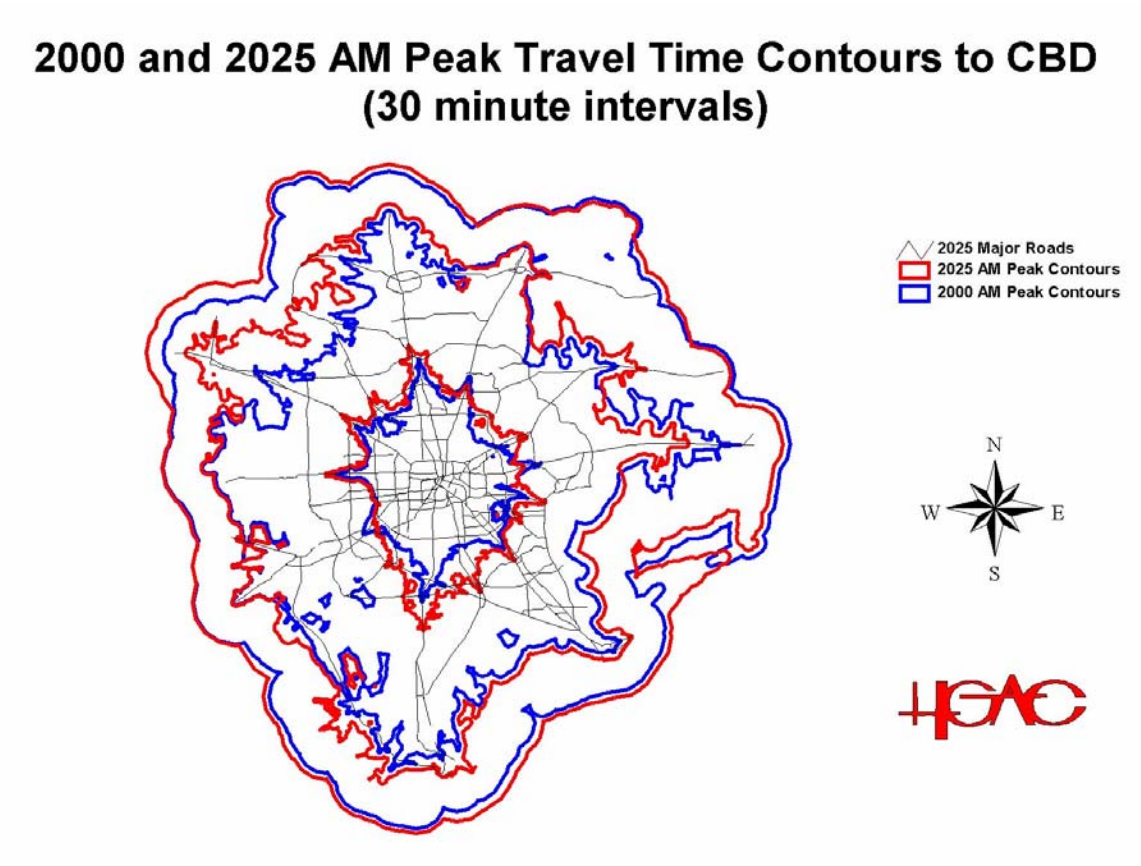
Analysis- Appendix A

Chapter 3: Regional Travel Patterns

This chapter explores two types of predominant regional travel patterns: work commutes to the four major activity centers, and work commutes from suburb to suburb. Information is also presented on other large concentrations of employment in the region that are creating new types of travel patterns.

Historically, the radial roadway and public transit system in Houston, like the hub-and-spokes of a wheel, focused on the (CBD) as the primary work trip destination. This system has been supplemented with a series of loop freeways that facilitate cross-town travel without going through the downtown/CBD hub.

Figure 35

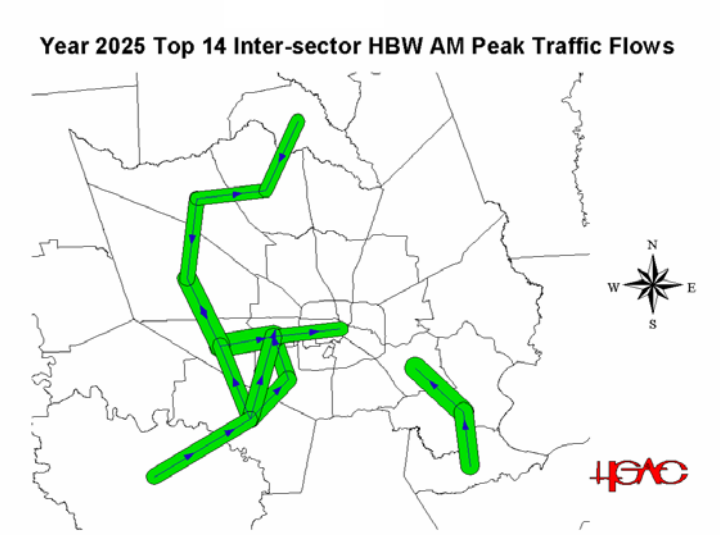


While the commute to downtown will continue to be the largest single type of commute, its predominance will shrink by 2025. The decentralized development pattern that has emerged in Houston since the 1960s has contributed to an enlarged urbanized area that is now characterized by multiple major employment centers, employment corridors, and other activity districts outside of the CBD. In addition, large residential developments outside of the IH 610 Loop coupled with employment growth in the same areas, have resulted in more localized travel, reverse commutes, and suburb-to-suburb travel patterns.

The dominant (highest volume) peak-period travel patterns indicate that large numbers of travelers are making the suburb-to-suburb commutes to and from work on a daily basis and those

volumes will increase along with the complexity of those movements in the future.

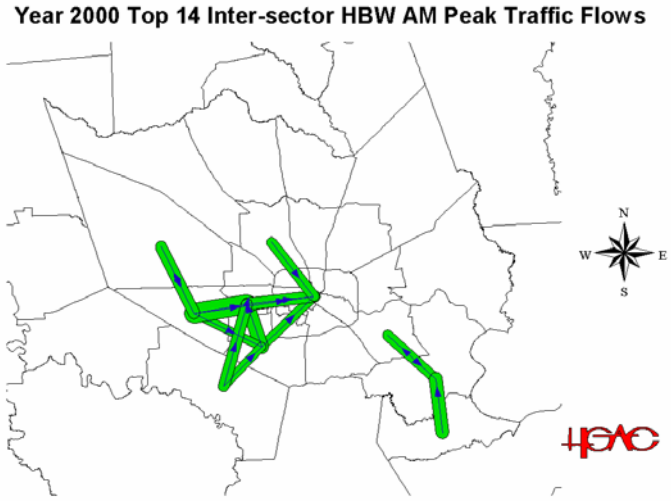
Figure 36



In the future, it is projected that a greater percentage of travel will move directly between the suburbs, rather than between the suburbs and the major activity centers. There will be a quantitative shift of trips outward towards the suburbs and an increasing complexity of travel patterns defined by a multitude of trip links. Travel will be less focused along the major freeways, but will become increasingly complex. This process will take a long time, but it is important that we anticipate these changes.

A second trend is that travel will shift slowly away from the major freeway corridors. There will be a need to provide more travel routes for the areas between the freeways. There will also be a need to provide more alternatives in terms of both routes and travel modes. Transit service, which is almost non-existent outside of Harris County, will need to be provided for the growing suburban populations. These types of improvements (and more) will be needed to meet the growing complexity of travel that will occur in the region.

Figure 37



Analysis- Appendix A

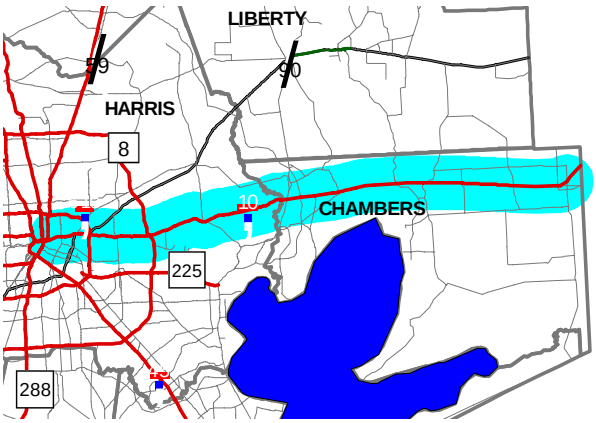
Chapter 4: Corridor Summaries

The corridor studies are a detailed overview of the twenty-one corridors and the four major activity centers in the Houston metropolitan region. This information is standardized for each corridor and activity center, so that comparisons between the corridors can easily be made. Used principally as a reference and planning guide, the studies provide the following descriptions:

- overview describing the physical location and boundaries
- regional map (I-10 East is shown as an example) showing the regional context
- land use identifying employment and residential areas
- major trip generators and attractors

- transit services available on the corridor
- demographics for 2000 and 2025 listing employment and population within the area
- traffic analysis describing current and future congestions levels
- safety problems in the area as related to traffic; and
- TIP/planned long-range infrastructural improvement projects

Figure 38 **I-10 East Corridor**



Each summary is intended as a stand-alone description, and can be used to make comparisons across corridors, as well as identify specific elements or information within the corridors.

Analysis- Appendix A

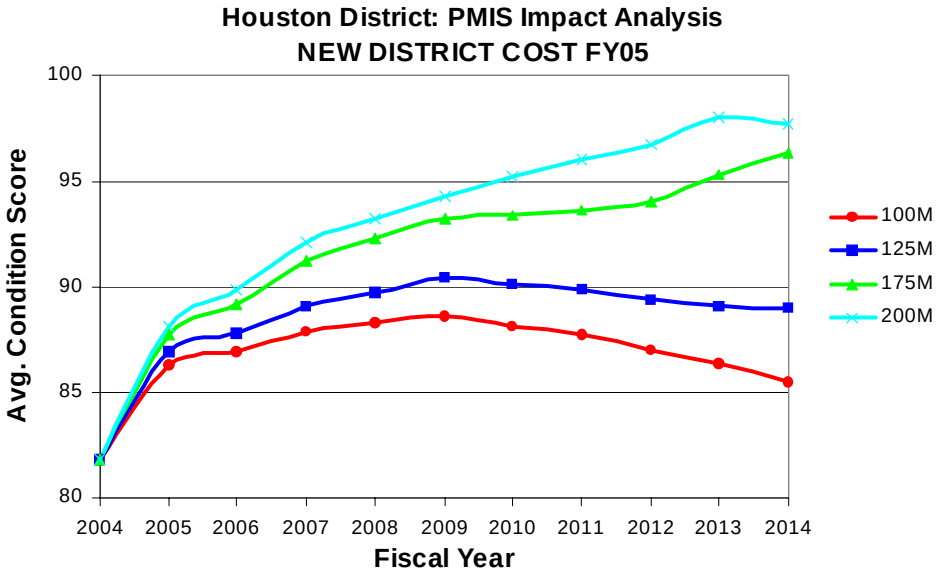
Chapter 5: Preservation, Maintenance and Rehabilitation

National transportation policy has prioritized the need to maintain existing infrastructure for more than a decade. In the context of shrinking resources for new facilities and aging transportation systems it is imperative for regional transportation plans (like the 2025 RTP) to prioritize activities that preserve and maintain the current systems.

Preservation maintenance and rehabilitation (PM&R) is the process of maintaining infrastructure, whether it is roadways, traffic signals, lighting, buses and rail cars, or airport and port facilities. It is a continual and major activity that is required to keep the transportation system functioning. Typically, bridges last 30-40 years; freeways last 20-30 years; and arterials last 20 to 30 years. In addition, preventive maintenance (essentially, repaving a road) is typically implemented every 7-10 years while routine maintenance is an on-going activity.

Over the years, TxDOT and other municipalities have become increasingly proactive in the maintenance and rehabilitation of existing roadway infrastructure. The Pavement Management Information System (PMIS) is the primary system currently being utilized by TxDOT to program, budget, schedule, and prioritize preventive maintenance and other life extension activities for existing roadway facilities. TxDOT reports on the condition of Texas pavements in an annual report. The report provides pavement ratings and/or scores on a county level basis and performs a needs estimate analysis.

Figure 39



In August 2001, the Texas Transportation Commission set a goal to have 90 percent of Texas pavement lane miles in "Good or better" condition by 2011. "Good or better" was defined as a PMIS Condition score of 70 or above. To evaluate fulfillment of this goal, TxDOT- Houston staff ran four different modeling scenarios, each having increasingly higher yearly pavement budgets, for a ten year period, with a starting PMIS Condition score of 82. The preliminary results depicted in the figure above, show that at least $ 175 M per year would be needed in the Houston District to meet the statewide PMIS Condition goal.

Although $ 234 M is programmed for 2005, approximately $48 M in expenditures are allocated for non-pavement items such as ITS, traffic system and mobility, and $58 M is allocated for bridge and railroad grade separations, leaving $128 M for pavement related items. Thus, the region can only expect to receive approximately 73% ($128/$175) of actual pavement maintenance expenditure need. Details are presented in Appendix A, Chapter 5: Preservation, Maintenance and Rehabilitation.

Analysis- Appendix A

Chapter 6: Travel Forecasting Procedures

Land Use and Demographic forecasts for the TMA are developed by H-GAC. Under 1990 geography (census related), H-GAC has designated 2,680 detailed traffic analysis zones (TAZs) in the Houston-Galveston TMA. This includes 2,634 internal zones and 46 external stations.

The Houston-Galveston Regional Travel Models are cooperatively developed and maintained by H-GAC, TxDOT and METRO. The regional travel models were applied in a unique version of the traditional four step process of trip generation, trip distribution, mode choice, and assignment. H-GAC develops person trip tables by purpose (i.e. trip generation and trip distribution) and provides them to METRO who then performs mode choice analysis and

estimates transit patronage. METRO then provides H-GAC with the transit patronage estimates. H-GAC develops highway vehicle trip tables using the same person trip tables input to mode choice and the transit patronage estimates and using the vehicle trip tables, estimate highway usage.

Two key sets of data are input to the model: (demographic, socioeconomic, land use information); and (the multimodal transportation network level-of-service (LOS) data). In the first stage of the modeling process--trip generation--estimates are developed for eight trip purposes:

- Home-based work person trips
- Home-based school person trips
- Home-based shopping person trips
- Home-based other person trips
- Non-home-based person trips
- Truck and taxi vehicle trips
- External-local vehicle trips
- External-through vehicle trips

The primary strategy for the trip attraction model is to determine the relationship between district-level trip attractions and the land use variables using linear regression. These relationships are standard, between work attractions and employment and between shopping attractions and retail employment.

The H-GAC trip production model rates were developed from a set of three-way cross classification models using household size, household income, and vehicle availability which were subsequently combined to yield a two-way cross classification model of household size by household income.

The trip production model determines the relationship between trips generated per household and household income in combination with household size. Thus, trip production rates are stratified by household income and household size for each trip purpose.

The trip distribution models are applied at the detailed TAZ level. These models link or connect trip ends estimated in the trip generation model, determining trip interchanges between each pair of zones. In addition to estimates of the magnitude of activity in each TAZ, the models consider the effects of impedance and accessibility on destination choice. The trip distribution models receive direct feedback from trip assignment, a lower model component.

Mode Choice models are mathematical expressions used to estimate travel market modal shares given various competing mode's time and cost characteristics and the urban resident's demographic and socio-economic characteristics. Mode choice models predict traveler's decisions to choose a particular mode of travel and are designed to be an integral link in the travel demand chain, with *possible* direct feedback mechanisms to a number of related model components -- auto ownership, trip generation, and trip distribution.

Summary of Recommendations - Appendix B

Chapters:

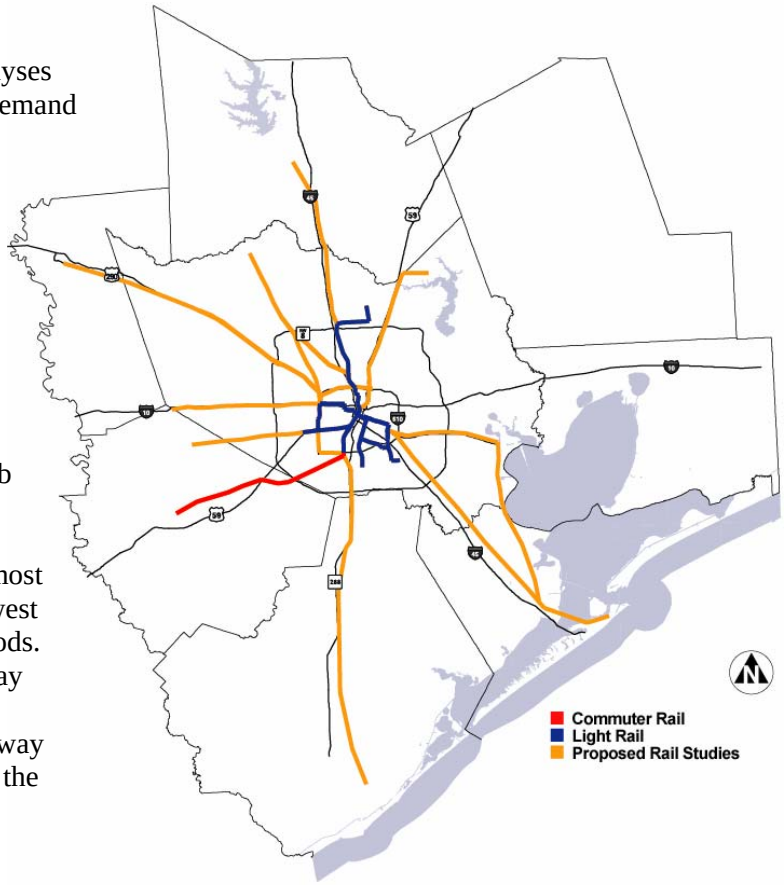
1. Regional Transportation Needs Analysis
2. Operations Management
3. Freight and Goods Movement
4. Bicycle and Pedestrian Plan

Summary of Recommendations - Appendix B
Chapter 1: Regional Transportation Needs Analysis

H-GAC initiated a Regional Transportation Needs Assessment (RTNA) process to augment the standard call for projects from stakeholder agencies in the region. During the call for projects, transportation agencies and their jurisdictions submitted projects for inclusion in the regional plan, and the MPO staff prioritized those projects for funding. Additional sources of information helped create the RTNA, including public input from various sources, roadway system deficiency analyses, and transit system service analyses.

Figure 9

Regional Transit Rail System Conceptual Plan



The roadway system deficiency analyses are based on projected 2025 travel demand on the planned 2022 MTP roadway facilities. This analysis considered the regional freeway and arterial roadway systems with serious and severe levels of congestion measured by Level of Mobility (LOM).

A second roadway deficiency analysis was based on historical speed profiles from the Transtar Web site for major freeway segments during peak travel periods in 2002. That data indicates the 10 worst or most deficient locations based on the slowest average speeds during the peak periods. Further analyses of projected roadway system congestion levels have also identified more added capacity roadway projects that are warranted based on the travel demand. This information is included in Appendix C, Chapter 3:

Unfunded Needs.

Currently there are eight transit agencies and social service providers serving the region. These services include traditional fixed-route busses, trolleys and light rail, express commuter busses running on dedicated high-occupancy vehicle (HOV) lanes operating on the Southwest, Gulf, Katy, North, Eastex and Northwest freeways.

Beyond METRO Solutions, H-GAC estimates that 1.5 million people live in high-density areas outside the METRO service area. Less densely developed areas in the region also have noticeable gaps in service coverage. H-GAC also identified communities that have individuals with special transit needs. This information is used to recommend service expansion to member transit agencies and service providers.

The Needs-Based Analysis Transit Plan explores the impact on the transportation system of extending rail lines beyond METRO Solutions, particularly along the major corridors. Several commuter lines appear to offer the potential for sizeable transit volume, among which are an SH 225-SH 146 (Harbor) line, an U.S. 59 East (Kingwood) line, an I-45 North (North) line, and an I-10 West (Katy) line. Expanding the transit system (bus and rail) beyond the current Metro Solutions Plan has the potential for absorbing VMT along particular corridors.

Transit coverage in the broader region outside of the METRO service area requires further examination. Options include: expanding the METRO service area to include other areas and jurisdictions; setting up alternative public transit agencies to cover areas outside of the METRO service area; having local jurisdictions fund private transit services; or creating an alternative region-wide transit agency. H-GAC is looking at a variety of alternatives for providing transit service to the broader region.

Commuter and light rail services were analyzed and tested for potential ridership in major travel corridors throughout the region. Including: U.S. 290, U.S. 90A, SH 249, SH 225, SH 146, U.S. 59 North, SH 3, SH 288, I 45 South. Extensions to the METRO Solutions light rail corridors were examined in the I-10 West, I-45 North and Westpark corridors. The feasibility of these commuter rail routes will be studied in more depth for future RTP refinements. Any adoption of a regional transit service plan is contingent on the substantial commitment of cost share by local governments.

Summary of Recommendations - Appendix B

Chapter 2: Operations Management

The goal of operations management is to use the transportation network as efficiently as possible by optimizing its operations. Efficient operation is a major factor in mitigating congestion. Operations management provides viable alternatives to the region's transportation investment by maximizing resources and potentially reducing the need for additional freeways or tollways.

Operations management is composed of several tools or procedures. Some of the more common tools are traffic signal timing, access management; and corridor management. H-GAC is also working on implementing other technologies that help manage traffic flow: Smart Streets, Federal Intelligent Transportation System Priority Corridor, and Regional Computerized Traffic Signal System (RCTSS).

By improving traffic flows on major thoroughfares, the intrusion of through traffic through neighborhoods and adjacent land uses is reduced, while potentially providing some relief to major freeway corridors. These facilities also have improved landscaping to blend seamlessly into existing neighborhoods. Some Smart Streets may also have through and local lanes.

Figure 40

From a functional standpoint, Smart Streets will benefit the surrounding roadways, including interstates and state highways, by providing additional regional connectivity. Implementation may require the addition of travel lanes in some areas within current rights-of-way. H-GAC believes that the greatest mobility improvements are realized through the application of traffic and access management techniques.

The systems collectively referred to as the Regional Computerized Traffic Signal System (RCTSS) improve traffic operations and can reduce vehicle idling time and lessen stop-and-go conditions on major thoroughfares. RCTSS components include:

- State of the art traffic signal controllers with vehicle and incident detection Signal synchronization
- Priority movement for transit and emergency vehicles
- Improvements to intersection turn lanes

Summary of Recommendations - Appendix B
Chapter 3: Freight and Goods Movement

Planning for the efficient movement of freight is a goal of the 2025 RTP. Various strategies to address problems with the movement of freight are being evaluated and implemented. For example, a policy restricting trucks to certain lanes on an 8-mile stretch of I-10 East was evaluated by the Texas Transportation Institute. After implementing the lane restrictions, there was a 68 percent reduction of crashes along the test section of the corridor. Other strategies include an Intermodal Congestion Quick Response Team that responds to congestion problems identified by the goods movement industry.

According to the statewide transportation plan, the percentage of trucks on major roadways in 2000 in the region was 11.3 percent of total traffic, on average, with more than 30 percent of truck trips on I-10 east of Houston. By 2025, the percentage of trucks on major roadways in and around Houston will increase to 13.6 percent, on average, with some roads carrying as many as 36 percent trucks.

Summary of Recommendations - Appendix B
Chapter 4: Bicycle and Pedestrian Plan

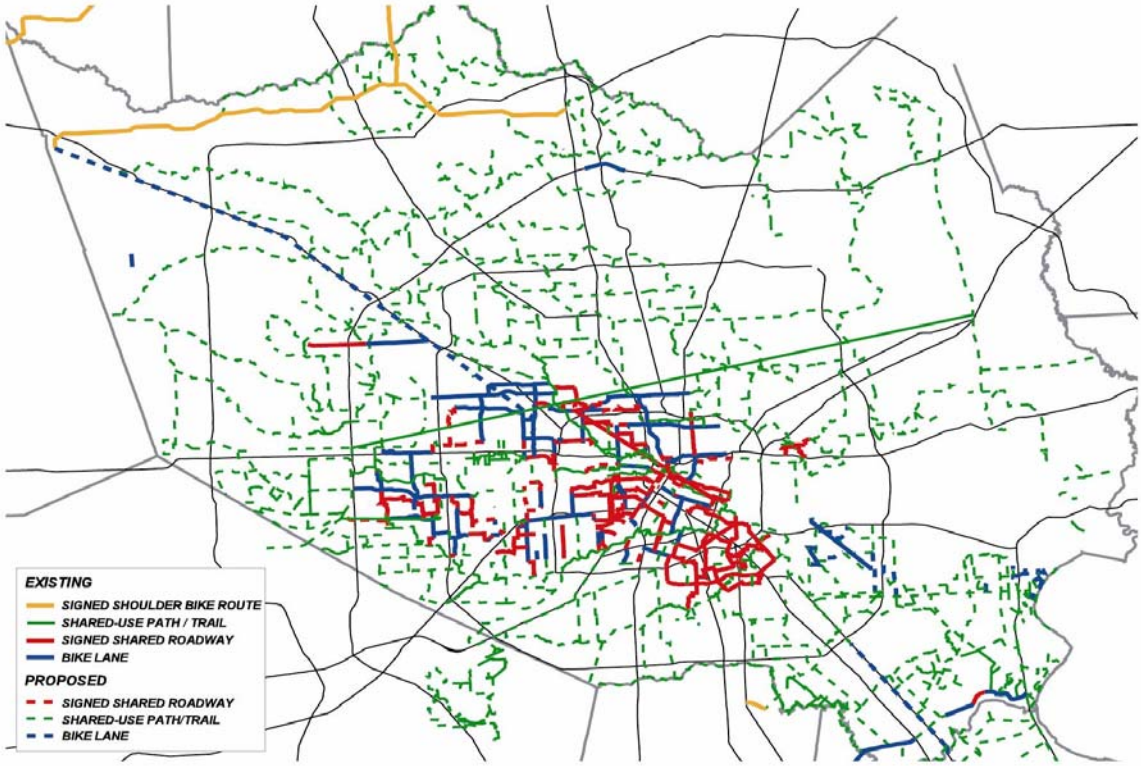
Increasing the share of trips made on foot or by bicycle will offer congestion relief, reduced pollution, improved public health and “quality of life” benefits. However, the conversion of a significant number of automobile trips to non-motorized modes will require changes in travel behaviors, land use patterns, and the way that pedestrian and bicycle facilities are planned, designed and maintained.

The safety of the facilities is fundamental to their being used. The region currently has a very high incidence of pedestrian and bicycle crashes with motor vehicles (see Appendix C, Chapter 1: Safety). Adequate lane widths and appropriate design of intersections, crosswalks, medians, driveways, storm grates and roadway seams are also important elements of a non-motorized travel system. The combination of good design, regular maintenance, and effective education measures can allow automobiles, pedestrians and bicycles to coexist with a much higher level of safety.

H-GAC has updated its Regional Bikeway Plan for the first time since 1998. This plan includes major on- and off-street bicycles and other non-motorized modes, plus bicycle/shared use facilities identified in the preferred alternatives of Major Investment Studies. However, the region's overall system of pedestrian and bicycle facilities still has many gaps, as well as inconsistencies in design and level of maintenance.

Figure 41

Existing and Proposed Bicycle Facilities in and Around Harris County



Roadway project sponsors should consult the *Regional Bikeway Plan*, as well as any local bikeway plan(s), to determine whether their project limits include any designated on-street bikeways and provide appropriate accommodation to ensure system continuity. As part of the RTP, H-GAC has also developed a set of *Guidelines for Accommodating Pedestrians and Bicyclists*. Project sponsors should consult these guidelines, as well as the AASHTO Guide for the Development of Bicycle Facilities, in determining appropriate on- and off-street accommodations for pedestrians and bicyclists on various types of roadways, bridges/overpasses and major intersections. H-GAC has updated its Regional Bikeway Plan. These TxDOT and local government projects include major on- and off-street bicycle and other non-motorized modes facilities plus bicycle/shared use facilities identified in the preferred alternatives of Major Investment Studies. However, the regions overall system of pedestrian and bicycle facilities still has many gaps, as well as inconsistencies in design and level of maintenance.

In 2003, H-GAC performed a Pedestrian and Bicycle Special Districts Study to establish a basis for developing and evaluating future bicycle and pedestrian improvements within the 8-county region. Potential generators of pedestrian and bicycle activity, such as educational institutions,

parks, schools, METRO transit centers and park and ride stations were developed. Indicators, such as population density, age, income, education, trip attractions, land use and employment diversity, and balance of jobs and housing, were analyzed to produce a list of top candidate districts. The top scoring districts, all within Harris and Galveston Counties, are shown in maps below.

Figure 42

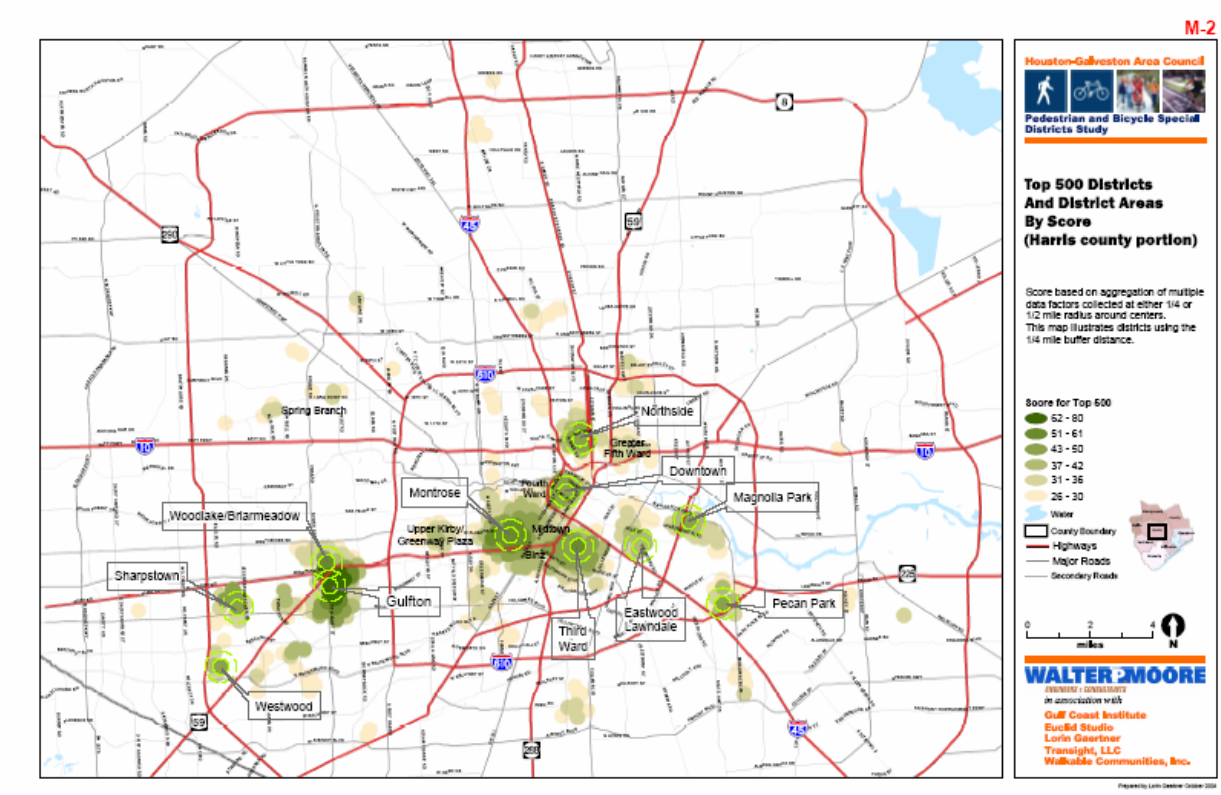
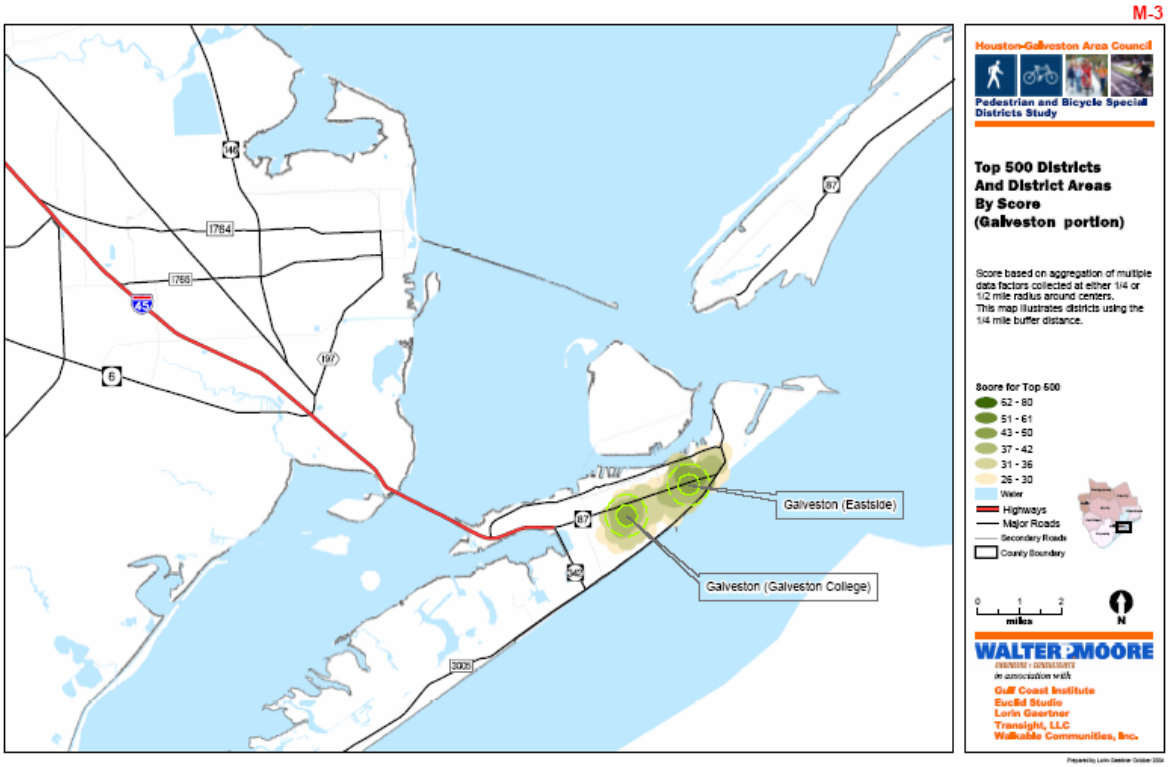


Figure 43



H-GAC is working with local project sponsors to develop comprehensive plans for improving walking and bicycling conditions in these districts. Specific improvements within these pedestrian-bicycle districts include new segments of sidewalk, American Disability Act compliant sidewalks, bicycle parking, pedestrian signal heads and signal activation. A total of $18 million funding in the 2025 RTP is dedicated towards strategic investments to improve walking and bicycling conditions within these special districts.

Special Topics – Appendix C

Chapters:

1. Safety
2. Transportation and Land Use
3. Public Involvement and Outreach
4. Environmental Justice

Special Topics – Appendix C

Chapter 1: Safety

The Houston region has the worst safety record in the State of Texas. From 1998 to 2000, there were 243,616 serious crashes in the eight county region involving 1,616 fatal crashes and 158,395 injury crashes. In these crashes, 1,793 persons were killed and 274,926 were injured. Furthermore, the 243,616 serious crashes represented 25.9 percent of the state's serious crashes. The injuries were 27 percent of the state's total injuries from motor vehicle crashes and 16.5 percent of the state total fatalities. There were more crashes in the eight-county Houston-Galveston region than in the sixteen-county Dallas-Fort Worth region (where there were 221,701 serious crashes).

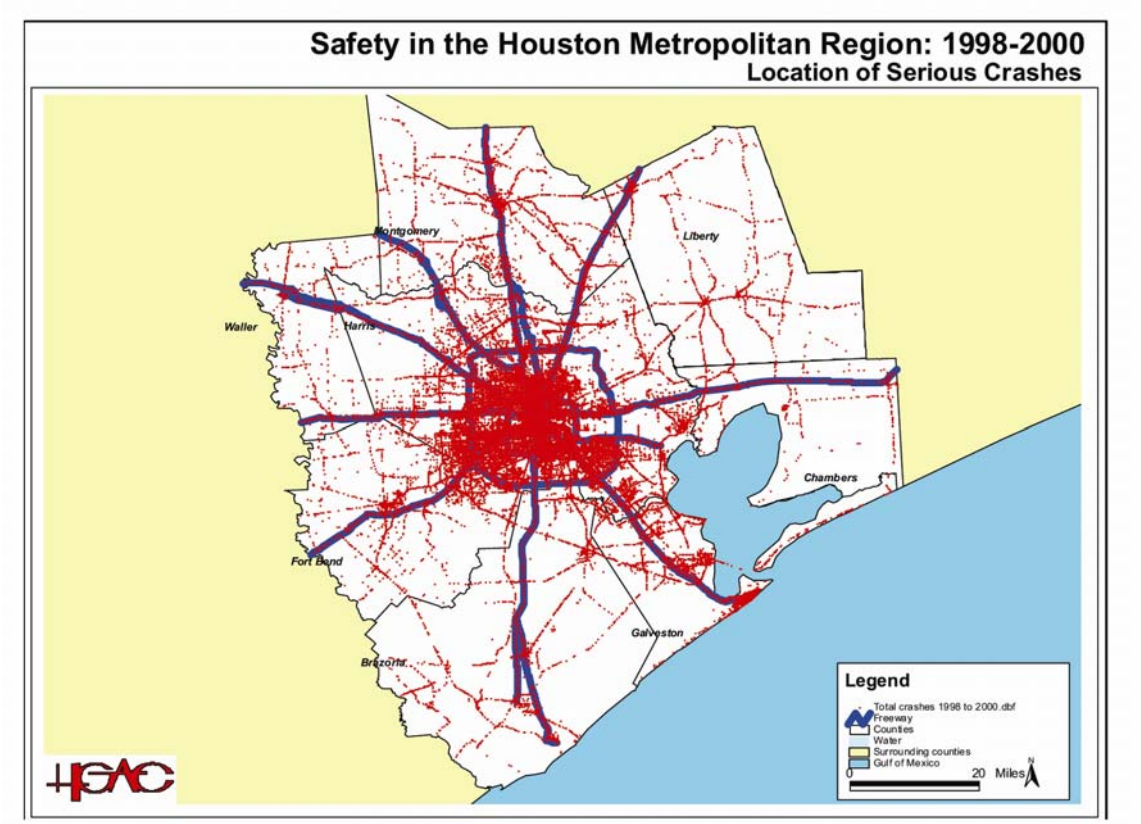
Speeding is the single most important driver error, a factor in (39 %) of all crashes. Red-light running and driving while intoxicated or under the influence of drugs are also major driver errors, being involved in 8 and 7 percent of all crashes respectively. Other types of common driving errors include failing to yield to another vehicle (20%), failing to stop at a signal or stop sign (11%), and following too close (3%). Teenagers, ages 16-19, have a particularly high incidence, being involved in 21 percent of all serious crashes in the region.

H-GAC is developing a long-term safety plan that will significantly improve safety on the road system. H-GAC has identified 344 hot spot locations that account for about 20% of all crashes in the region. Without a detailed engineering study, the actual costs of mitigation cannot be calculated. However, as a rough estimate, on the assumption that each hot spot would cost on average $500,000 to mitigate, the total costs would be around $172 million. The benefits would derive from the number of crashes reduced. On the assumption that mitigating each hot spot would reduce the total number of crashes at that location by 20% (again, some more and some less), it was estimated that there would be 39 fewer fatal crashes, 6,767 fewer injury crashes, and 3,065 fewer serious property damage only crashes. Using the National Safety Council methodology of estimating comprehensive costs and assuming that the distribution of fatalities and injuries for the crashes at these locations follows the same distribution as for all crashes, the approximate *annual* benefits were estimated as $123 million.

Note that the annual benefit expected from improving hot spots, which would reduce the number of victims by more than 5,000 per year, almost cover the total mitigating costs. Based on these

estimates, the benefits would pay for the costs of mitigation within a year and a half. In addition, there would be cumulative benefits for many years thereafter-5,000 fewer victims each year, fewer medical costs, less pressure on emergency services, and less pressure on insurance rates (which are among the highest in the country).

Figure 44



Special Topics – Appendix C

Chapter 2: Transportation and Land Use

Transportation planners are aware that land use patterns-both at local and regional levels-significantly affect congestion and mobility patterns, but often have few opportunities to coordinate transportation goals and land development policies and practices. The resulting mismatch often creates congestion and decreased mobility levels that might have otherwise been avoided. This chapter analyzes the effects that various regional development scenarios have on congestion and mobility, and offers suggestions and recommendations on how local jurisdictions can encourage closer integration between land use and transportation planning.

The main reason for examining this interaction is to find other, less expensive ways to resolve the region's congestion and mobility problems. Projections show that substantially more roadway/railway capacity projects beyond those listed in this RTP are going to be needed by 2025 to maintain the levels of mobility that are experienced today. Therefore, understanding how current land use practices and paradigms incur travel demand are first steps in finding ways to reduce travel demand, and, ultimately, the expense in maintaining acceptable mobility levels.

H-GAC developed five different scenarios that modeled different land use patterns and transportation network scenarios. These scenarios were contrasted with a baseline of the expected distribution of population and employment. The differences between these scenarios and the baseline reveal how alternate regional development patterns increase or decrease mobility and congestion on the transportation network. The scenarios examined no additional rail; transit-oriented development in conjunction with a full-fledged rail network; no flood-plain development; concentrating employment in existing employment centers; and dispersing employment from existing centers.

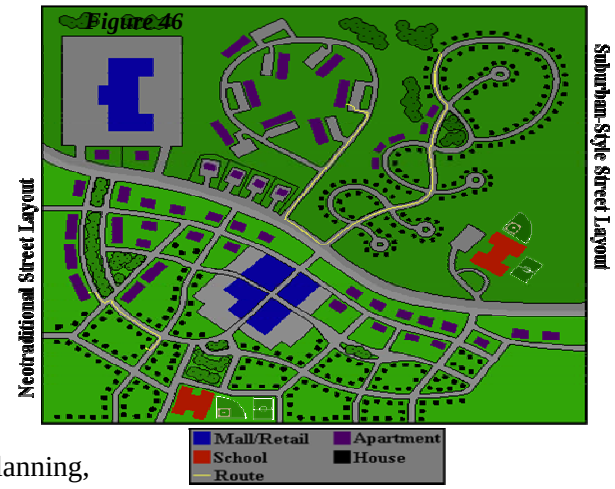
The results from examining alternate regional development patterns were as follows:

Figure 45

Scenario/ Effect	No Additional Rail	Transit-Oriented Development	No Flood Plain	Employment Concentration	Employment Dispersion
VMT	+	+/-	+	+	+/-
Transit	-	+	+	+	-
Auto	+	+/-	-	-	+
Mobility	-	+	+	+	+/-

Key: + = increase - = decrease +/- = no change or mixed results; VMT = Vehicle Miles Traveled in the Afternoon Peak Period

Equally important to regional mobility is the method of how local land uses are connected to and accessed by the roadway network. For example, the number of driveways on a heavily-traveled arterial roadway can significantly affect its level of congestion. Similarly, while insular suburban street patterns with limited points of entry have lower crash rates than grid street patterns, allowing even modest increases in street connectivity can significantly reduce congestion by reducing the demand on collector and arterial streets. On the local scale, there are several policies that local jurisdictions can employ that would help integrate transportation and land use planning, including:



Source: DPZ Architects and Town Planners

- improving access management-consolidate driveways on arterials, improve intersections, and raise medians
- improving connectivity-in subdivision street layouts to enhance opportunities for walking, bicycling and transit, and give more access points to the neighborhood (see figure at right)
- closing arterial gaps
- using pedestrian-scales, context-sensitive designs
- creating town/village centers
- increasing densities/support urban cores/offer more transportation choices

Special Topics – Appendix C
Chapter 3: Public Involvement and Outreach

H-GAC's Transportation Public Involvement Plan (TPIP) provides for a structured and ongoing process for public involvement and outreach in compliance with federal regulations. Public involvement efforts include meetings conducted in all eight counties within the region as well as an official public comment period.

H-GAC's TPIP focuses on four areas: public education, public outreach, citizen participation, and new strategies for public involvement. For its public education campaign the TPIP calls for the development of educational materials that support a cooperative planning process, and that describe regional transportation and related air quality plans and activities in a concise and straightforward manner. These materials are geared to demonstrate how transportation plans are affected by federal clean air mandates and how the failure to meet these mandates will affect the region economically.

To help increase awareness of and interest in transportation plans and the transportation planning process the TPIP calls for the use of a variety of innovative approaches. To encourage public participation in transportation planning activities at every level the TPIP calls for providing frequent opportunities to participate in the development of H-GAC transportation plan for the general public and interested parties from the private business community, the public sector, environmental interests, neighborhood organizations, the disabled, and other groups impacted by transportation plans.

During the development of the 2025 RTP, the public had a variety of opportunities to comment on the RTP, including emails, letters, faxes, speaking at public meetings, and completing formal or informal public opinion surveys. Two surveys were conducted during Phase I of the 2025 RTP development and a third survey was mailed during Phase II of the 2025 RTP development.

Special Topics – Appendix C
Chapter 4: Environmental Justice

H-GAC has taken steps in the preparation of the RTP with respect to the federally mandated guidelines of the *Executive Order 12898: Federal Actions to Address Environmental Justice (EJ) in Minority Populations and Low-Income Populations*. The goals of this executive order are to ensure that minority and low-income groups are properly represented and fully considered in all matters related to the RTP, transportation, and mobility.

To meet these requirements H-GAC commissioned a series of consumer focus groups, community roundtable discussions, and in-depth interviews with community leaders on Environmental Justice in 2000. All research was qualitative and designed to get a better understanding of environmental, transportation and safety concerns from poverty-level residents in the region. Findings include:

- Ethnic subgroups vary and need to be addresses in unique ways to effectively reach them
- Low-income and ethnic subgroups are underserved with respect to adequate transportation
- The current public transportation system could be enhanced to include areas like neighborhoods and small communities that are currently circumvented
- There are many safety issues associated with the current disrepair of the roads in the area

H-GAC is also conducting research to determine if certain segments of the population experience longer travel times to major activity centers (MACs) than other segments of the population. The purpose of the analysis is to determine equity in accessibility to the transportation system. Some of the affected groups include zero auto households, low-income households, and census tracts populated with large numbers of minorities.

H-GAC achieved the goal of an inclusive public outreach plan by conducting a series of community dialogues to receive public input specifically regarding the 2025 Draft RTP for the eight-county region. Community dialogues began in late May 2003 and continued through November 2003. Community dialogues were held in the East End, Kashmere/Fifth Ward, Pasadena, Third Ward and Southwest Houston (Chinese Community School). The photo to the

right illustrates the need for equitable transportation improvements in EJ targeted areas.

Setting Regional Priorities – Appendix D

Chapters:

1. Project Prioritization Process
2. Project Listing
3. Unfunded Needs
4. Financial Plan

Setting Regional Priorities – Appendix D

Chapter 1 - Project Prioritization Process

The transportation projects included in the 2025 RTP go through a ranking and prioritization process. This process is based in part on federally-required factors, and on local considerations. The intent of the scoring system is to prioritize projects for the RTP. The scoring system is one way to rank the projects within the projected financial revenues. The rank and scores are not a commitment to funding; they are a means for determining what types of transportation improvements are financially possible over the next 20 years.

The Transportation Efficiency Act for the 21st Century (TEA-21) formulated seven planning factors that were to be addressed in the RTP. The seven factors are:

1. Support the economic vitality of the United States, the States and metropolitan areas, especially by enabling global competitiveness, productivity and efficiency;
2. Increase the safety and security of the transportation system for motorized and non-motorized users;
3. Increase the accessibility and mobility options available to people and freight;
4. Protect and enhance the environment, promote energy conservation and improve quality of life;
5. Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight;
6. Promote efficient system management and operation; and
7. Emphasize the preservation of the existing transportation system.

Using these planning factors and comments received from the general public, H-GAC initiated a

process to translate these factors into specific planning goals and objectives. The Transportation Policy Council (TPC) approved an overall vision for the MPO: ***Enhance mobility by providing an efficient, affordable, safe, and environmentally responsible transportation system for both people and goods.***

This framework links the criteria used to evaluate specific projects for both the RTP and the Transportation Improvement Program (TIP). All projects in the TIP are calculated with the same quantitative data used to develop the scores for the RTP. The TIP analysis then goes beyond quantitative analysis and incorporates more subjective criteria allowing for adjustments to the selection and ranking process. Such qualitative analysis allows transportation planners to address regionally significant impacts resulting from the implementation and development of various projects. These impacts include community and environmental concerns, and land-use impacts, as well as political considerations. Fine tuning the ranking process is ongoing and adjustments to the methodology will continue to be made as new information and measures become available.

The RTP evaluation process includes both quantitative and qualitative criteria for system wide comparisons and for project level prioritization as summarized in the table below. The planning factors account for the other 50 percent of the total score.

Figure 47

RTP GOALS	PLANNING FACTOR	PERFORMANCE MEASURE	PROJECT (P) SYSTEM (S)
1. Safety/Security	1,2	Serious Crash Risk	P
2. Reduce Congestion	1,3,5,6	Travel Time Index, TT Savings	S, P
3. Improve Access	1,3,5	User Benefits, TCR, Travel Times	S
4. Environmental	4	AQ Conformity, Cost/lb reductions	S,P
5. Preservation, Maintenance	1,7	Pavement Condition Rating	P

The goals and objectives were converted into quantifiable measures during a two-year process. H-GAC translated the RTP goals into performance measures which are quantifiable indices allowing candidate projects to be evaluated and monitored.

After the initial test of the measures, the performance measures were further refined. Discussions were held with staff and with H-GAC's Technical Advisory Committee, Transit Stakeholders Committee, Bicycle/Pedestrian Committee, TIP subcommittee and the Operations Task Force. The use of these measures was clarified by combining the actual scoring of the measures with a benefit-cost analysis of the impacts of the project on travel mobility.

Setting Regional Priorities – Appendix D

Chapter 2: Project Listing

As part of H-GAC's continuing, cooperative, and comprehensive regional transportation planning process, local sponsors submit candidate projects to H-GAC for inclusion in the RTP. H-GAC analyzes and ranks all candidate projects for inclusion and selects the most beneficial and regionally significant projects within the RTP's projected financial revenue.

H-GAC evaluates travel needs beyond those identified by local agencies in an effort to identify potential future regional mobility challenges. Travel demand modeling analysis provides an indication of the extent and location of future challenges and H-GAC has proposed potential means for addressing them. The 2025 RTP project list includes H-GAC proposals and identifies the lead agency as TBD (To Be Determined). The projects are a result of planning analysis that identifies facilities where projected volume exceeds capacity. Local sponsors have the option to evaluate these projects and can design and develop them to address the targeted needs of their communities.

Projects receiving federal funding require an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA). The purpose of an EA is to provide sufficient evidence that an Environmental Impact Statement (EIS) is required, or must detail a Finding of No Significant Impact (FONSI). The EIS process provides an opportunity for broad-based review and comment on a wide variety of environmental and community issues, by both natural resource agencies and the public. If a final EIS is not approved by the U.S. Environmental Protection Agency (EPA), the project plan must be modified or the project withdrawn.

Projects not receiving federal assistance do not need to perform an EA, although they are still subject to federal regulations as well as any other pertinent state and local environmental regulations. This gap has caused community concerns because the EA is the only comprehensive public review of environmental, as well as community, impacts of a project. Sponsors of such projects may wish to consider other avenues for reviewing environmental and community impacts as part of project planning.

Setting Regional Priorities – Appendix D

Chapter 3: Unfunded Needs

This project listing contains several categories of projects which are ***not included in the financially constrained 2025 RTP.*** They are based on a projected 2025 travel demand analysis of the transportation system. The recommended roadway project improvements are in response to projected travel that are in excess of planned capacity in corridors that may not have adequate rights of way available today. Future demands indicate that some level of investment will be needed in those corridors in the future, if the forecasted travel becomes reality. In addition, the Smart Streets concept is envisioned to be phased in over time in the highest priority locations. The initial improvements include operational treatments such as access management and traffic signal synchronization and intersection widening. Subsequent phasing might require added lanes but are not considered to be viable at this time. Nonetheless, the projects are identified in advance for future plan development as more funding becomes available, or as local and regional priorities change.

The recommended transit system improvements are the result of systematic analyses of census data, travel patterns and modeled transit routes. Details are included in the Appendix B, Chapter 1: Regional Transportation Needs Assessment (it includes roadway and transit system needs).

H-GAC is expanding programs that collaborate with local, state, and federal entities to improve air quality, such as the Commute Solutions and the Clean Cities/Clean Vehicle Programs. The Clean Cities /Clean Vehicles program specifically, which is federally funded by Congestion Mitigation Air Quality dollars, is a locally based public/private partnership, designed to

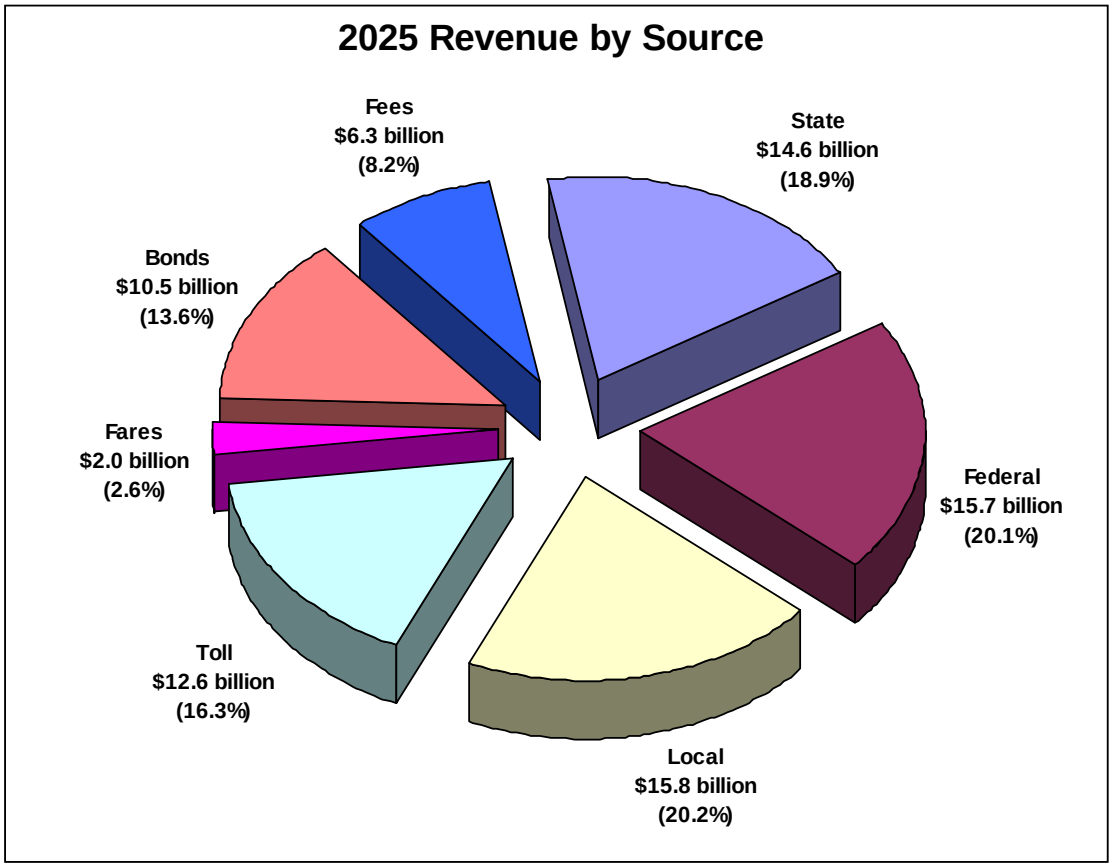
accelerate the use of clean fuels and clean engines. This program targets heavy-duty diesel vehicles, as these engines are the most cost-effective to reduce NOx and VOCs from on-road mobile sources. Additionally, by utilizing clean fuels and clean engines in heavy-duty diesel vehicles the additional benefit is the reduction of particulate emissions.

Setting Regional Priorities – Appendix D

Chapter 4: Financial Plan

The financial analysis has the primary goal of ensuring that expected revenues cover the projects in the RTP. The extent that estimated revenues materialize determines how much of the plan will be implemented. Revenues that the region will receive are dependent on State, Federal and local decisions, which, in turn, are dependent on tax revenues and numerous economic and social factors. The following are the principal findings of the baseline analysis.

Figure 48

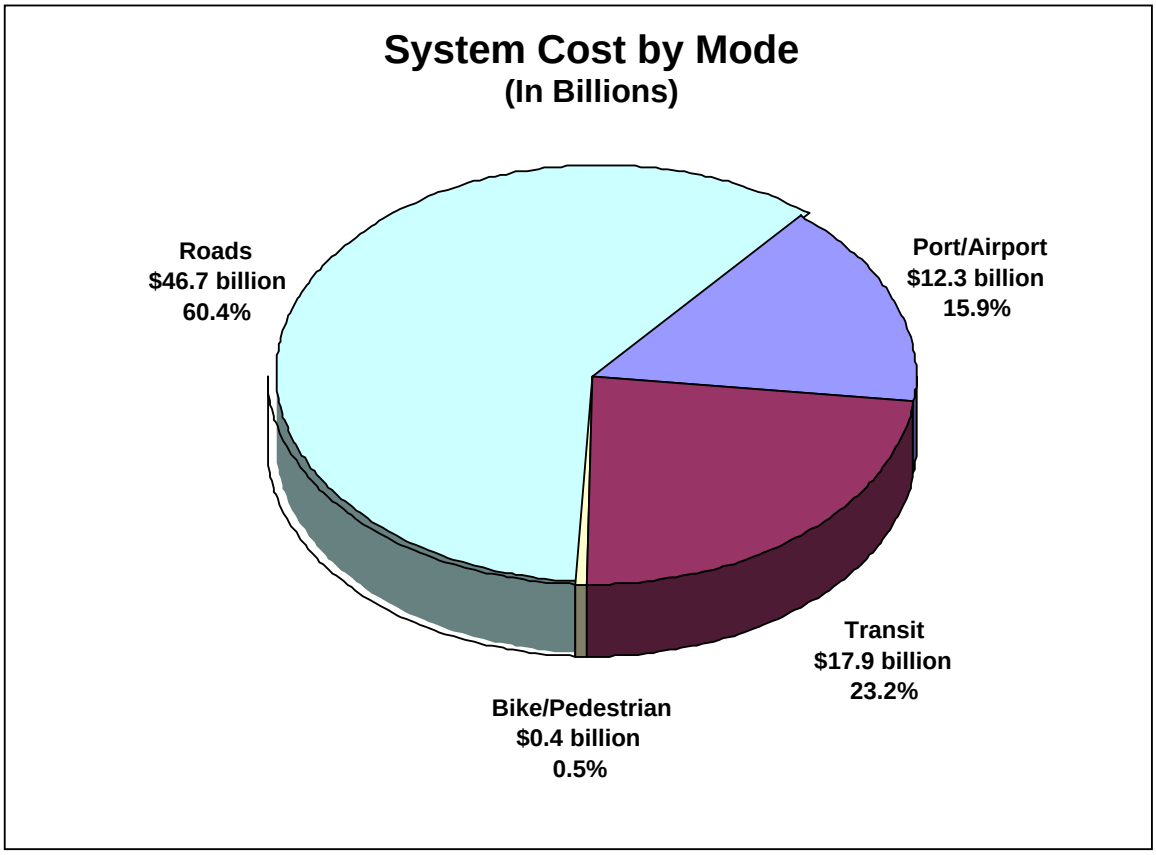


- The region's expected expenditures on transportation will average approximately $3.3 billion annually over the 2003-2025 period, based on projected needs. For the 23-year period through 2025, total expenditures will be $77.3 billion.
- Of this $3.3 billion per year, $1.0 billion is required to operate and maintain the system, $1.0 billion, for capital preservation, and $0.9 billion complete planned system expansions and

other improvements $0.40 billion.

- The average annual revenue available for transportation from Federal, state, local, bonds and other sources is approximately $3.3 billion during the 2003-2025 time-frame. Over the 23-year period through 2025, total revenues will be $77.5 billion.

Figure 49



Based on the estimated expenditures and revenues, the financial plan is fiscally constrained. This means that it is expected that sufficient revenue will be generated to meet projected costs.

The following revenue estimates are expressed in 2003 constant dollars as expected from various funding sources. The sources are principally: TxDOT, local toll road authorities, local governments, and local transit authorities.

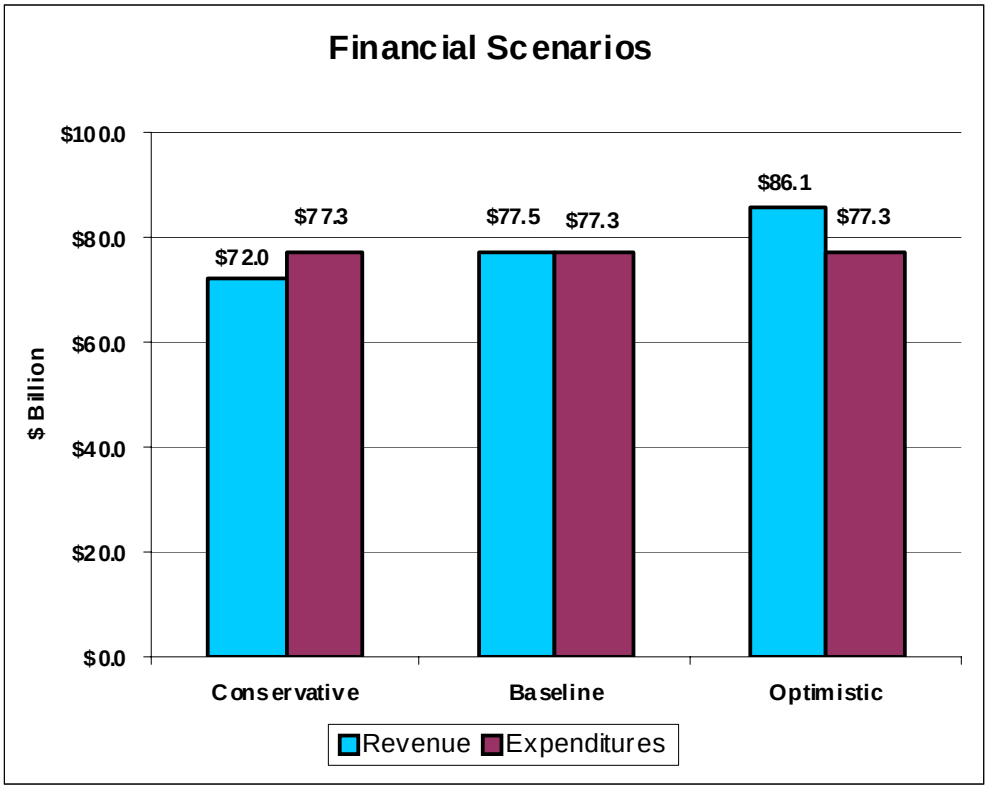
The Houston-Galveston region's share of TxDOT's funds has declined over the last decade as compared to the region's portion of the state's population. The declining percentage of funds means that there are proportionately fewer resources available to accommodate the travel needs of the growing population. The I-10 West (the Katy Freeway) expansion marks a beginning shift of additional resources to the region.

There is a long-term national problem for funding transportation projects. Texas, like all other states, receives a substantial portion of its transportation funds through the Highway Trust Fund. The Highway Trust Fund is a separate set-aside fund that can only be used for surface transportation programs (roadways and transit) that is funded almost entirely by the gas tax. Currently, drivers pay a federal gasoline tax of 18.4 cents per gallon. Most states also add a tax

to fuel use, which is used to supplement the federal transportation funds. In Texas, the current State gas tax is 20 cents per gallon, approximately 75 percent of which goes for transportation projects. For Texas, the fuel taxes (both state and federal) account for approximately 32 percent of all transportation revenue available (the national figure is 35 percent).

Since 1992, the gas taxes have risen much slower than inflation and the cost of construction, rehabilitation and maintenance of the road system. The slower growth in gas taxes means that revenues from these traditional sources will not be sufficient to meet the transportation needs of the State and its jurisdictions. Thus, various financing alternatives will need to be addressed, such as increases in transit fares, toll fares, vehicle registration fees, and congestion pricing. H-GAC is examining alternative means for increasing revenues to cover the shortfall including:

Figure 50



- reducing the number of projects;
- stretching the timeline of projects past 2025;
- increasing the motor fuel tax;
- indexing the motor fuel tax to the rate of inflation;
- limiting the use of the motor fuel tax to transportation expenditures;
- increasing vehicle registration and driver license fees;
- adding new toll roads;
- adding managed (tolled) lanes to existing facilities;
- allowing toll road authority surpluses to be used for construction of non-toll facilities;

- expanding the sales tax used by transit (currently capped at 1%) to other areas not served by METRO or other transit authorities;
- increasing property and other local taxes; and
- adding a personal property tax on automobiles.

There are advantages and disadvantages to each method. A key issue, though, is whether the revenue source is tied to travel behavior and, hence, becomes a user fee (e.g., the motor fuel tax, toll roads, and managed lanes) or whether the revenue source is a general fee untied to travel behavior (e.g., property taxes, personal property taxes). Existing user fees have not kept up with the rate of inflation, or the greater growth in VMT. The region will need to address this issue.

Appendix E: Air Quality Conformity

This eight-county area has historically been and currently is non-compliant with the Clean Air Act for ground-level ozone. Ozone is a ground-level pollution causing lung irritation and is created neither from vehicles or smoke stacks, but instead from the mingling of gases, principally volatile organic compounds (VOCs) and nitrogen oxides (NOx), with sunlight. The Houston-Galveston Area (HGA) produces a large amount of VOCs and NOx principally from stationary sources followed by both on and off road mobile sources, plus the region generally has an abundance of sunlight.

The Environmental Protection Agency (EPA) has established a criterion called the National Ambient Air Quality Standards (NAAQS) to judge when an area has a pollutant that has become a health threat. If an area is deemed to have a health threat it is thereafter, until compliant, referred to as 'non-attainment'.

Through the conformity process, the 2025 RTP addresses the tracking of on-road mobile air quality improvements. Transportation conformity is an analytical methodology that establishes the major connection between projected on-road emissions, known reductions in the motor vehicle emission budget and the transportation plan. The State Implementation Plan (SIP) establishes the motor vehicle emission budget through a photochemical modeling procedure. Through the process of transportation conformity, the RTP uses the SIP on-road mobile strategies and air quality targets to demonstrate if the RTP complies with the federal air quality requirements. Vehicle emissions resulting from the implementation of transportation projects in the 2025 RTP cannot exceed emission budgets established by the SIP. The Houston-Galveston region must demonstrate that the 2004 - 2006 Transportation Improvement Plan (TIP) and the long-range plan (2025 RTP) result in less volatile organic compounds (VOC) and nitrogen oxides (NOx) than established and approved by EPA for the base year and each horizon year.

The conformity process begins when the Texas Commission for Environmental Quality publishes the motor vehicle emission budget for the one-hour ozone standard using MOBILE6. Next, the EPA will review the State's motor vehicle emission budget (MVEB) and the SIP as a whole to determine if the budget is "adequate" and the SIP meets attainment. Once the EPA finds the budget adequate, H-GAC will be able to submit the 2025 RTP, TIP, and conformity analysis for federal approval to the Federal Highway Department and U.S. EPA. The results from the previous conformity determination adopted in June 2002, which lapses in June 2005, showed the Houston-Galveston transportation management area met the requirements of the SIP with reductions in both nitrogen oxide (NOx) and volatile organic compound (VOC) emissions.

Milestones

On June 4, 2002, the Federal Highway Administration certified that the Houston-Galveston area's *2022 Metropolitan Transportation Plan (MTP) Update* and the *2002 – 2004 Transportation Improvement Program (TIP)* conformed with the requirements of the State Implementation Plan for the Houston-Galveston ozone nonattainment area. The June 4, 2002 conformity finding was established with the *Revisions to the State Implementation Plan for the Control of Ozone Air Pollution, Post-1999 Rate-of-Progress and Attainment Demonstration for the Houston-Galveston Ozone Nonattainment Area* State Implementation Plan (SIP) (hereafter referred to as the December 2000 SIP) that was submitted to the U.S. Environmental Protection Agency (EPA) by the Texas Natural Resources Conservation Commission (TNRCC) on December 20, 2000.

On November XX, 2004, the Texas Commission on Environmental Quality (TCEQ, the agency formerly known as TNRCC) submitted the Rate-of Progress portion of the *Revisions to the State Implementation Plan for the Control of Ozone Air Pollution, Houston/Galveston/Brazoria Ozone Nonattainment Area* (hereafter referred to as the "*Mid-Course Review SIP")* to the EPA. The TCEQ submitted the Attainment Demonstration portion of the Mid-Course Review SIP to EPA on December XX, 2004. The on-road portion of the Mid-Course Review differs from the December 2000 SIP in several significant aspects: MOBILE6 was used, the latest demographics were used, the Inspection and Maintenance (I/M) programs for rural counties were removed, and temperature/humidity corrections were applied to vehicle categories. As a consequence, 2007 Attainment Demonstration budgets for on-road mobile emissions are at 175.49 tons per day of nitrogen oxides (NOx), and 89.74 tpd for volatile organic compounds (VOC). The Mid-Course Review SIP also establishes new Rate-of-Progress emissions budgets for 2005 and 2007. The EPA found the Attainment Demonstration Mid-Course Review SIP MVEBs adequate, effective MONTH XX, 2005 and approved the Rate-of-Progress budgets on MONTH XX, 2005. The submission of these new budgets requires a conformity determination of the *2025 Regional Transportation Plan* and the *2002-2004 Transportation Improvement Program* to the new MVEBs established in the Mid-Course Review SIP. Conformity must be determined by June 4, 2005 or the RTP and the TIP will lapse.

Conformity Requirements

The Clean Air Act Amendments of 1990 (CAAA) require transportation plans, programs, and projects in nonattainment areas, which are funded or approved by the Federal Highway Administration (FHWA) or Federal Transit Administration (FTA), to conform to the SIP. This ensures that transportation plans, programs, and projects do not produce new air quality violations, worsen existing violations, or delay timely attainment of the National Ambient Air Quality Standards (NAAQS).

Additional requirements that apply include:

· Use of the latest planning assumptions

· Analysis based upon the latest emission estimation model available

· Interagency consultation as well as a public involvement process must be conducted during the analysis

· Timely implementation of Transportation Control Measures (TCMs)

· The RTP and the TIP must be consistent with the MVEBs established in the applicable SIP

· The RTP and the TIP must include all regionally significant projects expected in the nonattainment area

Regional Inventory

H-GAC conducts regional emission analyses of transportation plans and transportation improvement programs to ensure transportation activities are consistent with the air quality goals identified in the Mid-Course Review SIP. This conformity analysis of the Houston-Galveston-Brazoria nonattainment area accounts for emissions resulting from the nonattainment area's transportation plan, including all regionally significant projects, and the effects of emission control programs.

Motor Vehicle Emission Budgets

The budgets established in the Mid-Course Review SIP are as follows:

TABLE 1: Mid-Course Review Motor Vehicle Emission Budgets

Rate-of-Progress		
Budget (tpd)		
Year	NOx	VOC
2005	257.3	104.2
2007	210.0	90.0
Attainment Demonstration		
Budget (tpd)		
Year	NOx	VOC
2007	186.13	89.99

Source: Mid-Course Review SIP, TCEQ

These motor vehicle emission budgets (MVEBs) represent the maximum allowable amount of emissions that may be produced by on-road sources as a result of the implementation of the RTP and TIP. These budgets are developed based on the emission inventories and photochemical modeling conducted for the development of the Mid-Course Review SIP and includes emission reduction benefits from federal and state control programs.

Conformity Tests

As specified by the Code of Federal Regulations (40 CFR §93.109[c] as amended by 62 FR 43807, Aug. 15, 1997) all ozone nonattainment areas designated moderate and above must pass a motor vehicle emissions budget test if an adequate or approved SIP budget exists. The Houston-Galveston-Brazoria area is designated as "Severe 17" under the 1-hour ozone rule. Due to this and the Mid-Course Review MVEBs, the budget test must be satisfied for conformity. This test is satisfied when emissions of the ozone pollutant's precursors (VOC and NOx) for each analysis year are less than or equal to the MVEBs established in the SIP. For the ROP test, each year with an MVEB must be modeled. Thus the ROP analysis will consist of the years 2005 and 2007. For the Attainment Demonstration test, the regional

emission analysis may be performed for any years within the timeframe of the transportation plan, provided they are not more than ten years apart, and include the attainment year (2007) and plan horizon year (2025). To meet this requirement analysis, years 2007, 2015, and 2025 were selected. Finally, as allowed in Phase-1 of the 8-hour ozone rule (INSERT RULE HERE), if an adequate 1-hour Attainment Demonstration budget is in place, that budget can be used for purposes of conformity as an alternate emissions test for the 8-hour attainment year. Since the Houston-Galveston-Brazoria area has been designated as "Moderate" for the 8-hour standard with an attainment year of 2010, the year 2010 will be included in the analysis.

Modeling

Two modeling suites were used in this process. The Travel Demand Modeling at H-GAC uses the EMME/2 model, with a special post-mode choice speed model. On the emissions side, the TTI suite of emissions software is used in conjunction with the latest version of EPA's MOBILE6 model to replicate the on-road modeling performed in the SIP. The data used in this conformity analysis is consistent with what was used in the SIP, except where more recent planning assumptions have been developed.

Conformity Analysis Results

The results of this conformity determination show that the *2025 Regional Transportation Plan* and the *2006 - 2006 Transportation Improvement Program* for the Houston-Galveston Transportation Management Area meet the requirements of the SIP for the Houston-Galveston Ozone Nonattainment Area, as submitted December XX, 2004, according to the Clean Air Act (42 U.S.C. 7504, 7506 (c) and (d)), as amended on November 15, 1990, and the final conformity rule (40 CFR Parts 51 and 93)**.**

TABLE 2: Conformity Analysis Summary

Analysis Year	VOC Emissions (tons/day)	VOC Budget (tons/day)	NOx Emissions (tons/day)	NOx Budget (tons/day)
1990 Baseline	321.7	--	391.1	--
2005 ROP		104.2		257.3
2007 ROP		90.0		210.0
2007 AD		89.99		186.13
2015 AD		89.99		186.13
2025 AD		89.99		186.13
2010 (8-hour Alternate Emissions Test)		89.99		186.13