

# *Bridging* OUR COMMUNITIES

# 2035



THE 2035 HOUSTON-GALVESTON  
REGIONAL TRANSPORTATION PLAN

**UPDATE**

Adopted 10/29/10  
Approved 1/25/11



## DISCLAIMER

This document was funded, in part, through grant[s] from the Federal Highway Administration, Federal Transit Administration, U.S. Department of Transportation, and Texas Department of Transportation. The views and opinions of the authors, expressed herein, do not necessarily reflect those of the U. S. Department of Transportation or the Texas Department of Transportation.

## REVISIONS

This document was adopted by the Transportation Policy Council on October 29, 2010. It was revised on January 18, 2011 based on comments by the Federal Highway Administration review. The revisions are as follows:

- page 46: on Figure 22, the label “Other Federal” was formerly “Federal” and the label “TxDOT 2035 Forecast” was formerly “State”;
- page 49: on Table 9, two notes, denoted with “+” and “+++”, were added; and
- page 62: on Table 14 the information regarding the Congestion Mitigation Process (CMP) stated that the CMP was based on the 2025 RTP. This text was revised to reflect that the CMP was revised in 2009.
- Appendix E Project ID 10025: The word “LANE” was erroneously omitted from the project description. The corrected project description now reads: *“RECONSTRUCT EXISTING CONCRETE RDWY, INCL. ACQUISITION & ENGR OF 3 LANE CONCRETE RDWY W/ PARKING CURBS, SIDEWALKS, STREET LIGHTING & UNDERGROUND UTILITIES”*



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## **UPDATE TO THE 2035 REGIONAL TRANSPORTATION PLAN**

***Our community will have a better quality of life through improved mobility, better access and a healthier environment.***

With over 3 million new residents expected by the horizon year of 2035, the Regional Transportation Plan (RTP) Update addresses regional growth and its attendant mobility needs in relation to new financial forecasts and information. Based on expected growth patterns, the demand for vehicle travel will double during the plan's time horizon. The movement of goods, however, may triple in volume over our network of highways and rail corridors during this same time period. Given the projected growth and development in the years to come, the 2035 RTP Update is intended as a tool for determining regional priorities and strategies that meet the region's transportation needs today and in the future.

The 2035 RTP Update was spurred by new projections for future transportation revenues and the requirement to have a plan that is fiscally constrained to those projected revenues. The largest change in the future revenues for transportation funding comes from an expected decrease in fuel tax receipts. The number of vehicles that have greater fuel efficiency is

increasing on our roadways. Even though vehicles are typically traveling farther and creating a greater need for transportation projects to maintain mobility, they are using less fuel, thus decreasing the funding available for transportation. This plan focuses on the reallocation of funding to priority projects in the Houston region to most effectively maintain mobility within the newly constrained fiscal environment.

The Houston region has already experienced a decrease in project lettings in the years since 2007 due to financial constraints. In February 2009, the American Recovery and Reinvestment Act (ARRA) created a new source of revenue that has provided the funding for a host of roadway and transit projects throughout the region. Many of these projects would not have been possible without this additional funding. The Houston area received \$489 million for roadway projects and \$106 million for public transportation projects. More information regarding ARRA and projects funded is provided in the Appendices.

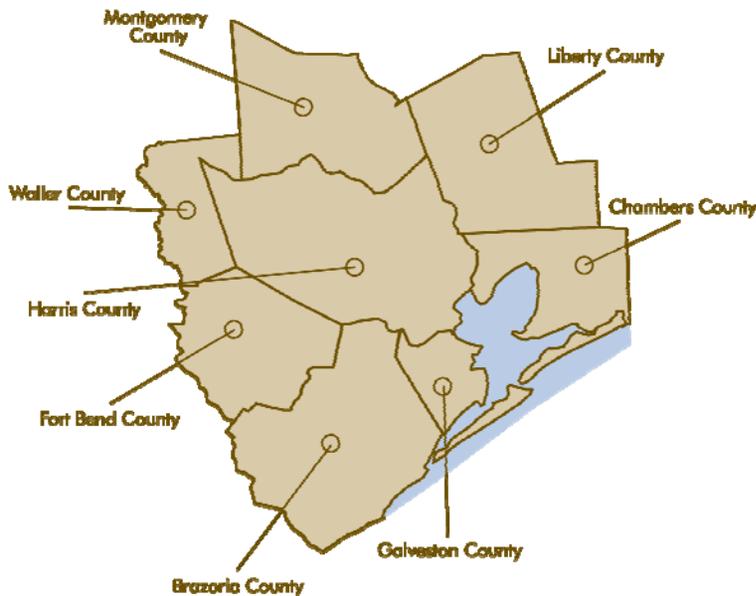
This update maintains certain key assumptions such as the horizon year, regional demographic forecast, and the goals and objectives that were developed for the 2035 RTP in 2007. Significant changes have been made to the financial forecast, air quality assessment and the program of projects. Also changed in this document is information regarding updates to H-GAC programs and activities since 2007. Throughout this document, updates to regional activities and programs are

noted.

**The Region**

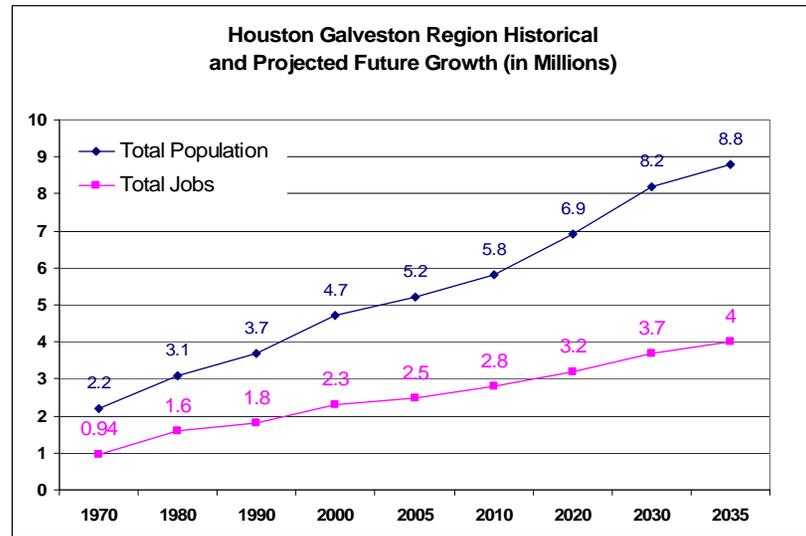
The regional transportation plan considers the transportation needs of the Houston region, and is updated, at a minimum, every four years. As shown in Figure 1, the geographic area covered by this plan includes the eight-county transportation management area (TMA) which encompasses Harris and the seven adjacent counties, a region of more than 8,000 square miles and 5 million residents.

**FIGURE 1 EIGHT-COUNTY REGION**



The region is projecting a significant increase in population and employment over the next 25 years. The additional population will bring total regional population to 8.8 million persons by 2035. Based on the projected job growth, a 60% increase in employment is expected. See Figure 2.

**FIGURE 2 POPULATION AND EMPLOYMENT FORECAST**



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. The H-GAC Transportation Policy Council (TPC) is responsible for the development of the long-range transportation plan. The TPC provides coordination with

regional stakeholders, including cities and counties in the eight-county area, the Texas Department of Transportation (TxDOT), other transportation and transit agencies, as well as the 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<sub>3</sub>). While transportation is not this region's sole source of ozone precursor 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.

### ***Transportation Planning Process***

To examine the impacts of future growth, the 2035 RTP Update expands upon the existing planning approach and conclusions from the 2035 RTP, which largely consisted of a visioning concept called envision+Houston Region (e+HR). The envision+Houston Region effort was a broad based public outreach initiative carried out in 2005, and involving hundreds of stakeholders, elected officials, students and citizens throughout the region. e+HR stakeholders participated in a series of visioning workshops and forums and contributed their ideas for a future transportation system through statements and the spatial allocation of future jobs and housing. A summary of

the e+HR effort can be found on H-GAC's website ([www.h-gac.com](http://www.h-gac.com)).

The outcome of the e+HR process includes citizen-created common goals and values, which, in turn, guided the development of the 2035 RTP, and continue to be reflected in the 2035 RTP Update.

### ***The 2035 RTP Update Goals are:***

- ***Improve mobility, reduce congestion***
- ***Improve access to jobs, homes and services***
- ***Increase transit options***
- ***Coordinate transportation and land use plans***
- ***Create a healthier environment***

By seeking out the articulated goals of the region's citizens, this RTP introduces a new dimension in public participation and public understanding for the transportation planning process. That process incorporates the region's projected mobility needs and fiscal limitations while promoting the transportation outcomes needed to support the region's goals and values.

The 2035 RTP Update shows that with just a few proactive strategies regarding how and where we grow, new, more sustainable communities can develop as the region's continuing mobility dilemmas are addressed. These dilemmas,

including congestion and insufficient capacity, are a reflection of the continued growth this region is projected to have. This plan proposes finding the most efficient and cost effective approach to improving regional mobility while seeking measures to decrease the rate of congestion growth.

## SUMMARY OF SYSTEM BENEFITS

Given the population and employment growth that is expected to occur in the region as shown in Table 1 above, it is not likely that peak period congestion levels will be reduced from today's levels through the implementation of the strategies, programs and projects in the 2035 RTP Update. Also, because of the reduction to the program of projects necessitated by lower revenue projections and the requirement for achieving fiscal constraint, it comes as no surprise that the system benefits of Update do not fare as well as the original 2035 RTP. However, traveling conditions as a result of the Update are still vastly better than in a 'no-build' scenario. Among others, the region can expect to see the following benefits:

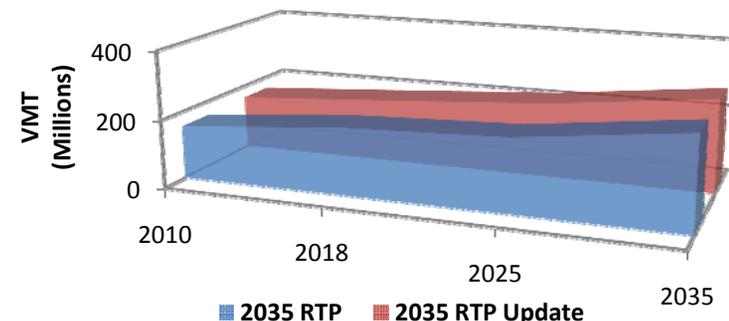
- A doubling of transit usage from current levels if higher density development patterns are coupled with the RTP projects;
- A healthier environment through improved air quality from reduced on-road emissions and expansion of programs such as the Clean Cities program;
- An increase in travel options through expansion of the Commute Solutions and regional Bicycle and Pedestrian programs; and
- An almost \$ 400 million annual reduction in the cost of vehicle crashes.

System-wide benefits are measured by the change in the number of vehicle miles traveled (VMT), the number of vehicle hours traveled (VHT), and average driving speeds.

### *Vehicle Miles Traveled*

In 2010, the region's daily VMT is approximately 160 million miles. Figure 3 shows that by 2035, daily VMT is expected to increase to about 275 million miles, an increase of 71%. This outcome compares very favorably to the original 2035 RTP of 270 million miles (68%), showing only a 3% increase.

**FIGURE 3 VEHICLE MILES TRAVELED (VMT)**

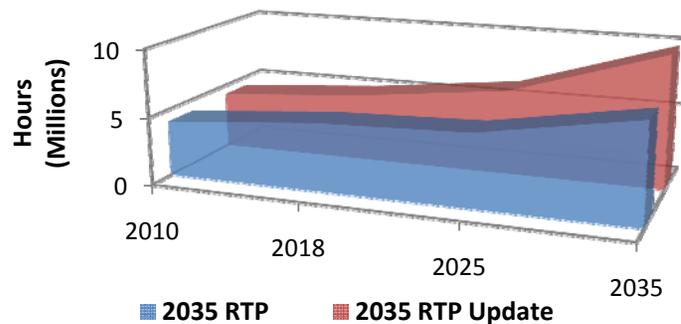


### *Vehicle Hours Traveled*

In terms of vehicle hours traveled, the region is currently generating 4.2 million hours per day. By 2035, under a 'no build' scenario, the region's daily VHT would increase to over 13 million hours (a 210% increase), due to the increasing

number of vehicles on the roadways. In the original 2035 RTP, VHT was projected to increase to 7.3 million hours (72%), but the 2035 RTP Update expects to see VHT increase to 9.8 million hours (a 133% increase over today). See Figure 4.

**FIGURE 4 VEHICLE HOURS TRAVELED (VHT)**

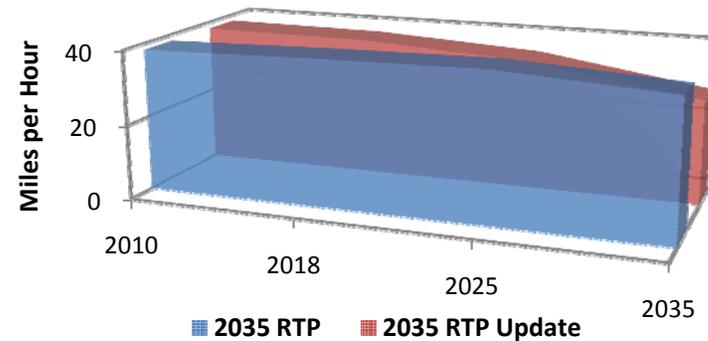


The 24-hour average system speeds, as seen in Figure 5, show that travelers will experience a decrease in average travel speeds when compared to today or the 2035 RTP. At present, 24-hour average system speeds are 38 miles per hour (MPH). After implementing the 2035 RTP Update, this is expected to decline to 28 MPH by 2035.

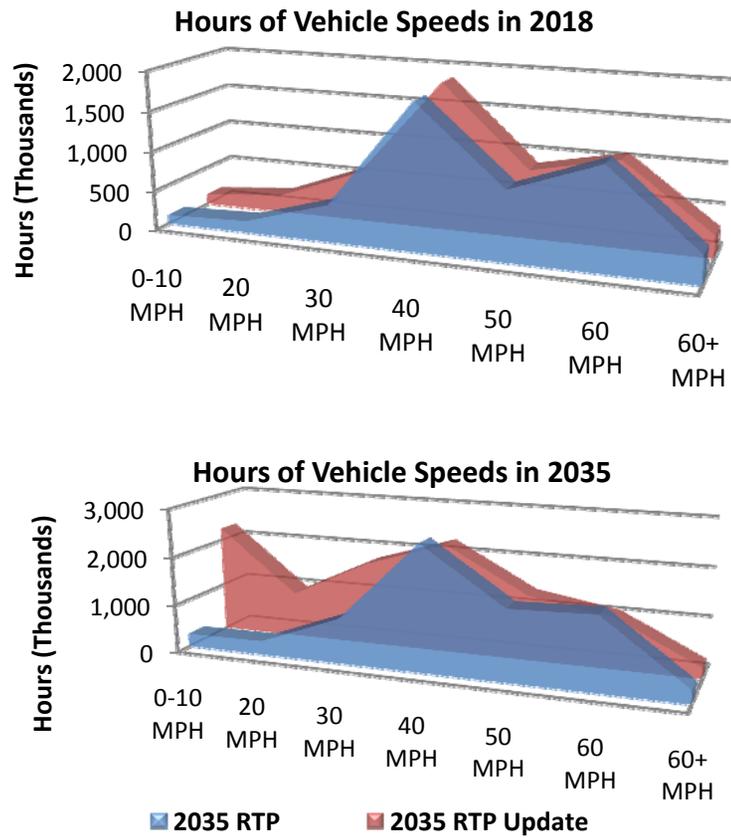
Figure 6 shows the hours spent by motorists at a particular speed. A comparison of the hours of vehicle speeds between the original 2035 RTP and the Update does not show dramatic differences by 2018, but by 2035, the hours traveled as 60 MPH is greatly reduced, while the 10, 20, and 30 MPH

speeds show significant increases. However, the largest increase is forecast for stop-and-go traffic, as depicted by the 0-10 MPH.

**FIGURE 5 24-HOUR AVERAGE SYSTEM SPEED**



**FIGURE 6 HOURS OF VEHICLE SPEEDS IN 2018 AND 2035**



## THE FOUR STRATEGIES

The 2035 RTP Update proposes a collection of strategies to moderate the rate of congestion growth associated with our growing population. These strategies use a combination of programs and projects to improve regional mobility, and by providing more travel options they foster a better quality of life for all residents. The four strategies of the 2035 RTP Update are:

- Increase roadway and transit capacity;
- Reduce peak-period travel demand;
- Improve the efficiency of existing facilities; and
- Coordinate land use and transportation investments.

To the extent that these strategies can be implemented, the goals of improving regional mobility and safety, and reducing the rate of congestion while minimizing the associated negative air quality impacts can be achieved more effectively. Any reductions in congestion will be evidenced by improved levels of mobility or levels of service.

### STRATEGY 1: SYSTEM CAPACITY

Though the region cannot build itself out of congestion, additional system capacity is necessary throughout much of the region. Table 1 provides an overview of the recommended

system capacity improvements contained in the 2035 RTP Update.

**TABLE 1 SURFACE TRANSPORTATION CHANGE 2009-2035**

	Roadway		Transit		Non-Motorized	
	Freeway/ Tollway	Arterial	METRO Solutions		Bikeway	
Lane miles	+32%	+11%	Bus Service	+50%	Lane miles	+47%

### Roadway

Even with the implementation of the 2035 RTP Update, congestion levels will increase over today’s levels. However, if the RTP were not implemented, future congestion would more than double by 2035. Due to limited growth in traditional funding, one of the best opportunities to address regional mobility is in the continued use and expansion of the region’s toll roads as well as increasing the number of managed lane facilities. These facility types provide viable options to maintain reasonable levels of mobility in the region.

Managed lanes carry HOV travelers as well as single occupant vehicles that pay a fee for use of the facility, and have been successfully employed on the Katy Freeway. Coupled with traditional lanes and other operational strategies, managed lanes is an approach that can encourage more effective and

efficient use of roadway facilities. Table 2 summarizes the total roadway lane miles, and Figure 7 depicts the region’s freeways and tollways.

**TABLE 2 2035 TOTAL LANE MILES**

	Freeway/ Tollway	Principal Arterial	Other Arterial	Collector	Managed Lanes	Total
2009	4,135	6,033	9,482	4,200	185	24,035
2035	5,446	6,698	10,736	4,692	425	27,997

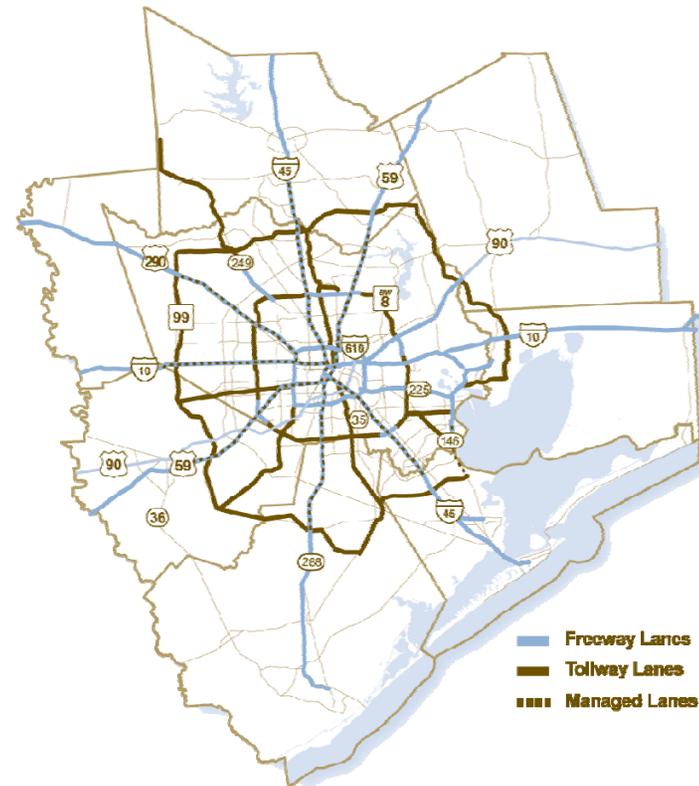
**Mode Share Analysis**

According to the 2000 census, over five million people live in our region, and they make 1.8 million trips every day. In terms of their mode of travel, 78% of daily trips are done by people driving along in an automobile (see Table 3). Although the share of trips on public transportation is relatively small at 3%, transit plays a critical role in the region’s travel patterns. When compared to the national average of 4.7%, the Houston region uses slightly fewer transit trips.

**Transit**

One of the answers to roadway congestion is better transit service. Today there are seven public transit providers serving different areas of the Houston region: three are public transit providers:

**FIGURE 7 REGIONAL FREEWAY/TOLLWAY MAP**



- Metropolitan Transit Authority of Harris County (METRO),
- Harris County Transit and
- Fort Bend County Transit, and

**TABLE 3 PERCENT WORK TRIPS BY MODE SHARE**

	1990	2000	2005	2008
Drive Alone	76	77	78	78
Carpool/Vanpool	15	14	13	12
Public Transit	4	3	3	3
Walk/Bicycle	2	2	1	2

Source: 1990 & 2000 from Census; 2005 & 2008 from American Community Survey 2000.

four serve small urbanized areas

- Island Transit serving Galveston,
- The District serving The Woodlands,
- Connect Transit serving Lake Jackson/Angleton and Texas City/La Marque, and
- Colorado Valley Transit serving Waller County.

As regional population and employment continues to grow, transit will become an increasingly important tool for improving mobility. Transit is forecast to significantly increase from its current 485,000 daily passenger boardings, to over 725,000 daily boardings by 2035. This significant increase will be attributed to:

- Expansion of transit services (increased bus and rail transit services);
- New transit modes (commuter rail transit and signature

express bus service);

- Transit connectivity to multiple employment centers; and
- Coordination of transit services among regional public transportation providers.

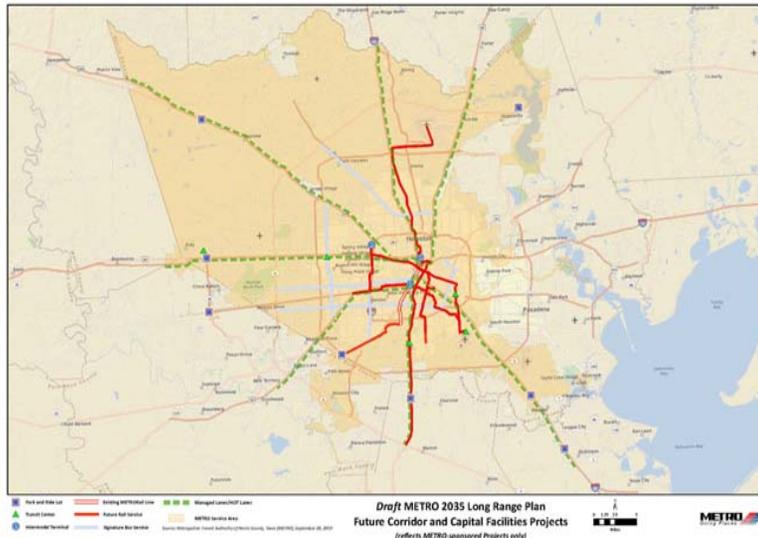
***Metropolitan Transit Authority of Harris County (METRO)***

The Metropolitan Transit Authority of Harris County (METRO) is the region’s largest transit authority, providing fixed route and demand response service in more than two-thirds of Harris County and a portion of Fort Bend and Montgomery Counties. The cornerstone of METRO’s transit improvements is METRO Solutions: a long-range plan that calls for significant expansion of the current transit system to encompass a network of integrated high capacity transit facilities on major travel corridors (see Figure 8). This plan also identifies significant service expansions beyond the METRO service area. New improvements scheduled for implementation through the year 2035 include high occupancy tolls, a new intermodal terminal (see Figure 9) and several new high capacity transit corridors throughout the region.

Additional key elements of the METRO Solutions plan are:

- 89 miles of fixed light-rail transit (LRT);
- 84 miles of commuter rail transit (CRT); and
- 40 miles of Signature Bus service.

**FIGURE 8 METRO 2035 LONG-RANGE PLAN**



Since 2007, METRO has broken ground on the East End and Southeast light rail lines; received authorization from FTA to begin preliminary engineering on the University light rail line; received an American Recovery and Reinvestment Act (ARRA) grant to convert existing HOV lanes to HOT lanes; and, received authorization to begin analysis of the Southwest (US 90A) commuter rail corridor as a prelude to a New Starts Alternatives Analysis.

### ***Harris County Transit***

Harris County Transit provides demand response and some

**FIGURE 9 RENDERING OF PROPOSED METRO INTERMODAL TERMINAL**



fixed route service in areas of Harris County not served by METRO. Since 2007, Harris County has expanded existing fixed route service and initiated new circulator and commuter services in Baytown, Pasadena and other areas serving the southeastern portion of Houston.

### ***Fort Bend County Transit***

Fort Bend County Transit provides fixed route commuter service into employment centers within the City of Houston; demand response service in the rural portions of the county.

Since 2007, Fort Bend County Transit enhanced its existing commuter service into the City of Houston, added a new route into the Texas Medical Center, and expanded its demand response service.

### ***Island Transit***

Island Transit is owned and operated by the City of Galveston, and serves the Galveston urbanized area (UZA). In 2008, Island Transit's service was abruptly interrupted by Hurricane Ike, a Category 3 storm that caused severe damage in much of Galveston Island. Since then, Island Transits efforts have largely focused on restoring service, replacing capital equipment and repairing damaged facilities.

### ***Connect Transit***

Connect Transit, owned and operated by the Gulf Coast Center, serves Texas City/La Marque and Lake Jackson/Angleton UZAs; provides scheduled service in the urban areas and demand response service in rural portions of Brazoria and Galveston counties. Since 2007, Connect Transit, in partnership with Island Transit, initiated service from the Mall of the Mainland into the city of Galveston; it initiated fixed route service between Lake Jackson, Angleton, Freeport and Clute in southern Brazoria County.

### ***The District***

The District provides commuter service from Conroe and The

Woodlands UZA into the City of Houston, and it provides demand response service in rural portions of Montgomery County. Since 2007, The District, in partnership with The Friendship Center, expanded demand response service and initiated shuttle service to Sam Houston State University and opened the Sterling Ridge park and ride service from The Woodlands into the Houston CBD.

### ***Colorado Valley Transit***

Colorado Valley Transit (CVT) provides demand response service in rural portions of Waller County. Since 2007, CVT has expanded its demand response service in Waller County and initiated a deviated route service.

### ***Other Transit Activities***

The Regional Transportation Coordination Plan was developed as part of statewide transportation coordination and planning effort in response to Texas HB 3588 which mandated the coordination of public transportation and human services transportation<sup>1</sup>. An Action Plan was included in the regional coordination plan and steps have been taken to implement the highest priority (pilot) projects from that Action Plan as

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<sup>1</sup> Gulf Coast Region Coordinated Regional Public Transportation Plan (2006) for H-GAC by the Goodman Corp et al. The project website is [www.ridethegulfcoast.com](http://www.ridethegulfcoast.com) for more information.

summarized in the sample Report Card in Figure 10.

H-GAC was designated as the lead agency for the development of the plan and the facilitation of quarterly Steering Committee meetings. The project Steering Committee has evolved into the Regional Transit Coordination Subcommittee (RTCS) to the H-GAC Technical Advisory Committee (TAC). Three work groups have been formed to provide ongoing voluntary support and collaboration on the development of the highest priority regional coordination strategies which include public information, resource sharing, and a seamless fare system.

Since 2007, additional transit planning efforts include county-specific transit plans in the suburban and rural counties of the region, including Montgomery, Liberty, Chambers, Brazoria, and Matagorda Counties. Those transit plans were developed to provide more focused recommendations for improved public transportation services in those counties. The county-specific transit planning documents are available at: [www.h-gac.com/transportation](http://www.h-gac.com/transportation)

Transit recommendations based on the Regional Public Transportation Coordination Planning and Regional Transit Needs Assessment (RTNA) from the 2035 RTP are still valid. These recommendations include:

**FIGURE 10 TRANSIT REPORT CARD**

GULF COAST REGIONAL COORDINATED PUBLIC TRANSPORTATION PLAN REPORT CARD-2010 UPDATE		
STRATEGY	TASKS	STATUS
Develop and maintain a regional stakeholders committee to meet the intent of HB 3588  On-going	Continued Regional Transit Coordination Subcommittee (RTCS) <ul style="list-style-type: none"> <li>On-going quarterly meetings.</li> <li>Formed three Working Groups to develop the following coordination programs: <ul style="list-style-type: none"> <li>Regional Public Information-Developing Regional Transit Brochures</li> <li>Seamless Regional Fare System (under development).</li> <li>Regional Resource Sharing through the H-GAC Buy Cooperative Purchasing Program: <ul style="list-style-type: none"> <li>Resolved the barrier (with FTA) that prevented transit fleet vehicle purchases.</li> <li>Initiated fleet fuel card program.</li> <li>Considering fleet insurance pools for transit providers.</li> </ul> </li> </ul> </li> </ul>	★★
Advance priority pilot projects from the Regional Transit Coordination Plan  On-going	Implemented several pilot projects from the Regional Transit Coordination Plan (2006). <ul style="list-style-type: none"> <li>Developed transit plan and implemented the following recommendations in Montgomery County (2008): <ul style="list-style-type: none"> <li>County-wide general public demand response service.</li> <li>A commuter shuttle service between The Woodlands employment center and the Sam Houston State University (SHSU) campus in Huntsville (discontinued).</li> </ul> </li> <li>Completed county-level sub-regional transit plans (2009): <ul style="list-style-type: none"> <li>Liberty County Transit Plan</li> <li>Chambers County Transit Plan</li> </ul> </li> </ul>	★★
	Developing transit plans for the following areas: <ul style="list-style-type: none"> <li>Colorado Valley Transit District- Multicounty Transit Plan Update (2010).</li> <li>Matagorda County Transit Plan (2010).</li> <li>Walker County Transit Plan (Tentative 2011)</li> </ul>	★

★★★ A three-star rating indicates that actions to address the strategy are close to completion.  
★★ A two-star rating signals that the strategy is still in progress. While significant actions may have been completed, some actions will occur in 2010-2011.  
★ A one-star rating shows that the strategy was initiated, but that most work will occur in later years. Typically, initiated strategies are so large in scope that it is unrealistic to accomplish in one year.

- Expand public transportation services by filling gaps inside and outside the METRO service area and expanding service to cover the 13-county Gulf Coast region;
- Improve connectivity, by exploring opportunities for expanding and developing transit facilities that serve as multi-modal transportation hubs for connecting local and express buses, taxis, vanpools, and airports shuttles;
- Work with local transportation providers to develop flexible, seamless fare polices that will allow customers to use a single ticket or pass to travel on all providers of public transportation;
- Explore projects utilizing public-private partnerships to fast-track commuter rail in the US 90A, US 290 and SH-3 corridors;
- Promote Jobs Access and Reverse Commute (JARC) programs to assist former welfare recipients and other low-income residents with obtaining access to public transportation; and
- Explore other potential high capacity transit (HCT) corridors. Currently, H-GAC has identified corridors along US 249, US 290, SH 521, SH 288, SH 225 - SH 146 and SH 35 as meriting consideration for HCT.

In 2009 H-GAC began work on the Regional Transit Framework Study (RTFS) with a team of consultants and an

advisory committee comprised of regional transit providers and stakeholders. The RTFS focuses on the 8-county region and expands with greater detail some of the recommendations from the previous studies. Specifically, the effort includes a detailed level of analysis of current and future transit system plans, needs, and provides recommendations for a regional decision-making framework to guide future transit policy decisions. Furthermore, it is intended to foster connectivity between activity centers, enhance community mobility through a variety of modes, and through the use of scenarios, create a vision for a model regional transit network.

### **Non-Motorized Transportation**

According to the 2000 Census, three percent of all journey-to-work trips were attributed to bicyclists, with an even higher share in other areas throughout the region (see Table 3). Based on demographic, land use, and transportation factors, several areas throughout the region appear to be much more conducive to additional walking and bicycling infrastructure. H-GAC continues to identify districts where there are significant opportunities to replace vehicle trips with pedestrian or bicycle trips and to improve pedestrian and bicycle safety. These areas also have the potential to be the most tightly clustered trip destinations and comparatively higher levels of existing pedestrian-bicyclist travel. To date, H-GAC has worked with local partners to develop comprehensive pedestrian and

bicyclist plans in seven of these districts with two more studies slated to begin by the end of 2010.

The existing bikeway network is currently 617 miles throughout the 8-county region, with the majority of the network in Harris County. Communities with extensive bikeway or pedestrian networks include Alvin, Conroe, City of Houston, Lake Jackson, La Porte, Missouri City, Pasadena, Sugar Land, and The Woodlands. H-GAC plans to continue to work with sponsors to identify projects that further the development of the local bikeway and pedestrian network. All such projects will be carefully coordinated with roadway infrastructure planning and existing and planned developments. The Plan also includes guidelines to insure proper consideration of bicycle and pedestrian needs during project development, design, and selection for all transportation projects.

## **STRATEGY 2: DEMAND MANAGEMENT**

### **Travel Demand Management Programs**

Travel demand management strategies focus on moving people, rather than moving vehicles. Their primary goal is to modify travel habits through incentives or disincentives so that demand is lessened by either shifting travel to a non-peak period or other mode of transportation. Such programs encourage use of other modes, non-peak period travel, and alternate routing. The underlying concept is that mobility can

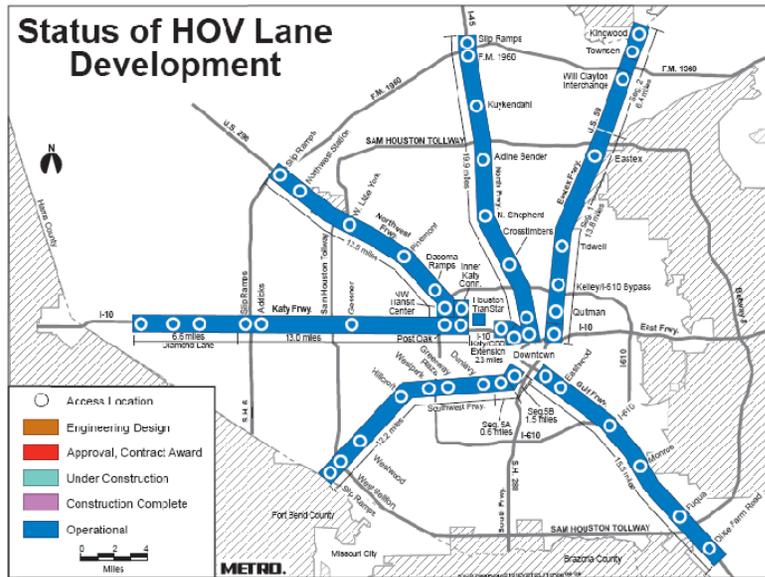
be significantly improved by switching traffic from roadway facilities operating at capacity to other modal options better equipped to accommodate the negative impacts resulting from an overflow of single-occupancy vehicles. Many of these programs are funded through programs that strive to improve region's the air quality.

### ***Peak Period Pricing and Managed Lanes***

Much as the hotel industry charges more for rooms during peak tourist seasons, and the airline industry offers off-peak discounts, peak period pricing sets tolls based on levels of congestion. Also referred to as value pricing, toll rates on participating facilities would vary according to congestion levels by time of day. Charging for road usage based on congestion levels creates incentives for drivers to modify behavior by changing some of their trips to off-peak times, other routes or using alternative modes of transportation. METRO services will utilize these facilities after conversion. Conversion will occur by 2015 and will include two-directional operations. Figure 11 highlights the current status of HOV lane development. A relatively small shift in the proportion of peak-period trips can lead to substantial reductions in congestion. Generally, the benefits of peak period pricing include:

- Offers incentives for more efficient use of existing capacity;

**FIGURE 11 REGIONAL HIGH OCCUPANCY VEHICLE (HOV) LANES**



- Indicative of potential need for future mobility enhancement;
- Locally generated and dedicated revenue for system expansion, operation and maintenance; and
- Cost and travel time savings, including reductions in delay and increases in vehicle speeds.

The 2035 RTP Update includes plans to implement peak period pricing within the managed High Occupancy Toll (HOT) lanes of the major freeway corridors in the region. This strategy is

especially important in congested corridors with limited potential for the building of additional lanes. Through 2035, the H-GAC region is expected to see increases in high occupancy vehicle, high occupancy toll, and regular toll lane miles. Notably, by 2035 the region will see an overall decrease in HOV lanes offset by increases in HOT lanes. The conversion of HOV lanes to HOT lanes will increase the efficiency of the network, and will allow area stakeholders to more effectively deploy existing transportation resources.

The HOV lanes on the Katy Freeway (IH-10 West) were converted to managed lanes in April 2009, by the Harris County Toll Road Authority. Transit buses and vehicles with two or more passengers may still use the managed lanes for free, but converting to HOT lanes provides the opportunity for the valuable capacity during peak periods to be utilized by single occupant vehicles for a nominal charge.

**Voluntary Mobile Emission Reduction Programs (VMEPS)**

The Voluntary Mobile Emission Reduction Program (VMEP) is a voluntary control strategy under Texas’ State Implementation Plan (SIP). VMEPs include a number of voluntary measures aimed at reducing emissions from motor vehicles beyond the mandated emission reductions. Some VMEPs include alternative fuels, employee trip reduction, public education, ozone-season fare reduction, sustainable development, non-road ozone-season reductions, tier II

locomotive engines, off-road heavy duty diesel engine retrofits, and vehicle retirement and maintenance. Several of these elements are combined in two of the more notable VMEP programs of H-GAC.

### ***Commute Solutions***

Commute Solutions supports the promotion of transit, vanpools, carpools, telework, and other transportation-related options and services as an alternative to driving alone. The use of these commute alternative strategies provides commuters with major cost savings, including reduced gasoline, parking, and car maintenance expenses; relieve commute and parking-related stresses; and provide faster commuting times using high occupancy vehicle (HOV) lanes.

Employers also benefit from the Commute Solutions Program because it produces more positive and productive employees, less employee tardiness and fewer absences. Increased retention of employees and an enhanced corporate image has also been noted by employees and employers using alternative commute programs. As the “one-stop” resource on commute alternatives, Commute Solutions offers advice, answers and assistance to employers and employees on all commuting options.

### ***Clean Air Action***

Clean Air Action is a federally funded public education

program that focuses on the health hazards of exposure to high levels of ozone smog from on-road motor vehicles; and encourages voluntary actions to reduce vehicle emissions. Program elements include media and public service programs, public affairs programming, and other public relations campaigns and special events. This outreach and education initiative aims to reduce pollutant emissions through greater public awareness and participation in air quality improvement efforts. This initiative also provides marketing and administrative support for companion programs such as Commute Solutions, Clean Cities/Clean Vehicles, Houston-Galveston Area Emissions Reduction Credit Organization (AERCO), the Smoking Vehicle Program, and the Low Income Vehicle Replacement Assistance Program (LIRAP), also referred to as the AirCheck Texas Program. Additionally, Clean Air Action makes information available to the public on topics ranging from the ozone alert system, upcoming conferences, grant funding, and air quality studies.

### ***Clean Cities/Clean Vehicles***

The Clean Cities/Clean Vehicles Program provides subsidies to public and private entities to facilitate the voluntary usage of cleaner burning fuels and engines. The primary goal of this program is to reduce emissions from mobile-source pollutants and particulate matter, while maximizing the usage of cleaner fuel and low-emissions vehicles operating within the region.

An ongoing partnership with the Texas Department of Transportation, local governments, and area businesses has empowered fleet operators within the 8-county non-attainment area to retrofit, upgrade, and replace their vehicles for the benefit of their organizations and the larger community. Outreach and education for fleet managers are key components of the program, through which new technologies are better understood and opportunities for action are optimized to attain the best, most cost-effective results.

### **STRATEGY 3: OPERATIONS MANAGEMENT**

Usually far less expensive than added capacity projects, operational management strategies are useful for reducing congestion through the development of new or expanded infrastructure and small-scale infrastructure efficiency improvements. The 2035 RTP Update proposes the deployment of intelligent transportation systems (ITS) and other access management strategies.

The RTP includes operational strategies that 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 process (CMP) is one means of achieving this objective by monitoring the implementation of transportation system management (TSM) and transportation demand management (TDM) improvements in advance of added capacity.

### **Access Management**

The 2035 RTP included a description of the Smart Streets Program. The Smart Streets concept was developed and introduced in the 2025 RTP as an additional tool to increase mobility and improve transit access and safety by providing operational improvements along strategic regional thoroughfares. Since the adoption of the 2035 RTP, the Smart Streets program has been redefined as the Access Management program. Access Management is the same concept as Smart Street but defines specific improvements in corridors through planning studies and the implementation of recommended solutions, and is part of a “complete street”, where priorities among all modes of street users has been rebalanced (see Figure 12.)

**FIGURE 12 RENDERING OF A COMPLETE STREET**



Access Management focuses on a range of operational management techniques to reduce delay, improved traffic flow

and reduce crashes, including:

- Traffic light synchronization;
- Deployment of roundabouts;
- Medians;
- Constructing or extending (as needed) turn bays;
- Consolidation of duplicate driveways, and, as appropriate; and
- Partial grade separation of some traffic lanes at major intersections.

Expected future benefits of the Access Management program include:

- 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; and
- Enhanced regional evacuation routes.

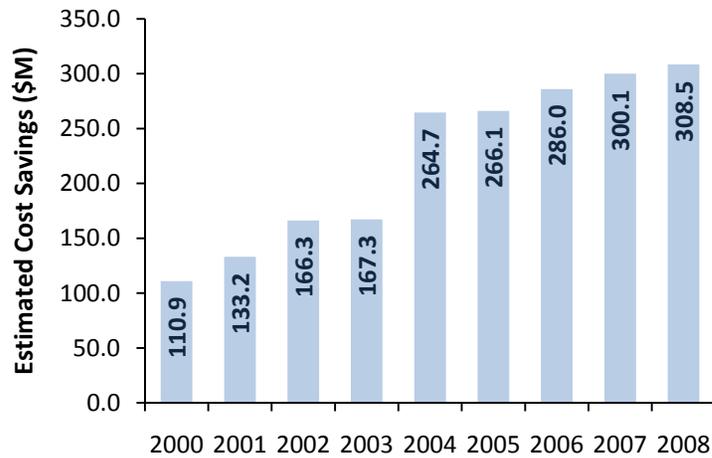
Since 2004, four access management studies in four different corridors have been completed. Two studies are currently underway and five additional studies are planned to begin in

2011. Of the completed studies, the state and local governments have initiated a number of projects to implement recommendations from the studies including Phase 1 improvements on FM 1093 and intersection and signalization improvements in the SH 6 corridor in Missouri City and Sugar Land. Most recently, medians were introduced in the FM 1960 corridor between SH 249 and IH 45, one of the primary recommendations from the access management study.

### **Intelligent Transportation Systems**

The Houston-Galveston region has one of the most advanced Intelligent Transportation Systems (ITS) in the nation. The region's premier intelligent transportation management and operations system is anchored by the Houston TranStar Traffic Management Center. Houston TranStar is one of the most comprehensive advanced traffic management centers in the country, and is responsible for coordinating the planning, design, operations and maintenance of transportation and emergency management in the greater Houston region. Additional traffic management elements in the region include: incident detection and response, courtesy patrol and motorist assistant, changeable message signs, and coordinated traffic signal timing. Figure 13 shows the annual cost savings for area motorists from 2000 to 2008 due to the application of ITS

**FIGURE 13 ANNUAL MOTORIST COST SAVINGS**



technology and the services provided by Houston TranStar.<sup>2</sup>

Recent advances utilizing Bluetooth technology are allowing for the City of Houston and Harris County to be one of the first to capture real-time arterial travel times and speeds in the nation. In addition, the City of Houston's implementation of WiMax technology will allow for communication with all of its devices at a significantly lower cost than the traditional use of fiber. It's innovation such as this that keeps the Houston-Galveston region in the national forefront for intelligent transportation systems.

The development and adoption of a regional ITS

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<sup>2</sup> Houston TranStar, 2008 Annual Report

architecture and guidance document by 2011 will ensure that private and commercial motorists are provided with current and consistent travel information. Planned ITS deployments in the TMA through 2035 include:

- Increased freeway surveillance, with expanded regional coverage;
- Arterial traffic flow monitoring and incident detection;
- Centralized regional traffic signal control;
- Automated HOV and HOT lane operations;
- Real-time multi-modal and transit traveler information systems;
- Integrated electronic payments systems for tolls, transit, and parking; and
- A HAZMAT identification and monitoring system.

### **Safety**

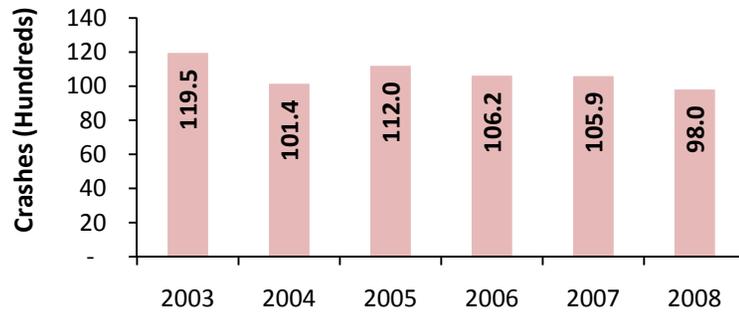
A viable safety evaluation and improvement program is an integral component of the 2035 RTP Update. According to National Safety Council methodology, traffic crashes cost the region approximately \$5 billion a year in motor vehicle damage, medical care, lost wages and productivity, insurance costs, and costs incurred by emergency management.<sup>3</sup> In

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<sup>3</sup> Statistics Department, National Safety Council, and Children's Safety

addition, it is estimated that half of the congestion experienced in the region is the result of incidents on the highway.<sup>4</sup> While motor vehicle crashes have been on the decline over the past few years, down from 119,540 in 2003 to 98,026 crashes in 2008, over 275 serious incidents still occur daily on average involving injury, death or extensive property damage. See Figure 14.

**FIGURE 14 ANNUAL REGIONAL MOTOR VEHICLE CRASHES**



The H-GAC instituted a formal safety program in 2006 with the creation of the Regional Safety Council (RSC). The RSC provides policy-level recommendations for local communities and the State regarding transportation safety issues. The

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Network, Economics and Insurance Resource Center, Pacific Institute for Research and Evaluation.

<sup>4</sup> *Urban Mobility Report: 2009*, Urban Transportation Center for Mobility, Texas Transportation Institute, July 2009

Council is comprised of elected officials, law enforcement, medical and emergency response personnel, and other transportation professionals. The RSC has hosted several safety conferences, which have since become state-wide traffic safety conferences, and annually publishes a *State of Safety in the Region* report.

The H-GAC Transportation Safety Program works to identify and develop recommendations to remediate traffic safety issues throughout the region. The program helps to determine high frequency crash locations as well as crash types and evaluates a range of countermeasures to reduce these crashes based on relevant factors. To date, the Safety program has taken the following actions, in addition to those previously mentioned:

- Receipt and analysis of six years of crash data using a GIS-based crash information techniques;
- Produced over 40 safety reports on the safety conditions in cities and counties, corridors, and other small areas throughout the TMA;
- Identified high crash locations and other areas showing a disproportionate number of crashes relative to travel volume;
- Conducted public outreach campaigns for bicycle, freight, and child occupant safety; and
- Sponsored numerous safety engineering studies of

hazardous locations. To date, safety engineering studies have been conducted in the cities of Houston, Pasadena, Galveston, and Sugar Land; and access management studies were conducted on FM 518, FM 1960, and SH 6.

### **Security-Evacuation**

In April 2006, a list of recommendations regarding evacuation capacity was approved by the H-GAC Board of Directors. The recommendations covered four major topics: command and control, traffic management, special needs, and public outreach; and four minor topics: credentialing, wind refuges, radio communications, and school coordination. As a starting point upon which to build an evacuation plan, H-GAC is currently modeling a hurricane evacuation event to determine the best available routes, times, and impacts of changes to known bottlenecks. Currently contra-flow plans have been developed to relieve traffic congestion at choke points on major routes along IH 10, IH 45, US 290, and US 59 North. Although a regional evacuation plan is in its infancy, the following additional elements have been confirmed to be in place should another catastrophic event occur in the region:

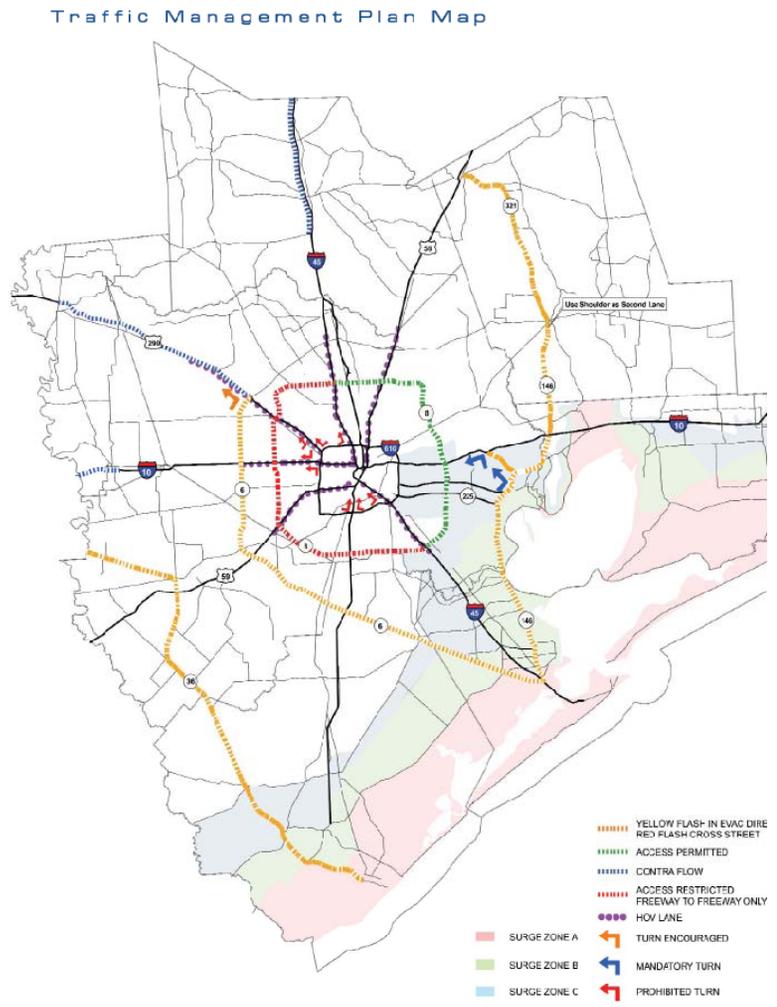
- Pre-positioned tow trucks;
- Designated fuel stops;
- State directed fuel resources;

- Buses at pre-designated locations such as the Reliant Park and George R. Brown Center; and
- Pre-arranged destinations and lodging.

The Houston region has an estimated forty lanes on primary and secondary routes, including nine contra-flow lanes that can be used to efficiently evacuate Galveston/League City/Houston/Woodlands Urban Areas. The estimated daily capacity is 417,800 vehicles without contra-flow, and 505,550 vehicles with the added contra-flow lanes. This capacity level means that in order to evacuate the approximately one million residents living or working in the storm surge zones in the urban areas for a Category 3 or higher storm event, it would take at least thirty-six hours, assuming all lanes were flowing at capacity with no incidents. Figure 15 depicts some of the key components of the evacuation traffic management plan proposed by the Houston-Galveston Area Evacuation and Response Task Force.

H-GAC continues to work with local governments to prepare for large evacuation events. Since the 2007 adoption of the 2035 RTP, H-GAC has developed a data base of traffic control points, and has worked with TxDOT to develop a web-based evacuation map that will allow the user to track the implementation of the traffic management plan. Annual meetings are held around the region to update the traffic management plan and workout any issues that developed

**FIGURE 15 EVACUATION ROUTES**



during previous events or due to new construction.

In response to the recommendations presented to the Board in 2006, H-GAC has also developed a Hurricane Evacuation for Special Needs Communication Plan. As part of the plan training was provided to local emergency managers and agencies that work with various special needs groups. H-GAC also developed a number of communications tools that convey a very simple message to special needs for use by emergency managers.

After Hurricane Ike in September 2008, the region has turned its focus towards planning and preparing for recovery. Planning for recovery means changing policies on how we build in vulnerable areas. It also means building sustainable infrastructure.

**STRATEGY 4: LIVABLE CENTERS**

While we can increase system capacity, manage demand, and improve the efficiency of the existing system, the strategy with potentially the most effect upon improving mobility and quality of life is the strategy of connecting transportation and land use. Land use choices have direct impacts on the ability of the region’s transportation system and agencies to deliver a variety of travel choices. The 2035 RTP Update has shown that major investments in roadway capacity will only moderate, and will not eliminate the level of future traffic congestion. However, more significant mobility gains are possible through better

coordinated land use and transportation planning. An outgrowth of the envision+Houston Region (e+HR) process, showed that by redirecting some future growth along transit corridors and into “emerging cities”, a 10% reduction in daily vehicle miles traveled could be achieved. These results reinforce the public’s intuitive notions about coordinated transportation and land use planning.

The 2035 RTP Update continues the three-pronged land use and transportation coordination strategy identified in the 2035 RTP to create bicycle and pedestrian friendly Centers; establishment of better Connections between the centers, and designs based on the Context of the surrounding land uses. This 3C's strategy, in addition to enhancing mobility choices, is expected to produce economic, environmental and “quality of place” benefits for the region.

### **Livable Centers Program**

H-GAC has taken several steps towards implementing the 3C’s program. The Livable Centers program has been established, offering opportunities for sponsors to propose both Livable Centers studies and implementation projects. In the 2008-2011 TIP sponsors have proposed Livable Centers planning and implementation projects totaling \$25 million.

Since 2007 H-GAC has completed four livable centers studies, in the Cities of Waller, Tomball, and the East End and Midtown neighborhoods of the City of Houston. As of June

2010, livable centers studies were underway in the Energy Corridor, Fourth Ward, Upper Kirby, and Northside neighborhoods of the City of Houston. These studies examine how to create walkable, mixed-use places that are easy to get around by multiple modes. The studies focus on strategies for implementation of identified needs in the pedestrian realm. In 2009 three areas were selected to receive five million dollars each of ARRA (American Recovery and Reinvestment Act) funding for Livable Centers implementation, Uptown, Upper Kirby, and the East End neighborhoods of the City of Houston.

In addition to funding studies and implementation projects through the Livable Centers program, H-GAC has utilized GIS to assess land use patterns in project corridors to help promote context sensitive designs. Extensive analyses have also been conducted in an attempt to quantify the potential benefits of centers and compact development patterns. Staff has produced publications, given presentations and conducted workshops to familiarize local officials and other stakeholders with these proposed land use and transportation alternatives. In future RTPs, a greater level of coordination between local land use plans and transportation projects is planned.

### **Transit and Land Use**

In addition to expanding the regional transit system, transit ridership and efficiency can be improved by coordinating

transit and land use. Development along transit lines that increases density and integrates transit with the development can make transit more accessible and decrease the need for single-occupancy vehicle trips. Recommended strategies include:

- improving transit connections particularly between local transit and regional transit systems;
- encouraging development of convenient and safe sidewalks, street crossings, bicycle, and pedestrian facilities to serve local and regional transit facilities;
- promoting pedestrian and bicycle connections between regional transit facilities and nearby neighborhoods;
- collaborating with partners to accommodate growth by developing Public Private Partnerships;
- considering incentives for economic development and joint development opportunities adjacent to major transportation system corridors;
- providing a minimum level of access to social, work, welfare, and resource activities, including the creation of a customer-oriented, regionally coordinate public transit system;
- encouraging conveniently located pedestrian-oriented businesses and services near regional transit facilities;
- encouraging building design and placement, street improvements, parking standards, and other measures that

encourage pedestrian access and use of local and regional transit; and

- promoting higher density initiatives along dedicated right-of-way transit corridor.

## REGIONAL FREIGHT

Houston's freight transportation network consists of four different modes: truck, rail, marine and air. Freight transportation in the Houston region is heavily influenced by the region's concentration of petrochemical industries. The region has more than 400 chemical manufacturing establishments with more than 35,000 employees.<sup>5</sup> The strategic placement of petrochemical facilities to port infrastructure facilitates the import and export of its products and makes its products available to the world via trucking, rail, pipeline or maritime transportation.

### *I-69/Trans-Texas Corridor*

In 2008, TxDOT announced that to develop I-69, the department would follow existing right of way wherever possible, upgrading existing highways to interstate standards. In 2009, TxDOT officially retired the Trans-Texas Corridor concept with the publishing of Innovative Connectivity in Texas|Vision 2009. This document stated that projects formerly planned for development under the Trans-Texas Corridor concept would now be developed under a series of smaller

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<sup>5</sup> The Greater Houston Partnership website:  
<http://www.houston.org/industryGuide>

projects, designed with local and regional needs in mind. Additionally, this document called for not only dropping the TTC concept, but for retiring the TTC moniker as well. Instead projects would be developed as their original project names, for example, I-69, Loop 9, SH 130, and so on.

For I-69, this has meant impaneling five corridor segment committees charged with the formulation of recommendations to TxDOT and the Transportation Commission for planning and building I-69. I-69 Segment Committees Two and Three are the citizen committees in the H-GAC region that are working on plans and needs for I-69 using the existing roadways.

Currently, there is no dedicated funding for building I-69, so an implementation schedule is not available. While awaiting funding, the environmental documentation process continues, and the I-69 Master Planning Comprehensive Development Agreement awaits execution, pending completion of legislatively required reviews and certifications.

Segment Committee meeting information and project segment maps are available at [http://www.dot.state.tx.us/public\\_involvement/committees/i69/default.htm](http://www.dot.state.tx.us/public_involvement/committees/i69/default.htm). In the Houston region, the I-69/TTC will affect the following counties: Fort Bend, Brazoria, Waller, Harris, Liberty, and Chambers. The official route(s) for the highway has not been determined.

**Commercial Trucking**

The Houston urbanized area has 422 miles of Interstate and other highways, plus 755 miles of other principal arterials. Using this network, commodities are transported throughout the region and to other parts of the country. The top five commercial truck freight commodities (in tons) for the region in 2007 were: petroleum and coal; chemicals and allied products; non-metallic minerals; stone, clay and glass products; and food and kindred products. Truck freight transportation accounted for 9% of the total eight county VMT in 2005.

Table 4 shows commodity flows into and out of the Houston region by truck in 2007 as well as the projected flows for 2035. As the table demonstrates, the thirteen counties comprising the Houston region in this study are major exporters and importers of commodities. By 2035, total traffic in the region is expected to increase by almost 77%, demonstrating the need for additional freight transport capacity.

Table 5 shows annual VMT in the eight-county Houston region by vehicle type and county. Light duty vehicles comprise most of the VMT for the region.

To improve commercial truck traffic safety; laws and ordinances have been enacted within the region to restrict commercial truck traffic to certain lanes during the day. Commercial trucks are restricted from using the far left lane Monday through Friday from 6 AM to 8 PM on

**TABLE 4 TRUCKING COMMODITY FLOWS INTO AND OUT OF THE HOUSTON REGION, 2007 (THOUSANDS OF TONS)**

Truck Mode & Type of Freight Movement	Actual 2007 Tonnage	%	Projected 2035	%
Originating in Region	152,886	32	280,159	35
Terminating in Region	160,286	34	239,173	30
Through Region	67,786	14	132,113	17
Local in Region	91,233	19	140,674	18%
Total	472,191		792,120	

Source: IHS Global Insight, 2009.

**TABLE 5 HOUSTON AREA ANNUAL VMT BY VEHICLE TYPE, 2005 (MILLIONS)**

Light Duty Vehicles	Heavy-Duty Gasoline Trucks	Heavy-Duty Diesel Trucks	Total VMT
128,862 91%	2253 1.6%	10,862 7.7%	141,978

Source: H-GAC Transportation Department, Air Quality Section, 2007.

certain segments of the following facilities: IH 10, IH 45 North, US 290/Northwest Highway, and SH 225. The Texas Transportation Institute evaluated the impacts of truck lane restrictions and found that: the restriction was a positive experience; commercial truck related crashes were reduced by 68%; a 95% compliance rate was observed with limited impacts to overall freeway operations. Additional findings also showed that by implementing such a policy on a regional basis

may not be operationally feasible, and restricting commercial vehicles to one lane may conflict with other vehicles entering and exiting the freeway.

While there has been success with the truck lane restrictions, implementation of the policy on a wide spread basis may not be feasible from an operational standpoint. The restriction of trucks to certain lanes has hazards that potentially cause conflicts with cars and trucks, like cars entering and exiting a freeway with the commercial vehicles in that lane. The inner most lane restriction will not be useful unless it is separated from the other freeway traffic by a concrete barrier. To control travel demand for peak period travel, region wide policies to reward truck movements during non peak periods may need to be explored.

***Rail Freight***

**THE HOUSTON-GALVESTON REGION SERVES AS A MAJOR RAIL HUB FOR THE NATION AND HAS FIVE FREIGHT RAIL YARDS. THE RAIL NETWORK IS DOMINATED BY UNION PACIFIC (UP) AND BURLINGTON NORTHERN SANTA FE (BNSF); WITH UP RAIL LINES TRANSPORTING THE MAJORITY OF THE TONNAGE ON THE SYSTEM. THE SETTEGAST AND ENGLEWOOD RAIL YARDS IN HOUSTON ARE MAJOR YARDS FOR THE SOUTHERN PART OF TEXAS SERVING THE PETROCHEMICAL INDUSTRY ALONG THE TEXAS GULF COAST. UP ALSO HAS AN INTERMODAL**

**FACILITY AT THE PORT OF HOUSTON. BNSF HAS TWO INTERMODAL FACILITIES IN THE HOUSTON AREA, ONE NEAR HOBBY AIRPORT AND ANOTHER AT THE PORT OF HOUSTON. BNSF ALSO SERVES THE PORTS OF GALVESTON AND TEXAS CITY.**

Table 6 displays commodity flows by rail into and out of the Houston region in 2007 as well as the projected flows for 2035. The Houston area is a major importer of rail-shipped commodities. Although some of these commodities remain in the Houston region, much of the volume is exported through area's ports. Houston is expected to remain a strong importer of rail commodities in 2035, with the share of terminating volume rising to 68.4% from 65.8% in 2007. Overall rail traffic in the region is expected to increase by 42.3% by 2035.

**TABLE 6 RAIL COMMODITY FLOWS INTO AND OUT OF THE HOUSTON REGION, 2007 (THOUSANDS OF TONS)**

<b>Rail Mode &amp; Type of Freight Movement</b>	<b>Actual 2007 Tonnage</b>	<b>%</b>	<b>Projected 2035</b>	<b>%</b>
Originating in Region	44,039	28	57,516	26
Terminating in Region	102,295	66	151,290	68
Local in Region	9,140	6	12,497	6
Total without through traffic	155,474		221,302	

Source: IHS Global Insight, 2009

As shown in Figure 16, the majority of rail freight,

approximately 75%, is transported within the south central states. Chemicals represent almost 64% of all rail commodities originating in the Gulf Coast port districts, and is the largest rail commodity originating in the Houston area. The most heavily traded rail commodities for the Houston region in 2007 were: chemicals and allied products; coal; nonmetallic minerals; farm products; and petroleum and coal products.

**FIGURE 16 RAIL COMMODITY FLOWS TO AND FROM HOUSTON, 2003**



The Texas Department of Transportation completed the Houston Freight Rail Study in 2007. The study addressed deficiencies in the Houston region’s freight network and

included roads, ports, and railroads. Improvements that may provide relief to residents and the traveling public adversely affected by delays, interruptions, and noise attributed to the movement of freight within the region were identified, as well as alternatives that may improve regional freight rail capacity by enhancing the efficiency and operations of the railroads.

Overall, \$3.3 billion of improvements were identified for the 8- county region, which are categorized as:

- Grade Separations;
- Grade Crossing Closures;
- Improvements to existing railroad infrastructure; and
- New railroad corridors.

More information about the study and the Gulf Coast Rail District can be found at <http://www.houstonrailplan.com>

***Marine Freight***

The Houston region is served by the Port of Houston, the Port of Texas City, and two smaller ports at Freeport and Galveston. Crude oil and chemical products, which are handled in large quantities at the ports in the region, are frequently processed at or in close proximity to the ports. The resulting product is then shipped out again or transported via oil pipeline to destinations such as Oklahoma. In 2007, the Port of Houston ranked ninth among U.S. containership ports, handling nearly 1.4 million of

Twenty-Foot Equivalent Units (TEUs)<sup>6</sup>, and ranked second in the nation in terms of total tonnage. The Port of Texas City is a privately owned, for-profit port that almost exclusively handles bulk liquid products, such as chemical and crude oil products.

Table 7 shows annual marine freight tonnage at the region’s four ports. Total traffic in 2007 was 384 million tons, a 23% increase over the 312.5 million tons in 2006. More than two two-thirds of total tonnage is foreign imports or exports. Marine freight is then sorted at multi-modal freight facilities and transferred to highways and railways. Increases in imports and exports thus add to traffic not only at ports, but also on connecting corridors.

**TABLE 7 WATERBORNE COMMERCE AT HOUSTON AREA PORTS, 2007 (THOUSANDS OF TONS)**

	Port of Houston		Port of Texas City		Port of Galveston		Port of Freeport		Total Short Tons
	Short Tons	Rank	Short Tons	Rank	Short Tons	Rank	Short Tons	Rank	
Imports	94,692	1	35,919	8	1,339	63	24,065	16	187,085
Exports	50,651	2	4,561	27	4,071	29	3,098	32	73,852
Domestic	70,722	3	16,307	20	4,381	62	5,533	54	123,182
Total	216,064	2	56,787	13	9,791	54	29,598	27	384,119

Source: U.S. Army Corps of Engineers, *Waterborne Commerce of the United States* database, 2007.

Water transportation is the lowest cost freight transportation option. The Gulf Intracoastal Waterway (GIWW), a 1,300 mile man-made canal runs along the Gulf Coast of Mexico. GIWW links all of the Gulf Coast ports and enables these ports to access the inland waterway system of the United States.

To accommodate truck traffic into and out of the ports, certain infrastructure improvements are critical. Specifically, the Port of Houston recommends improvements to the following gateways to their facility: SH146, SH225, Port Drive, Barbour's Cut Blvd, Spencer Road, and Red Bluff. Many of the Port of Houston priority projects are in the H-GAC Transportation Improvement Program (TIP) for funding years 2011 – 2014. For Port Freeport, improvements to SH36 are critical to its ability to handle projected growth.

### *Air Freight*

The Houston-Galveston region has three major airports: George Bush Intercontinental Airport/Houston (IAH), William P. Hobby Airport (HOU), and Ellington Field (EFD). IAH handles the vast majority of air cargo for the Houston Airport System – 448,113 tons in 2007, as shown in Table 8. IAH ranks 30th among the nation’s cargo-service airports in terms of landed weight. HOU handles only a small amount of air cargo, while Ellington field does not handle commercial traffic.

<sup>6</sup> U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center.

### ***Freight Policy***

Since 2007, H-GAC has undertaken a Regional Goods Movement Plan to develop a system-level overview of freight movements in the region. This two-year plan addresses the recommendations from the 2003 Freight Stakes Workshop by

**TABLE 8 HOUSTON AREA TOTAL AIR CARGO FLOWS, 2007**

Airport	Air Cargo (tons)		
	Inbound	Outbound	Total
George Bush Intercontinental (IAH)	215,414	232,699	448,113
William P. Hobby Airport (HOU)	6,981	9,295	16,276
Total	222,395	241,993	464,389

Source: Bureau of Transportation Statistics, Air Carrier Statistics T-100 database.

including work steps that engage the freight private sector, ensure the planning process engages intermodal options, and analyzes more efficient options for freight trucking movement.

The approach to developing the Plan links together freight system, commodity flow, economic, and supply chain analyses to identify the most critical infrastructure, operational, and market issues and chokepoints impacting the region. The plan will describe how those issues and chokepoints impact key regional industries, facilities and communities and identify projects and strategies to address them.

At the MPO level, the implementation of provisions in the Freight Transportation Gateways Program (SAFETEA-LU, Section 1205) should be explored. A “Freight Transportation

Gateway” is a nationally or regionally significant transportation port of entry or hub for domestic and global trade, military mobilization, and includes freight intermodal and Strategic Highway Network connections that provide access to and from these gateways. Under this program, states and localities are encouraged to adopt innovative financing strategies for freight improvements, including new user fees and private sector investment. The purposes of the program include: 1) facilitating and supporting multimodal freight transportation initiatives at the state and local levels; 2) providing capital funding to address infrastructure and freight operational needs; 3) encouraging adoption of new financing strategies; and 4) supporting military mobilization and readiness.<sup>7</sup>

To encourage innovative financing options for implementation of projects, SAFETEA-LU includes the following provisions which will encourage private sector investment:

- Private Activity Bonds are used to attract private investment for projects that have a distinct public benefit. Until now, airports and maritime ports were the

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<sup>7</sup> Federal Highway Administration, A Summary of Highway Provisions in SAFETEA-LU, 2005.

only eligible transportation projects. Qualified projects now include surface transportation projects for which an international entity authorized under federal or state law responsible and facilities for the transfer of freight from truck to rail or rail to truck (including any temporary storage facilities related to the transfers). These bonds are not subject to the general annual volume cap for private activity bonds for state agencies and other issuers.

- Transportation Infrastructure Finance and Innovation Act (TIFIA) provides Federal credit assistance to nationally or regionally significant surface transportation projects, including highway, transit, and rail. To encourage broader use of TIFIA financing, the threshold required for total project cost has been lowered to \$50 million (\$15 million for ITS projects), and eligibility is expanded to include public freight rail facilities or private facilities providing public benefit for highway users, intermodal freight transfer facilities, access to such freight facilities and service improvement to such facilities including capital investment for ITS.

## ENVIRONMENTAL JUSTICE

The primary objective of H-GAC environmental justice outreach activities is to improve public transit services in underserved communities. H-GAC has taken steps to ensure that the 2035 RTP Update meets all federal goals of Environmental Justice, as described in the guidelines of *Executive Order 12898: Federal Action to Address Environmental Justice (EJ) in Minority Populations and Low-Income Populations*; in addition to, internal agency goals of maximizing public participation by providing opportunities and forums beyond minimum requirements by pro-actively reaching out to more citizens prior to formal decision making. A public involvement plan has been developed that provides a structured set of procedures designed to engage the full and fair participation of all potentially affected communities in the transportation decision-making process. H-GAC reviews projects to verify that the effects of the RTP are not disproportionately borne by minority or low-income populations, including but not limited to health, environmental, social and economic effects. Consideration will also be given to the equitable distribution of possible benefits resulting from the RTP, including emissions reductions, congestion relief, and increased mobility for EJ communities.

The environmental justice analyses undertaken in the 2035 RTP consisted of two major components: a technical

analysis and a public involvement and public outreach effort in conjunction with local agencies. The purpose of the technical analyses was to identify EJ communities and analyze the costs and benefits of RTP transportation projects to EJ communities through a mode share and accessibility analysis. Public involvement and outreach activities included meetings, presentations, mailings, notices, attitudinal surveys, and prompt responses to incoming telephone calls and e-mail messages. The purpose of which, is to ensure an open planning process that supports early and continued public involvement, timely notice and response, as well as full public access to information regarding key decisions. Information gained from these activities was included in the Public Transportation Coordination Plan which is a component of the 2035 RTP.

As the environmental justice technical analysis performed for the 2035 was based on 2000 census data, and new census data has not yet come available, the technical analysis has not been revised for the 2035 RTP Update. H-GAC has worked to expand upon the findings of the analysis by undertaking work in producing Neighborhood Profiles for EJ communities of high concern, as identified in the 2035 RTP, and by producing a technical analysis on the effects that a toll road network may impose on EJ communities.

As tolling has become part of our major transportation network, H-GAC has expanded efforts to understand the effects of transportation on EJ communities by completing an

analysis focused on the cumulative and indirect effects of toll roads on the region and EJ communities. This report is currently being integrated into a new technical analysis that will be done when the 2010 Census data is available. Additionally, H-GAC continues to work on maintaining current public involvement practices that are designed to appropriately reach EJ communities with new and advancing technologies.

One new tool for public outreach to some of our high-concern EJ communities is reflected in the Neighborhood Profiles being developed by H-GAC. These profiles are based on the Accessibility Analysis for EJ communities in the 2035 RTP. The first Neighborhood Profiles will consist of the following six communities selected in the 2035 RTP as areas of EJ concern:

- Galveston;
- Gulfton;
- Conroe;
- Baytown;
- Hempstead; and
- Third Ward.

The Neighborhood Profiles will provide a snapshot of the selected communities that includes demographic and socioeconomic information vital to understanding the dynamics of each community, a summary of known issues in the

community, as well as a listing of community groups and organizations. The profiles will allow H-GAC staff to provide better outreach to the communities by providing a better understanding and representation of the community, its needs and community leaders. If successful, H-GAC will expand the neighborhood profiles to additional communities of concern that will be based on a future, more expansive accessibility analysis when 2010 census data becomes available.

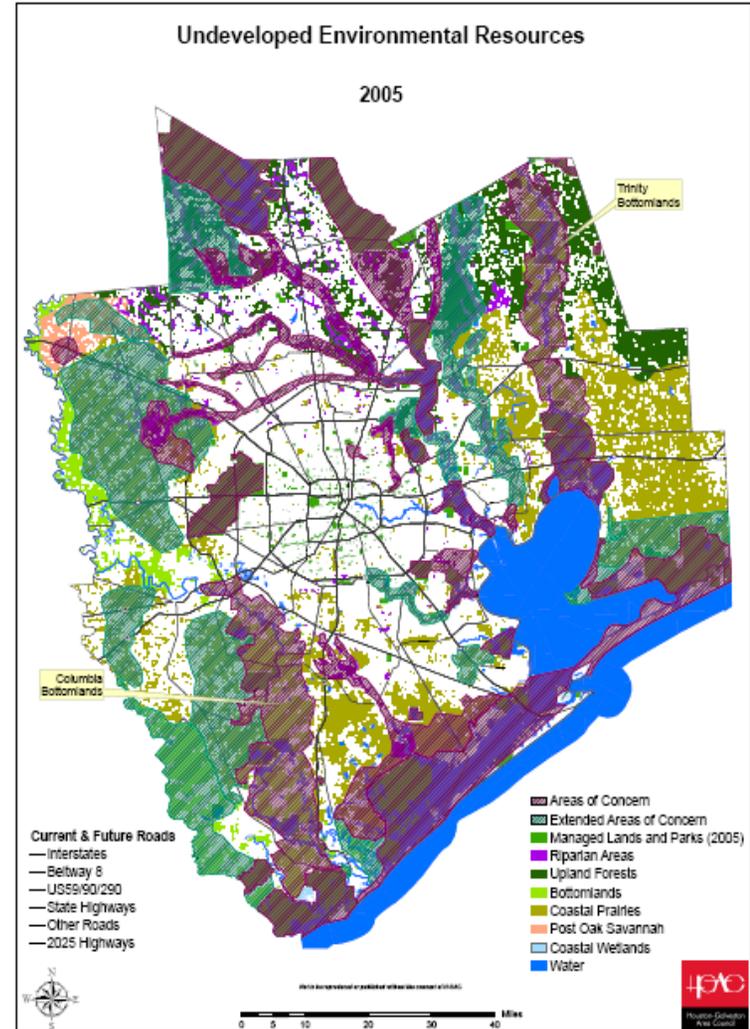
## ENVIRONMENTAL ANALYSIS

As growth and development are part of our region’s future, it is not feasible that every environmental parcel will be able to be conserved. However, it is feasible that the region identifies and works to conserve those areas that have the most significant ecology.

Prairies, Wetlands, Bottomland Forests, Upland Forests, and Riparian Corridors ecosystems provide natural beauty to the Houston region. Each of these resources serves particular functions, and also faces threats to its survival. These environmental resources are a major part of our region’s quality of life, providing vital functions such as flood protection, air quality, water quality, wildlife habitat, ecotourism, and recreation opportunities. These resources contribute to our region’s identity and sense of place, making the region truly unique. Protection of these natural resources that contribute to our region’s quality of life is an important priority when planning for our region’s future growth and transportation requirements, a desire that was strongly echoed at the envision+Houston Region workshops and forums.

Figure 17 reflects a process undertaken during the 2035 RTP planning process to identify areas of concern that are distinct environmental resources within the H-GAC region for special consideration in the transportation planning process. These resources were identified by a committee of

**FIGURE 17 UNDEVELOPED ENVIRONMENTAL RESOURCES**



environmental professionals from federal and state resource agencies, as well as other organizations with similar expertise referred to as the Environmental Advisory Committee.

It should be noted that this identification was not at a geographically precise scale. The lack of geographic precision limited the applicability of the map to evaluate potential impacts of proposed transportation projects, as transportation projects have specific limits. An additional limitation was the fact that the mapping was not in an interactive, GIS-based format, limiting its application beyond inclusion in the RTP. For example, it was not possible to overlay transportation project potential alignments. The areas of concern highlighted by the committee were also not prioritized. Instead, all resources were presumed to be equal, with no metric-based evaluation of the intrinsic quality of the resources.

In light of these limitations, and looking forward toward the development of the 2040 RTP, H-GAC was awarded an FHWA Eco-Logical grant in 2008 to improve upon this initial effort. The goal of the Eco-Logical project is to develop a Regional Decision Support System (RDSS), an interactive, Geographic Information Systems (GIS)-based mapping tool that can be used to integrate long-range transportation and environmental planning and to help identify and, ultimately conserve, high-value environmental resources in the region.

Over the course of two years (2008-2010) H-GAC

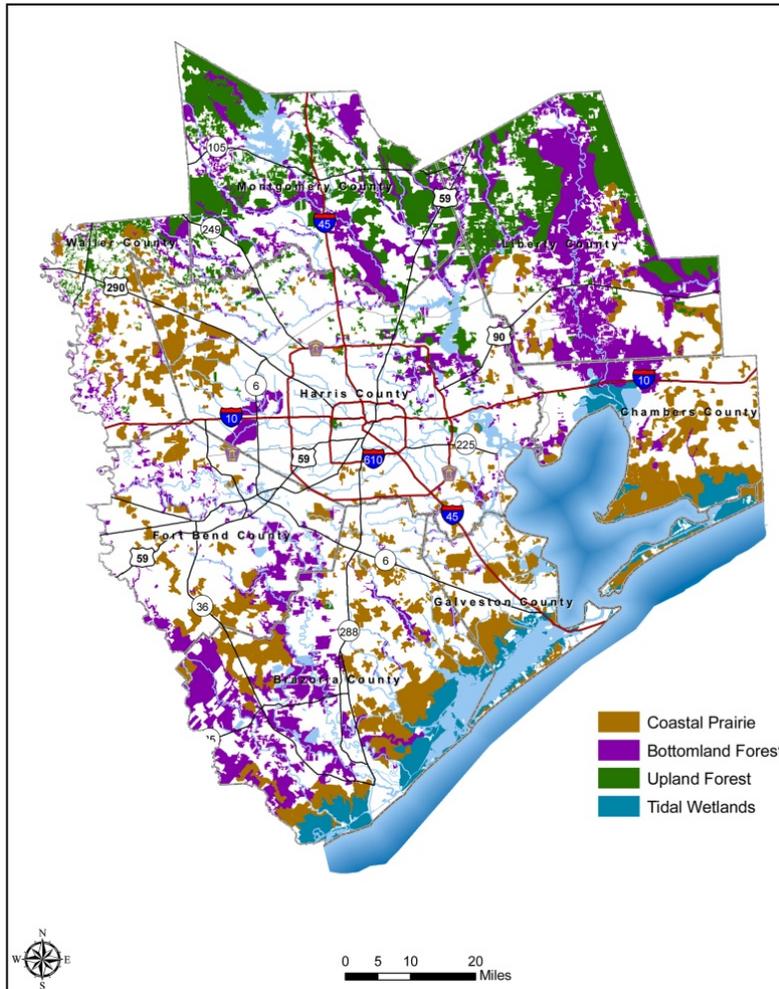
worked with the reconvened Environmental Advisory Committee (EAC) to receive input and feedback into the process, mapping, metrics, and development of the RDSS. One of the tasks completed by the EAC was to define and map the ecotypes found in the region.

Next, the EAC determined the metrics that are indicators of high value environmental resources. The metrics were applied to the ecotypes that were mapped during the course of the project to determine how environmental resources are prioritized. The metrics include:

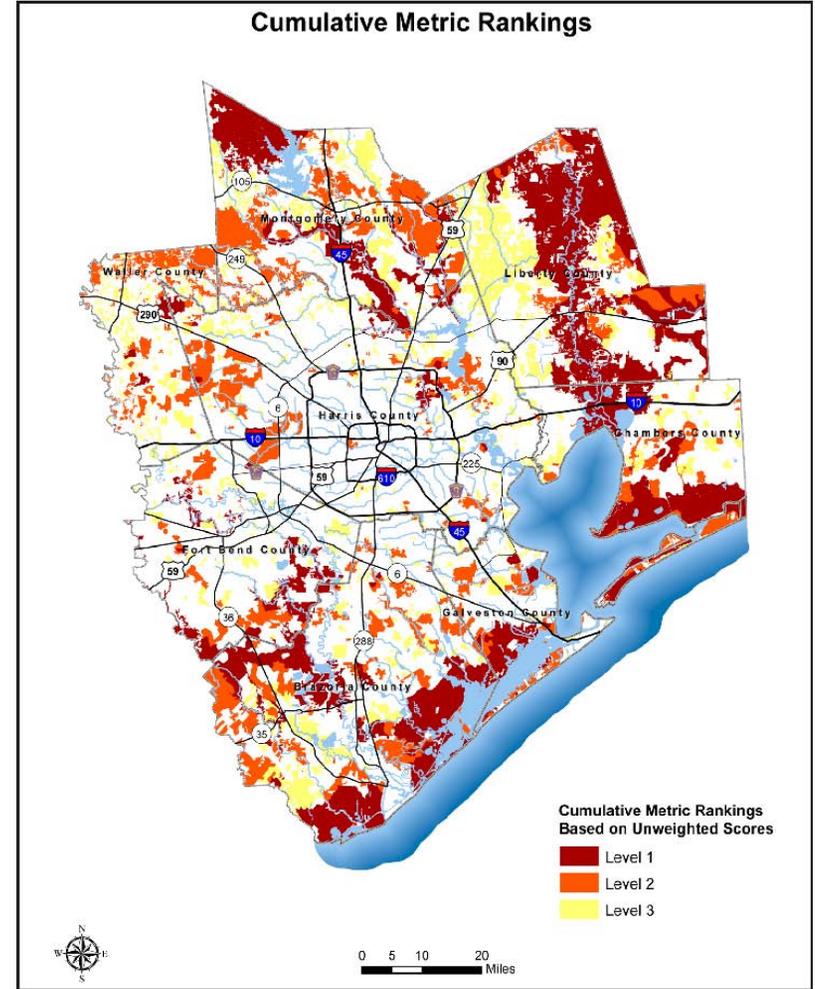
- Size;
- Shape;
- Scarcity (regional and watershed);
- Adjacency;
- Isolation;
- Presence of threatened and endangered species;
- Diversity; and
- Quality.

These metrics scores are aggregated to generate a cumulative ecological score for the proposed project, with Level 1 areas represented by the color red being the highest priority environmental resources in the region as seen in Figure 18 and Figure 19. In addition to being able to view metrics for each resource, users of the tool may overlay potential transportation

**FIGURE 18 LOCATION OF ECOTYPES, 2010 ECO-LOGICAL PROJECT**



**FIGURE 19 RANKINGS OF ECOTYPES, 2010 ECO-LOGICAL PROJECT**



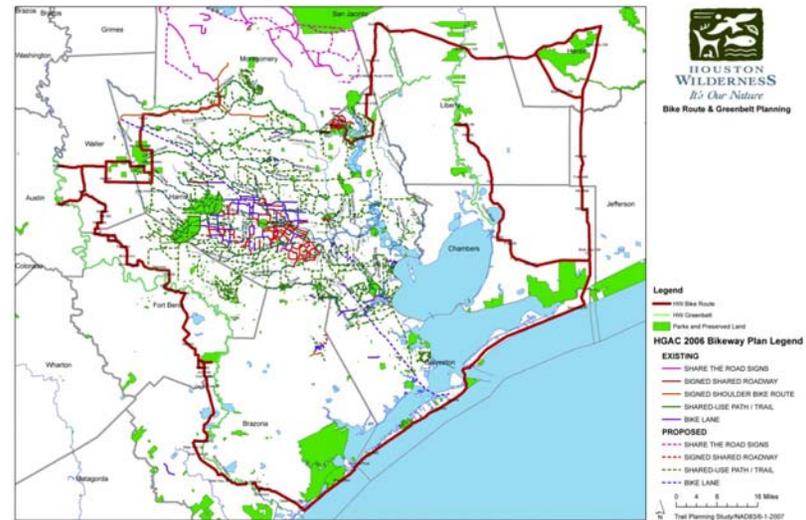
projects with the mapping tool to determine potential conflicts with Level 1, 2, or 3 environmental resources.

H-GAC intends to incorporate use of the RDSS into the 2040 RTP. By incorporating the Eco-Logical project into the RTP, the impacts of transportation projects to sensitive environmental areas can be assessed prior to inclusion in the long-range plan for the region. The RDSS is unique in that it is the first consensus-driven, regional-scale tool that identifies priorities for future conservation efforts in the Houston-Galveston area. Through continued coordination of transportation planning and environmental conservation using tools like the RDSS, the Houston-Galveston region can meet the challenge of ensuring mobility for the growing population while simultaneously preserving the region's unique resources for future generations to enjoy.

Figure 20 is a regionally significant greenway concept surrounding the Houston region, linking important existing contiguous wildlife habitat, steer development away from floodways, preserve ecological habitats and provide other preserves and conservation areas with major parks, bayous and rivers in a continuous loop. This greenway would provide important environmental benefits. A pedestrian and bike trail is planned in the conceptual greenbelt to further Houston Wilderness goals of environmental education, recreation and ecotourism. H-GAC will continue to work with environmental agencies and awareness groups to preserve green space for

ecosystem and habitat preservation and regional recreational opportunities.

**FIGURE 20 BIKE ROUTES AND GREENBELT PLANNING**



## TRANSPORTATION AND CLIMATE CHANGE

On-road mobile sources are a major contributor of greenhouse gas (GHG) emissions, contributing nearly 30 percent of all U.S. GHG emissions.<sup>8</sup> While other environmental concerns such as pollutant emissions and ecological health have been addressed for decades in the transportation sector, there is relatively less knowledge about greenhouse gases, climate change, and the implications for transportation agencies.

Texas ranks first in the nation as GHG emitter, and Texans emit 26% more metric tons of carbon equivalents per capita than the rest of the country.<sup>1</sup> In addition, the overall energy use in Texas is projected to increase by 36% over the next 20 years—a growth rate of 1.5% per year.<sup>9</sup> As a consequence GHG emissions will increase rapidly unless significant changes are made. Due to the geographic location of the H-GAC region, it is highly vulnerable to extreme weather events, aggravated by GHG emissions, like hurricanes and flooding. This region's significant vehicle traffic and strong industrial base represents a considerable percentage of the total GHGs emitted in Texas.

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<sup>8</sup> U.S. EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006*. Washington D.C., accessed March 2, 2009, [http://www.epa.gov/climatechange/emissions/downloads/08\\_CR.pdf](http://www.epa.gov/climatechange/emissions/downloads/08_CR.pdf).

<sup>9</sup> Intergovernmental Panel on Climate Change Report, <http://www.ipcc.ch/#>

Climate change is anticipated to have a tremendous effect, including significant alterations in temperature and precipitation, sea level rise, and an increased frequency and intensity of storms. These effects can severely affect the transportation infrastructure through accelerated deterioration, inundation of roadways and loss of service.<sup>10</sup> The USDOT's Gulf Coast Study identifies the following as possible climate effects by the year 2100 for the HGB region<sup>11</sup>:

- Average annual temperature rise of 2 to 7 degrees F;
- Sea level rise of two to five feet (with a possibility of 25 feet due to storm surge);
- Increase intensity and frequency of extreme weather events; and
- Similar annual precipitation levels, however more intense and frequent storms separated with longer dry periods.

Based on the climate change scenarios discussed in the previously-mentioned Gulf Coast Study, the Foresight Panel on Environmental Effects at H-GAC estimated that approximately

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<sup>10</sup> Transportation Research Board. *Special Report 290: Potential Impacts of Climate Change on U.S. Transportation*. Transportation Research Board, Washington D.C., 2008.

<sup>11</sup> *Transportation's Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I*.

9,690 miles of existing roads could be affected by flooding, approximately 1,812 miles of existing roads affected by sea level rise, and around 6,400 miles of existing roadway inundated by sea level rise and storm surges.

Climate change may also have an impact on the air quality of the region. The Houston region is currently in nonattainment of the 8-hour ozone standard. Increased temperatures during the summer months could lead to a greater number of days with very high ozone concentrations.

Several bills have been introduced in the 111<sup>th</sup> Congress, from both the House and the Senate, to address climate change and energy issues. The bills would impose/permit control on GHG emissions. Due to this imminent mandate to control GHGs by the MPOs and to include them into their regional transportation planning, H-GAC is working with TxDOT, Texas Transportation Institute and Houston Advanced Research Center on a project called “Methodology for Estimating Green House Gas Emissions and Assessing Mitigation Options for Project Level and County Level Applications for On-Road Mobile Sources”. This project focuses on the issue of GHG mitigation, i.e. the reduction of GHG emissions. Mitigation options for transportation are generally classified as vehicle measures, fuel options, activity

reduction, or system operation improvements.<sup>12</sup> This proposed project addresses mitigation options for on-road mobile sources from the perspective of DOTs, MPOs and local transportation agencies. Such agencies may have varying degrees of control over different options for mitigation. At this time there is no methodology for transportation agencies to study the impact of GHG at the project level and to evaluate strategies for reducing GHG impacts.

This research will help agencies to track progress toward reaching GHG reduction goals, as well as provide them with an understanding of the various options available for GHG emissions mitigation. The methodology can therefore help practitioners improve planning decisions made at the statewide, regional, metropolitan, or local levels to reduce GHG emissions.

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<sup>12</sup> Cynthia Burbank. *Global Climate Change: Transportation's Role in Reducing GHG Emissions*. Presentation at the American Association of State and Highway Transportation Officials (AASHTO) Annual Meeting, October 19, 2008.

## **PUBLIC INVOLVEMENT**

In conjunction with the development of the 2035 RTP, the region's Transportation Policy Council adopted a Public Participation Plan to define protocols and strategies for public involvement efforts undertaken by the MPO. Public involvement efforts for the 2035 RTP Update are in accordance with the Public Participation Plan. Details of the outreach effort are provided in Appendix B.

## FINANCIAL PLAN

The Financial Plan is a comprehensive analysis of the region's transportation funding capacity, and is based upon the information provided by the region's entities that make transportation investments. The cities, counties, transit operators, toll road authorities, and other transportation entities in the region make investments by building, operating, maintaining and preserving transportation facilities, as well as by implementing demand management and air quality improvement programs. The purpose of the financial plan is to ensure that the program of projects anticipated by these entities and contained in the RTP can be implemented using resources that are reasonably expected to be available. When expected revenues equal or exceed anticipated costs, the financial plan is considered to be fiscally constrained.

A financial plan makes estimations of future transportation investment dollars by looking at past levels of investment and making assumptions on future growth. Predicting the financial future is speculative in tranquil times; it is even more challenging when the economy is in turmoil and historic transportation trends are in flux.

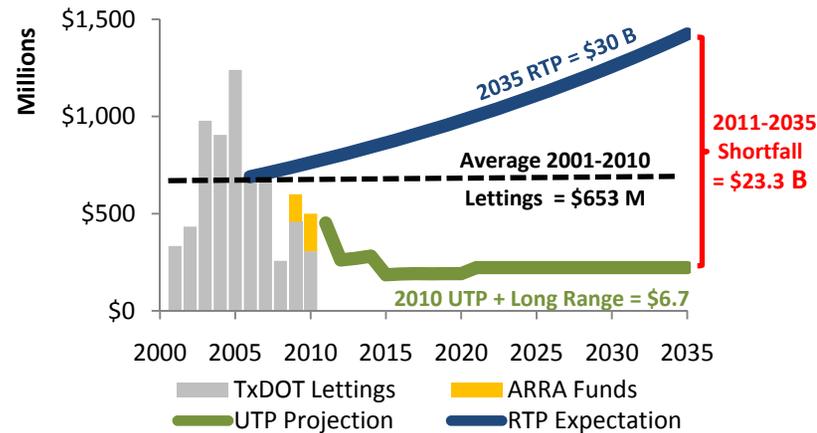
In 2006 H-GAC completed an extensive financial review of the local and state entities with significant expenditures on the transportation system. However, since then the economy has gone into a recession, and steady yearly

increases in vehicle miles traveled and gallons of gasoline sold have discontinued. In addition, the current federal transportation funding legislation that expired in 2009 has been given only interim extensions through continuing legislation, and on two occasions Congress rescinded transportation funding authority.

Based on some of these changes, as well as the expectation that future motor fuels tax revenues will decrease significantly due to the increase in fuel efficiency rates, the Texas Department of Transportation (TxDOT) recently revised sharply downward its outlook on transportation spending as expressed in its 2010-2020 Unified Transportation Program (UTP) and its long-range expenditure projections developed by the Texas Transportation Commission. In 2007, when the original financial plan was adopted for the 2035 RTP, it anticipated TxDOT funding to be \$30.0 Billion for the years 2011-2035, whereas the new estimate is now \$6.7 Billion, see Figure 21. Consequently, the impetus for issuing this 2035 RTP Update is a direct response to TxDOT's revised financial outlook.

Unchanged in this financial plan are the expectations for all other transportation investment entities as well as the assumptions on growth and inflation. H-GAC is currently developing a wholly new comprehensive financial review of the region's transportation entities in preparation for the next regional transportation plan, with the hope, if not expectation,

**FIGURE 21 TXDOT CONSTRUCTION FUNDING FORECASTS: ORIGINAL AND CURRENT (NOMINAL DOLLARS)**



that federal funding issues may be soon clarified.

**Assumptions**

Since 2005, federal law requires that revenues and future project costs estimates must use an inflation rate to reflect “year of expenditure dollars” and to include total project costs. This plan fulfills both of these requirements. “Year of expenditure dollars” also known as nominal dollars, as opposed to current year, real, or today’s dollars, are adjusted upwards to account for the effects of inflation by a given rate for each year the expenditure is made farther into the future. For example, a project that costs \$100 in today’s dollars will cost \$122 in ten years at 2% inflation. Thus, expressing all expenditures in

nominal dollars tries to account for the weakening effects that inflation has on the dollar’s actual purchasing power.

Total project cost is comprised of adding together the capital (construction) and financing costs that have been historically reported along with related cost such as purchasing right-of-way, relocating utilities, and engineering. Although some of these related costs are not funded locally (for example, right-of-way is purchased from a statewide account), they are now included to give a more complete understanding of a project’s total financial costs.

Historically, the region is experiencing, on average, a robust, 1.7% increase in population each year. This rate serves as the proxy for growth in the financial model. Inflationary growth is assessed at 2.54%, based on a 10-year average of the Consumer Price Index from 1996-2006. Toll revenues are developed from expectations expressed by the toll road authorities and have been revised to reflect delay or abandonment of selected projects based on the anticipated loss of state dollars invested on collateral projects. Although all other financial information remains unchanged in this plan when compared to its predecessor, the numbers still cannot be directly compared to each other due to the shortened frame of time. The original plan covered the years 2006-2035; this updated financial plan covers the years 2011-2035.

### Revenues

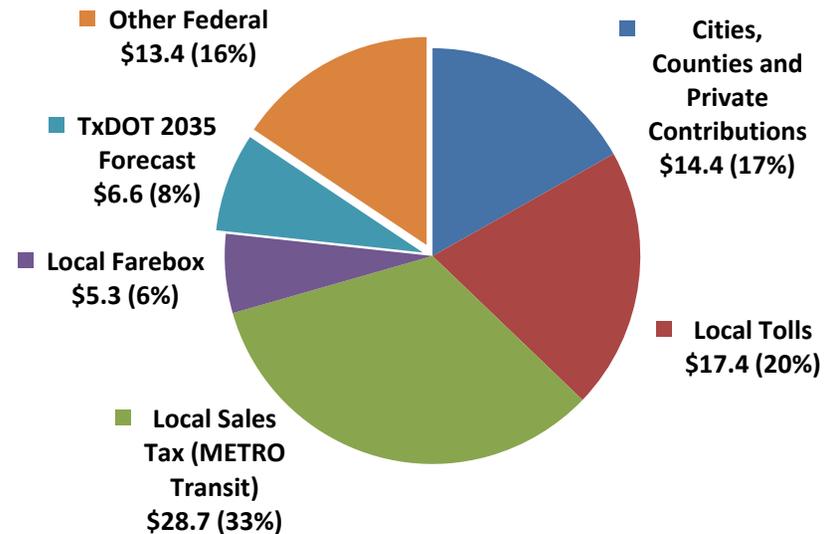
The estimated total revenue available for the 2035 RTP Update is \$85.7 Billion (see Figure 22). The revenue comes from federal, state, and local sources. Among the federal sources are the federal gas tax, programmed funds from the Federal Highway Administration and the Federal Transit Administration, congressional earmarks, as well as other funds that are allocated to the individual states. State sources include the motor fuel tax, vehicle registration fees, pass-through financing agreements (as reimbursed from federal sources), Proposition 12 and 14 bond funds, and other state allocations. Local sources include property and sales taxes collected by the cities and counties, toll revenues, farebox collections from transit agencies, and private (developer) contributions.

The various local sources comprise 76% of all revenues, while Federal and State sources make up the remaining 24%. It is particularly important to note that the region's dependence on toll receipts to fund the RTP is growing. Although the Harris, Fort Bend, Brazoria and Montgomery County Toll Road Authorities are not obligated to spend toll receipts on transportation projects, in the past they have reinvested toll-generated revenues into the toll and connecting roadway networks.

### Expenditures

Total estimated expenditures in the 2035 RTP Update

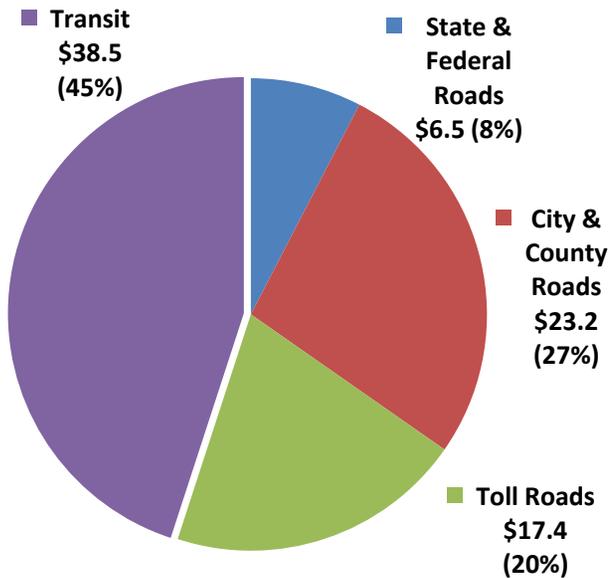
**FIGURE 22 REVENUES BY SOURCE**  
**\$85.7 BILLION TOTAL (NOMINAL DOLLARS)**



Source: H-GAC Financial Model 2006/2010

are \$85.6 Billion (see Figure 23). When examined by mode of travel (roadway or transit), 55% of all expenditures are for roadway projects that support the automobile. In a region known for its dispersed suburbanized housing, this percentage is not unusual. However, over the last several years transit investments have increased, and this trend is expected to continue, thereby improving choices among transportation modes.

**FIGURE 23 EXPENDITURES BY MODE  
\$85.6 BILLION (NOMINAL DOLLARS)**

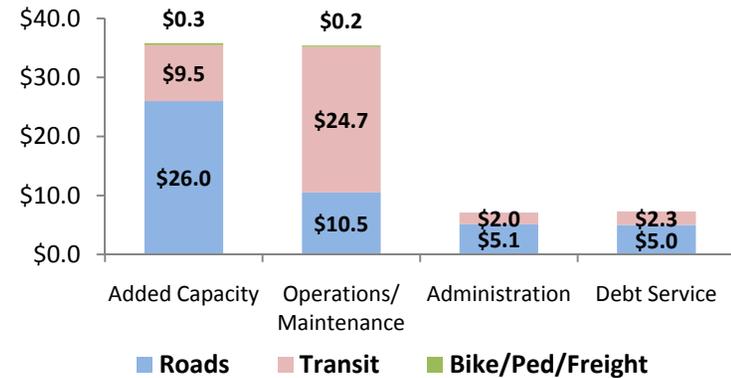


Source: H-GAC Financial Model 2006/2010

Not only will there be a larger network to maintain in the future, but also system preservation efforts are currently underfunded. In the future, more revenues will be needed for system preservation to prevent further deterioration of roadway surfaces.

Expenditures on the transportation network can also be listed by function (see Figure 24), including building new and improving existing roadways and transit lines (added capacity), operating and maintaining the network including the reconstruction of existing facilities when they reach the end of

**FIGURE 24 EXPENDITURES BY FUNCTION  
\$85.6 BILLION (NOMINAL DOLLARS)**



Source: H-GAC Financial Model 2006/2010

their useful life (operations/maintenance), wages and salaries for roadway and transit agency staff (administration), and financing costs associated with debt incurred for transportation projects (debt service).

***Comparing the Original and Update Revenue Forecasts***

It would seem that there is a \$71.5 B difference between the revenue forecasts of original 2035 RTP and the Update. However, the numbers cannot be directly compared because the plans not only cover differing time periods, as mentioned earlier, but also differ in what each considers as a revenue source. Table 9 aligns these two plans to allow for a direct comparison.

**TABLE 9      COMPARISON OF THE ORIGINAL 2035 RTP FINANCIALS AND THE UPDATE (NOMINAL DOLLARS IN BILLIONS)**

<b>Revenue</b>	<b>Original 2006-2035</b>	<b>Original 2011-2035</b>	<b>Change</b>	<b>Update 2011-2035</b>	<b>Change</b>
Federal <sup>+</sup>	28.1	24.2	-3.8	13.4	-10.8
State <sup>++</sup>	32.6	29.9	-2.7	6.6	-23.3
Local	16.5	14.4	-2.1	14.4	0.0
METRO Sales Tax	31.2	28.7	-2.5	28.7	0.0
Toll	21.3	19.8	-1.5	17.4	-2.4
User Fees	5.7	5.3	-0.4	5.3	0.0
Bonds	19.1	14.9	-4.2	0.0*	-14.9
Other	2.8	0.0**	-2.8	0.0	0.0
<b>Total</b>	<b>157.2</b>	<b>137.1</b>	<b>-20.0</b>	<b>85.7</b>	<b>-51.4</b>

<sup>+</sup> = "Federal" is "Other Federal" for the Update.

<sup>++</sup> = "State" is "TxDOT 2035 Forecast" for the Update.

\* = "Bonds" is zeroed out because the repayment of the principal is not included among expenditures. However, debt financing costs, i.e., "interest", are listed.

\*\* = "Other" are short-term local revenues (e.g., sale of property), that concluded prior to 2011.

The original 2035 RTP covers 30 years (2006-2035), and the Update covers 25 years (2011-2035). After subtracting 2006-2010 from the original forecast, it decreases by \$20.0 B to \$137.1 B (numbers may not add precisely due to rounding).

The Update forecast also does not include "Bonds" or debt financing as a revenue source. The money received by local governments and entities by issuing bonds is not a source of new revenues, such as creating a new tax or fee, nor is it the increase of an existing source, such as raising the gas tax. Instead, bonds bring future revenues into the present, mainly

by paying investors interest on the principal that is borrowed. Because bonds are not a true revenue source, the Update does not include it. Therefore, to make a direct comparison between the original and the Update, "Bonds" would have to be eliminated from the original forecast (a zero balance is shown in the Update). Thus, when accounting for the elimination of bonds, the actual difference between the time-horizon-aligned plans is not \$51.4 B, as shown, but only \$36.5.

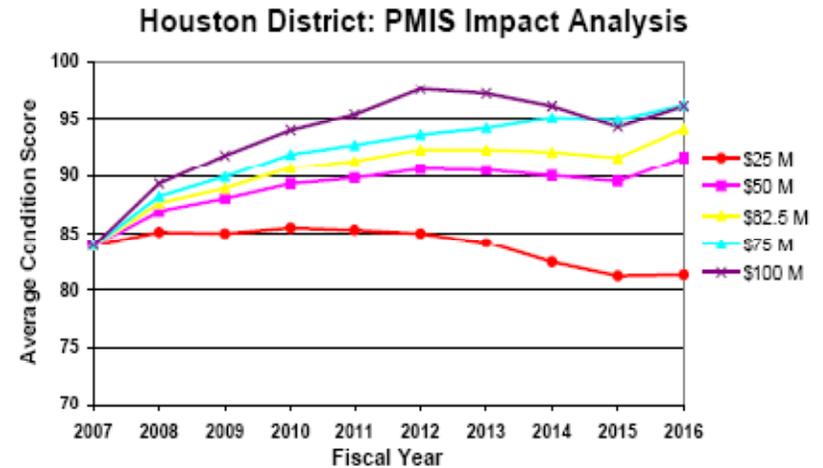
## PRESERVATION, MAINTENANCE AND REHABILITATION

The regional road system is either the largest capital asset or among the largest capital assets under the responsibility of local area governments. With nearly all of the regional highway and roadway system being built to its outermost limits, an emphasis on maintenance and rehabilitation has become paramount. As pavements near the end of its useful life, and as pavement deficiencies develop, decisions must be made about when, where, and how to allocate funding for maintenance and preservation.

In August 2001 the Texas Transportation Commission set a goal to have 90% of Texas pavements in good or better condition by the year 2017. In keeping with this goal, H-GAC and TxDOT staff ran a Pavement Management Information System (PMIS) analysis using several yearly pavement budgets for a ten year period assuming a baseline average pavement condition score of 82 (good condition). The basic question asked as part of this analysis was “What would be the required expenditure level for the Houston District to maintain the future network at or above a condition score of 90 (very good condition)?” The results of this analysis are seen in Figure 25.

The scenarios correspond to expenditure levels from \$25 million to \$100 million. To achieve and maintain an average pavement condition score of 90 or very good pavement

**FIGURE 25 PAVEMENT MANAGEMENT INFORMATION SYSTEM**



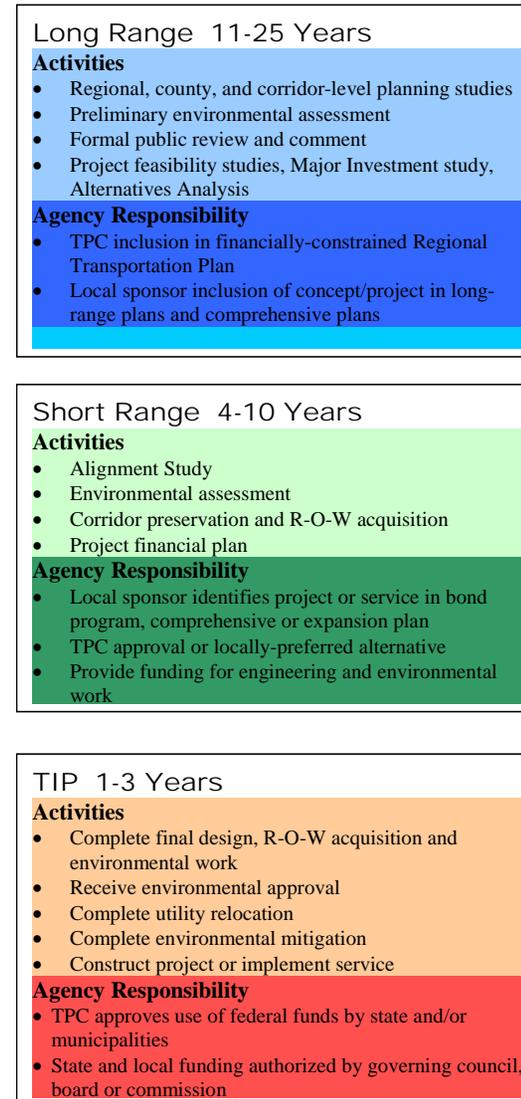
condition; between \$50 million to \$75 million is needed to improve from a good condition score (83) to a very good condition score (90), and thus meet and maintain the statewide goal. The selection of any allocation strategy however, will be formed in part through an economic analysis involving trade-offs. The end result will be a set of maintenance projects ranked by need and scheduled by year for the long-term good of the region.

## PROJECT PRIORITIZATION

The RTP groups projects into three timeframes: long-range, short-range and imminent for construction, shown in Figure 26. Generally, all 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,

FIGURE 26 PROJECT DEVELOPMENT



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 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. The current TIP in development is the 2011-2014 TIP.

***Project Prioritization Process***

The 2035 RTP Update project prioritization process is a systematic procedure to rank projects in the long-range plan from higher to lower priority. Projects listed in the long-range plan do not require the identification of a specific funding source. The intention of this process is to determine the types of transportation improvements that are financially feasible over the next twenty years or more. Projects ranked near the top of the listing have the expectation of providing the greatest achievement of desired regional outcomes for every dollar expended.

The process involves several basic steps to achieve the end result of linking regional goals and objectives to specific quantitative and qualitative performance indicators. The process begins with a list of modeled projects from the most

current plan and a pre-determined set of RTP planning factors. Next, all projects are placed into one of the eligible program categories as seen in Table 10.

**TABLE 10      TRANSPORTATION FUNDING PROGRAM CATEGORIES**

Program 1.	System Development and Preservation
Program 2.	Pedestrian-Bicycle Air Quality – Non Pedestrian-Bicycle
Program 3.	Operations Management Intersection and Bottleneck Improvements – Non ITS Intersection and Bottleneck Improvements – ITS
Program 4.	Transit Services Transit Capital Livable Centers

The remaining steps are summarized as follows:

- Determine the benefit-cost ratio of each project;
- Apply points or scores to the B/C ratio and other planning factors;
- Compute total scores and rank-order each project from high to low based on overall scores; and
- Submit the list of projects to the TPC for final review and approval.

The project prioritization process also establishes the context

for implementing the Long-range Vision for the future of the region. The vision as stated in the 2035 RTP Update began with the outcomes prescribed by SAFETEA-LU and other critical issues in transportation identified by the Executive Committee of the Transportation Research Board (TRB). The prescribed legislation and guidance, coupled with envision+Houston Region recommendations, cumulated into these broad statements of regional values and goals:

- Better mobility, less congestion and cost;
- Easier access to jobs, homes and services;
- More transit;
- More green space and preservation of floodplain areas for aesthetic and recreational activities; and
- Healthier environment.

SAFETEA-LU requires consideration of eight broad areas:

1. Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency, including through services provided by public and private operators;
2. Increase the safety of the transportation system for motorized and non-motorized users;
3. Increase the security of the transportation system for motorized and non-motorized users;

4. Increase the accessibility and mobility of people and for freight, including through services provided by public and private operators;
5. Protect and enhance the environment, promote energy conservation, and promote consistency between transportation improvements and State and local planned growth and economic development patterns;
6. Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight, including through services provided by public and private operators;
7. Promote efficient system management and operation; and
8. Emphasize the preservation of the existing transportation system, including services provided by public and private operators.

The Executive Committee of the Transportation Research Board (TRB) of the National Academies has outlined the most critical transportation issues facing the nation as:

- Congestion, increasingly congested facilities across all modes;
- Emergencies, vulnerability to terrorist strikes and natural disasters;
- Energy and Environment, extraordinary challenges;

- Equity, burdens on the disadvantaged;
- Finance, inadequate revenues;
- Human and Intellectual Capital, inadequate investment in innovation;
- Infrastructure, enormous, aging capital stock to maintain;
- Institutions, 20<sup>th</sup> century institutions mismatched to 21<sup>st</sup> century missions; and
- Safety, lost leadership in road safety.

The three foundational elements of the prioritization process, SAFETEA-LU, TRB critical issues, and envision+Houston Region are summarized in Table 11, which provides a compact, seamless linkage of the guiding principles for the 2035 RTP Update. This new emphasis represents a shift from predetermined modal decisions, toward a broader consideration of tailored multimodal solutions within the context of transportation performance expectations or indicators. As such, this emphasis is intended to result in transportation plans, programs, and decisions driven by a general statement of community values, the desired ends of the planning process, and an assessment of programs, projects, and services with respect to overall transportation plan goals and objectives.

The benefits to be gained from this approach could be substantial. The ability to better direct resources to those programs and projects that provide the best return on

transportation investments as determined by measurable indicators from a planned course of action and the associated tradeoffs is crucial for this planning horizon.

**TABLE 11 2035 RTP UPDATE GOALS AND OBJECTIVES**

<b>Goals</b>	<b>Objectives</b>	<b>Criteria</b>	<b>Indicators</b>
4	Support the economic vitality of the 13-county metropolitan area via land use and other planning strategies that support state and local managed growth and economic development.	Economic Development and Quality of Life	New Development, Town Centers, Employment and Population Growth within quarter mile of new town centers, Development in flood plain.
1	Reduce congestion.	Congestion	Reduction in VMT and VHT in town centers, delay index, congestion index.
1,3	Increase accessibility and mobility options for motorists, pedestrians, bicyclists, freight carriers, and special need segments of the population.	Mobility and Equity	Employment and Population growth within quarter mile of transit.
3	Enhance the integration, connectivity, and coordination of the transportation system and services for people and freight across all modes.	Coordination of Transportation Services	Transit PMT and PHT, Transit accessibility index
5	Provide protections to the human and natural environment and promote resource and energy conservation.	Environmental Protection and Air Quality	NOx and VOC emissions,
1,2	Improve the safety of the transportation system for all motorized and non-motorized users.	Safety	Safety Improvement Index
1,2	Increase the ability of the transportation system to support homeland security and safeguard the personal security of all motorized and non-motorized users.	Security	Hurricane Evacuation Zones

## **DEVELOPMENT OF THE 2011-2014 TRANSPORTATION IMPROVEMENT PROGRAM**

The 2011-2014 Transportation Improvement Program (TIP) has been developed in accordance with the requirements of metropolitan planning guidance received from FHWA and FTA. Specific requirements of the TIP and a brief discussion of how H-GAC met the requirements are outlined below:

- The TIP must include a priority list of projects to be implemented during the four-year TIP period.  
*The 2011-2014 TIP contains a list of priority roadway and transit projects to be implemented over the next four years. To ensure that high priority, cost-effective projects were selected; all proposed projects were reviewed and adopted by the TPC.*
- The TIP must include a financial plan which shows the source of funding for the projects contained therein.  
*H-GAC, TxDOT, METRO and other transportation agencies in the region have worked to identify the amount of funding available annually for highway and transit transportation improvements. The 2011-2014 TIP includes a separate financial plan for highway and transit elements, which documents these amounts. Each year is financially*

*constrained to funding availability. Together, this ensures that the most cost-effective projects are given top priority and implemented at the earliest possible opportunity given the funding and construction constraints.*

- Projects identified in the TIP must be consistent with the RTP.  
*The method used to select projects for the 2011-2014 TIP is consistent with H-GAC's regional transportation planning process. The 2011-2014 TIP is endorsed by the TPC, subject to the condition that projects selected for the TIP are included in a conforming RTP.*
- There must be reasonable opportunity for public comment prior to approval of the TIP.  
*Discussions regarding TIP development are conducted at TPC and TAC meetings each month. An opportunity for public comment is included in both meetings. H-GAC also holds a thirty-day public comment period on the draft TIP prior to approval of the final document. Notices regarding the public comment period are placed on the H-GAC Transportation web site and are advertised in the Houston Chronicle.*
- The TIP must cover the entire metropolitan area, including the designated non-attainment area.

*All projects in the eight-county TMA selected for federal-aid are included in the TIP. Federal formula transit funding for each urbanized area is included within the boundaries of the TMA and in the TIP.*

- The TIP must show progress in implementing projects from the previous TIP periods.

*The 2011-2014 TIP identifies priority roadway and transit projects scheduled for implementation in the next four years in the Houston region. The TIP contains the first four years of funded priority projects within our region and is considered the implementation tool for the Regional Transportation Plan. The TIP includes any transportation project in our region receiving federal funds as well any locally funded regionally significant project.*

The scope of work for transportation investments considered for federal funding are uniquely different which results in a variety of benefits for our transportation system. For this reason the Transportation Policy Council approved the Coordinated Development Programs for project solicitation and selection. The objective was to organize the project improvements into four areas by goals and activities eligible for funding. The four program areas are:

***PROGRAM 1: System Development and Operational Non-***

***ITS Improvements***

Projects are evaluated for their impact on relieving bottlenecks and filling gaps in the existing transportation network. Benefits evaluated also include the project's positive impacts on the economy, provisions for additional travel choices, and investments to address safety concerns. This criterion gives some recognition to projects that preserve and maintain our existing infrastructure and to those local government's conducting corridor planning efforts that include the study of access management.

***PROGRAM 2: Bicycle, Pedestrian and Air Quality***

The evaluation criteria recognize projects for their impact on filling gaps in the existing pedestrian and bicycle network. Benefits evaluated include the project's convenience and safety for the users as well as the project's design accommodations. These projects are also evaluated on their air quality improvements. Projects competing for the Air Quality Programs were evaluated on their emissions benefits and cost effectiveness.

***PROGRAM 3: Traffic Operations and Management***

The evaluation criteria recognize projects for regional coordination and connectivity with area stakeholders and systems. Regional benefits from these projects can include providing traveler information during emergencies and

improved traffic flow along an entire corridor without the need for roadway expansion. There are other factors used in the evaluation of these projects that relate to the planning efforts of the project sponsors such as preparing back up in case of system failure, identifying leverage, and the development of a maintenance plan. This criterion has been updated to give some recognition to projects that maintain a high level of emissions over the life of the project. There will also be a cost effectiveness threshold to fund projects with a minimum air quality benefits.

***PROGRAM 4: Transit Service, Transit Capital and Livable Centers***

Transit services are evaluated for their benefits in providing coordinated and connected services for the region. Services were evaluated on the potential to reach new riders and the ability of the service to continue at the conclusion of CMAQ eligibility. This criterion was updated to give recognition to projects that operate vehicles using cleaner fuels. There was also some recognition to projects ensuring the safety and security of the riders.

There are two new criteria developed for this TIP. The first is transit capital developed to address the benefits of facilities to the region and the users. The benefits of capital transit include the safety of the facility, the coordination of services to that facility, and the use of ITS for the users.

Sponsors must also have a ridership plan to document the expected increase in use.

The second criteria are for a new Livable Centers program category. Livable Centers projects are focused on a geographical area and have private investor interest. Livable center projects are evaluated on their ability to redevelop a community, provide a safe walkable environment, provide community identity through landscape design, are part of a comprehensive plan, and provide multiple mode opportunities.

## AIR QUALITY CONFORMITY

The eight-county TMA continues to be non-compliant with the Clean Air Act for ground-level ozone. Ozone is a ground-level pollutant that causes lung irritation, which at high levels is dangerous to the elderly, the young, and individuals with chronic diseases, such as asthma or other heart-lung ailments. Ground-level ozone is created by a chemical reaction between volatile organic compounds (VOCs) and nitrogen oxides (NOx) and sunlight. The Houston region emits large amounts of VOCs and NOx, from on and off road mobile sources, as well as from area and point sources.

Under the Clean Air Act, the Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS) to determine the health threat of pollutants. If an area has a health threat, it is designated as a non-attainment area until it becomes compliant. Through the conformity process, the 2035 RTP Update addresses the tracking of on-road mobile air quality emissions. To receive federal approval for the expansion of the regions roadway and transit system, the 2035 RTP Update must demonstrate compliance with specific reductions in air pollutants caused by on-road vehicles.

These specific emission reductions are stated in the 8-hour Ozone Standard Houston-Galveston-Brazoria State

Implementation Plan (HGB SIP). The last approved SIP did not have an Attainment Demonstration for the 1997 8-hour Ozone standard; it had a Reasonable Further Progress portion to which we have conformed using its 2008 Motor Vehicle Emission Budgets (MVEBs). The EPA found these MVEBs adequate on March 21 2008 (effective by April 7, 2008) and approved them on April 22 2009 (effective by June 22, 2009). The emission budgets are listed in the Table 12, and are measured in tons per day (tpd).

**TABLE 12 REASONABLE FURTHER PROGRESS BUDGETS**

Year	NOx (tpd)	VOC (tpd)
2008	186.13	86.77

Transportation conformity is obtained by demonstrating that on-road emissions associated with all projects in the 2035 RTP Update do not exceed emission limits established in the HGB SIP. Thus, a conformity determination means that on-road vehicle emissions are within the on-road vehicle emissions budget as determined by the SIP.

Transportation conformity is an analytical methodology that establishes the connection between projected on-road emissions from the RTP, and the motor vehicle emission budget from the State Implementation Plan (SIP). Through the

process of transportation conformity, the RTP uses the SIP's on-road mobile strategies, and air quality targets to demonstrate that the RTP complies with the federal air quality requirements. The Houston region must demonstrate that the 2011-2014 Transportation Improvement Plan (TIP) and the 2035 RTP Update result in less VOCs and NOx than established and approved by EPA for all the emission budget years and each horizon years.

### ***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 NAAQS.

Additional requirements that apply include:

- Use of the latest planning assumptions;
- Analysis based upon the latest emission estimation model available;
- Calculation of air quality emissions for each year the SIP has a budget;
- The analysis years cannot be more than 10 years apart;

- 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; and
- The RTP and the TIP must include all regionally significant projects expected in the nonattainment area.

### ***Conformity Analysis Results***

The results of this conformity determination show that the 2035 RTP Update and the 2011-2014 TIP for the Houston-Galveston-Brazoria TMA meet the requirements of the SIP for the Houston-Galveston Ozone Nonattainment Area, 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), as seen in Table 13.

**TABLE 13 AIR QUALITY CONFORMITY ANALYSIS SUMMARY**

<b>Analysis Year</b>	<b>VOC Emissions (tons/day)</b>	<b>VOC Budget (tons/day)</b>	<b>NOx Emissions (tons/day)</b>	<b>NOx Budget (tons/day)</b>
<b>2011</b>	60.57	86.77	135.50	186.13
<b>2018</b>	40.25	86.77	55.79	186.13
<b>2025</b>	38.11	86.77	38.77	186.13
<b>2035</b>	45.80	86.77	42.66	186.13

## SUMMARY

The examination of the growth scenarios in the 2035 RTP Update does not constitute a consensus on the nature or location of development in the eight-county region. It is intended to give policy makers additional information against which to assess the need for and scope of potential transportation investments. The 2035 RTP Update will help set the stage for future exploration of transportation and land use coordination by all stakeholders and local governments as they look to maximize the use of public transit, reduced commute distances, and increase cycling and walking opportunities.

This Plan is a step towards improving the regions accessibility and quality of life while recognizing that as the region and local economy continues to grow, that growth must be managed strategically. The 2035 RTP Update has identified a myriad of solutions for improving regional transportation. Over this planning horizon, utilizing a combination of strategies to include: roadway expansions, intelligent transportation technologies, alternatives to driving alone in heavily traveled corridors, the creation of live-work communities, and connecting transportation with land use reduces the reliance on vehicular trips and encourages a more efficiently functioning transportation network. The incremental and cumulative effects from the implementation of the four major strategies will build more overall system capacity at an

acceptable level-of-service. Table 14 shows the compliance of this document to SAFETEA-LU requirements.

**TABLE 14 SAFETEA-LU 2035 COMPLIANCE**

<b>SAFETEA-LU Requirement</b>	<b>SAFETEA-LU Provision</b>	<b>Issue(s) Addressed in Update</b>	<b>Location in Update</b>
Added a new stand-alone factor to “increase the security of the transportation system for motorized and non-motorized users.”	Sections 5304 (d) (1)	Security concerns, specifically evacuation planning, are addressed in the 2035 RTP Update. Consultation and coordination activities occurred under Hurricane Evacuation Task Force.	Four Strategies: Operations Management
Added a new stand-alone factor to “increase the safety of the transportation system for motorized and non-motorized users.”	Sections 5303 (h) (1)	The Regional Safety Council, consisting of safety stakeholders, developed safety goals and strategies included in the 2035 RTP Update.	Four Strategies: Operations Management
Environmental Mitigation Activities: Plans shall include a discussion of environmental mitigation activities and this discussion shall be developed with stakeholder agencies.	Sections 5303 (i) (2) (B) and 5304 (f) (4)	The 2035 RTP Update includes a discussion of potential impacts, avoidance, and mitigation activities at the policy level. An Environmental Advisory Committee consisting of stakeholder agencies identified areas of environmental concern. In addition, staff in coordination with TxDOT and EPA, utilized the GIS-ST program to identify possible advanced mitigation sites.	Environmental Analysis
Public Transit Element: Plans shall include a Coordinated Public Transit-Human Services Transportation Plan	Sections 5310, 5316, and 5317	A Regional Coordinated Public Transportation Plan was developed through a process including representatives of public, private, and nonprofit transportation and human service providers and the public.	Four Strategies: Transit
Transportation Facilities: Operations and Management strategies in MTP.	Sections 5303 (i) (2) (D), 5303 (k) (3), 5304 (f) (7), and 5304 (i)	The 2035 RTP Update contains operations and management strategies for both the highway and transit network that improve the intermodal connectivity of the existing transportation systems (including use of ITS technologies).	Four Strategies: Operations Management
Fiscal Constraint	Sections 5303 (i) (2) (C); (j) (1) (C), (j) (2) (B); (j) (3) (D) and 5304 (f) (5); (g) (4) (E); (g) (4) (F)	The 2035 RTP Update demonstrates fiscal constraint through an analysis of regional revenues and costs. This analysis confirms revenues and costs related to system operations and maintenance activities covered in transportation plans and programs.	Financial Plan
Consultation and Cooperation: Transportation Plans	5303 (g) and (i) (4) and 5304 (f) (2)	The 2035 RTP Update was developed in continued consultation with partners (including TxDOT and local officials) as well as the public (including envision+Houston Region effort).	Public Outreach
Consultation and Cooperation: Land Use Management and Other Resource Agencies	5303 (i) (4) and 5304 (f) (2) (D)	The 2035 RTP Update was developed in consultation with local/State land use management, natural resource and other agencies. The plan was compared with available conservation plans and inventories of natural resources through the Environmental Advisory Committee process and GIS-ST analysis.	Environment Analysis
Congestion Management Process	5303 (k) (3)	The 2035 RTP Update “Congestion Management Process” is based on the congestion management system adopted in 2009.	Four Strategies: Operations Management